Proceedings of LFG13

Miriam Butt and Tracy Holloway King (Editors)

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Contents

1 Dedication

We dedicate this volume of the LFG proceedings to the memory of Prof. Ivan Sag (1949-2013).

Ivan Sag was the main proponent of HPSG, a constraint-based theory of grammar which shares architectural properties with LFG, but which works differently enough so that the contrast between LFG and HPSG has led to many spirited exchanges and theoretical advances over the years. Everyone who knew Ivan will attest to his enthusiasm for all things linguistic, an enthusiasm that was coupled with deep linguistic insight — together they translated into linguistic work that has significantly advanced our understanding of how language works and that has put an indelible mark on the field.

We personally interacted with Ivan most in our days as graduate students at Stanford (where among South Asianists, he was also known as "Mr. Spinach"). We came to know Ivan as a person who exuded bonhomie like no other professor. He cared deeply about his profession and he cared deeply about people and had a genius for networking and bringing people together (his LSA institute accommodation arrangements are the stuff of legends). With him, the field has lost a truly wonderful person much too soon.

2 Editors' Note

The program committee for LFG13 were Dag Haug and Anna Kibort. We would like to thank them for coordinating the review process and judiciously putting together the program that gave rise to this collection of papers. Thanks also go to the executive committee and the abstract and final paper reviewers, without whom the conference and the proceedings would not have been possible in this form. With respect to the local organizing committee, we especially thank Tibor Laczkó, György Rákosi, Éva Kardos, Gábor Csernyi, who put together a superbly organized conference (with a wonderful accompanying social program)! Finally, as always, we would like to thank Dikran Karagueuzian for his and CSLI's unfailing support.

The table of contents lists all the papers presented at the conference. Some papers were not submitted to the proceedings. For these papers, we suggest contacting the authors directly.

PSYCHOLOGICAL PREDICATES AND VERBAL COMPLEMENTATION IN ARABIC

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Abstract

The issue of verbal complementation patterns in the Arabic vernaculars is one which is relatively under-researched: this paper aims to make a small contribution in this area, focussing on essentially two issues (i) the syntax of so-called experiencer-object psychological predicates (EOPVs) (that is, predicates in the *frighten* or *please* classes) and (ii) the syntax of aspectual or phasal predicates (that is, verbs such as *begin* and *continue*). We argue that the latter class of verbs are in fact raising verbs and go on to show that in some dialects the interaction of EOPV and aspectual predicates permits a pattern reminiscent of Copy Raising.

1 Introduction

The issue of verbal complementation patterns in the Arabic vernaculars is one which is relatively under-researched: this paper aims to make a small contribution in this area, focussing on essentially two issues (i) the syntax of so-called experiencer-object psychological predicates (EOPVs) (predicates in the *frighten* or *please* classes) and (ii) the syntax of aspectual or phasal predicates (that is, verbs such as *begin* and *continue*). Our work concentrates on the complementation patterns for these classes of verb in three geographically diverse dialects, Hijazi Arabic (a Gulf dialect from the West of Saudi Arabic, henceforth HA), Egyptian Cairene Arabic (henceforth ECA) and Maltese (henceforth MT). EOPVs are known to exhibit unusual properties crosslinguistically, and we will explore the extent to which this is true for Arabic and provide evidence that the experiencer really *is* a normal OBJ in this class of verbs. As for the aspectual verbs, we will argue that they are raising predicates in Arabic. We will then show that in some dialects, the interaction of EOPVs with aspectual verbs shows a pattern highly reminiscent of copy raising, although this in turn raises a number of open questions about the correct approach to the analysis of such constructions. Throughout, our principal aim is not theory development but a relatively detailed description of some under-studied verbal complementation patterns.

2 Psychological predicates

The term psychological predicates refers to those classes of predicates with an argument structure or thematic role grid involving an experiencer and a theme or stimulus argument (the content or object of the mental state). Verbs such as *fear* and Italian *temere* 'fear', which map their arguments so that the experiencer is the SUBJ and the theme or stimulus is the OBJ contrast sharply with verbs such as *frighten* or Italian *preoccupare* 'worry', which exhibit the inverse mapping, with the experiencer as OBJ and the theme or stimulus as SUBJ. Furthermore this 'inverted' mapping occurs whether or not the stimulus is interpreted causally. A third class of verbs also exhibiting an apparently 'inverse' mapping include those which mark the experiencer with a

†A version of this work was presented at the 6th International Arabic Linguistics Symposium, in Ifrane, Morocco. We thank participants at ALS and at LFG2013 and our reviewers for comments and feedback. All remaining errors are our own.

preposition or dative case marker, for example Italian *piacere* ‘please’. These classes are illustrated with the examples from Belletti and Rizzi (1988, 291).[1]

(1) Gianni teme questo
Gianni fears this

(2) Questo preoccupa Gianni
this worries Gianni

(3) A Gianni piace questo
to Gianni pleases this

(4) Questo piace a Gianni
this pleases to Gianni

In common with other literature we use the term EOPV to refer to predicates in both of these last two classes, that is, as a superordinate term for the *frighten*, *preoccupare* and the *piacere* classes (Belletti and Rizzi (1988)’s Classes 2 and 3). Class 3 (*piacere*) predicates are always stative and class 2 predicates (*frighten*, *preoccupare*) are usually ambiguous between stative and eventive readings. A representative sample of the class of predicates is given in Table 1.

Meaning	**HA**	**ECA**	**MT**
anger	yuġdib, yuzaʕil	-	jagħdab
overcome	yaġlib, yusaiṭir	yiġlib	jegħleb
tease/annoy/bother	yuzʕiğ, yuqliq	yiġīz, yidaayeʔ	jdejjaq
tire	yatʕib	yetʕib	jgħejja
hurt	yağraḥ	yigraḥ	jweġġa’
frighten	yaḫawif	yixawwef	jbeżża’
make happy/please	yafarriḥ	yifarraḥ, yibsit	jferraħ
like	yaḥib	yiʕgib	jogħġob
make sad	yaḥzin, yuʕlim	yizaʕʕal	jnikket
enable	yumakin	yiʕaddar	-

Table 1: Experiencer Object Psych Predicates

Arabic verbal morphology is characterised by a system of forms (Arabic *ʔawzān* (sg: *wazn*) or Hebrew *binyanim* (sg: *binyan*)) involving derivational morphological processes by which new verbal lexemes are formed. In the Western tradition, these forms (or measures) are referred to by means of roman numerals, with the Ist form being the basic underived lexeme. In Arabic we find some *fear-frighten* pairs expressed through a change in *binyan*, such as ECA *xaaf* ‘fear’ < SUBJ OBL> (Ist binyan) and *xawwef* ‘frighten’ <SUBJ, OBJ> (IInd binyan) or MT *beża’* ‘fear’ (Ist binyan) - *beżża’* ‘frighten’ (IInd binyan).[2] In other cases, we find that the same verbal stem

[1] For Belletti and Rizzi (1988) verbs in the *fear* class have the experiencer as an external argument, while the remaining two classes lack an external argument and associate the experiencer argument with ACC and DAT case respectively. For *piacere* the experiencer can ‘end up’ in preverbal subject position while for the *preoccupare* class the theme is generated in canonical object position but ends up in preverbal position, while the experiencer is sister of V′.

[2] These two EOPVs are IInd binyan derived verbs. Amongst the semantic shifts associated with the use of the IInd binyan is causativisation, but it is also associated with a number of other semantic shifts. Note that EOPVs in the IInd binyan are *not* necessarily interpreted as agentive or causative.

simply permits both the experiencer-SUBJ mapping and the EOPV mapping.

The following examples from ECA illustrate the class of EOPV predicates we are concerned with. In (5) it is *el-walād* 'the boys' that controls verbal agreement as SUBJ of the matrix clause.[3] Note however that, just as in other languages, an animate SUBJ stimulus does not necessarily entail an agentive or causative interpretation. In (6) the experiencer argument occurs as an OBJ incorporated pronominal *-ha* and the SUBJ is the inanimate theme/stimulus *el-sarāħa* 'frankness'.

(5) el-welād bi-dayʔ-u el-banāt
DEF-boys BI-annoy.IMP.3-PL DEF-girls
The boys annoy the girls. ECA

(6) b-t-ʕegeb-ha el-sarāḥa
BI-3SGF-like.IMP-3SGF.ACC DEF-frankness
She likes frankness. ECA

The stimulus argument may be propositional, with default 3SGM agreement on the verb as in (7) and (8). Although we will not pursue this matter here, examples with a propositional stimulus argument raise the interesting question of whether the propositional argument *is* the subject or whether these are essentially extraposition structures with an expletive subject and an XCOMP or COMP argument. We note that it is possible for the experiencer argument to correspond to the SUBJ of the embedded proposition, as in (9)-(10).[4]

(7) bi-dāyeʔ-ni ʔin el-sōt yi-kūn ʕāly
BI-annoy.IMP.3SGM-1SG.ACC COMP DEF-sound 3-be.IMP.SGM loud.SGM
It annoys me that the sound is loud. ECA

(8) ya-ʕġib-ha ʔin Muħammad ḍal
3-like.IMP.3SGM-3SGF.ACC COMP Muhammad remain.PV.3SGM
sākit
quiet.ACT.PRT.SGM
It pleases her that Muhammad remained quiet. HA

In the dialects, the morphological system of binyanim or ʔawzān is basically a system of templatic phonological structures with appended affixes. The IInd binyan involves gemination of the verb's second radical.

[3]The gloss BI marks a particular indicative realis form of the imperfective verb. This matter is discussed in some detail below. Other glosses are standard.

[4]Further interesting issues are raised by examples such as (i), in which the psych verb agrees with *Marija*, suggesting that this NP is the SUBJ. The question is whether this subject is raised from the embedded predication, which we would then expect to be an XCOMP, or whether on the other hand the matrix SUBJ is thematic and the clause has the status of an adjunct. We leave this matter for future research.

(i) Marija d-dejjaq-hom to-ħroġ weħid-ha
Mary 3-annoys.IMP.SGF-3PL.ACC 3-goes.out.IMP.SGF alone-3SGF.ACC
Mary annoys them going out on her own. MT

(9) ya-ʕġib-ha Sarah ta-ẖrōġ li-waḥda-ha
3-pleases.IMP.3SGM-3SGF.ACC Sarah 3SGF-go.out.IMP for-alone-3SGF.ACC
It pleases Sarah to go out alone./Going out alone pleases Sarah. HA

(10) Jien j-o-għġob-ni n-o-ħroġ
I 3-FRM.VWL-pleases.IMP.SGM-1SG.ACC 1-FRM.VWL-go.out.IMP.SG
waħd-i
alone-1SG.ACC
It pleases me to go out alone.
Going out alone pleases me. MT

Although the stimulus or theme does correspond to the SUBJ with verbs in this class, it is worth noting that it does not always appear in the canonical SUBJ position in terms of word order in Maltese. While both SVO and VSO (and indeed other orders) are quite freely available in ECA and HA, Maltese is a predominantly SVO language. However there appears to be a marked preference for the SUBJ stimulus of these verbs to follow the verb, as in example (14). Note that such a postverbal SUBJ is really part of the matrix sentence, and not in a clause-external dislocated position (although the language makes extensive use of such dislocation structures involving external topics). Nonetheless, this (postverbal position) is not an invariant requirement as examples such as (11) have the experiencer in postverbal position and the stimulus or theme preverbally.

(11) Xi kliem li nt-qal dejjaq
some word.SGM COMP PASS-said.PV.3SGM annoyed.PV.3SGM
lin-nies
ACC.DEF-people
Some words that were said annoyed the people. MT

For the majority of the EOPV verbs we have investigated, the experiencer is coded as an OBJ. This can be seen in examples such as (6)-(10), where the pronominal experiencer is coded by means of an OBJ inflection on the verbal element. The contemporary Arabic dialects do not exhibit case marking, but the corresponding nominals would be marked with ACC case in Modern Standard Arabic (MSA). For some verbs, however, the experiencer is either an OBL or marked by the dative (i.e. goal or recipient) marker/preposition *li-*. Note that in MT, pronominal *li*-marked arguments are also expressed inflectionally as part of the verbal form.[5]

[5]Elsewhere we have argued that recipient/goal *li*-marked arguments in Maltese are actually instances of the grammatical function OBJ_θ rather than OBL (Sadler and Camilleri, 2013). For some discussion of the possibility that this might also be the case in ECA see Camilleri et al. (2013). We will have nothing further to say here on this question.
In relation to (14), a reviewer questions our assumption that this is a *psych* predicate in this context, suggesting that *li* may mark 'a recipient or goal' here, a function which it certainly has in other contexts. While we believe that it does mark an experiencer in this example, detailed discussion of this example would take us too far afield. A further example of a psych verb with a DAT-marked experiencers is

(12) kabas ʕalē-ha al-noum
compress.PV.3SGM on-3SGF.ACC DEF-sleep
Sleep overcame her. ECA

(13) ṣār yu-saiṭir ʕala Muhammad al-nawm
become.PV.3SGM 3-overcome.IMP.SGM on Muhammad DEF-sleepiness
Muhammad is overcome by sleepiness. HA

(14) Naqas-l-i d-dawl
reduce/lack.PV.3SGM-DAT-1SG DEF-light
Lit: The light reduced to me
I am experiencing increased blindness. MT

Before leaving the question of pronominal experiencers, it is worth noting in passing that while these are expressed as verbal affixes in neutral discourse conditions, it is possible in Maltese to use a full pronoun in cases of contrastive focus such as (15).

(15) LILHA għoġob il-ktieb, u mhux lili.
her please.PV.3SGM DEF-book.SGM CONJ NEG me
It was she who liked the book and not me. MT

In a recent book on experiencers, Landau (2010) proposes that many of the unusual properties that experiencer objects exhibit crosslinguistically follow if the experiencer arguments of non-agentive (readings of) psych verbs are not OBJ but are taken to be underlyingly obliques, that is, objects of an abstract locative preposition, as mental locations. In particular, he argues for this position in Modern Hebrew, a related Semitic language. However, data from the Arabic dialects we are concerned with does not appear to support the extension of this abstract analysis to Arabic. As we have already noted, evidence from the surface forms supports the view that the experiencer is straightforwardly an OBJ; in particular, pronominal experiencers are verbal inflections. Objects of prepositions are expressed as prepositional inflections (and these inflectional paradigms are not identical, at least in the form used to realize the 1SG set of values).[6] A further piece of robust evidence is the fact that the experiencer argument may be the SUBJ under passivisation of predicates in this class

appella 'appeal', as in (i):

(i) Appella-t-l-i ferm dil-esperjenza
appealed.PV-3SGF-DAT-1SG a.lot DEM.SGF.DEF-experience.SGF
This experience appealed to me a lot.

[6]It must of course be acknowledged that the use of ACC morphology does not provide irrefutable proof of GF status, especially given that in Maltese there is a set of defective verbs (the 'pseudo-verbs') (Peterson, 2009) which take ACC pronominal markers in what is probably a SUBJ function e.g. *donn-ok, donn-hom, donn-ha* 'appear'/'seem', *il-ek, il-u, il-na* 'long.time' and *qis-ni, qis-kom, qis-ha* 'as.though/look like/appear'. Nonetheless the general point is clear - the morphological evidence is most consistent with the OBJ rather than the OBL analysis of the experiencer arguments.

(despite the fact that Belletti and Rizzi (1988, 309) claim that experiencer object verbs cannot be passivised). (16)-(17) illustrates this with a HA active-passive pair involving a shift from the Ist to the VIIth binyan and (18)-(19) an active-passive pair in MT involving a shift from the IInd to the Vth binyan. (In (18) and other subsequent examples, the parenthesised NPs indicate typical positions for the NP, which may also be dropped.)[7]

(16) al-film ya-fġaʕ-ha
DEF-film 3-frighten.IMP.SGM-3SGF.ACC
The film frightens her. HA

(17) n-faġaʕ-at minn al-film
PASS-frighten.PV-3SGF from DEF-film
She was frightened by the film. HA

(18) (Lil Mario) t-beżżgħ-u l-mewt (lil Mario)
ACC Mario 3-make.fear.IMP.SGF-3SGM.ACC DEF-death.SGF ACC Mario
Death frightens Mario. MT

(19) Mario dejjem t-bezza' mill-mewt
Mario always PASS-cause.fear.PV.3SGM from.DEF-death.SGF
Mario was always frightened by death. MT

One special property of the experiencer which Landau (2010, 5) interprets as favouring an OBL analysis concerns the distribution of resumptive pronouns (RPs). This also holds in Maltese, and for this reason we mention the relevant data here, although it is not clear to us that any analytic consequences in terms of GF follow from this observation. Landau notes that in Hebrew, while a RP is typically optional in OBJ position within relative clauses, a RP encoding an *experiencer* object is obligatorily present. In this respect, the experiencer appears to behave more like an oblique, since

[7] Passivisation in Classical Arabic and MSA involves the use of specific vowel patterns but this strategy is largely (although not entirely) absent in the contemporary vernaculars, where derivational processes in the binyanim system are generally used for verbal diathesis alternations. In Classical Arabic and MSA these same binyanim fulfill other broadly intransitivising functions. The fact that these forms yield passives in the dialects is well established in the literature (see Holes (2004, 135-138) and Abdel-Massih (1979/2011, 195)). Further evidence can be provided from MT, which also has a syntactic passive formed from the use of *ġie* 'come' and the passive participle. The following pair shows the promotion of the experiencer to SUBJ of the syntactic passive.

(i) a. J-beżżagħ-ni l-fatt li ħa m-mut-u
3-make.fear.IMP.SGM-1SG.ACC DEF-fact.SGM COMP PROSP 1-die.IMP-PL
The fact that we will die frightens me.

b. Ġej-t im-beżża' mill-fatt li ħa m-mut-u
come.PV-1SG PASS.PRT-fear.SGM from.DEF-fact COMP PROSP 1-die.IMP-PL
I was frightened from the fact that we will die.

obliques involve an obligatory RP. A similar pattern is found in MT: normally an object relative clause with a definite head noun would involve a gap, but the experiencer OBJ of an EOPV requires an obligatory RP. We give the data in (20)-(21) but as noted, it is not clear what to make of this observation.

(20) Kellim-t lit-tifel li weġġgħ-et-**u**
spoke.PV-1SG ACC.DEF-boy COMP make.hurt.PV-3SGF-3SGM.ACC
ras-u / għajr-u-**h** xi subien
head-3SGM.ACC / tease/call.out.names.PV.3-PL-3SGM.ACC some boys
ilbieraħ
yesterday
I spoke to the boy whose head was hurting yesterday/who some children teased yesterday. MT

(21) Kellim-t lit-tifel li ra-t-***u**
spoke.PV-1SG ACC.DEF-boy COMP saw.PV-3SGF-*3SGM.ACC
omm-i ilbieraħ
mother-1SG.ACC yesterday
I spoke to the boy who my mother saw yesterday. MT

When we turn to data involving binding and scope, the pattern which emerges is one in which the experiencer OBJ patterns alongside the OBJ of other verbs, contrary to the special behaviour which is reported for (non-agentive) EOPVs in other languages. Here we merely summarise the situation as it appears in the data we have explored: very little is clear about the syntactic hierarchical and linear conditions on binding and scope in Arabic in general. We can conclude, however, that the accessibility relations for experiencer objects are little or no different from those for standard transitive objects, supporting the view that such arguments are indeed OBJs. Consider first so-called **backward binding**, where an EO but not a 'normal' object can bind a reflexive within the subject (compare *Pictures of herself pleased Mary* with **Pictures of herself hit Mary*). In the dialects we consider, on the other hand, there is no difference in this regard between EOPV objects and other objects, as shown in the MT examples in (22) and ECA (23).

(22) a. Dal-kliem dwar-u nnifs-u$_i$
DEM.SGM.DEF-words.SGM about-3SG.ACC breath-3SG.ACC
dejjaq lil Pawlu$_i$ / dejjq-u$_i$ 'l Pawlu
bother.PV.3SGM ACC Paul / bother.PV.3SGM-3SGM.ACC, ACC Paul
These words about himself bothered Paul. MT

b. ħolma dwar-u nnifs-u$_i$ qajjm-et 'l
dream.SGF about-3SG.ACC breath-3SG.ACC make.wake.PV-3SGF ACC
Pawlu$_i$ b'ħasda
Paul with.shock
A dream about himself woke up Paul all of a sudden. MT

(23) ʕali dayʔ-u el-kalam ʕan nafs-u
Ali annoy.PV.3SGM-3SGM.ACC DEF-talk about self-3SGM.ACC
Ali was annoyed by the talk about himself. ECA

A second data constrast is argued to arise for English in terms of **weak crossover**. EOPV (but not other objects) allow crossover violations, inverse variable binding of the reflexive within the subject by the experiencer argument. However our initial investigations suggest that EOPV pattern just like other transitive verbs in not permitting weak crossover violations, as shown in (25)-(27).

(24) a. His$_i$ promotion pleases everyone$_i$
His$_i$ health worries every patient$_i$

b. *His$_i$ father hit everyone$_i$
$*$His$_i$ father killed everyone$_i$

(25) a. ʔuslūb-uh$_i$ bi-ġīz kol wāḥed$_j$
behaviour-3SGM.ACC BI-annoy.IMP.3SGM every/each one
His behaviour annoys everyone/each one. ECA

b. ʔumm-uh$_i$ gawb-et kol wāḥed$_j$
mother-3SGM.ACC answer.PV-3SGF every/each one
His mother answered everyone/each one. ECA

(26) a. solūk-uh$_i$ ya-zʕiǧ kul wāḥid$_j$
behaviour-3SGM.ACC 3-annoy.IMP.3SGM every one
His behaviour annoys everyone. HA

b. ʔumm-uh$_i$ ǧawab-at kul wāḥid$_j$
mother-3SGM.ACC answer.PV-3SGF every one
His mother answered everyone. HA

(27) a. Imġiebt-u$_i$ għadb-et ’l kulħadd$_j$
behaviour.SGF-3SGM.ACC angered.PV-3SGF ACC everyone
His behaviour angered everyone.

b. Omm-u$_i$ wieġb-et lil kulħadd$_j$
mother-3SGM.ACC answered.PV-3SGF ACC everyone
His mother answered everyone. MT

A third issue concerns **anti-local binding**. It is claimed that non-agentive EOPVs do not allow local binding of an anaphor in direct object position by the causer subject (see (28)). But here too, Arabic EOPVs appear to permit local binding in a manner analogous to other verbs. Contrary to Landau (2010)’s ‘universal’ claim that this is not possible (on non-agentive readings), examples such as (29) and (30) have non-agentive readings and involve local binding.[8]

(28) a. ??John amuses/disgusts/horrifies/irritates himself.

b. John killed/hurt himself.

(29) Muḥammad$_i$ bi-yi-tʕib nafs-u$_i$
Muhammad BI-3-tire.IMP.SGM self-3SGM.ACC
Muhammad tires himself. ECA

(30) In-dejjq-u$_i$ lil xulxin$_i$ / lilna nfus-na$_i$ xi kultant
1-bother.IMP-PL ACC each.other / us breath-1PL.ACC some time
We bother each other/ourselves sometimes. MT

Our investigation of the syntactic properties of these verbs, in which the experiencer argument maps to a lower function than SUBJ leads us to conclude that there is good evidence that the experiencer is a *bona fide* OBJ for verbs in this class. In particular, it appears to lack many of the special properties often ascribed to EOs. In the following section, we turn to a completely different set of verbs which embed verbal complements, before turning in section 4 to the interaction of these two classes of predicates.

3 Aspectual or Phasal verbs

By aspectual or phasal verbs we refer to a cass of predicates which take a verbal complement and which denote the inception, duration, continuation or termination (and so on) of an event or state. Such verbs are typically either PRED-less auxiliaries, or (more often) control or raising predicates. A representative sample of verbs in this class for the dialects we discuss is given in Table 2; (31) and (32) exemplify the structure.

Meaning	HA	ECA	MT
begin	bada/qām	badaʔ	beda/qam
remain	qaʕid/ḍal	ʔaʕad/fedel	baqa'/fadal
finish/achieve	baṭṭal/liḥiq	battal/leḥeʔ	laħaq
repeat	-	regeʕ	reġa'
(be)near/almost	qarrab	ʔarrab	qorob
become	ṣār	baʔa	sar

Table 2: Aspectual/Phasal Verbs

[8]A fourth observation is that EOPV but not standard transitives permit both scopings of SUBJ and OBJ in cases such as (8) (Kim and Larson, 1989).

(i) a. What worried everyone? what> ∀, ∀ > what

b. Who hit everything on purpose? who > ∀, *∀ > what

We have not yet investigated this for the dialects.

(31) Beda j-i-ġbor l-iltiema
begin.PV.3SGM 3-FRM.VWL-gather.IMP.SGM DEF-orphans
He started gathering the orphans. MT

(32) el-welād badaʔ-u ya-kl-u
DEF-boy.PL start.PV-3PL 3-eat.IMP-PL
The boys started to eat. ECA

The most salient properties of this class of verbs include the fact that they are time reference dependent. Al-Aqarbeh (2011) provides extensive discussion of the complementation patterns of Jordanian Arabic (JA), documenting this property (amongst others) for JA *ballash* 'begin', see (33), and other verbs in this class.

(33) ʕali ballash yi-ktub i-risalih
Ali begin.PV.3SGM 3-write.IMP.SGM the-letter
Ali began to write the letter. (Al-Aqarbeh:128) JA

Further salient properties are that (i) they take verbal (or nominalised verbal) complements, (ii) typically nothing intervenes betwen the aspectual verb and its verbal complement, (iii) that generally, there is no embedded complementiser, (iv) the aspectual verb and the embedded verb have the same SUBJ, which is not expressed as an NP in the lower clause, and (v) the embedded verb shows subject agreement and is a morphologically finite form.

Arabic does not have an infinitival verb form, although it does have a nominal (verb-noun) form, the *masḍar*, and participle forms. Morphologically, the basic contrast is between the perfective and the imperfective stem. In Classical Arabic (and MSA) the imperfective stem is used to form the imperfective indicative, the future and two 'moods' — the jussive and the subjunctive in the Western tradition. These moods are essentially dependent verb forms used in a variety of contexts.[9] The dialects which we discuss here all display a basic contrast between perfective, imperfective and future (the form of the latter involving a prefix added to the imperfective forms). In addition, ECA (and other dialects such as JA) distinguish between an imperfective form with a *bi-* prefix, which is used in most indicative declarative contexts and seems to be essentially a realis form, and a 'bare' imperfective form, which is used in many modal and embedded contexts, and may be thought of as an irrealis form. We simply gloss the former form as BI. Formally, the distinction made by the Classical Arabic system of moods built on the imperfective verb form does not exist in HA (as far as we are aware) and MT. The verbal complements to the class of aspectual verbs across all three dialects are usually the imperfective forms (and in ECA usually bare imperfective forms), but perfective and future forms are not completely excluded.

[9] Compound tenses are formed using combinations of imperfective and perfective verbs with perfective and imperfective forms of *kān* 'be'. The fact that the basic perfective and imperfective forms can be used to relate speech time to reference time and to relate reference time to event time provides significant evidence that morphological forms must be sharply distinguished from their (multiple) interpretations. See Fassi Fehri (2012) for some discussion of the Arabic tense and aspect system.

Evidence that the aspectual verbs have PRED values and hence head their own f-structures (rather than forming complex predicates with the lexical verb or introducing only featural information under a co-head analysis) comes from their interaction with modifiers and with negation. Consider the meaning distinction which arises between (34a) and (34b), and similarly between (35a)-(35b) and (36a)-(36b), according to whether the aspectual verb or the embedded verb is negated. Example (37) shows that modification may target the predicates separately (and this is true also of the other dialects).

(34) a. el-walad ma-badaʔ-š ya-kul
DEF-boy NEG-start.PV.3SGM.NEG 3-eat.IMP.SGM
The boy didn't start to eat. ECA

b. el-walad badaʔ ma-ya-kul-š
DEF-boy start.PV.3SGM NEG-3-eat.IMP.SGM.NEG
The boy started to not eat. ECA

(35) a. ma ḍal ʔa-kallim-ak kul yawm.
NEG remain.PV.3SGM 1SG-speak.IMP-2SG.ACC every day
I will not remain/stay talking to you every day. HA

b. qaʕid ʔali ma ya-kallim-ni li modat ʔisbūʕ.
stay.PV.3SGM Ali NEG IMP.3-speak-1SG.ACC for period week
Ali stayed not talking to me for one week. HA

(36) a. Ma n-o-qgħod-x in-kellm-ek
NEG 1-FRM.VWL-stay.IMP.SG-NEG 1-speak.IMP.SG-2SG.ACC
darb'oħr-a
once.SGF.another-SGF
I won't stay speaking to you next time.
I will not endure speaking to you next time. MT

b. Qagħad ma j-kellim-ni-x għall-ġimgħa
stayed.PV.3SGM NEG 3-speak.IMP.SGM-1SG.ACC-NEG for.DEF-week.SGF
sħiħ-a
complete-SGF
He stayed not talking to me for a whole week. MT

(37) a. Jekk j-i-bde-w kull darba j-morr-u l-għada
if 3-FRM.VWL-start.IMP-PL every once 3-go.IMP-PL DEF-tomorrow
If they start all the time going the next day ... MT

b. Jekk j-i-bqa' l-ħin koll-u
if 3-FRM.VWL-stay.IMP.SGM DEF-time.SGM all-3SGM.ACC
j-iekol ħafna
3-eat.IMP.SGM a.lot
If he remains all the time eating a lot.... MT

If we are correct in arguing that the aspectual verb has a PRED value, the verbal complement (with controlled subject) could in principle be a case of control or raising. We believe that the evidence favours the conclusion that this is in fact raising.

First, at least some verbs in this class, but not all, allow a variant structure in which the aspectual verb takes default 3SGM agreement (and no NP subject) and the embedded verbal complement may contain its own independent subject. (35a) above illustrates that the HA *ḍal* 'remain' permits this: others include MT *baqa'/fadal* 'remain', *sar* 'become' and *laħaq* 'achieve'.[10] If these are raising verbs, then both variants have the same set of thematic or semantic arguments. But under a control analysis, the two variants of the verb do not share a single thematic/semantic argument frame underlying the surface valency patterns. (38) shows that both patterns occur with MT *sar* 'become', in contrast with HA *ṣar* 'become', which does not permit the 3SGM default/impersonal pattern. In (40) both the aspectual verb and the embedded verb show 3SGF agreement with the subject 'she', in contrast to (41), which shows default agreement on the aspectualiser.

(38) Sar/sar-et ma t-i-swa xejn
become.3PV.SGM/become.PV-3SGF NEG 3-FRM.VWL-cost.IMPV.SGF nothing
il-ħajja
DEF-life.SGF
It became such that life costs nothing, i.e. is futile. MT

(39) ṣar-at/*ṣar ma ti-swa ḥāǧah al-ḥayāh.
become.PV-3SF/*become.PV.3SGM NEG 3SGF-cost.IMP thing DEF-life
It becomes such that life costs nothing. HA

(40) Qed t-i-bqa' t-webbes ras-ha
PROG 3-FRM.VWL-remain.SGF 3-make.hard.IMP.SGF head-3SGF.ACC
Lit: She is continuing to harden her head.
She keeps being hard-headed. MT

(41) Baqa' n-a-għmel dan koll-u
remain.PV.3SGM 1-FRM.VWL-do.SG DEM.SGM all-3SGM.ACC
Lit: It remains I do all this.
I still have to do all this. MT

For MT in particular, we find structures with multiple embedded impersonal (default 3SGM) verb forms, with the thematic argument expressed by a DAT-marked pronoun, suggesting that these verbs impose no selectional restrictions on their SUBJ.

[10] There is very little literature on the topic of subjectless, expletive subject or impersonal constructions in Arabic. However see Firanescu (2010) for discussion of a similar pattern with a subset of aspectual verbs in Syrian Arabic.

(42) Ha j-e-rġa' j-i-bda
PROSP 3-FRM.VWL-repeat.IMP.SGM 3-FRM.VWL-start.IMP.SGM
j-kol-l-i mara t-għin-ni fid-dar
3-be.DAT-1SG woman 3-help.IMP.SGF-1SG.ACC in.DEF-house
Lit: It will repeat start it be to-me a woman helps me in the house
I will again start having a woman helping me in the house MT

Second, aspectual predicates (irrespective of whether they permit impersonal constructions such as those illustrated in (41) above) do not appear to impose any selectional restrictions on their subjects, permitting human, inanimate and idiom chunks (preserving idiomatic meaning). Inanimate subjects are shown in (43) and (44) and an idiom chunk in (45).

(43) al-bard bada ya-ğì.
DEF-cold start.PV.3SGM 3-come.IMPV.SGM
It started being cold. HA

(44) Baqgħ-et t-a-għmel/nieżla
remain.PV-3SGF 3-FRM.VWL-do.IMP.SGF/PROG.PRT.falling.SGF
x-xita
DEF-rain.SGF
The rain continued falling/It continued to rain. MT

(45) Alla skont il-muntanja (j-i-bqa')
God according DEF-mountain (3-FRM.VWL-remain.IMP.SGM)
j-ti-ha s-silġ
3-give.IMP.SGM-3SGF.ACC DEF-ice/snow
Lit: God keeps giving snow according to the mountain.
God will never give you more than you can handle. MT

Third, the passivisation test supports the conclusion that these verbs are instances of raising: the version with an active embedding in (46) and the corresponding passive embedding in (47) are equivalent in meaning in the sense that they describe the same event, as is expected with raising verbs but not with control.[11]

(46) el-walad badaʔ ya-kul el-ʔakl
DEF-boy start.PV.3SGM 3-eat.IMP.SGM DEF-food
The boy started to eat the food. ECA

[11]Note that the aspectual verb 'start' in (47) is given here in the VIIIth binyan, but this is not itself a passive: it is the embedded verb which is passive. It would also be possible to use an (underived) Ist binyan form here, although the resultant sentence is less natural.

(i) el-ʔakl badaʔ yi-t-ākel
DEF-food start.PV.3SGM 3-PASS-eat.IMP.SGM
The food started to be eaten. ECA

(47) el-ʔakl ʔibtada yi-t-ākel
DEF-food start.PV.3SGM 3-PASS-eat.IMP.SGM
The food started to be eaten. ECA

(48) a. bada ya-ğamiʕ al-maḥṣūl
start.PV.3SGM 3-gather.IMP.SGM DEF-harvest
He started gathering the harvest. HA

b. al-maḥṣūl bada ya-n-ğimʕ
DEF-harvest start.PV.3SGM 3-PASS-gather.IMP.SGM
The harvest started being gathered. HA

(49) a. Beda j-i-ġbor l-iltiema
begin.PV.3SGM 3-FRM.VWL-gather.IMP.SGM DEF-orphans
He started gathering (together) the orphans. MT

b. L-iltiema bde-w j-i-n-ġabr-u
DEF-orphans begin.PV.3-PL 3-FRM.VWL-PASS-gather.IMP-PL
The orphans started being gathered (together). MT

This section has considered the behaviour of a class of verbal predicates, the aspectual or phasal verbs, all of which take same subject verbal complements, while a small number of them also permit a construction with an impersonal or expletive subject. These temporally dependent complements are usually, but not always, in the imperfective form. In ECA, which distinguishes a clearly tensed realis form of the imperfective (using the verbal prefix *bi-*) from a dependent form of the imperfective (used inter alia in modal contexts), it is the dependent form of the imperfective which is used. Standard tests for distinguishing cases of raising from control support the conclusion that verbs in this class are raising verbs. We suggest that this is indeed the case. There is no reason in principle to reject a raising analysis on the basis of the embedded verbal morphology. First, there is substantial evidence in the literature that languages including Greek, Romanian, Bulgarian, Nguni, Shona, Kikuyu and Kirundi have finite raising or hyperaising. Second, we must clearly distinguish the use of particular surface *forms* (that is, finiteness as a inflectional property of verbs) from grammatical content (that is, FINITENESS as a property of a clause in discourse); see Sells (2007) for discussion of this point. The use of morphologically finite verb forms in Arabic does not then necessarily entail that these verbal complements are syntactically FINITE, and certainly does not rule out a raising analysis using functional control, even if it should turn out that they are in fact syntactically finite. Arka (2000) suggests an f-control analysis for raising out of finite complements in Indonesian, while on the other hand Asudeh (2005, 495) proposes that all cases of finite control should be analysed as obligatory a-control. On the basis of the observations made in this section, we suggest that these aspectual verbs are indeed raising predicates.

4 EOPV complements to Aspectual Predicates

In section 2 we argued that a certain class of psychological predicates in the Arabic vernaculars ECA, HA and MT are EOPVs: the stimulus or theme argument is SUBJ and the experiencer argument is usually OBJ, sometimes OBJ_{θ} or OBL. In section 3 we argued that a class of aspectual or phasal verbs in these dialects are subject to subject raising verbs (with a small number of verbs in this class also permitting a non-raised construction, with default 3SGM verbal morphology). If these observations are along the right track, it is expected that the EOPV non-experiencer argument will raise in the complement of an aspectual verb. This is shown in (50)-(52).

(50) el-welād bada?-u yi-day?-u mona
DEF-boys start.PV-3PL 3-annoy.IMP-PL Mona
The boys started to annoy Mona. ECA

(51) bad-u al-?awlād yu-ḍayiq-ū-n mona
started.PV.3-PL the-boys 3-annoy.IMP-PL-IND Mona
The boys started to annoy Mona. HA

(52) Is-subien bde-w i-dejq-u 'l-bniet
DEF-boys started.PV.3-PL 3-bother.IMP-PL ACC.DEF-girls
The boys started to bother the girls. MT

Abstracting away from a number of details (for example simply using the gloss labels as VFORM:VALUE pairs), and assuming for the purposes of illustration an XCOMP f-control analysis rather than a COMP a-control analysis, the structure of such examples would be as in (53), and the lexical entry for a verb form such as that in (50) would include the information in (54).

(53)
$$\left[\begin{array}{ll}
\mathrm{PRED} & \text{‘BEGIN} < \mathrm{XCOMP} > \mathrm{SUBJ}\text{’} \\
\mathrm{VFORM} & \mathrm{PV} \\
\mathrm{SUBJ} & \\
\mathrm{XCOMP} & \left[\begin{array}{ll}
\mathrm{VFORM} & \mathrm{IMP} \\
\mathrm{PRED} & \text{‘ANNOY} < \mathrm{SUBJ\ OBJ} > \text{’} \\
\mathrm{SUBJ} & \left[\begin{array}{ll}
\mathrm{PRED} & \text{‘BOYS} \\
\mathrm{NUM} & \mathrm{PL} \\
\mathrm{PERS} & 3 \\
\mathrm{DEF} & +
\end{array}\right] \\
\mathrm{OBJ} & \left[\begin{array}{ll}
\mathrm{PRED} & \text{‘MONA’} \\
\mathrm{NUM} & \mathrm{SG} \\
\mathrm{PERS} & 3
\end{array}\right]
\end{array}\right]
\end{array}\right]$$

(54) *bada?*-u:
($\uparrow$ PRED) = ‘BEGIN< XCOMP> SUBJ’
($\uparrow$ XCOMP VFORM) = IMP

However, the intriguing fact is that a further possibility is found robustly in HA and ECA, but not in MT. In these cases, the EO in the embedded clause is apparently allowed as SUBJ of the matrix aspectual predicate, with the EO being a pronominal form that is co-referent with the matrix subject. Examples in (55)-(58) illustrate this pattern with various word orders: note that the aspectual verb agrees with *Mona* (the experiencer of the embedded predication) and the psych verb agrees with *the boys* (the stimulus).

(55) badaʔ-et mona yi-dayʔ-ū-ha el-welād
start.PV-3SGF Mona 3-annoy.IMP-PL-3SGF.ACC the-boys
Mona started to be annoyed by the boys. ECA (VSVS)

(56) mona badaʔ-et yi-dayʔ-ū-ha el-welād
Mona start.PV-3SGF 3-annoy.IMP-PL-3SGF.ACC the-boys
Mona started to be annoyed by the boys. ECA (SVVS)

(57) mona bad-at ya-ḍayiq-un-aha al-ʔawlād
Mona start.PV-3SGF 3-annoy.IMP-PL-3SGF.ACC the-boys
The boys started to annoy Mona. HA (SVVS)

(58) mona bad-at al-ʔawlād ya-ḍayiq-un-aha
Mona start.PV-3SGF the-boys 3-annoy.IMP-PL-3SGF.ACC
The boys started to annoy Mona. HA (SVSV)

Although we have not (yet) made any systematic investigation of written MSA sources, and we know of no literature on MSA (or indeed on any of the dialects) which discusses the possibility of this unusual pattern of apparent raising, the following example, taken from Haddad (2012, 73), appears to illustrate a similar phenomenon in MSA. In the second conjunct of (59) (*wa-badʔa-at ya-ġlib-u-hā l-sawād-u l-kāḥil*) the aspectual verb agrees with what is also the SGF object of the psych verb *ya-ġlib-u* 'overcome' while the psych verb agrees with its SGM subject *l-sawwad-u l-kāḥil* 'pitch blackness'. Note that here too, the raised subject also occurs as an OBJ affix on the embedded predicate.

(59) Sawwad-ū l-malāmiḥ-a l-ʔarabīyat-a wa-badʔa-at
blacken.PV.3-MPL DEF-features-ACC DEF-Arab-ACC and-started.PV-3SGF
ya-ġlib-u-hā l-sawād-u l-kāḥil
3-overcome.IMP-IND-3SGF.ACC DEF-blackness-NOM DEF-pitch
They tarnished the Arab face, and it started to look pitch black. MSA

The existence of this construction, which to our knowledge has not been discussed in the literature on (varieties of) Arabic, raises many interesting analytic questions, which we cannot address in full here. In particular, it has a number of characteristics in common with Copy Raising (CR), and these commonalities suggest a possible analysis.[12] In recent work, Asudeh (2012) and Asudeh and Toivonen (2012) distinguish English copy raising, illustrated in (60), from a complementation pattern found with perceptual resemblance verbs (such as *look, sound,...*), illustrated in (61).

(60) Chris seemed like he enjoyed the marathon.
John seems like the judges ruled that he defeated Mary.
John seems like Mary defeated him.

(61) John looked/sounded/smelled like Bill had served asparagus.

Copy raising with verbs such as *seem, appear* has the following characteristics: (i) a pronominal copy of the raised subject is found in the complement of the copy raising verb (according to Asudeh and Toivonen (2012) the copy is obligatory for nearly all speakers of English); (ii) the copy raised subject must be interpreted as a perceptual source (PSOURCE). Note that PSOURCE is not a *thematic argument* of the copy raising verb, but is an entailed participant in the state that the verb denotes (Asudeh and Toivonen, 2012, 334). On the other hand, Asudeh and Toivonen (2012) argue that this argument *is* thematic in the case of the perceptual resemblance verbs (see *inter alia* Landau (2011) for a different view on copy raising verbs and the notion of thematic argument).

A striking aspect of the Arabic construction we focus on here relates to this key notion of a PSOURCE, which seems to be applicable to the circumstances in which these 'raised object' constructions arise. Asudeh and Toivonen (2012) note for English and Swedish that "a copy raising subject is interpreted as the PSOURCE - the source of perception - and ascribing the role of PSOURCE to the subject is infelicitous if the individual in question is not perceivable as the course of the report." This also appears to hold for the distribution of this construction in Arabic. Examples such as (55)-(58) above are felicitious (roughly) when the state of affairs can be verified by inspection of *Mona*: that is, *Mona* is a perceptual source. This is naturally often the case when the embedded predication is a psych verb. Although we are at an early stage of investigating this pattern for other classes of verbs, we have found that examples of this 'raised object' construction such as (62) and (63) are acceptable under particular conditions, for example when inspection of the state of the car leads one to conclude that Ali has started driving it. This is perhaps suggestive of a connection to the PSOURCE factor which is at work in English and Swedish copy raising, although these remarks are necessarily highly speculative at this point.

(62) el-ʕarabeyya badaʔ-et yi-suʔ-ha ʕali
DEF-car(SGF) started.PV-3SGF 3-drive.IMP.SGM-3SGF.ACC Ali
The car started to be driven by Ali. ECA

[12] In addition to our discussion here, Sadler (2013) provides for a preliminary exploration of how the approach of Asudeh (2012) and Asudeh and Toivonen (2012) might be extended to the Arabic data, although many questions remain unexplored.

(63) badaʔ-et el-ʕarabeyya ʕali yi-suʔ-ha
started.PV-3SGF DEF-car(SGF) Ali 3-drive.IMP.SGM-3SGF.ACC
The car started to be driven by Ali. ECA

In MT we do not find this construction at all with the aspectual/phasal verbs. However, it does seem to occur with verbs such as *seem, happen*. In (64) the matrix verb agrees with the experiencer of the embedded predication in the raised version, and may alternatively show default 3SGM agreement, with *Marija*, (if present), left or right dislocated from the embedded clause containing the OBJ pronominal. A further example showing putative 'object raising' is given in (65).[13]

(64) (Marija) t-i-dher/j-i-dher (li)
Mary 3-FRM.VWL-appears.IMP.SGF/3-FRM.VWL-appears.IMP.SGM COMP
j-o-għġob-ha dal-ktieb (Marija)
3-FRM.VWL-pleases.IMP.SGM-3SGF.ACC DEM.SGM.DEF-book.SGM Mary
Mary, it appears that the book pleases her.
Mary appears such that this book pleases her. MT

(65) Seħl-u/seħel qabad-hom n-ngħas.SGM
happen.PV.3-PL/happen.PV.3SGM catch.PV.3SGM-3PL.ACC DEF-sleepiness
It appears that they were overcome by sleepiness.
They happened to be overcome by sleepiness. MT

A characteristic of CR (see the examples in (60)) is that the copy can be embedded at some distance within the complement. We can show this to be the case with the pseudo-verbs of appearance such as *donn-* or *qis-*. These so-called pseudo-verbs in MT are aspectually defective predicates which use ACC bound pronominal forms to code what is in fact (we believe) their SUBJ argument. The examples in (66) and (67) show that agreement on the matrix (pseudo-verb) predicate may be controlled by either argument of an embedded EOPV: that is, alongside the expected pattern in which the theme or stimulus is raised (*donn-kom* and *qis-u*, respectively), an alternative is grammatical in which the experiencer controls agreement on the pseudo-verb. The crucial example is now (68): here an additional level of embedding is inserted into the complement of the pseudo-verb by adding an aspectual predicate, and we see that the pseudo-verb may still agree with the (experiencer) object of the embedded psych predication, showing the long distance pattern also found in cases of CR in other languages. Both the long distance agreement and the appearance of the pronominal copy in a range of different grammatical functions[14] would follow from the analysis of CR proposed by Asudeh and Toivonen (2012) which involves anaphoric binding between the matrix SUBJ (as the antecedent) and the embedded GF.

[13] It appears so far that this 'object raising' pattern is heavily restricted: the examples we give all involve embedded EOPVs.

[14] In MT the copy can be an OBJ, OBJ_θ, POSS or OBL OBJ.

(66) Donn-kom/ha għoġob-t-u-ha
think-2PL.ACC/3SGF.ACC pleased.PV-2-PL-3SGF.ACC
She seems to have been pleased by you.
You seem to have pleased her. MT

(67) Qis-u/hom għelib-hom
measure-3SGM.ACC/3PL.ACC overcome.PV.3SGM-3PL.ACC
in-ngħas.SGM
DEF-sleepiness.SGM
They seem to have been overcome by tiredness.
Tiredness seems to have overcome them. MT

(68) Qis-ha / donn-ha ġa bde-w
measure-3SGF.ACC / think-3SGF.ACC already started.PV.3-PL
j-i-stkerrh-u-ha
3-FRM.VWL-disgust.IMP-PL-3SGF.ACC
She seems/appears as though they already started disgusting her. MT

If the observations in this section are on the right track, a promising approach would be to extend the style of analysis outlined in Asudeh (2012) and Asudeh and Toivonen (2012) to these data from the Arabic dialects. Such an analysis would need to take account of a number of syntactic differences between these constructions and English Copy Raising, not least the lack of an intervening *as if, like* predication, which plays a crucial role in the syntactic part of that analysis. Since our concern here is mainly with establishing and discussing the data patterns which we have investigated, we leave these details of analysis for future work.

5 Conclusion

This paper has aimed to make a contribution to the syntactic description of the contemporary Arabic vernaculars from the perspective of LFG. We have investigated two classes of verbs. We have shown that the dialects in question have a class of psych predicates in which the experiencer is realized as a surface OBJ, and we have shown that this argument shares the properties we associate with normal transitive objects. We then showed that the dialects have a class of aspectual verbs which should be treated as subject-subject raising verbs. The final section explored the interaction of these two classes of verbs, where we see a construction which bears a number of resemblances to Copy Raising.

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NOMINAL ASPECT IN MARORI

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Abstract

This paper discusses nonverbal TAM (Tense-Aspect-Mood), focusing on the completive perfective stative aspect marked by *-on* in Marori (a Papuan language of Southern New Guinea). The nonverbal aspect is grammatical in nature, with its coding local but possibly imposing a nonlocal morphosyntactic constraint on the clausal auxiliary verb. In terms of Nordlinger and Sadler's (2004) typology, Marori nonverbal aspect marking belongs to two types: the Independent Nominal and the Propositional Nominal Aspect types. It is demonstrated that its broad aspectual meaning, in terms of Reichenbach's notation, is [E-R,S], which is exactly the same as the Present Perfect in English. While having this similar broad meaning as with English, its morphosyntactic realisation and constraints in the grammar are quite different. An LFG analysis accounting for the distribution of *-on* is proposed, making use of the inside-out mechanism to account for the non-local constraint of *-on*, which extends to the clausal TAM.

1 Introduction*

TAM (Tense-Aspect-Mood) has traditionally been considered a property of verbs. However, cross-linguistic studies by Sadler and Nordlinger (2001) and Nordlinger and Sadler (2004) show that non-verbal tense is not unusual, and encountered in many languages. There is a debate, however, about whether there is indeed any such thing as nominal tense as discussed by Nordlinger and Sadler (2004). Tonhauser (2008), after examining the full range of the semantics of the nominal temporal marker in Guaraní (which is included in Nordlinger and Sadler's typology), disagrees with Nordlinger and Sadler's analysis (or label) of the Guaraní markers as nominal TNS markers, because these markers do not tally their properties with the verbal tense in this language.

In this paper, I present fresh data from Marori (a highly endangered Papuan language of Southern New Guinea, Indonesian west Papua, around a dozen of fluent speakers left) contributing to this debate, providing further empirical evidence for non-verbal tense-aspect. In line with Nordlinger and Sadler's stance, I argue that Marori does have a grammatical nominal (tense-)aspect. The Marori data also reveals that it exhibits both Independent/Local Nominal Aspect and Propositional/Clausal Nominal Aspect. In addition, Marori exhibits a

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complex interplay between tense and aspectual properties, with distinct temporal anchors relevant for both sub-clausal and clausal units, forming a constructed aspect coding, thus adding another mixed type, not noted by Nordlinger and Sadler in their nominal TAM typology.

The paper is structured as follows. A brief overview of Marori clausal structure in given in section 2, followed by a description of Marori TAM and the associated domains in section 3. Nonverbal aspect by *-on* is presented in section 4, and the interaction between local aspect marking and its clausal constraint is discussed in section 5. The LFG analysis with its discussion is given in section 6, which is followed by the conclusion in section 7.

2 A brief overview of Marori clausal structure

The basic clausal structure in Marori depicted in (1) shows that it is a non-configurational verb-final language. Argument (subject and object) NPs typically come before the verb, without a fixed order, but they may also appear after the verb. The verbal predicative complex typically consists of a lexical predicate (X), not necessarily a verb, which is immediately followed by a (light or auxiliary) verb (V). The verb is inflected bearing tense, aspect and mood (TAM) agreement morphology. Certain lexical of high frequency such as 'run', 'walk', and 'sit' are directly affixed with TAM morphology.

(1)	NP*	,	X	V
	(argument)		(lexical predicate)	(inflected)

Marori marks heads as well as dependents. In general, an agentive argument receives suffixed verbal agreement, whereas a patientive argument receives prefixed verbal agreement. The internal morphological makeup of the verb is quite complex, showing not only nominal argument number but also verbal number (or pluractionality).[1] The verbal template is given in Figure 1. As shown, the prefix encodes S/O agreement, whereas the suffix encodes S/A agreement.[2] The circles indicate that number

[1] See Arka (2011) for discussion of verbal number in Marori.

[2] The abbreviations S, A, and O follow their traditional use in typological linguistics: S (intransitive subject), A (transitive subject), and O (transitive object). Other abbreviations used in the example glosses are alphabetically ordered: 1,2,3 (first, second and third person), AUX (auxiliary), CPLT (completive), D.AUX (dynamic auxiliary), DEIC (deictic), DUR (durative), F (feminine), FUT (future), HAB (habitual), LOC (locative), IRR (irrealis), NPL (nonplural), M (masculine), MP (macro present), NrPST (near past), O (object), PL (plural), POSS (possessive), PRES (present), Q (question marker), REAL (realis), STAT (stative), SG (singular), U (undergoer).

information is distributed across different exponents in an overlapping space.

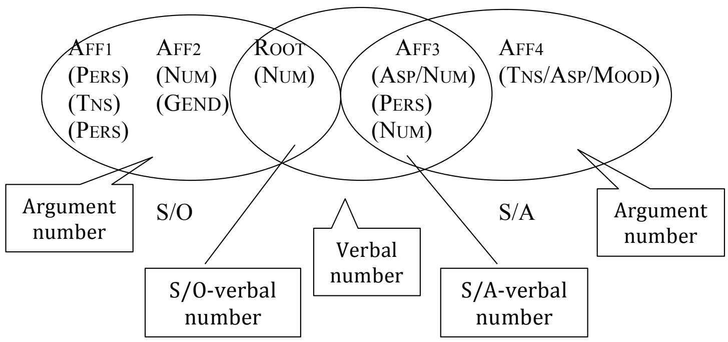

Figure 1. Verbal template in Marori (Arka 2011)

Free pronouns and S/O prefix forms in Marori show a singular/nonsingular (SG/NSG) distinction, shown in Table 1. The corresponding S/A suffixes are quite complex, as shown in Tables 2–3. These suffixes are portmanteau forms showing person, number, tense, aspect, and mood. They are of two classes, depending on the aspectual properties they encode in their past tenses: completive (or telic) and durative.[3] Note that there is often syncretism between the singular and dual forms, giving rise to a nonplural (singular or dual) vs. plural contrast.

Free core argument NPs are marked showing an apparent split-S system (though intransitive motion verbs complicate the picture, as we show below): patientive NPs receive the *=i* clitic and prefix verbal agreement, whereas agentive NPs are unmarked and receive suffix verbal agreement. Thus, the patientive intransitive subject (S.p) and the transitive object (O) are treated in the same way, i.e. marked by *=i*. As seen in (2), *na* '1SG' is marked by *=i* and receives the prefix *y(u)/i-* agreement on the verb.

		1	2	3
Free Pronoun:	SG	*na*	*ka*	*efi*
	NSG	*nie*	*kie*	*emnde*
S/O Pref:		*i-*	*k-*	*∅-*

Table 1: Free pronouns and S/O prefixes in Marori

[3] The formatives *-re*/*-ro*/*-ri* are, strictly speaking, not a part of the pronominal argument suffixes but mark Actor verbal number (S/A verbal number, see Figure 1). They are included here to show that they serve to encode the general opposition of underspecified NSG vs. PL.

	(1a) IRR/FUT			(1b) NrPST (Completive)			(1c) RmPST (Completive)		
	1	2	3	1	2	3	1	2	3
SG	*-ru*	*-Ø*	*-Ø*	*-ben*	*-f*	*-f*	*-fori*	*-fi*	*-fi*
DU	*-ren*	*n--Ø*	*-Ø*	*-ben*	*n- -f*	*-f*	*-fori*	*n- -fi*	*-fi*
PL	*-men*	*n-(ri)m*	*-(ri)m*	*-freben* *-frendu*	*n- -(fre)f*	*(fre)f*	*-mbrofori*	*-mbrofi*	*mbrofi*

Table 2: Class 1 Argument suffixes in Marori

	(2a) REAL/MacroPRES (Completive/extended)			(2b) NrPST (Durative)			(2c) RmPST (Durative)		
	1	2	3	1	2	3	1	2	3
SG	*-du*	*-Ø*	*-Ø*	*-men*	*-m*	*-m*	*-maf*	*-maf*	*-maf*
DU	*-den*	*n-Ø*	*-Ø*	*-men*	*n- -m*	*-m*	*-maf*	*n- -maf*	*-maf*
PL	*-men*	*n--Ø*	*-Ø*	*-ben*	*n- -b/-m*	*-b/-im*	*-baf*	*n- -baf*	*-baf*

Table 3: Class 2 Argument suffixes in Marori

(2) Patientive argument NPs: S.p=O

a. *na=i patar yu-nggo-f*
1SG=U cold 1SG-AUX-NrPST
'I suffered from being cold.'

b. *Pa na=i Thomas ter=i-mo-∅*
soon 1SG=UThomas hit-1-AUX-3
'Thomas will hit me.'

Neither the transitive subject (A) nor the agentive intransitive subject (S.a) can be marked by *=i*. They receive verbal suffix agreement.

(3) Agentive argument NPs: S.a=A

a. *na (*=i) fis kund-ra-**mon***
1SG yesterday run-PL-1NPL.DUR.PST
'I was running yesterday.'

b. *na tefye-**ben** menjun awo=i paya-ke*
1SG seeSG.M.O-1SG.NrPST small.SG kangaroo=U forest-LOC
'I saw a small kangaroo in the forest yesterday.'

In a ditransitive structure, *=i* typically marks the recipient (R) object NP as in (4)a. Both objects can be marked with *=i* as in (4)b. It is the R object that gets verbal object agreement, as seen from the contrast between (4)a and (4)c.

(4) Ditransitives

a.

Nawa	*tamba*	*Albert=**i***	*njime-ben*	*bosik.*
1SG	already	Albert=U	3SG.O.M.give-1NPL.NrPST	pig

'I already gave Albert a pig.'

b.

Pafe	*sorweri=**i***	*John*	*jim-im*	*poyo=**i***
DEF	basket=U	John	fill-DUR.NrPST	coconut=U

'The basket was filled (with) coconuts by John.'

c.

Na	*njomo-bon*	*Maria=i*	*bosiki*	*sokodu.*
1SG	3SG.O.F-1NPL.NrPST	Maria=U	pig	one

'I already gave Maria a pig.'

It should be noted that Marori does not have a strictly split-S system because motion verbs pattern like A (with suffix agreement), irrespective of whether they are patientive or agentive. Importantly, the subject of the motion verb cannot received the *=i* clitic.

(5)

*na /*ni=u*	*fis*	*kwi*	*uyow*	*soron-ndu*
1SG	yesterday	tree	top	fall-1SG.PRES

'I fell off from the tree yesterday.'

Having outlined the basic morphosyntax in Marori, I now present the TAM system in both the verbal and non-verbal domains in Marori.

3 TAM and their associated domains

Marori has a grammatical TAM system, which, for Marori means that tense, aspect and mood are obligatorily marked in finite sentences and impose certain morphosyntactic constraints. Tense Aspect and Mood are tightly intertwined and are expressed by portmanteau morphemes on the finite verbs. Each is now described separately. For the purpose of exposition, I assume Riechenbachian (two-dimentional) theory of tense-aspect (Reichenbach 1947: 297, Kamp and Reyle 1993).

3.1 Tense and aspect

The term 'tense' refers to morphosyntactic oppositions (typically on the verb but also on non-verbal units) that encode linear temporal relations between event time (E) and a reference point (R). R such as 'yesterday' (past tense) or 'tomorrow' (future tense) is not, however, always explicitly expressed. Tense is related to, but not the same as, temporal perspective/viewpoint, or viewpoint aspect.[4] This is the relation between R and S (speech or utterance time). These temporal points interact with aspectual properties such as stativity/durativity, inception, culmination/termination and result, typically inherent to or determined by certain event types (or lexical classes). This is lexical aspect. In this subsection, I demonstrate that tense, viewpoint aspect and lexical aspect interact in a complex way, giving rise to a TAM system that is quite distinct from familiar Indo-European languages such as English.

The first salient property is the classification of the temporal line into a rather nonsymmetrical four-way TENSE system: Present (PRES), Near Past (NrPST), Remote Past (RmPST), and Future (FUT). There is no remote future. In addition, the present tense form is usable for temporal points covering today, yesterday and tomorrow; hence we can say that there is a category of macropresent in Marori. The tense categories mapped onto the temporal line are shown in Figure 2.

As seen, the meaning of the TNS categories are described in terms of Reichenbach's contextual temporal anchors at the bottom part of the diagram: S (speech time), R (reference time), and E (event time). Different lines showing different combinations of temporal points correspond to different morphological shapes of verbs (distinct root and inflectional/agreement suffixes), whose classes are numbered and given on the right of the bottom part of the diagram. The numbers refer to the suffix types shown in Tables 2–3. The tense complexity arises due to the fact that there is more than one way of expressing the same temporal relation. For example, the future meaning [S-E,R] can be expressed by using the future tense, making use of the irrealis verb (1a), or by using the (macro)present tense by making use of the realis verb (2a). The reverse

[4] Note that, while using Reichenbach's labels S, R and E, I follow Kamp and Reyle (1993:598) in defining tense as the temporal relation between the location time of the described eventuality (E) and Temporal Perspective point (TPpt), or R. Note that in Reichenbach's original conception, tense is the temporal relation of R and S, which in Kamp and Ryle's analysis is a TP (Temporal Perspective) relation. This TP, also known as Viewpoint Aspect, is distinct from Lexical Aspect, or *Aktionsart*. The term 'Aspect' used in this paper to refer to Aspect in its two senses, discussed in 3.2. The focus of this paper, however, is Aspect in its Viewpoint/TP sense. It shows complex temporal properties analysable the 'anterior present' (tense) in Reichenbach's system, or the Perfect, a category between tense and aspect (Kibort 2009). Unlike Kamp and Reyle who make use of [+/–STAT] and [+/–PERF] features, in addition to [+/–PAST] (as the values of TP) and *past/pres/fut* (as the values of TENSE), I keep Richenbach's simple labels of E, R and S. These simple primitives *are* arguably adequate to capture the tense-aspect meanings in Marori.

also holds: the same tense, in particular the macropresent tense, can be used to express more than one temporal relation. This is exemplified in (6) where the same verb form (with the verbal suffix *–du*, in bold) is used with three distinct (R) adverbials (underlined).

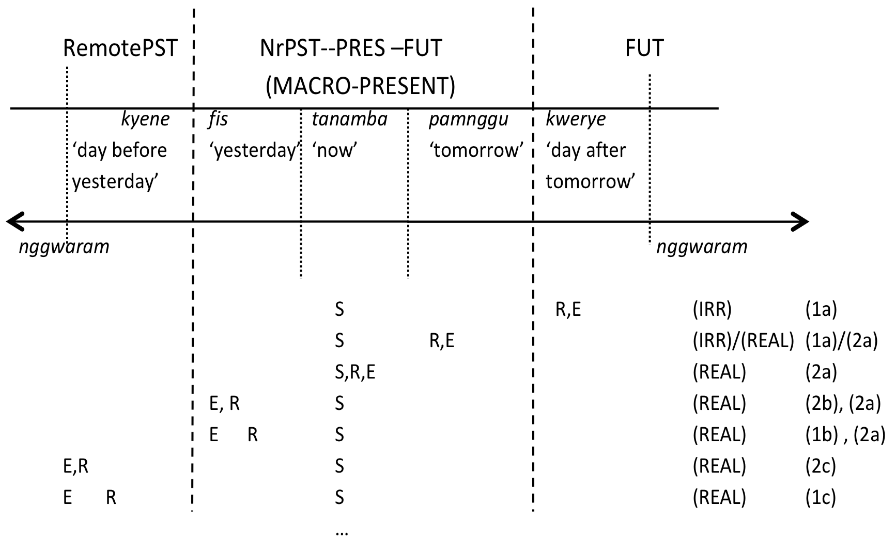

Figure 2. Tense categories and their associated temporal points in Marori

(6) *na* *fis / tanamba / pamnggu* ***nde-n-du***
1SG yesterday now tomorrow bring-DEIC-1SG.MP

stone=U here
mara=i kenggari

'I brought the stone here yesterday.' [E,R—S]
'I now bring the stone here.' [E,R,S]
'I (will) bring the stone tomorrow' [S—E,R]

3.2 Viewpoint and lexical aspect

Viewpoint and lexical aspect interact in a complex way in Marori. The interaction is manifested in the choice of the actor suffix and the auxiliary root on the verb. There are two salient lexical aspectual properties in Marori: stative vs. dynamic and durative/terminative (completive), further discussed in section 6. At this stage, I outline how lexical aspect of the verbal root and its affix must be aspectually harmonious. For example, verbs of inherently durative events such *fyu* ‘sleep’ as seen in (7) must take a durative actor suffix, e.g. *-mon* instead of *–bon* (cf. Tables 2-3). In addition, the selected auxiliary also encodes natural posture meaning, e.g. *kufa* ‘lie down’ for the verb ‘sleep’.

(7) *Nawa fyu kufa-mon* / * *kufa-bon*
1SG sleep lie.down-1SG.NrPST.DUR lie.down-1SG.NrPST.NonDUR
‘I was sleeping/slept.’

The significance of stative/dynamic aspectual difference is evidenced by the psychological verb such as *raron* ‘know’. ‘Knowing’ in Marori is a stative predicate. However, a change of state ‘coming to know (e.g. understand something after an explanation)’ is dynamic. The same verb *raron* therefore has to select different verbal auxiliary roots and receives different agreement patterns. The state of knowing uses the copular ‘be’ with the macropresent actor suffix agreement (8a) whereas the inchoative counterpart in (8b) uses the dynamic root *nggo* with undergoer prefix agreement.

(8) a. *Nawa raron tombo-du efi siem=i* (stative)
1SG know BE-1SG.PRES the answer-OBJ
‘I know the answer.’ [E,R,S]

b. *Nawa tamba raron yu-nggo-f* (inchoative, dynamic)
1SG already know 1SG-AUX-NrPST [E,R—S]
‘I have understood.’

Note that the inchoative meaning of knowing (8b) is perfective dynamic in its viewpoint aspect, made explicit in its free translation. That is, the ‘inchoative event of coming to know’ has been completed prior to S. The NrPST marker *–f* marks this completive culmination meaning. The perfective particle *tamba* ‘PERF/already’ augments the perfective completive meaning.

3.3 Mood

Marori also shows realis/irrealis mood. Irrealis is used for future tense and imperative structure. Mood is encoded in the shape of the root for certain verbs and in the shape of the agreement subject agreement suffix on the finite verb. For example, the verb for ‘sit’ has a distinct verb form depending on its MOOD: *kuye* ‘sit.REAL’ and *mi* ‘sit.IRR’. Thus we have the following contrast:

(9) a. *Mbe* *ka* *kuye-∅* *ai*? b. *paku* *ka* *mi!*
MBE 2SG sit.REAL-2NPL.PRES Q there 2SG sit.IRR
'Nyoman, are you sitting (there)?' 'Sit there!'

The following are examples of declarative sentences in future/irrealis mood (10a), and in past/realis mood (10b).

(10)
a. *Na* *kursi* *uyowu* *mi-ru* b. *Na* *kursi* *uyowu* *kuye-men*
1SG chair on sit.IRR-1SG.FUT 1SG chair on sit.REAL-1NPL.NrPAST
'I will sit on the chair' 'I sat on the chair yesterday.'

4 Nonverbal aspect

In this section I show that Marori non-verbal units may express their own temporal structures. Consider the contrast in meaning due to the marking of the completive/terminative perfective aspectual meaning by -*on* in (11a)[5] with the corresponding sentence without it in (11b):

(11) a. *Nam-**on*** *nggafi* *nuron* *te* [E–R,S]
1POSS-CPLT that.SG wife STAT.AUX.3NSG.PRES
'That is my ex-wife/that is the one who was my wife.'

b. *Nam* *nggafi* *nuron* *te* [E,R,S]
1POSS that.SG wife STAT.AUX.3NSG.PRES
'That is my current wife/that is the one who is my wife.'

The perfective meaning (11a) represented as [E–R,S] means that the (husband)-wife-relation (E) took place in the past (i.e. already terminated at some point in the past), and E is viewed from the perspective/reference of present utterance time (i.e., S=R). Given its completive/perfective meaning, -*on* is hereafter glossed as CPLT. Without –*on* (11)b, the wife-possession relation persists at the moment of speaking (i.e. [E,R,S]). This kind of perfective meaning is precisely the same meaning encountered in the English present perfect, e.g. *John has lived in Bali* [E–R,S]. That is, that John's event of living in Bali (E) already terminated at some point in

[5] The suffix -*on* can be relaises as –*won* or -*(w)en* showing vowel harmony with the glide *w* appearing after a vowel final stem.

the past, and it is viewed by the speaker from the perspective of present utterance time (i.e., S=R).[6]

In addition to possession, *-on* can encode completive meaning associated with different kinds of relations. Example (12a) is associated with a past property ('being deaf'). The suffix shows up on the lexical head of the predicative NP (*mburo*) (12a). Its absence indicates that the 'deaf' property is persistent at the moment of speaking (12b).

(12) a. *Na mburo-won tombo-du*
1SG deaf- CPLT AUX.NPL-1SG.PRES
'I am no longer deaf.'

b. *Na mburo tombo-du*
1SG deaf AUX.NPL-1SG.PRES
'I am deaf.'

In the following examples, *-on* marks past locative and purpose relations:

(13) a. *botol-on bir*
bottle-CPLT beer
'beer that used to be in a bottle'

b. *bir-en botol*
beer-CPLT bottle
'bottles previously for beer'

The locative meaning in the noun-noun modification appears to be due to world-knowledge; e.g. a bottle is a container and therefore (13a) means that the *-on* modifier is the past container of the modified entity ('beer'). Reversing the order (13b) results in the noun 'beer' being the modifier signalling a past purpose: the bottle was used as container for the beer.

In the following examples, *-on* is associated with origin of the entity depicted by the head. That is, at the moment of speaking, the fish (14a) and the skin (14b) are no longer in their original locations.

(14) a. *rur-en awe*
river- CPLT fish
'fish caught from the river'

b. *kwi-wen paar*
tree- CPLT skin
'detached bark/skin from a tree'

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[6] Surely, as pointed out by the anonymous reviewer, the meaning of the English present perfect is rather complex in that it can be ambiguous. For example, *John has lived in Bali for 5 years* can mean that the event of living (E) persists at the utterance time (S). This second reading is, as pointed out by Kamp and Reyle (1993:567–8), an idiosyncrasy of English. Other languages such as German and French must use the simple present tense to capture the second reading.

A modifying verb affixed by *-on* within a nominal encodes a past process. For example, sago or fish already baked/grilled can be expressed by an NP with the modifying verb affixed with *-on*:

(15) a.	*puraw-on*	*nggi*	b.	*puraw-on*	*awe*
	bake- CPLT	sago		grill- CPLT	fish
	'baked sago'			'grilled fish'	

It should be noted that the contrast of the presence and absence of *-on* correlates with the contrast between the stative [E–R,S] (a past property/quality/relation (E) such as possession, process etc., no longer true at the utterance time) and [E,R,S] (a current property/quality that is true or persistent at the utterance time). For simplicity, I just focus on the interpretation of the relation (E) that is marked by *-on*, which corresponds to what Tonhauser calls the nominal/possessive time (t_{poss}/t_{nom}). It is instructive to investigate whether there is any other temporal/aspectual contrast within the NP in Marori. It turns out that there is: the (E) relation within the NP can have its progressive (on-going) or habitual aspect highlighted, and is therefore marked accordingly. More investigation is needed with respect to the full extent of the semantics of the aspectual contrast within nominals in Marori, but I outline my preliminary findings in this subsection.

The ongoing aspect within a nominal is encoded by *=fa*. Then, we can have an aspectual difference within an NP as shown in (16). The form *=fa* is glossed as 'still', in contrast to the completive meaning of *-on*.[7] The contrastive aspectual meaning can be informally represented as E,R,S; 'E: still'] for *=fa* vs. [E–R,S; 'E: no longer'] for *-on*.

(16)	*Kwi=fa*	*paar*	vs.	*kwi-wen*	*paar*
	tree=STILL	skin		tree-CPLT	skin
	'bark still attached to its tree'			'bark detached from its tree'	
	[E,R,S; 'E: still']			[E–R,S; 'E: no longer']	

The habitual nominal aspect is expressed by *mbe*, a marker that is encountered to mark a non-finite clause. Given its habitual meaning translatable as 'usually', I gloss *mbe* as HAB in its aspectual function in nominals. The examples showing the contrast are given in (17).

[7] *=fa* as a nominal aspect marker appears to be the grammaticalisation of the postposition comitative *=fa*.

(17) a. *nasi mbe bobo* vs. b. *nasi-wen* bobo
rice HAB plate rice-CPLT plate[8]
'a plate usually for rice' 'a plate previously for rice'

(18) a. *Puraw mbe nggi* vs. b. *puraw-on nggi*
bake HAB sago bake-CPLT sago
'sago usually for baking' 'baked sago'

To conclude, there is evidence that a nominal domain can have its own temporal structures, e.g., showing terminated/completive (past) relations in contrast to on-going or habitual relations. Except for -*on*, the resources used to mark these different temporal relations in Marori are also used in other constructions. A full analysis for the progressive and habitual aspect within nominals in Marori requires further research. In what follows, I will focus on the completive/terminative -*on* for which I have enough data for a coherent analysis.

5 The clausal TAM constraint of -*on*

This section discusses the morphosyntactic constraint imposed by -*on* on clausal TAM in Marori. But first I describe the morphosyntax of the verbal complex of the clause. As described in section 2, TAM in Marori is marked on the auxiliary verb, if present; otherwise on the lexical predicate. When the inflected auxiliary is present, the lexical predicate comes before the auxiliary and is not inflected. For example, the lexical verb *kibib* 'roll' is not inflected in (19a-b), whereas the auxiliary verbs (*nggurim, pendim*) are.

(19) a. *Tanambadu nggafi sokodu bola kibib nggu-ri-m*
just.now that one ball roll AUX-DUR-3.NrPST
'The ball was rolling just now.'

b. *John sokodu bola=i kibib pendi-m*
John one ball=U roll 3SG.M.make-3.NrPST
'John rolled the ball/ made the ball roll.'

Note that the verb *kibib* in (19a) is the lexical predicate of the clause. It is not inflected to encode its durative/progressive aspect in the past tense. In contrast, as discussed in the preceding section, a non-verbal predicate can be inflected in this position when it expresses completive-perfective aspect; e.g. examples (11) and (12). Crucially, there is a

[8] Plate made of coconut shell.

syntactic restriction in that *-on* requires that the clausal auxiliary verb must be aspectually stative (i.e. the copular verb *te*) and in the present tense form. Consider the following contrast in (20), where the dynamic auxiliary (with the *ngg* root) is not acceptable.

(20) a. *Emde usindu kara-**won** tere / * nggo-ro*
3NPL all sick-CPLT BE.3PL.PRES D.AUX3SG-PL
'They are all no longer sick.' [E–R,S]

b. *Nam-**on** nggafi nuron te / * ngguo.*
1POSS-CPLT that.SG wife BE.3PL.PRES D.AUX3SG
'That is my ex-wife/that is the one who was my wife.'
(Lit. That is the wife that I previously owned) [E–R,S]

The dynamic auxiliary *ngg* is used only in the dynamic event, as seen in (21). This is, however, a different kind of tense-aspect, not the one in the Present Perfective aspect. Note that the dynamic auxiliary is in the present tense (21a) and in the past (21b). In these cases *kara* cannot be marked with *-on*.

(21) a. *Emnde usindu tanamba kara nggo-ro.*
3NSG all now sick D.AUX3NSG-PL
'They are all (being) sick now.' [E,R,S] (E: 'dur'; R,S: 'now')

b. *Emnde usindu fis kara nggo-ro-b*
3NSG all yesterday sick D.AUX3NSG-PL-NrPST.DUR
'They were all (being) sick yesterday.' [E,R–S] (E: 'dur', R: 'yesterday')

In contrast to *-on* in (20) (associated with the non-verbal clausal predicate), *-on* associated with an argument NP does not constrain the TAM of the clausal head. For example, the NP subject in (22) comes with *-on* but the copula verb is of the dynamic type, which can be in the present tense (a) or the past tense (b).

(22) a. [*nam-on nuron*] *kara nggo-ra tanamba*
1POSS-CPLT wife sick D.AUX-3.DUR.PRES now
'My ex-wife is sick now.'

b. [*nam-on nuron*] *fis kara nggo-ra-m*
1POSS-CPLT wife yesterday sick D.AUX-DUR-3.NrPST
'My ex-wife was sick now.'

Likewise, the presence of *-on* associated with an NP object does not require that the clausal TAM be in the present stative tense:

(23) *mar na nasi-wen bobo sokodu ife-ben*
NEG 1SG rice-CPLT plate one 3SG.see-1NPL.PST
'I didn't see the plate previously used to hold rice.'

To sum up, *-on* may or may not constrain the clausal TAM. This depends on whether *-on* is part of a lexical predicate of the clause or is an argument.

6 Analysis and discussion

In this section, I address the relevance of Marori data first in wider typological and theoretical contexts, and then provide an LFG analysis.

Typologically, Marori is not unique in that similar cases of nominal tense-aspect are, as discussed in Nordlinger and Sadler (2004), encountered in many other languages of different genealogical groupings. As mentioned in section 1, there is a debate whether there is such a thing as nominal tense. Tonhauser (2008) disagrees with Nordlinger and Sadler's analysis (or label) of the Guaraní markers as nominal TNS markers. While she entertains the label 'nominal grammatical aspect/modality markers' (Tonhauser 2006), she is reluctant to classify them as such in her later publication (Tonhauser 2007).

The present study in Marori contributes to this debate, providing further empirical evidence for non-verbal tense-aspect. On the analysis that the temporal structure of tense (i.e. the relation between E and R) is simpler than (or part of) the temporal structure of aspect (where the E and R relation is viewed from R relative to S), we can say that *-on* in Marori marks a nominal (viewpoint) aspect (i.e. [E-R,S]), rather than nominal tense. That is, it encodes a complex temporal structure, rather than a simple past precedence between E and R. As described earlier, verbal tense in Marori is a four-way system (RmPst, NrPst, Present and Fut), and *-on* does not fit in with any of these. Temporally it is associated with 'past E' and 'present' (R,S) perspective; hence its completive-perfective aspectual meaning.

While *-on* is essentially an aspect marker, its associated present tense meaning is in fact part of its important morphosyntactic properties because, as pointed out in the preceding section, its clausal TAM must be in the present tense with stative auxiliary root. For this reason, the correct label (despite its being rather long) is the 'present perfective stative aspect marker'. That *-on* carries tense information is recognised in the analysis as seen in the representation of the f-str below. For simplicity, however, we can keep the simple label *-on* as an nominal aspect marker in Marori (while keeping in mind the complexity of its temporal structure as discussed earlier).

Having making my analysis explicit that *-on* is a non-verbal aspect marker in Marori, I now proceed to the next issue regarding the typology. According to Sadler and Nordlinger (2001) and Nordlinger and Sadler (2004), there are two kinds of nominal TAM: Independent Nominal TAM and Propositional Nominal TAM. Independent Nominal TAM has TAM information locally relevant to the nominal itself, independent from the clausal/propositional TAM.

Marori shows both the Independent Nominal type and Proposional Nominal type. The Independent Nominal Aspect is exemplified by subject NP with *-on* in (22) and object NP with *-on* in (23). In these instances, the nominals have their own temporal structure (namely, [E-R,S]), which is independent of the verbal/clausal TAM. We have seen, for example, that subject/object NP with *-on* can appear with the clausal/propositional TAM in the present or past tenses in dynamic aspect.

The Propositional Nominal/Nonverbal TAM of *-on* needs a bit of discussion. It is slightly different from the Propositional Nominal TAM exemplified in Sadler and Nordlinger (2001) and Nordlinger and Sadler (2004). In their account, when attached to dependent nominals (argument and adjunct NPs in verb-headed clauses), propositional TAM involves nonlocal interpretation of the TAM marker, in the sense that it is not interpreted with respect to the nominal to which it is attached but rather to the higher clause within which it is embedded.[9]

The situation for the non-verbal tense-aspect *-on* in Marori is slightly different. Recall that *-on* can appear not only with a noun but also with other categories such as an adjective; see example (20a). The crucial characteristic of *-on* is that it is both local and non-local (i.e. propositional): *-on* in the (20a-b) marks the temporal point associated with the E of the stem it is attached to, e.g. *kara-won* 'sick-CPLT= past sickness' and *nam-on* '1POSS-CPLT = past possession'. The marker is, however, also clausal/propositional since it contributes to and constrains the type of the clausal auxiliary it must co-occur with. This strategy of aspect marking in Marori can be thought of as a constructed strategy:

[9] See Lardil examples in Klokeid (1976) and Nordlinger (2004:791) where the nominal tense markers are in a sense 'tense agreement' because they are additionally marked in the verb.

more than one exponent in syntax is involved to construct the 'present completive/perfective stative aspect'.

In short, the non-verbal aspect in Marori presents a slightly different kind of aspect type: while it is essentially a Propositional type, its encoding shows a constructed strategy involving both local and clausal auxiliary markers. This local-clausal property of non-verbal aspect type is a category not explicitly mentioned in Nordlinger and Sadler's (2004) typology.

I now discuss how the two types of nominal aspect in Marori can be captured in LFG. Before I move on to the LFG analysis, however, more discussion on the nature of aspect with its associated ASP feature is necessary. As pointed out in Tables 2 and 3, Marori subject suffixes show inflection encoding tense and aspect. I have also pointed out that a close investigation reveals a complex interplay of two temporal distinctions (*durative* vs. *completive* and *stative* vs. *dynamic*) in Marori grammar. The two distinctions cross-cut each other, and give rise to the aspectual space shown Figure 3.

The first two cells (stative durative and stative completive) are restricted in their temporal structure variations, as they both take the auxiliary *te*. The dynamic aspects (dynamic durative and dynamic completive) are rich in their variations, giving rise to numerous valence structures. Discussing them in considerable depth is beyond the scope of the present paper. For the analysis in this paper, which is on the non-verbal tense-aspect, we are only concerned with cell 2 of Figure 3, which encodes the completive stative aspect. Recall that we have two types of nonverbal aspect in Maori: the Independent Aspect associated with argument NPs and the Propositional Aspect (which in Marori is constructed by marking locally on the lexical predicate and also non-locally on the auxiliary verb).

	durative	completive
stative	(1) verbal aspect: stative aux ***te*** [present tense only] [restricted temp. structure: E,S,R]	(2) non-verbal & verbal aspect: *-on* (+ stative aux *te*): 'perfective' [if predicative, present tense only] [restricted temp. structure: E–R,S].
dynamic	(3) verbal aspect dynamic aux *ngg, mo*: [any tense, possibly in progressive with *mba*] [unrestricted temp. structure]	(4) verbal aspect dynamic aux *ngg, mo*: [any tense, possibly in perfective with *tamba*] [unrestricted temp. structure]

Figure 3. Types of aspectual values in Marori

On the basis of the previous discussions, which highlight the point that tense and aspect are tightly intertwined properties in Marori (as also seen in Figure 3), I propose to have a TNS-ASP feature in the f-str, whose value is an f-str with TNS and ASP as shown in (24). For Marori, the values of the TNS and ASP are slightly different from the values of the corresponding TNS and ASP in familiar languages like English.[10]

(24) $\begin{bmatrix} \text{TNS-ASP} & \begin{bmatrix} \text{TNS} & \{\text{pres} \mid \text{nr.pst} \mid \text{rm.pst} \mid \text{fut}\} \\ \text{ASP} & \{\text{sta-dur} \mid \text{sta-cplt} \mid \text{dyn-dur} \mid \text{dyn-cplt}\} \end{bmatrix} \end{bmatrix}$

Having the TNS-ASP feature in place, I now turn to the complete f-str representation. The analysis is to allow the feature TNS-ASP to appear in a non-verbal domain (e.g. adjective or nominal) and its associated local f-str. The Independent Nominal Aspect can be straightforwardly captured as it strictly local. For instance, sentence (25a) can be represented as having the f-str shown in (25b).[11]

(25) a. [*nam-on* *nuron*] *kera* *nggo-ra* *tanamba*
1POSS-CPLT wife sick D.AUX.3NSG-DUR.PRES now
'My ex-wife is sick now.'

b.

$$\begin{bmatrix} \textbf{PRED} & \text{'be<SUBJ, PREDLINK>'} \\ \textbf{TNS-ASP} & \begin{bmatrix} \textbf{TENSE} & \textbf{pres} \\ \textbf{ASP} & \textbf{dyn-dur} \end{bmatrix} \\ \textbf{SUBJ} & \begin{bmatrix} \textbf{PRED} & \text{'wife'} \\ \textbf{PERS} & \textbf{3} \\ \textbf{NUM} & \textbf{sg} \\ \textbf{GEND} & \textbf{F} \\ \textbf{POSS} & \begin{bmatrix} \textbf{PRED} & \text{'pro'} \\ \textbf{PERS} & \textbf{1} \\ \textbf{NUM} & \textbf{sg} \\ \textbf{TNS-ASP} & \begin{bmatrix} \textbf{TNS} & \textbf{pres} \\ \textbf{ASP} & \textbf{sta-cplt} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \textbf{PREDLINK} & \textbf{PRED} \quad \text{'sick'} \end{bmatrix}$$

---

[10] An alternative way to capture the complex system in Marori is to have the following attribute values: TNS {pres | past | fut}, REMOTE { + | – }, AKTIONART {stative | dynamic}, EVENT-EXECUTION {dur | complete}. In this way we avoid using singular values and we can use a recurring feature space and combine it in different ways. In the interest of space, while promising, this proposal is not implemented in this paper. I thank the anonymous reviewer for the suggestion.

[11] Note that for the main copula predicate, I adopt a closed-function of PREDLINK analysis (Butt et al. 1999, Dalrymple, Dyvik, and King 2004, Attia 2008). This is mainly due to the fact that the copula predicate in Marori is obligatory for non-verbal predication.

The f-str says that the clausal propositional aspect is dynamic-durative in the present tense.[12] This captures the meaning that the event of being 'sick' (E) is true and persists at the moment of speaking 'now' (S,E); that is, the temporal properties of E, S and R overlap ([E,S,R]). The subject NP also has its own aspect whose value contains [ASP sta-cplt]. Given that the interpretation of *-on* is [E–R,S] (a stative relation terminated prior to the utterance time) in which the present-tense temporal anchoring is implied (and enforced on the clausal auxiliary in the case where the unit it marks is predicational), I therefore also include the [TNS pres] feature in the f-str of the nominal domain. In short, the idea of nominal (tense-)aspect being independent from the clausal aspect can be straightforwardly captured in our LFG representation.

The non-verbal Propositional Aspect is slightly more complicated than the Independent Nominal aspect. This is due to the fact that *-on* imposes a constraint on its auxiliary:

(26)	*Emde*	*usindu*	*kara-**won***	*tere* / *	*nggo-ro* (=(20))
	3NPL	all	sick-CPLT	BE.3PL.PRES	D.AUX3SG-PL
	'They are all no longer sick.'				

To capture the non-local clausal constraint originated from the lower unit in the structure, I make use of an inside-out constraint. The inside-out constraint is imposed by *-on* is specified in the lexical entry of this suffix, partially shown in (27). The notation ((PREDLINK ↑) TNS-ASP) =c (↑TNS-ASP) says that when its corresponding f-str is part of the value of PREDLINK attribute in a larger f-str, which itself also contains TNS-ASP, this TNS-ASP must have the same values (namely TNS=pres and ASP= sta-cplt). Note that the inside-out constraint is optional (placed within brackets) as it will not apply when *-on* is not part of a PREDLINK structure, in which case the clause has its own TNS-ASP value.

(27) *-on* suff (↑ TNS-ASP) = ↓
(↓ TNS)= pres
(↓ ASP)= sta-CPLT
((PREDLINK ↑) TNS-ASP) =c (↑TNS-ASP))

With all these in place, sentence (26) can now be represented as

[12] Note that 'being sick' in Marori is considered 'dynamic' as it implies a change of state; that is, the default state is assumed to be 'healthy' and sickness would have a starting point (and typically an ending point too).

having the f-str shown in (28). Both the lexical predicate (PREDLINK) ‘sick’ and the clausal predicate (‘be’) has TNS-ASP with the same values: ‘stative completive’ aspect in the ‘present’ tense.

(28)

$$\begin{bmatrix}
\textbf{PRED} & \textbf{‘be<SUBJ, PREDLINK>’} \\
\textbf{TNS-ASP} & \begin{bmatrix} \textbf{TNS} & \textbf{pres} \\ \textbf{ASP} & \textbf{sta-cplt} \end{bmatrix} \\
\textbf{SUBJ} & \begin{bmatrix} \textbf{PRED} & \textbf{‘pro’} \\ \textbf{PERS} & \textbf{3} \\ \textbf{NUM} & \textbf{nsg} \end{bmatrix} \\
\textbf{PREDLINK} & \begin{bmatrix} \textbf{PRED} & \textbf{‘sick’} \\ \textbf{TNS-ASP} & \begin{bmatrix} \textbf{TNS} & \textbf{pres} \\ \textbf{ASP} & \textbf{sta-cplt} \end{bmatrix} \end{bmatrix}
\end{bmatrix}$$

7 Conclusion

Nonverbal temporal markers and their interpretation are of great interest typologically and theoretically. There is increasing evidence from under-described languages that TAM is not exclusively associated with the verbal domain. While it is true that the verb remains the native domain of rich and complex TAM coding, the semantics of non-verbal TAM is arguably equally complex. In this paper, I have presented preliminary research on nonverbal TAM in Marori, focusing on only one aspect of it, namely the completive perfective stative aspect marked by *-on*. I have argued that its broad aspectual meaning is [E-S,R], exactly the same as in the Present Perfect in English. While having this similar broad meaning as in English, its morphosyntactic realisation and constraint in the grammar is quite different, e.g. while it equivalent to the prefix *ex-* or adverb *former* (as in *ex-wife* or *former wife*), *-on* in Marori has a wider distribution as it can be attached to nouns and non-nouns. I have proposed an LFG analysis accounting for the distribution of *-on*, in particular its non-local constraint that extends to the clausal TAM by making use of the inside-out mechanism in LFG. Further investigation is needed to account for the full extent of non-verbal TAM in Marori. The areas that need in-depth exploration include the nature of nominal progressive and habitual aspect (see section 4) as well as nominal mood in Marori, which yet requires further investigation.

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DISPLACED DEPENDENT CONSTRUCTIONS

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Abstract

An LFG treatment is proposed for 'Displaced Dependents' in English, including dependents of Degree Words, such as 'so', 'too', etc. and certain adjectives (e.g. 'difficult'), as in examples like 'too complex for anyone to understand', 'a difficult problem for anyone to understand' where 'for anyone to understand' is dependent on 'too' and 'difficult' respectively, but is not adjacent to them.

1 Introduction

The specific topic of this paper is the analysis of 'Displaced Dependents' (DDs) in English, exemplified in (1); the term 'Displaced Dependents' is from Kay and Sag (2012),[1] who provide an impressive constructional analysis in the framework of Sign-Based Construction Grammar (SBCG). We attempt to provide an LFG analysis with comparable empirical coverage and theoretical appeal, without significant extension to the theoretical apparatus of the framework. A secondary, but broader, issue is comparison of the technical apparatus of LFG with Head-Driven Phrase Structure Grammar (HPSG) and SBCG: specifically, the discussion will bring out differences in the apparatus for lexical selection, and in the methods for controlling interactions among long-distance dependencies.

The DD construction occurs with degree words (*too*, *so*, *as*, *enough*, *more*, and synthetic comparatives); some degree denoting adverbs (e.g. *sufficiently*, as in (1f)); and some adjectives (e.g. *difficult*, *impossible*, *fun*), e.g. in (1g):

(1) a. This problem is *too* complex *(for anyone) to understand*.
b. This problem is *so* complex *that we can't solve it*.
c. This problem is complex *enough* *to be give you a headache*.
d. This problem is *more* complex *than you can imagine*.
e. This problem is *harder* for them *than you can imagine*.
f. The problems were *sufficiently* complex *that we gave up*.
g. This is a *difficult* problem *for anyone to solve without help*.

Descriptively there are three key points to appreciate here. First, there is a genuine syntactic dependency. For example, *too* takes an optional non-finite clause with *for*, or a VP, but it is incompatible with a finite clause or a *than* clause:

(2) a. This problem is *too* complex *(for anyone) to understand*.
b. *This problem is *too* complex *that we can understand*.
c. *This problem is *too* complex *than we can understand*.

Compare: *so* takes a *that* clause, as in (1b), and *more* and comparative adjectives take *than* clause dependents, as in (1c), (1d).

† We are grateful to several people for insightful comments and stimulating discussion, notably, Miriam Butt, Mary Dalrymple, Dag Haug, Tracy Holloway King, Joan Maling, Ida Toivonen, and Adam Przepiórkowski, as well as several anonymous referees, and other participants at LFG 2013 in Debrecen, Hungary. None of these people can be blamed for deficiencies in what follows.

[1]DDs are called 'Indirect Complements' in Huddleston and Pullum (2002, cf p549). Berman (1974) christened the construction the 'Hard Nut' construction (cf. the expression 'a hard nut to crack'). Complements of degree words are sometimes referred to as 'result clauses', e.g. in Gueron and May (1984). Though we will concentrate exclusively on English, the construction appears in many other languages, including French and Polish (Adam Przepiorkowski, p.c.).

Second, it is a *discontinuous* dependency, and this discontinuity may be 'optional', or obligatory. In the case of adjectives like *difficult*, it is optional, in the sense of not being required in all circumstances (though still required in certain situations). For example, *difficult* does not require a dependent VP to be displaced, as witness the acceptability of (3) and (4). Displacement is allowed, as in (5), when the adjective is pre-nominal – and in fact in this situation it is required, as can be seen from (6).

(3) A problem *difficult* *to solve without help* may be easier with help.
(4) This problem is *difficult* *to solve without help*.
(5) This is a *difficult* problem *to solve without help*.
(6) *This is a *difficult* *to solve without help* problem.

With degree words, displacement appears to be required – *too* is typical:

(7) This problem is *too* complex *to understand*.
(8) *This problem is *too* *to understand* complex.
(9) *This problem is complex *too* *to understand*.

Dependent Displacement is not always optional or obligatory, of course. In fact, with most adjectives it is forbidden, as e.g. with *happy*, *grateful*, or *fond*:

(10) a. The voters *happy* *with the election result* filled the streets.
b. *The *happy* voters *with the election result* filled the streets.

(11) a. We got several letters from authors *grateful* *to the foundation for its support*.
b. *We got several letters from *grateful* authors *to the foundation for its support*.

(12) a. No readers *fond* *of classic crime fiction* will want to miss this book.
b. *No *fond* readers *of classic crime fiction* will want to miss this book.

Finally, while (as will appear below) displacement can occur over some considerable distance, it is not unbounded. It is at least clause bounded – in (14) *too solve* has been displaced out to the complement of *seem*, and the result is unacceptable.

(13) This will seem [to be a *difficult* problem *to solve*] when they encounter it.
(14) *This will seem [to be a *difficult* problem] when they encounter it *to solve*.

The remainder of the paper is structured as follows. In Section 2 we will briefly review two HPSG analyses and then introduce Kay and Sag (2012)'s SBCG analysis, which provides one of the leading ideas of our analysis (specifically, the idea that DDs involve a form of extraposition), and will also act as an empirical benchmark for our account. Our LFG treatment is presented in Section 3. Section 4 provides a conclusion.

2 Previous Analyses

We will not here attempt a comprehensive review of the literature on the DD construction. Instead, we will focus on three HPSG-style analyses that seem initially promising. The first two treat DDs as involving a form of 'Predicate Composition', the third treats DDs as involving a form of Extraposition.[2]

[2]Among the key sources this ignores are Bolinger (1972), Berman (1974), Huddleston and Pullum (2002), Chae (1992). As usual, Butt et al. (1999, see 119ff) contains relevant discussion. There is also a very extensive literature on comparatives – though this is mostly concerned with the internal properties of the

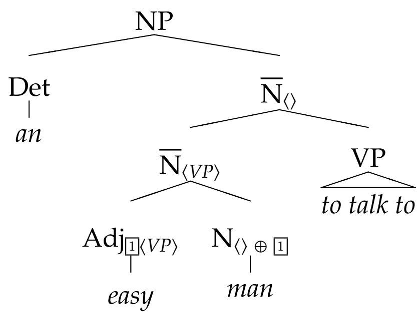
2.1 Flickinger and Nerbonne (1992)

In the context of a general discussion of lexical inheritance and adjectives, Flickinger and Nerbonne (1992) suggest an analysis of examples like (15) which involves some subcategorization requirements being 'transferable'. In particular, adjectives like *easy* are specified as being allowed to transfer their subcategorization requirements to a sister (in this case the noun they modify).

(15) John is an easy man to talk to.

Thus, in (16), the SUBCAT requirement of *easy* (which, for the sake of discussion we take to be a list containing just a VP) is appended to the subcategorization requirement of *man* (which we assume is empty). This new list is passed up from the N to the mother $\overline{\text{N}}$, in the normal way. The VP requirement is satisfied by the presence of the actual VP *to talk to*, so that the subcategorization requirement of the highest $\overline{\text{N}}$ is empty.[3]

(16)



In LFG, subcategorization restrictions are expressed in PRED values, so the spirit of this analysis could be captured in LFG as a form of syntactic complex predicate formation (e.g. Alsina, 1996; Butt, 1993). But this is not very appealing: the problem here is that in LFG complex predicate formation is standardly thought of as combining the PRED value (and hence the subcategorisation requirements) of a head with the PRED value of its argument. But here what we need is a method of combining the arguments of a head (e.g. a noun *man* or *problem*) with those of a *non*-argument – specifically, an *adjunct* (e.g. *easy*). Technical challenges aside, this is a theoretical extension which one would like to avoid, in the absence of independent motivation.

2.2 Kim and Sells (2011)

This particular problem is avoided in the analysis presented in Kim and Sells (2011). Here the degree word in a DD construction is treated as a 'functor' selecting (and successively combining with) an AP (e.g. *complex*), and a CP or VP dependent (*that we will never solve it*) – see (17) and (18).

Standard HPSG (e.g. Pollard and Sag, 1994) contains a variety of mechanisms for lexical selection, Kim and Sells adopt a proposal from Allegranza (1998a), Van Eynde (2003) and van Eynde (2007), which restricts these to essentially two: selection of subjects and complements by heads, and selection of heads by 'functors' (e.g. adjuncts, and specifiers). Formally, this is implemented by having two phrase types

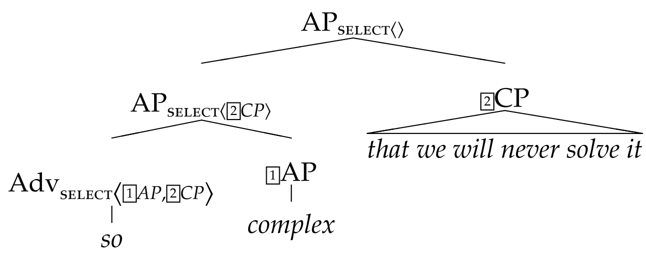
dependent clause, rather than the phenomenon of DDs.

[3]We write '⟨⟩' for the empty list, and '⊕' for append. Since $\boxed{1}$ designates ⟨*VP*⟩ on the Adj node, the specification '⟨⟩ ⊕ $\boxed{1}$' which appears on the N is the same as the specification ⟨*VP*⟩ that appears on the $\overline{\text{N}}$.

(*head-argument-phr*, and *head-functor-phr*), where in the latter, the non-head daughter bears a SELECT specification which must be satisfied by the head daughter. In a case like (17), this gives an analysis as in (18), based on a lexical entry for *so* as in (19).[4]

(17) This problem is *so* complex *that we will never solve it*.

(18)



(19) [FORM ⟨*so*⟩; HEAD [*adv*; SEL ⟨AP, CP[*that*]⟩]]

The idea of (19) is that *so* 'SELECT's an AP, and a *that* marked CP. Hence in (18) it first combines with the AP *complex*, discharging the AP requirement, and forming the higher AP, this then combines with the *that* clause, discharging the requirement for a CP, leaving at the top an AP whose selection requirements are fully satisfied (SELECT ⟨⟩).[5]

However, from an LFG point of view, the analysis is no more appealing than that of Flickinger and Nerbonne. The issue is that in LFG, as we already noted, the only general selection mechanism involves satisfaction of complementation requirements expressed in PRED values, and PRED values are borne by heads. Thus, we would have to assume that *so* is the head of *so complex*, and of *so complex that* .... But this runs counter to what one would naturally take to be the head-dependent relations, where the adjective *complex* is the head and *so* is a dependent (as Kim and Sells assume), and would lead one to expect the whole phrase to be an AdvP or DegP (depending on one's analysis of the category of *so*), when in fact it is an AP.[6]

2.3 Kay and Sag (2012)

[4]Kim and Sells do not discuss the DD construction directly, instead they focus on the so called 'Big Mess' construction (Berman, 1974), as in *so complex a problem that we will never solve it*, where *so complex... that...* is used attributively, modifying the nominal *a problem*. Their analysis is that in this construction *so* selects an AP (*big*), an NP (*a problem*), and a CP (*that...*). We think it is reasonable to assume that their analysis of the predicative use that we are concerned with simply omit selection of the NP.

Unrelated to this point, there is technical problem with Kim and Sells' analysis which seems to have passed unnoticed. In general, the idea is that head-functor structures involve a head discharging an element of the SELECT list of the non-head. Notice that at the top of (18) the CP discharges the SELECT value of the AP, requiring that the CP should be the head. This is of course entirely implausible (and incompatible with the category label AP on the topmost node).

[5]A first glance, it may be difficult to discern the difference between this approach and Flickinger and Nerbonne's, and indeed they are using the same basic formal machinery (lists, cancelation, percolation), but the grammatical principles involved are very different, as would be clear if the details were spelled out.

[6]Extending this approach to other DD constructions, one would have to assume that the adjective *difficult* is the head of *difficult problem to solve*, which one would normally assume is nominal, and that the adverb *sufficiently* is the head of *sufficiently complex that we gave up*, which is adjectival.

Kay and Sag (2012)'s analysis is more appealing from an LFG point of view. They analyse DD constructions as involving extraposition, analogous to extraposition of relative clauses as exemplified in (20). The account is formalised in the framework of Sign Based Construction Grammar (SBCG) (e.g. Sag, 2012).

(20) Then [a girl __] came in *who was clearly very pleased with herself*.

The key idea is that extraposition involves percolating an EXTRA list – that is, using similar apparatus as is used for handling long-distance dependencies (which are handled by percolating SLASH lists). Such dependencies are most easily understood as involving three components: a 'bottom', where the dependency is introduced, a 'middle', where the dependency is percolated, and a 'top' where the dependency is discharged.

If we consider an example like (21), the bottom of the dependency is the lexical entry for *so*, for which (22) gives the relevant details.

(21) (We were) *so* upset by the film *that we left early*.

(22)
$$\begin{bmatrix} \textsc{form} & \langle \textit{so} \rangle \\ \textsc{syn} & \begin{bmatrix} \textsc{cat} & \left[\textsc{select}\ \left[\textsc{syn}\ \left[\textsc{extra}\ \boxed{L}\ \right]\right]\right] \\ \textsc{extra} & \boxed{L} \oplus \langle \mathrm{S}[\textit{that}] \rangle \end{bmatrix} \end{bmatrix}$$

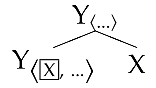
According to this, *so* is a functor (e.g. specifier or adjunct) of a head, and hence bears a SELECT feature describing this head. In the case of *so* the description includes the information that the head's EXTRA list is *L* (we ignore other restrictions, e.g. that the head should be adjectival). *So*'s own EXTRA list consists of *L* plus a *that*-marked S. In the typical case, e.g. *upset* in (21), the head's EXTRA list will be empty, so the EXTRA of *so* will just be ⟨*S*[*that*]⟩.

The 'middle' part of the dependency simply involves upwards inheritance of the EXTRA list from the functor daughter. The 'top' of the EXTRA dependency is handled by a special construction: the Head-Extraposition Construction (subtype of *headed-construction*), as in (23).

(23)
$$\textit{hd-extra-cxt} \Rightarrow \begin{bmatrix} \textsc{mtr} & \left[\textsc{syn}\ \ \boxed{Y}\ !\ \left[\textsc{extra}\ \ \boxed{L}\right]\right] \\ \textsc{dtrs} & \left\langle \boxed{H}\!: \left[\textsc{syn}\ \ \boxed{Y}\left[\textsc{extra}\ \ \langle \boxed{X} \rangle \oplus \boxed{L}\right]\right], \boxed{X} \right\rangle \\ \textsc{hd-dtr} & \boxed{H} \end{bmatrix}$$

According to this, the top of an extraposition path consists of a mother, whose SYN value is $\boxed{Y}$, and two daughters: a head daughter whose SYN is also $\boxed{Y}$, and a non-head daughter $\boxed{X}$. The head daughter's EXTRA list consists of $\boxed{X}$, plus a (possibly empty) list of other extraposed elements $\boxed{L}$ – which is also the EXTRA list of the mother.[7]

The central idea can be seen more clearly in (24), where the EXTRA list is represented as a subscript. Intuitively, the idea is to realise the first element of the EXTRA list as the right daughter of the head.

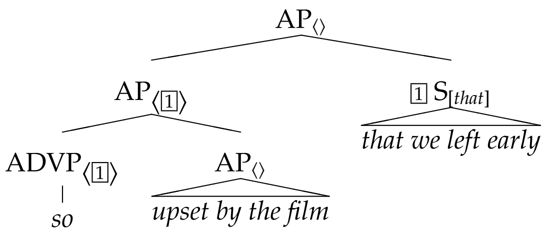
(24)


For example, in (25), the AP *upset about the film* has an empty EXTRA list, so the

[7] The '!' here indicates that this is a default value. This is not important here.

EXTRA list of the adverb *so* contains just the S[*that*] that is lexically specified. This specification is passed up to the AP (since the ADVP is the functor, i.e. non-head, daughter).[8] The top of the tree is an instance of the Head-Extraposition Construction: the right daughter realises the first element in the EXTRA list of the head daughter, and the (empty) remainder of the list is passed upwards.

(25)

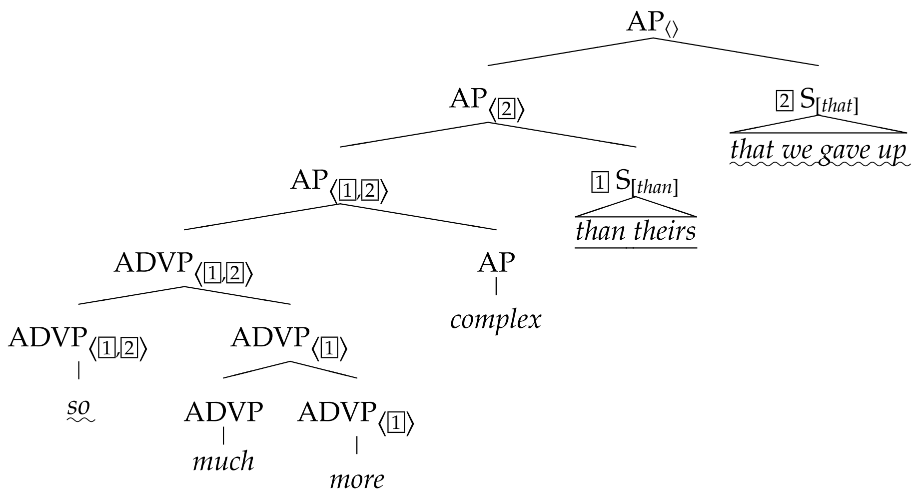


In an example like this it is not easy to see the motivation for using long-distance apparatus for this phenomenon. But the approach scales up easily to deal with cases involving multiple degree words, as in (26).

(26) (Our solution was) so much more complex than theirs *that we gave up*.

Here we see two degree words, both with displaced dependents: *so... that we gave up*, and *more... than theirs*. It is reasonable to assume that the lexical entry for *more* is like that for *so*, except that *more* requires its EXTRA list to contain a *than* marked S.

(27)



Again starting at the bottom, *more* passes its EXTRA requirement (the list containing the S[*than*]) to the adverbial *much more*.[9] *So* adds its EXTRA requirement (the list containing a S[*that*], here the 2) to the end of this, producing the list ⟨1, 2⟩ and passes this to the

[8] We have labelled the pre-terminal nodes as phrasal (ADVP) because in HPSG and SBCG the distinction between X and XP is standardly taken to relate to complement saturation (phrases have empty COMPS list). On this interpretation, an adverb like *so* is in effect a lexical ADVP, and *complex* is an AP in this structure

[9] Kay and Sag do not actually explain how this step works – notice that the EXTRA list should be inherited from the functor daughter, *much*, not as we have shown, from the head daughter, *more*. A possible solution would be to lexically specify *much* to share the EXTRA list of its head (i.e. like *so*, except that it does not add to the EXTRA list). Notice that all items that can modify items that permit extraposed will have to be similarly specified – e.g. adjectival modifiers like *very* which appear with DD adjectives, as in *very difficult... to please*. It is not clear if this creates problems.

mother ADV, and then to the A *so... complex*. The elements are then discharged from the EXTRA list, in order.

Notice that on this analysis, the displaced dependents of DD licensors like *so* and *more* are not complements: they originate on the EXTRA list of the licensors, and are never part of the complements list. This is presumably why the DDs never appear adjacent to such licensors – why displacement is obligatory: the only construction that would allow such adjacency would be the *head-complement* construction, which is obviously excluded if DDs are not complements.[10]

Cases where displacement is optional (e.g. with adjectives like *difficult*) can be handled by assuming the relevant dependents are complements when adjacent to the DD licensor, and that there is a non-branching lexical construction, which removes a complement from the VALENTS list (roughly the SUBCAT list of earlier work), and puts it on the EXTRA list:[11]

(28)
$$\begin{array}{c}
\begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{VAL} & \langle NP \rangle \\ \text{EXTRA} & \left\langle PP_{of} \right\rangle \end{bmatrix} \end{bmatrix} \\
| \\
\begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{VAL} & \left\langle NP, PP_{of} \right\rangle \\ \text{EXTRA} & \langle \rangle \end{bmatrix} \end{bmatrix}
\end{array}$$

(29) They are not very *proud* always *of their real achievements*.

An interesting feature of the analysis is that elements are removed from the EXTRA list in strict order, from the front. In the case of (26) above, this gives the right result, in that it ensures that the dependencies between DD licensors and DDs are nested. Thus (26) is good, whereas (30), which shows a crossing dependency, is not:

(30) *Our solution was so much more complex that we gave up than theirs.

However, Kay and Sag observe that not all DD licensors are alike in this respect. In particular, some DD licensors, like *more*, allow *crossing* dependencies. Alongside (31) with nested dependencies, we have (32) where the dependencies cross.

(31) This was *more* difficult in those days for people to solve *than we can imagine*.
(32) This was *more* difficult in those days *than we can imagine* for people to solve.

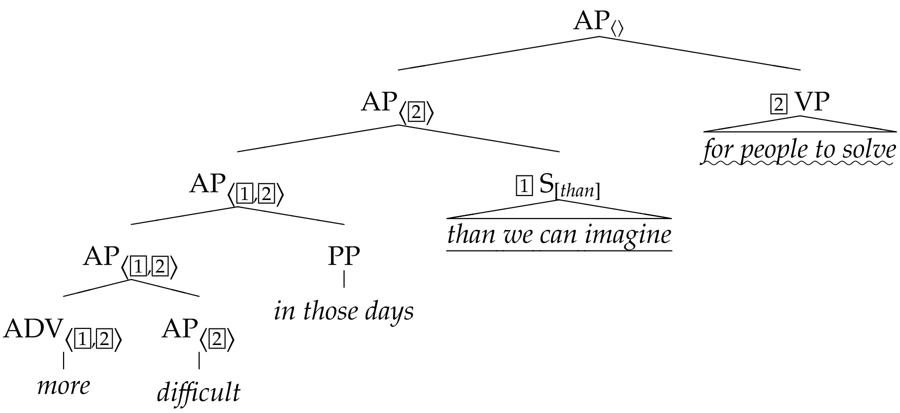
Kay and Sag's account of this is straightforward: whereas items like *so* add their complements to the end of their head's EXTRA list, lexical items like *more* are allowed to scramble their complements into their head's EXTRA list. In the case of (31) the *than* dependent should be added to the end of the EXTRA list of *difficult*, in the case of (32) it should be scrambled in before the EXTRA list of *difficult*. (33) gives the representation

[10] This is not completely accurate: it is not clear what prevents examples like **so that we gave up interesting*, as a result of so to speak 'string vacuous' extraposition. On the face of it, there is nothing to stop *so* and *that we gave up* combining in a head-extraposition construction, which then functions as an adjunct of *interesting*. The same problem will arise with DD adjectives. Notice it will not do to require the head in a head-extraposition structure to be phrasal, because as noted above (footnote 8) on the standard interpretation of this in HPSG and SBCG words like *so* are inherently phrasal.

[11] However, Kay and Sag do not offer an account of why items like *difficult*, which allow displacement in general, *require* it in some circumstances, as in **a difficult for us to solve problem*. We will address this problem in our LFG treatment below.

of (32).

(33)

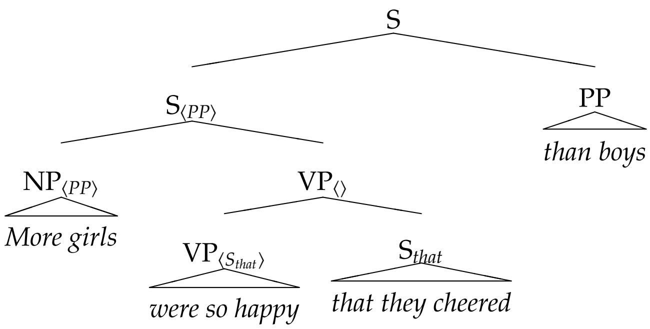


As regards the boundedness of Extraposition, Kay and Sag note the following:

(34) a. **More** girls were so happy that they cheered **than boys**.
b. ***More** girls were so happy **than boys** that they cheered.

At first glance, this is puzzling, because we observed that *than* dependents (dependents of *more*) could shuffle in among other displaced dependents, but in (34b) it appears this is not allowed. Kay and Sag suggest this is a bounding effect. We are dealing here with two distinct EXTRA lists: one from the subject (*more girls...*) and one from the predicate (*so happy...*). The contrast in (34) can be explained if the latter has to be realised before the former, for example if the *that* clause is realised as a sister of VP, and the *than* clause is realised as a sister of S.

(35)



To achieve this, Kay and Sag suggest that the subject-predicate construction has a constraint to the effect that the EXTRA list on a finite VP must be empty (so finite VP acts as a barrier to extraposition). Notice that (35) satisfies this constraint, but that it cannot be satisfied in a representation of (34b).[12]

Kay and Sag provide an account of the semantics of DD constructions, formulated in Minimal Recursion Semantics (MRS). The details of this are not important here. The key points are (a) that the non-branching constructions that move complements to the EXTRA list do not disturb the semantics; (b) *so*, *too*, etc. are interpreted as generalized

[12]It is not clear that this is the only, or the best account possible. Kay and Sag do not say how EXTRA lists percolate in head-complement or subject-predicate constructions, though they do hint (p248) at inheritance from the first daughter being the norm.

quantifiers which bind a degree variable and have a restriction associated with the expression they modify, and a scope associated with the element they add to the EXTRA list (i.e. the DD). That is, in either case, the semantics is handled 'locally' within the lexical item: displacement does not affect it. For example (36) has the roughly the semantics in (37).[13]

(36) Kim was so happy that she cried.

(37) $so(\delta, happy(s_0, Kim, \delta), cried(s_1, Kim))$

To sum up: Kay and Sag give an account of the syntax and semantics of DD constructions. Displacement is treated as a form of extraposition, and extraposition is handled by a collection of constructions. In particular, a construction that realises elements of the EXTRA list as right daughter to a head. Displacement possibilities are reflected in other constructions also, because of the way that EXTRA lists are percolated (or not, cf. the way the boundedness of the displacement is encoded by having constructions require certain EXTRA lists to be empty). There are some lexical stipulations, e.g. the semantics is given lexically, and the cases where displacement is obligatory (specifically, with degree words like *so*, *too*, etc.) arise because of the lexical properties of those items: they have no complements, their dependents appear on their EXTRA lists. Cases where displacement is optional arise where items are able to occur in the construction that moves complements from the COMPS list to the EXTRA list. Clearly, this will have to be stated in the lexicon. Likewise, cases where displacement is forbidden will arise because the relevant items are unable to appear in these constructions. Again, this will have to be stated in the lexicon.

The key idea here is that DDs involve a non-local dependency. In the next section we will explore how this idea can be developed to provide an account of the phenomena that can be expressed without significant extension to the theoretical apparatus of LFG.

3 LFG Analysis

The most obvious and natural way to capture the syntactic dependency that exists between DDs and their licensors is to treat DDs as complements (that is, COMPS or XCOMPS) of their licensors.[14] The question then arises whether DDs have, in addition to their in-clause function, an additional (e.g. discourse) function in their displaced ('upstairs') location: that is, whether there is an EXTRA feature, analogous to TOPIC, FOCUS, etc. We are not aware of any well developed LFG accounts of extraposition that would bear on this issue, or any clear evidence one way or another, but the simplest, most theoretically parsimonious, assumption is that they do not. Hence, we will assume that extraposition is a purely c-structure phenomenon. For simplicity, we will also assume that degree words and attributive adjectives are adjuncts of their heads.

That is, we assume an example like (38) receives a representation like (39).[15]

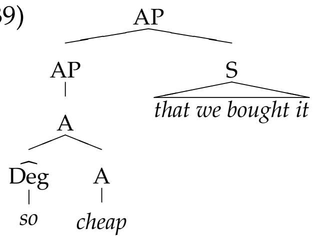
[13]Here δ is the degree variable associated with adjectives like *happy*, s_0 and s_1 are situation variables: the meaning is roughly there is a degree δ such that Kim was happy to degree δ in situation s_0, and this has a consequence that Kim cried in situation s_1.

[14]For simplicity, we will assume here that even complements that lack overt subjects (i.e. that are superficially VPs) are COMPS.

[15]We assume that the copula does not contribute a PRED value here, but nothing hangs on this. We will

(38) It was *so* cheap *that we bought it*.

(39)



$$\left[\begin{array}{ll} \textsc{pred} & \textit{`cheap}\langle\textsc{subj}\rangle\textit{'} \\ \textsc{subj} & [\textsc{pred}\ \ \textit{`pro'}] \\ \textsc{adj} & \left\{\left[\begin{array}{ll} \textsc{pred} & \textit{`so}\langle\textsc{comp}\rangle\textit{'} \\ \textsc{comp} & \left[\begin{array}{ll} \textsc{pred} & \textit{`buy}\langle\textsc{subj},\textsc{obj}\rangle\textit{'} \\ \textsc{subj} & \textit{`we'} \\ \textsc{obj} & \textit{`it'} \end{array}\right] \end{array}\right]\right\} \end{array}\right]$$

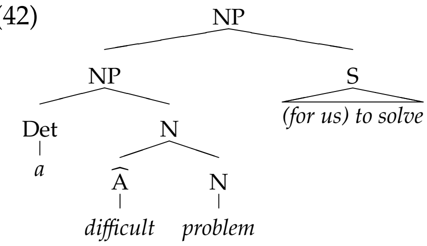
Producing the c- and f-structures in (39) will require a phrase-structure rule like (40), which makes the f-structure of the S into the COMP of an element of the ADJUNCT set of the AP.

(40) $\text{AP} \rightarrow \text{AP} \quad \underset{(\uparrow\ \textsc{adj} \in \textsc{comp}) = \downarrow}{\text{S}}$

Similarly (41) will receive a representation like (42), involving a rule like (43).

(41) This is a *difficult* problem *(for us) to solve*.

(42)



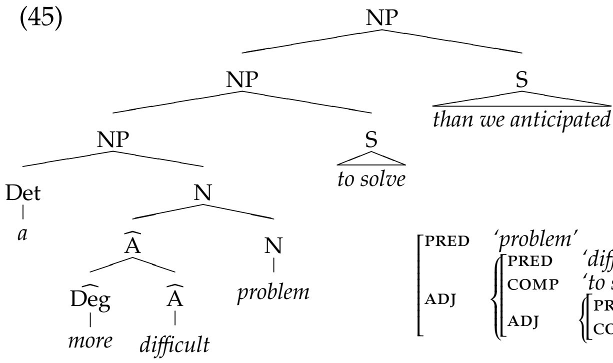
$$\left[\begin{array}{ll} \textsc{pred} & \textit{`problem'} \\ \textsc{adj} & \left\{\left[\begin{array}{ll} \textsc{pred} & \textit{`difficult}\langle\textsc{comp}\rangle\textit{'} \\ \textsc{comp} & \textit{`(for us) to solve'} \end{array}\right]\right\} \end{array}\right]$$

(43) $\text{NP} \rightarrow \text{NP} \quad \underset{(\uparrow\ \textsc{adj} \in \textsc{comp}) = \downarrow}{\{\text{S}|\text{VP}\}}$

The constraints in these rules must be generalised to deal with examples of longer distance displacement, as in (44), where *than we expected* is not a COMP of an adjunct of the head of NP, but of an adjunct's adjunct: see (45).

(44) This is a more difficult problem to solve than we anticipated.

(45)



$$\left[\begin{array}{ll} \textsc{pred} & \textit{`problem'} \\ \textsc{adj} & \left\{\left[\begin{array}{ll} \textsc{pred} & \textit{`difficult}\langle\textsc{comp}\rangle\textit{'} \\ \textsc{comp} & \textit{`to solve'} \\ \textsc{adj} & \left\{\left[\begin{array}{ll} \textsc{pred} & \textit{`more}\langle\textsc{comp}\rangle\textit{'} \\ \textsc{comp} & \textit{`than we anticipated'} \end{array}\right]\right\} \end{array}\right]\right\} \end{array}\right]$$

Generalising the above, we arrive at (46), which says that a phrase final S or VP

explain the significance of the 'hat' on $\widehat{\text{Deg}}$ here, and on $\widehat{\text{A}}$ in (42), below.

can be the COMP of a head, or of an adjunct of head, or of adjunct of an adjunct of the head, etc.

(46) $\text{XP} \rightarrow \text{XP} \quad \underset{(\uparrow\ (\text{ADJ} \in)^{*}\ \text{COMP}) = \downarrow}{\{\text{S}|\text{VP}\}}$

Notice that, given this, semantics along the lines suggested by Kay and Sag will be entirely straightforward. DD adjectives will be like other adjectives that take complements – when used attributively they will be associated with meaning constructors that consume the resources contributed by their complements, and produce constructors like those for simple adjectives (see Dalrymple (2001, p260ff)). Degree words will correspond to constructors that consume the resources associated with their complements, and the adjectives they modify, and produce resources with meanings like that given by Kay and Sag above. Roughly, the glue expression required is as in (47) (intuitively, this produces the interpretation of *too Adj VP* by consuming in turn the semantics of the DVAR (degree variable) of an item of which *too* is an adjunct ($(\text{ADJ} \in \uparrow)_\sigma \text{DVAR}$), the item of which *too* is an adjunct, and the complement of *too*):

(47) $\lambda d.\lambda P.\lambda Q.too(d, P(d), Q) : ((\text{ADJ} \in \uparrow)_\sigma \text{DVAR}) \multimap (\text{ADJ} \in \uparrow)_\sigma \multimap (\uparrow\ \text{COMP})_\sigma \multimap \uparrow_\sigma$

The schema in (46) is sufficient to license DDs, but it over-generates. As we observed above, displacement of dependents is sometimes necessary (e.g. with *too*, as in (48), (49)), sometimes optional (as with *difficult*, in cases like (50) and (51)), and sometimes forbidden (as with 'normal' adjectives like *grateful*, in (53), as compared to (54)), and *difficult* in an example like (52)).

(48) This problem is *too* complex *to understand*.
(49) *This problem is *too to understand* complex.
(50) This is a *difficult* problem *to solve without help*.
(51) A problem *difficult to solve without help* may be easier with help.
(52) *A *difficult to solve without help* problem
(53) *She is a *grateful* person *to her parents*.
(54) She is a person *grateful to her parents*.

The key assumption in our account of this will be that certain phrase structure positions – specifically, pre-adjectival and pre-nominal positions – are defective in not allowing the full range of phrasal projections of categories. This is not a novel suggestion. For example, Poser (1992) introduced the idea of 'small' categories, which was taken up by Sadler and Arnold (1994); Abeillé and Godard (2000)'s notion of 'LITE' expressions implements a similar idea in HPSG; Toivonen (2003) introduced the concept of 'non-projecting' categories. We will adopt a slightly modified version of Toivonen's idea.

According to Toivonen, (*loc cit* p55ff), as well as the usual X-bar categories (X^0, $\overline{\text{X}}$, XP), there are 'non-projecting' categories ($\widehat{\text{X}}$), which do not license higher levels of phrase structure (X^0 and $\widehat{\text{X}}$ are otherwise identical: intuitively, a $\widehat{\text{X}}$ is just an X^0 that cannot appear in an XP, though it may of course have a different distribution because of this, e.g. it will not be able to combine with complements and adjuncts in the normal way, and may appear in different c-structure positions). As well as the usual schemata in (55), which license structure in projections of X^0 and $\overline{\text{X}}$, Toivonen has the schemata in (56) which allow adjunction to of YP to XP, and $\widehat{\text{Y}}$ to X^0.[16]

[16]We make a minor departure from Toivonen in (55) and (56): where we have YP, she has YP*. Thus,

(55) a. $\mathrm{XP} \rightarrow \overline{\mathrm{X}} \quad \mathrm{YP}$
b. $\overline{\mathrm{X}} \rightarrow \mathrm{X}^0 \quad \mathrm{YP}$

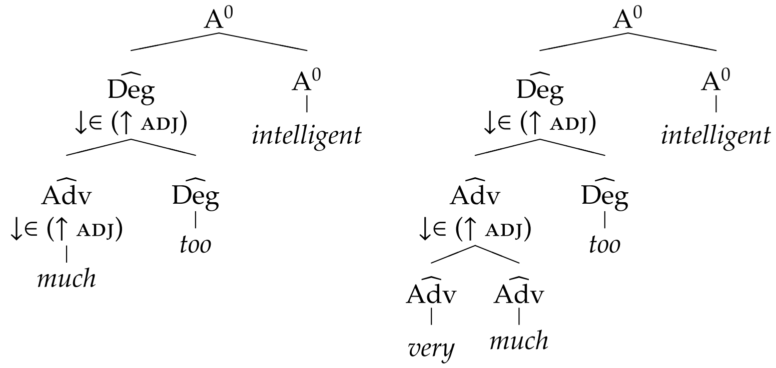
(56) a. $\mathrm{XP} \rightarrow \mathrm{XP} \quad \mathrm{YP}$ (Adjunction to XP)
b. $\mathrm{X}^0 \rightarrow \mathrm{X}^0 \quad \widehat{\mathrm{Y}}$ (Adjunction to X^0)

To these we will add the schema in (57), which allows modification of non-projecting categories (by non-projecting categories).[17]

(57) $\widehat{\mathrm{X}} \rightarrow \widehat{\mathrm{X}} \quad \widehat{\mathrm{Y}}$

We use the possibility of modification of non-projecting categories to provide an analysis of examples like *much too (intelligent)*, *very much too (intelligent)* which we assume have structures as in (58) (with *much* and *very much* being adjuncts of *too*).[18]

(58)



We make the following rather natural assumption:

(59) In general (i.e. by default), lexical items in categories that allow complements are X^0; $\widehat{\mathrm{X}}$ items do not have complements.[19]

The effect of this is just to establish $\widehat{\mathrm{X}}$ as the marked case for lexical items, as compared to X^0. This is a very natural assumption: what it says in effect is that lexical items that might in principle have complements (in virtue of their category) will appear in phrase structure contexts where those complements could be realised.

We require two additional assumptions that are specific to English:

(60) pre-head (in particular, pre-nominal and pre-adjectival) positions are restricted to $\widehat{\mathrm{X}}$s (e.g. $\widehat{\mathrm{A}}$, $\widehat{\mathrm{Adv}}$ and $\widehat{\mathrm{Deg}}$);

(61) post-head (esp. post-nominal and predicative positions) are restricted to XPs (i.e. projections of X^0)

We will now discuss some implications of these assumptions, and show that they

we generally assume a recursive phrase structure, where she assumes a flatter structure. We do not think anything hangs on this.

[17] This is less restrictive than Toivonen's position – she in fact claims that the schemata in (55) and (56) are the only ones that are permitted. However, we do not think the addition causes empirical problems for her proposals.

[18] Here and other representations, we generally suppress the $\overline{\mathrm{A}}$ between A^0 and AP, for reasons of space.

[19] Here, we assume that this means their PRED list is empty; that is, we are taking 'complement' to cover all grammatical functions, including SUBJ. Consequently, we assume that attributive adjectives do not select SUBJ functions. This assumption could be discarded by an appropriate re-definition of 'complement' as 'GF-⟨SUBJ⟩'

account for the range of data we require.

First, consider the fact that certain adjectives appear only pre-nominally or only post-nominally. Examples of adjectives the first kind include *mere*, *former*, *alleged*, *sheer*. These adjectives cannot appear post-nominally, or be used predicatively:

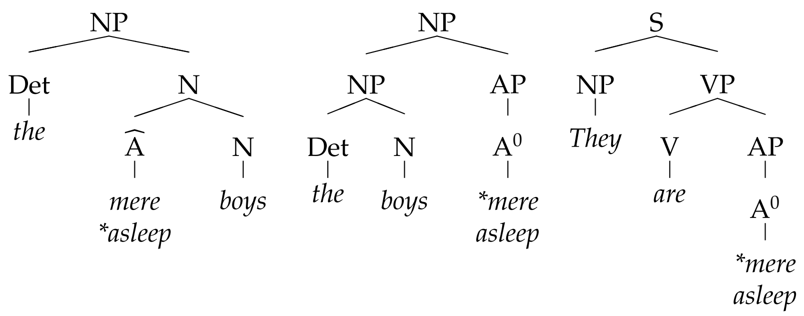
(62) They are mere boys.
(63) *They are boys mere.
(64) *They are mere.

This follows, given our assumptions, if these adjectives are lexically specified as $\widehat{\mathrm{A}}$. They are permitted to appear pre-nominally, but the only way they could appear post-nominally or predicatively would be if they could project an AP, which would require them to be A^0s. See the structures in (68).

Conversely, for adjectives like *awake*, *asleep*, *alive*, which cannot appear pre-nominally, but can appear post-nominally and predicatively: this behaviour follows if they are only A^0s. See (68).

(65) *The asleep boys were awakened by the noise.
(66) The boys asleep were awakened by the noise.
(67) The boys were asleep.

(68)



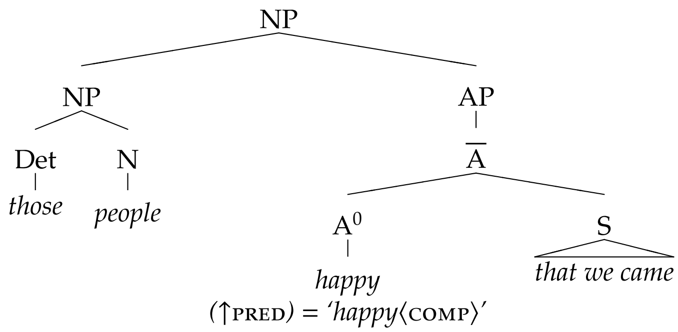
Secondly, consider the case of 'normal' adjectives (*happy*, *grateful*, *fond*, etc.), which appear post-nominally, and predicatively, with or without complements and post-nominal modifiers (as in (69)–(73)), but which can only appear pre-nominally when they do not have complements and are not themselves post-modified (as in (74)–(77)), even if as in (77) their dependents are displaced.

(69) those people *happy that we came*
(70) They are *happy that we came*.
(71) those people *happy at the moment*
(72) They are *happy at the moment*.
(73) Those people *happy* (irritate me, though I can tolerate them when they are sad).
(74) those *happy* people
(75) *those *happy that we came* people
(76) *those *happy at the moment* people
(77) *those *happy* people *that we came*

Our account is that such 'normal' adjectives lead double lives as $\widehat{\mathrm{A}}$s and A^0s, conforming to (59). That is, they are A^0s by default (since A is a category that allows complements), but can also appear as $\widehat{\mathrm{A}}$s – though in this case they will not project any higher phrase structure. When they have complements, e.g. in the use of *happy* that takes a sentential complement (‘*happy*⟨COMP⟩’) they will of necessity appear in APs, and similarly when they are post-modified.

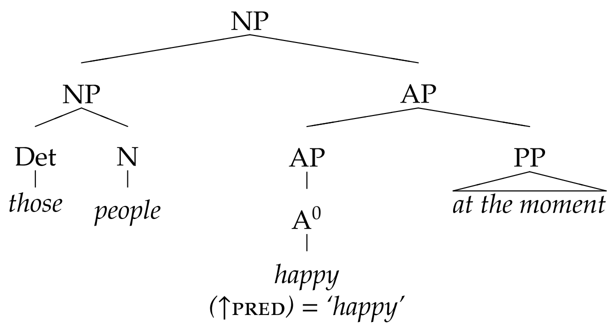
Consider an example like (69), where *happy* has an sentential complement *that we came*. This will have a structure like (78): X-bar principles (cf the schema in (55b)) dictate that the S complement has be a sister to A^0, and since we have an A^0, we also we get an AP, which is permitted post-nominally (and predicatively as in (70)).[20]

(78)



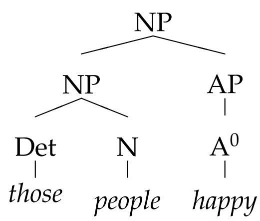
Similarly, an example like (71), where there is a post-nominal PP modifier, will have a representation like (79). X-bar principles dictate that the PP modifier *at the moment* has to be adjoined to AP, and AP requires an A^0 to project the structure (cf the X-bar schema in (56)).

(79)



An example like (74) (*those people happy*) will have a structure like *the boys asleep* in (68): simply because an item is an A^0 does not mean it has to have a complement, and one can have an AP without there being any post-modifiers.

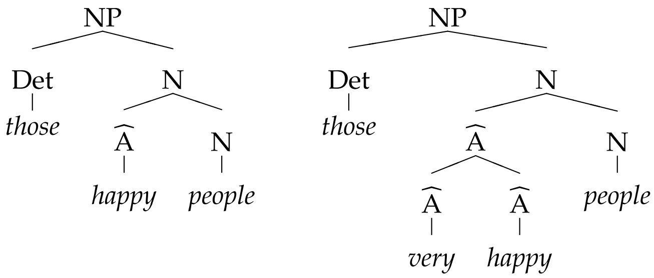
(80)



A normal pre-nominal adjective, such as in (74), will be an $\widehat{\mathrm{A}}$, giving a represen-

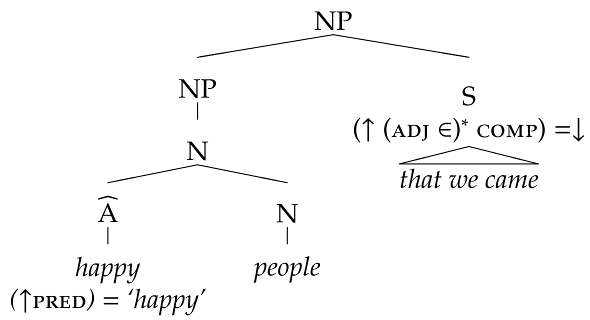
[20]Notice that in (78) or the following cases, a simple A^0 can be replaced by a pre-modified A^0 with a structure like the following: $[_{A^0}$ $[_{\widehat{\mathrm{Adv}}}$ very] $[_{A^0}$ happy]], as permitted by the schema in (56b).

tation like the following. The X-bar schema in (57) permits the $\widehat{\mathrm{A}}$ to be pre-modified, as in the second structure in (81).

(81)


The ungrammaticality of examples like (75), and (76) is straightforward: it follows from the fact that an expression like *happy that we came* or *happy at the moment* must be an AP, and pre-nominal position is restricted to $\widehat{\mathrm{A}}$s, excluding APs.

The ungrammaticality of (77), where *happy* appears in a DD construction, is equally straightforward: when *happy* is pre-nominal, it must be an $\widehat{\mathrm{A}}$; but this in general means it cannot have complements (in conformity to our assumption in (59)), hence it is automatic that it cannot have *displaced* complements. The representation would be along the lines of (82), which is a coherence violation (*that we came* is required to be a complement inside an adjunct somewhere lower in the structure – but there is no PRED that allows this).

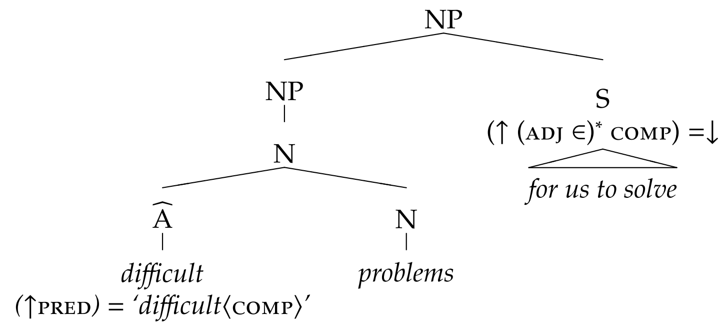
(82)


Thirdly, consider the case of adjectives, like *difficult*, that permit, but do not always require, DDs. These are exceptions to (59). They also lead a double life as $\widehat{\mathrm{A}}$ and a A^0, but in both cases they can have complements. But of course, if they are $\widehat{\mathrm{A}}$ (e.g. pre-nominal) their complements cannot be realised locally – they have to be displaced. Thus, we get the following data. The predicative use in (83) and the post-nominal use in (84) are exactly like the corresponding cases with *happy*, as is the contrast between the pre-nominal case with and without a complement in (85) and (86). The interesting case is (87).

(83) These problems are difficult for us to solve.
(84) Problems difficult for us to solve alone (can be easier with help).
(85) *A difficult for us to solve problem has been identified today.
(86) A difficult problem has been identified today.
(87) *difficult* problems *for us to solve*

The representation of (87) will be as in (88). This is parallel to (82), except that here the equation on the extraposed complement can be satisfied, making *that we came* the complement of *difficult*, and avoiding the coherence violation.

(88)



Finally, we come to degree words (*so*, *too*, *more*, etc.), whose complements displace obligatorily. They resemble adjectives like *difficult* in being exceptions to (59). The difference is that they lead a *single* life as $\widehat{\text{Deg}}$.

(89) too difficult for us to solve
(90) *too for us to solve difficult
(91) *difficult too for us to solve

Examples like (89) are allowed in the same way as examples like *difficult problems for us to solve* (see above). Examples like (90) are excluded because *for us to solve* is a complement, and must attach as sister to a Deg^0, but *too* is a $\widehat{\text{Deg}}$. Examples like (91) have two potential analyses. In one *for us to solve* would be a complement sister of *too*. This is excluded for the same reason as (90). An alternative (but equally non-viable) analysis would be that *for us to solve* is an extraposed complement of *too* (via an application of 'string vacuous' extraposition). However, this would still leave *too* in a post-head position, which would require it to be the head of DegP, which in turn would require it to be a Deg^0, which we have excluded.

The essence of our analysis is that degree words reflect an interesting mismatch between what one might think of as the demands of different components of the grammatical system. Lexically, they require complements, and this is reflected in f-structure, but their c-structure category is such that they can never realise their complements locally – hence for them extraposition is obligatory.

4 Conclusion

The original goal of the paper was to provide an LFG analysis of DDs that has comparable empirical coverage and theoretical appeal to existing accounts, specifically that of Kay and Sag (2012). With one reservation which we will address below, we think this goal has been achieved. The account we have given has a good empirical fit for the data, and while it is inspired by the account in Kay and Sag (2012), in that it treats DDs as involving extraposition, it uses only existing LFG machinery; specifically: (i) a novel, but very simple, story about extraposition (cf. (46)); (ii) a slight extension of an independent theory of non-projecting categories and their distribution (based on Toivonen (2003)); and (iii) plausible assumptions about lexical properties of Degree Words and DD adjectives: essentially that they show a mismatch between complementation and phrase structure projection properties – in being $\widehat{\text{X}}$ items that take complements.

There remain, however, a number of problems and open questions, which we will briefly review.

On the empirical side, our account under-generates in at least one respect. A descriptive consequence of our analysis is that pre-nominal adjectives cannot have complements. This generalisation is well-known to be false for at least two classes of case. One is exemplified by the pre-nominal adjective in (92). We do not find this very troubling, because it is part of a much more general phenomenon which allows almost any phrase to be converted into a pre-nominal modifier, cf. for example the clause in (93). These expression require special intonation, and seem to require special treatment independent of the phenomena we have looked at here.

(92) She's one of those very-tall-for-their-age-and-not-very-happy-with-it little girls.
(93) I'm having one of those I'm-so-sick-of-this-bloody-job-that-I-could-scream days.

A more problematic collection of counter-examples is given in the following.

(94) a taller than average child
(95) a difficult to please person
(96) a hard to solve problem

We have no good account of these, which are problematic for all other accounts, including those reviewed above. However, we note that not only are there restrictions on the adjectives that permit this (e.g. **a happy to be considered interviewee*), there are also restrictions on the kind of NP that can appear inside the construction. Thus, while *average* is acceptable in (94), it cannot be replaced with a referential or quantificational noun:

(97) *a taller than me child (cf. a child taller than me)
(98) *a taller than this mark child (cf. a child taller than this mark)
(99) *a more expensive than most houses car (cf. a car more expensive than most houses)

The account also over-generates. Our extraposition rule allows extraposition of COMP and from inside adjuncts; this is over-general. For example, relative clauses are adjuncts, and can contain complements, as in (100), cf. the representation in (102) but these complements cannot be extracted, as (101) shows.

(100) the man [who Kim thinks [that Sam admires]] in the brown suit
(101) *the man [who Kim thinks ___] in the brown suit [that Sam admires]

(102)
$$\begin{bmatrix} \text{PRED} & \textit{man} \\ \text{ADJ} & \left\{ \begin{bmatrix} \text{PRED} & \textit{'thinks'} \\ \text{SUBJ} & \textit{'Kim'} \\ \text{COMP} & \textit{'that Sam admires'} \end{bmatrix} \right\} \end{bmatrix}$$

Another area where out account is potentially deficient relates to the issue of boundedness. Recall that Kay and Sag treated the contrast between (34a) and (34b), repeated here, by requiring that the EXTRA list of finite VP be empty.

(103) a. **More** girls were so happy that they cheered **than boys**.
b. ***More** girls were so happy **than boys** that they cheered.

This is a natural thing to state in HPSG or SBCG, where the S and VP are associated with distinct data-structures. But it is *not* an easy thing to state in LFG, where there is no simple LFG equivalent of 'finite VP' as opposed to 'finite S' (finiteness is an f-structure property, and S and VP have the same f-structure). It would, of course, be possible to express this constraint by means of a complex c-structure category, but one would prefer to have independent motivation for such a move.

Fortunately, it seems this is not the correct characterisation. In particular, notice that finiteness is not the issue, since the same contrast arises with non-finite VPs, such as the non-finite complement of *prefer* (*prefer that . . . be . . .*):

(104) a. I would prefer that **more** girls be so happy that they cheer **than boys** than the reverse.
b. *I would prefer that **more** girls be so happy **than boys** that they cheer than the reverse.

However, an alternative account is possible: the facts follow if extraposition to S is limited to the elements of the subject, and extraposition to VP from subject is excluded. That is, if the constraints on S and VP are as follows:

(105) $S \rightarrow S \quad \underset{(\uparrow\ \mathrm{SUBJ}\ (\mathrm{ADJ}\ \in)^{*}\ \mathrm{COMP}) = \downarrow}{\{S|VP\}}$

(106) $VP \rightarrow V \quad \underset{(\uparrow\ (\mathrm{GF} - \mathrm{SUBJ})\ (\mathrm{ADJ}\ \in)^{*}\ \mathrm{COMP}) = \downarrow}{\{S|VP\}}$

However, this is certainly not the whole story. There are gaps in Kay and Sag's account here as well. For example, while complements of *more* can be displaced from subjects, not all DDs can move so far. For example, complements of DD adjectives like *difficult* cannot:

(107) A difficult problem *to solve* was raised at the meeting.
(108) *A difficult problem was raised at the meeting *to solve*.

We leave this as a topic for further research.

Comparison with the HPSG based account discussed in Section 2 brings out the very limited apparatus LFG has for lexical selection when compared to HPSG: there is nothing in LFG comparable to the MOD, or SPEC features, or the more recent SELECT feature that HPSG analyses can use to allow non-heads to select the sorts of head they will accompany. Given that we have provided an analysis that manages without such apparatus, this does not seem to be a disadvantage.

But there is one respect in which our account does not match that of Kay and Sag (2012), and this is a reflection of a genuine and important difference between the theoretical apparatus of HPSG/SBCG and LFG. Our account of DDs, like that of Kay and Sag, involves extraposition, and our account of extraposition uses functional uncertainty equations, which are in their nature *independent* statements about relationships. This is adequate for the cases above (with *more*) , which allow scrambling of DDs from different licensors. But Kay and Sag pointed out that some DD licensors (e.g. *so*) require nesting, e.g. (30) and (31) above, repeated here:

(109) (The problem is) *so difficult to solve that we gave up*.
(110) *(The problem is) *so difficult that we gave up to solve*.

This is handled straightforwardly, albeit by stipulation, in Kay and Sag's account: elements are discharged from the EXTRA list in strict order (from the front), items like *so* push their complements onto the end of the EXTRA list; hence these dependencies nest. Modelling long-distance dependencies with lists as in HPSG and SBCG gives very fine control over relations of the same kind. It is not clear how this can be expressed nicely in a functional uncertainty account: to get the same level of control in a functional uncertainty based account would appear to require a variety of off-path constraints and/or otherwise unmotivated features, which is not very appealing (cf. Dalrymple and King (2013) for discussion of phenomena that raise similar issues).

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LFG CONTRIBUTIONS IN SECOND LANGUAGE ACQUISITION RESEARCH: THE DEVELOPMENT OF CASE IN RUSSIAN L2

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Abstract

Learning a second language (L2) is a complex task, involving cognitive and affective factors, both personal and social. Hence theories of Second Language Acquisition (SLA) are many and varied. Among them, Processability Theory (PT) offers a principled transitional paradigm that deals specifically with grammatical development (cf. Pienemann, 1998; Pienemann, Di Biase & Kawaguchi, 2005). In this paper we will illustrate how LFG contributes substantially to the formulation of PT's developmental hypotheses. Specifically it provides PT with two fundamental concepts, ensuring that the different parts of a sentence fit together: the different syntactic (i.e., lexical, phrasal or sentence) levels within or across which their elements require unification; and the different kinds of correspondences among a-, c- and f-structures. Furthermore, within the PT framework, we will investigate the development of case in Russian L2. In this respect, the original proposal that we wish to make here is that King's (1995) descriptive account of case assignments in Russian can also be applied in a developmental perspective. In particular, we will show that King's four types of case assignments (semantic, configurational, lexical and grammatical functions) can be successfully interfaced with PT's stages for the development of case, and thus constitute a helpful resource for a better understanding of the learners' developmental process. Our hypotheses are then tested on cross-sectional data collected among 12 learners of Russian L2 at different proficiency levels and from a varied L1 background.

1 Introduction

In the first section of this paper we will briefly present the framework of Processability Theory (PT, cf. Pienemann, 1998; Pienemann, Di Biase & Kawaguchi, 2005; Bettoni & Di Biase, in preparation), and illustrate LFG's significant contribution to the formulation of its developmental hypotheses for syntactically-motivated morphology and pragmatically-motivated syntax. The remainder of the paper is then organised as follows. Section 2 discusses case in LFG with special attention to Nordlinger's Theory of Constructive Case and King's classification of case assignments in Russian. Section 3 presents the main characteristics of the Russian case system. In Section 4 we show our developmental hypotheses for Russian L2 and introduce our new proposal to incorporate King's classification of case assignments into our PT-based hypotheses. Section 5 will then provide supporting evidence for our hypotheses coming from a cross-sectional study of 12 learners of Russian L2 at different proficiency levels and from a varied L1 background.

2 Processability Theory

Processability Theory is a Second Language Acquisition (SLA) theory of grammatical development. It is cognitively founded (hence applicable to any language), formal and explicit (hence empirically testable), and extended, having not only formulated and tested hypotheses about morphology and syntax, but also paved the way for further developments at the interface between grammar and the lexicon and other important modules in SLA (Bettoni & Di Biase, in preparation). The theory was born in 1998, after Pienemann's first publication on PT. Since then, the theory has grown exponentially and widened its scope, especially thanks to Pienemann, Di Biase and Kawaguchi (2005), who incorporated new theoretical LFG work, such as the Lexical Mapping Theory by Bresnan (2001), which add a discourse-pragmatically motivated syntactic component to its first syntactically-motivated morphological module.

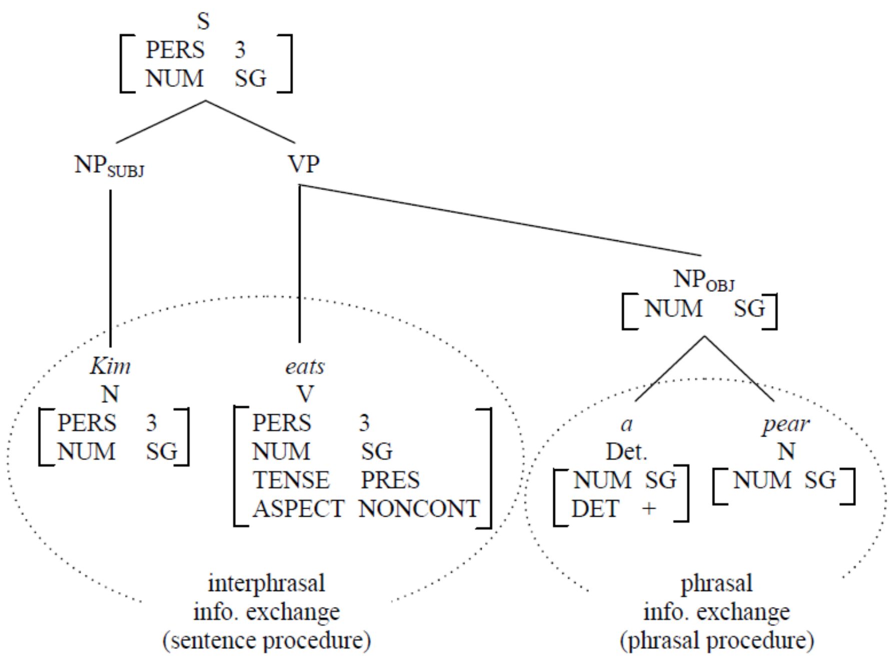
The underlying logic of PT is that at any stage of development learners can produce only those L2 forms which the current state of their language processor can handle (Pienemann, 1998). Hence it hinges on two formal models to account for – and interface – (a) language production, namely how the processor handles language, and (b) linguistic knowledge, namely what languages are like. For language production, PT relies on Levelt's Model (1989), a dynamic model which accounts for online language processing and within human psychological constraints, such as word access and human memory. It is precisely for linguistic knowledge, then, that PT relies on LFG. Notice that Levelt's Model and LFG interface successfully because (i) they are both lexicalist; (ii) they both aim at psychological plausibility; and (iii) Levelt himself bases his Model's lexicalist approach on LFG's non-derivational architecture.

Levelt's Model provides PT with the sequence in which grammatical procedures are activated. Following Kempen & Hoencamp's (1987) Incremental Procedural Grammar, Levelt (1989) maintains that grammatical encoding in mature monolingual speakers unfolds in this sequence:

a. the lemma
b. the category procedure
c. the phrasal procedure
d. the sentence procedure

Upon selecting the lemma, the category procedure is instigated, assigning a lexical category to the lemma. Then the category of the head lemma will instigate a phrasal procedure, resulting in a phrase. By means of the activation of the sentence procedure, phrases in turn will acquire their functions according to the syntactic frame of their head lemmas. This process is illustrated in the following tree representation.

(1) An illustration of the processing hierarchy for *Kim eats a pear*



Notice that the notion of information exchange between the items sharing the same attribute-value pairs at f-structure is borrowed from the LFG concept of 'feature unification'.
It is also important to note that the four-step sequence mentioned above is:

- *implicational*. This means, for example, that in order to activate the phrasal procedure, both the lemma and the category procedures must be activated, but that the sentence procedure need not be active;
- *incremental*. This means that all processors can operate simultaneously in parallel, but they all work independently on different language fragments of the utterance under construction. Implicit in Levelt's Model is the different cognitive cost required by different utterances.

PT's essential intuition is that the implicational hierarchy of the grammatical encoding process hypothesised by Levelt is reflected in the sequence in which learners acquire the grammatical structures of the L2. More specifically, with regard to morphological development, PT hypothesises that the availability of increasingly more demanding processing procedures defines the learners' progress through a sequence of stages which depend on the increasingly greater syntactic distance between the linguistic elements requiring feature unification. This universal sequence is shown in the table in (2), to be read from bottom to top.

(2) Hierarchy of processing procedures – morphological development (according to Pienemann 1998)

STAGE	t1	t2	t3	t4
4. SENTENCE PROCEDURE	–	–	–	interphrasal information exchange
3. PHRASAL PROCEDURE	–	–	phrasal information exchange	+
2. CATEGORY PROCEDURE	–	lexical form variation	+	+
1. WORD/LEMMA ACCESS	invariant forms & formulas	+	+	+

At the beginning, the only procedure L2 learners can activate is the access to the lemma. Thus they can produce only formulas and single words without formal variation. The main reason for this inability is that at this earliest stage the L2 lexicon is hardly annotated.

At the category procedure stage, learners begin to annotate their lexicon, and develop a system of lemmas whereby lexical concepts acquire first a syntactic category and later its subcategorisation diacritic features. At this stage, then, formal variation begins to emerge. The first category distinction that learners would tend to make is that between nouns and verbs; and the early values to be distinguished usually relate to the number feature for nouns, and the aspect/tense feature for verbs. However, whatever grammatical information is thus annotated, it does not carry beyond the word level. Because there is no exchange of information taking place, nothing is stored for further use somewhere else in the sentence.

With the next step forward learners reach the phrasal procedure stage. As the lexicon grows in number of items, learners add further diacritic features to their entries, and begin to distinguish categorically also adjectives and determiners from nouns, auxiliaries from lexical verbs, etc. At this stage, crucially, learners are able to distinguish the phrasal head from other elements within it and to produce phrasal agreements by checking the compatibility of the attribute-value pairs of the phrasal head against those of the dependent(s).

Finally, at the sentence procedure stage, learners are able to fully recognise the grammatical relations expressed by the constituents in the clause. In order to achieve this, the phrase needs to be attached to the S(entence)-node (that is, the mother node in the tree structure), with the sentence procedure determining the functional destination of the NP associated with the argument roles of the verb, such as NP_{SUBJ} or NP_{OBJ}. This implies that learners are now able to produce interphrasal agreements by checking the compatibility of the information coming from different phrases – typically from NP_{SUBJ} and VP.

With regard to syntactic development, LFG's crucial contribution to PT is nowhere clearer than in the 2005 extension of the theory, where two different paths are hypothesised for the development of syntax. The first is spelled out by the Discourse Functions Hypothesis (Bettoni & Di Biase, in preparation), which traces the staged development of syntax away from default solutions in linking c- to f-structure to the full flexibility of nondefault solutions in linking c- to f-structure. The second is described by the Lexical Mapping Hypothesis, which resorts to LFG's Lexical Mapping Theory to sketch out the staged development of syntax away from the rigidity of default canonicity to the full flexibility of optional choices allowed by the L2 lexicon in assigning GFs to thematic roles. In this study we will only focus on the Discourse Functions Hypothesis, whose universal stages are shown in the table in (3).

(3) PT: Syntactic development based on the Discourse Functions Hypothesis (Bettoni & Di Biase, in preparation)

STAGE	STRUCTURES
3. NONCANONICAL WORD ORDER	TOP_{XP} marked orders FOC_{XP} marked orders
2. XP_{DF} CANONICAL WORD ORDER	TOP_{XP} SVO / SOV / ... FOC_{WH-} SVO / SOV / ...
1. CANONICAL WORD ORDER	SVO / SOV / ...
single words; formulas	

After the single-word and formulaic stage, learners produce sentences with canonical word order.

At the next stage up, in declarative sentences learners will bring about a differentiation between SUBJ and TOP, and will thus be able to assign prominence to additional information in the clause by placing it in the first syntactic position. The less costly choice is that this new constituent be ADJ(unct) rather than an argument of the verb. Furthermore, in constituent questions, learners will be able to front FOC, but at this stage canonical word order will still follow.

At the next stage, the crucial step forward is the topicalisation/focalisation of a core argument other than SUBJ, typically OBJ. What enables this to happen is that the learner can now assign GF to each constituent irrespectively of the fixed position they occupy in the canonical order frame. This makes argument functions other than SUBJ sufficiently independent as to receive, by themselves, the assignment of a discourse function such as TOP or FOC.

3 Case in LFG

A case system is a prominent characteristic of dependent-marking languages. It is traditionally defined, in a general way, as a system marking dependent nominals to the type of relation they bear to their heads in a phrase (Blake, 1994). Case, then, is not a universal feature, as GFs can be identified by at least three different means: (a) case marking, which is the main means used by dependent-marking languages such as Russian, Japanese, and Warlpiri; (b) agreement, which is very productive in Romance languages like Italian and Spanish, where SUBJ and V can agree in person, number, and gender; and (c) word order or position in the phrase structure, used in configurational languages like English. Natural languages can then obviously exploit more than one means to identify GFs; for instance, Russian and Latin present both a rich case morphology and V agreement with SUBJ.

LFG offers a rich set of descriptions of case among typologically different languages. Among them, Nordlinger (1998) explains how in non-configurational languages, once the GF of an NP is unequivocally marked by case or agreement, other orders besides the canonical one can be grammatically acceptable for the three core elements (SUBJ, V, OBJ) in a sentence. This allows speakers to resort to different word orders and organise sentences according to the pragmatic requirements of the TOP-FOC structure of their sentences. Of particular interest for our study is King's (1995) identification of four types of case assignment with specific attention to

Russian: semantic case, configurational case, lexical case, and GF assignment.

Semantic case assignment, as the name itself suggests, occurs when a particular case is associated with a particular semantic role at a-structure. Semantic cases are common across languages (cf. Butt, 2006), but according to King (1995) the only candidate in Russian is the Instrumental case (INST) for <instrument>, as shown in (4).

(4)	*ja*	*napisala*	*pis'mo*	*karandaš-om*
	I	wrote	letter	pencil-INST

Configurational case assignment occurs when a specific case is assigned to a noun appearing in a certain position in phrase structure. In King's view, this occurs in Russian when genitive in N is daughter of NP, as illustrated in (5), and exemplified in (6). Notice that, unlike with semantic case, Genitive is assigned only by position in c-structure, because the genitive sister of N can mark different semantic roles, such as agent, as in (6), possessor, or a quality.

(5) NP $\rightarrow$ N(NP)
(($\downarrow$ CASE) = GEN)

(6)	*otvet*	*učenik-a*
	answer	pupil-GEN

Lexical case assignment occurs when case is governed by a particular preposition or verb, as formalised in the f-structure rules for prepositions in (7) and for verbs in (9), and exemplified in (8) and (10) respectively.

(7)	*u* 'at/near'	PREP <OBJ>
		($\uparrow$ OBJ CASE) = GEN

(8)	*u*	*okon*
	by	windows-GEN

(9)	*upravljat'* 'manage'	V <SUBJ, OBJ>
		($\uparrow$ OBJ CASE) = INST

(10)	*upravljaet*	*biznes-om*
	(s/he) manages	business-INST

Finally, case assignment can be determined by GFs. In Russian three GFs require their own default case, namely, nominative (NOM) for SUBJ, accusative (ACC) for OBJ, and dative (DAT) for OBL_{GOAL}, as formalised in (11). The sentence in (11) shows the match between the three cases and their related GFs. This would seem to contradict the rules in (7) and (9). However, we assume that the rules in (11) are default, whereas the rules in (7) and (9) are specific lexical requirements which can override the default.

(11) $(\uparrow \text{SUBJ CASE}) = \text{NOM}$
$(\uparrow \text{OBJ CASE}) = \text{ACC}$
$(\uparrow \text{OBL}_{\text{GOAL}} \text{ CASE}) = \text{DAT}$

(12) *mal'čik* *dal* *Inn-e* *knig-u*
boy-NOM gave Inna-DAT book-ACC
'the boy gave Inna a book'

With respect to this last type of case assignment, in our study we will consider only the case marking of the two core functions SUBJ and OBJ. On the other hand, the marking of OBL_{GOAL} is controversial for two reasons. First, care should be taken in determining the GF of DAT constituents, which are treated as OBL_{GOAL} by King (1995), but more recently as OBJ_{GOAL} by Kibort (2013). Second, the semantic restriction related to both OBL_{GOAL} and OBJ_{GOAL} suggests that L2 learners are likely to mark this type of constituents via semantic case assignment by associating DAT directly with the <goal> role at a-structure. These two points deserve further attention before the acquisition of DAT can be incorporated into our analysis.

4 The Russian case system

From a typological point of view, Russian is a language with a low degree of configurationality and a rich morphology that sets it among the dependent-marking languages. As already mentioned, non-configurational languages tend to express f-structure information by morphology rather than position, and case has the main role of constructing syntactic relations among constituents. Thus in Russian case markers on NPs encode GFs, and are almost never positionally predictable. However, Russian has a canonical word order, which is SVO[1], so NOM occurs before V, and ACC after V most often in the input received by learners – precisely 47% of the times in native oral production (Timberlake, 2004). For discourse and pragmatic reasons, however, constituents can occur in different positions, allowing for all the six possible combinations of the three core elements, as in (13) – even though it is important to note that word orders in (13d-f) rely heavily on prosodic features and, being highly marked, are rarely used by Russian L1 speakers (Kallestinova, 2007).

[1] For an alternative view on Russian word order, cf. King (1995), who suggests VSO as the unmarked, pragmatically neutral word order.

(13)	a.	Marij-a est kaš-u	SVO	‘Marija-NOM eats porridge-ACC’
	b.	Marij-a kaš-u est	SOV	
	c.	kaš-u est Marij-a	OVS	
	d.	est Marij-a kaš-u	VSO	
	e.	kaš-u Marij-a est	OSV	
	f.	est kaš-u Marij-a	VOS	

For learners of Russian L2, case is a complex feature to acquire. There are six cases: nominative, genitive, dative, accusative, instrumental, prepositional, which are fusionally enmeshed with other nominal features such as number (singular or plural), gender (masculine, feminine or neuter), animacy, and class.

The table in (14) shows the full case-marking paradigm for Russian. As we can see, overall, the many-to-many relations between cases and markers are noteworthy.

(14) Russian case-marking paradigm – Nouns (after Kempe & MacWhinney 1998)

	SINGULAR				
	MASCULINE		NEUTER	FEMININE	
	ANIMATE	INANIMATE		1ST CLASS	2ND CLASS
NOM	-ø	-ø	-o/-e	-a/-ja	-’ø
GEN	-a/-ja	-a/-ja	-a/-ja	-y/-i	-i
DAT	-u/-ju	-u/-ju	-u/-ju	-e	-i
ACC	-a/-ja	-ø	-o/-e	-u/-ju	-’ø
INST	-om/-em	-om/-em	-om/-em	-oj/-ej	-’ju
PREP	-e	-e	-e	-e	-i
	PLURAL				
	MASCULINE		NEUTER	FEMININE	
	ANIMATE	INANIMATE		ANIMATE	INANIMATE
NOM	-y/-i	-y/-i	-a/-ja	-y/-i	-y/-i
GEN	-ov/-ev/-ej	-ov/-ev/-ej	-ø /-ej	-ø/-ej	-ø/-ej
DAT	-am/-jam	-am/-jam	-am/-jam	-am/-jam	-am/-jam
ACC	-ov/-ev/-ej	-y/-i	-a/-ja	-ø/-ej	-y/-i
INST	-ami/-jami	-ami/-jami	-ami/-jami	-ami/-jami	-ami/-jami
PREP	-ax/-jax	-ax/-jax	-ax/-jax	-ax/-jax	-ah/-jax

When the stress does not fall on the last syllable, *-o* and *-a* are both pronounced /ə/

5 The developmental hypotheses

As we have previously remarked, case is an important morphological device for marking grammatical relations among constituents, and as such of great interest for PT because the two schedules for morphological and syntactic development presented in § 1 must crucially interface. Thus, unlike in § 1, in § 4.1 we propose to include both morphological and syntactic development in a single table. Our new LFG-based proposal is then presented in § 4.2. Here we hypothesise that King's case assignments discussed in § 2 can be interfaced with PT's stages for the development of Russian case.

5.1 PT-based hypotheses for Russian case

In (15) we show our PT-based developmental hypotheses for Russian case.

After the single-word and formulaic stage, as soon as the category procedure becomes operative for morphology, learners are able to distinguish categorially between nouns and verbs. Formal marking of nouns, then, begins to emerge at this stage. Once learners have annotated the case feature in their lexicon, they usually start to differentiate between the NOM and the ACC form of feminine nouns – typically between the *–a* marker and the *–u* marker (e.g., *kaš-a* 'porridge-NOM' vs. *kaš-u* 'porridge-ACC'). It is however important to keep in mind that, at this category procedure stage, formal variation triggers no information exchange with further elements in the phrase and/or clause, and is thus restricted within the word. Parallel to the category procedure stage in morphology, at the first syntactic stage learners can only produce sentences with canonical word order, that is, an underspecified SVO sequence with a preverbal N_{NOM} and a postverbal N_{ACC}, as shown in (16).

(16) *oxotnik-i* *ubit* *volk-a*
hunters-NOM *kills-3SG wolf-ACC
'the hunters *kills the wolf'

At the next stage up, with regard to morphological development, learners are able to produce phrasal agreements. In Russian this phrasal procedure stage involves a variety of structures. The relevant ones for this study are the agreement within PP, NP and VP. At this stage learners will be able to case-mark Ns within PP as lexically required by the preposition, as exemplified in (17).

(17) *v* *Moskv-e*
in Moscow-PREP

(15) Developmental hypotheses for Russian case

	STAGE	STRUCTURE	MORPHO-SYNTACTIC OUTCOME	EXAMPLE
Syntax	3. NONCANONICAL WORD ORDER	OVS, OSV, etc.	OBJ_{ACC} V $SUBJ_{NOM}$	*knigu čitaet mama* *[book-ACC reads mum-NOM]*
Morphology	3. SENTENCE PROCEDURE	TOP_{OBJ} V-agreement NP_{SUBJ} V-agreement		
Syntax	2. XP_{DF} CANONICAL WORD ORDER	TOP_{ADJ} SVO	ADJ $SUBJ_{NOM}$ V	*sejčas Oleg smotrit televizor* *[now Oleg-NOM watches television]*
Morphology	2. PHRASAL PROCEDURE	agreement in VP agreement in NP agreement in PP	V $OBJ_{INST/GEN/...}$	*Oleg upravljaet biznesom* *[Oleg manages business-INST]*
			N N_{GEN}	*kniga Olega* *[book-NOM Oleg-GEN]*
			P $N_{ACC/GEN/DAT/...}$	*u ozera* *[by lake-GEN]*
Syntax	1. CANONICAL WORD ORDER	SVO	N_{NOM} V N_{ACC}	*devočka est' kašu* *[girl-NOM eat porridge-ACC]*
Morphology	1. CATEGORY PROCEDURE	case marking on N e.g., NOM vs ACC/INST		
	single words and formulas			

Within the NP, they will also be able to mark the second NP as GEN, as configurationally required by the 'sister' N, like in (18).

(18) *život* *volk-a*
stomach wolf-GEN

Finally, within the VP learners will be able to check the value of the case feature of NP_{OBJ} against the value of the feature OBJ CASE of V, as shown in (19). If OBJ is marked by its default ACC case in its default postverbal position, the proof of intraphrasal exchange of information remains equivocal. We thus prefer to consider unequivocal proof of progress to this stage when OBJ is marked with cases other than ACC (e.g., INST).

(19)	*ona*	*zanimaetsja*	*muzyk-oj*
	she-NOM	does	music-INST
	'she practices music'		

With regard to syntax, we hypothesise that at this stage learners will be able to place an element other than SUBJ – typically ADJ – in the first position as in (20). This addition in turn will bring about a differentiation between $SUBJ_{NOM}$ and the topical first constituent in the clause.

(20)	*zdes'*	*ona*	*ne slyšala*	*sovet-u*
	here	she-NOM	not heard- FEM.SG	advice-ACC
	'here she didn't take the advice'			

At the last stage of their morpho-syntactic development, learners are able to assign GFs irrespectively of position. As we have seen, in Russian this requires two morphological resources: a head-marking strategy, namely SUBJ-V agreement for the identification of SUBJ; and a dependent-marking strategy, namely case-marking for identifying the two main argument functions – that is, SUBJ and OBJ. With regard to the former strategy, with the activation of the S-procedure, learners can now produce the agreement between the SUBJ features (number and gender) and the predicate. With regard to the latter strategy, still thanks to the activation of the S-procedure, information exchange between V and its complements can now happen across phrases. This crucially occurs when OBJ is displaced to the left of V, requiring learners to case-mark the displaced constituent with ACC as a result of the exchange of information between VP and the external NP, as shown in (21).

(21)	*vilk-u*	*prinesla*	*balerin-a*
	fork-ACC	brought-FEM.SG	dancer-NOM
	'the fork, the dancer brought it'		

At this last stage, then, the interplay between morphology and syntax in the development of case is self-evident. On the one hand, morphology feeds syntax in the sense that only when the S-procedure is firmly in place learners can case-mark constituents unambiguously regardless of word order constraints. On the other hand, along the path for morphological development, the most convincing proof that case is assigned via interphrasal information exchange is available only when learners are able to free up the rigidity of the canonical word order frame – crucially by choosing to topicalise OBJ.

5.2 The interface with King's case assignments

The table in (22) illustrates our proposal to interface King's case assignments with PT's stages. In particular, we will also show how King's labels applied to PT's stages contribute to resolving some of the issues concerning the interface between morphological and syntactic development. For example, recall that at the category procedure stage, learners are able to case-mark constituents without exchanging information with further elements in the clause. This would seem to contradict the fact that a case system crucially marks dependency relations. Furthermore, assuming that at this stage learners can produce sentences of canonical word order, how can they case-mark GFs without exchanging information with the verb?

(22) Interfacing PT's stages for morphological development (Pienemann, 1998) with LFG's types of case assignments (King, 1995)

DEVELOPMENTAL STAGE		CASE ASSIGNMENT
Sentence procedure	↔	Grammatical Functions
Phrasal procedure	↔	Lexical / Configurational
Category procedure	↔	'Proto-configurational' / Semantic

Unable to compute any information exchange and to disrupt the canonical word order frame, at the category procedure stage, learners can exclusively rely on two criteria to assign case: semantics and position. This leads us to hypothesise that at this first stage, learners can produce:

- semantic case assignment, in the sense that they will map case markers straight onto thematic roles, with NOM assigned to <agent> and ACC assigned to <patient>;
- proto-configurational case assignment, in the sense that, along with semantics, it is syntactic position that leads the way to assigning case, with the preverbal noun marked as NOM, and the postverbal noun marked as ACC.

Readers would appreciate that a few adaptations have been made from King's original classification presented in § 2. First, King does not consider NOM to <agent> and ACC to <patient> as evidence of semantic case assignment, because in target Russian these cases are assigned in direct association with GFs. However, the point we wish to make here is that learners at this stage of development will treat case semantically rather than grammatically, and thus undergo the same type of case assignment as that presented in (4) in § 2. As for INST on <instrument>, which King proposes as the sole instance of semantic case assignment in Russian, we consider it as structurally belonging to this stage (requiring no information exchange), but virtually unlikely to emerge for two reasons: on the one hand, it occurs rarely in the input for L2 learners; on the other hand, it is used to mark ADJs, and at this stage, learners' utterances tend to be short, including mostly argument functions. Secondly, we adopt here the label 'proto-configurational' rather than simply 'configurational' as King suggests, because canonical word order at this stage is minimally specified (Pienemann, Di Biase & Kawaguchi 2005), in the sense that the learners' c-structure is not yet organised hierarchically, and constituents are purely sequenced onto a flat c-structure.

With the activation of the phrasal procedure, we hypothesise that learners can produce:

- configurational case assignment, when they mark the NP by GEN in the structure NP → N (NP);
- lexical case assignment, when they assign case as lexically required by verbs or prepositions.

Notice that, with regard to lexical case assignment, we do not assume that all the particular cases required by the verb/preposition lexical entries will be learnt at the phrasal procedure stage. In fact, they will have to be learnt individually. We simply hypothesise that, once learners have annotated these cases as values of the OBJ CASE feature in their lexicon, they will need an operative phrasal procedure to produce lexical case assignment.

With the activation of the sentence procedure, then, we hypothesise that learners will produce GF assignment irrespectively of position.

Finally, we would also like to remark that we assume this developmental hierarchy of case assignments to hold cross-linguistically, with the only exception of configurational case assignment, whose position in the hierarchy is inevitably language specific.

6 Testing the hypotheses

The evidence we bring to test our PT-based hypotheses and their interface with King's case assignments comes from a cross-sectional study of 12 learners of Russian L2, four males and eight females, at different proficiency levels. Their L1 background is quite varied and includes Italian, Serbian, Azeri, and Georgian. Their exposure to Russian also varies a great deal: some of them have learnt Russian at university, with very limited L2 input; others have learnt it in an immersion situation in a Russian speaking environment, with extensive L2 input. We used five conversational tasks to elicit the structures targeted in our developmental hypotheses. Among them are transitive structures, prepositional phrases, lexical verbs requiring OBJ to be marked by cases other than ACC, and OBJ topicalisations.

Our analysis in this study includes a total of 1023 unequivocally case-marked nouns and pronouns. We have thus excluded from our corpus all the nouns and pronouns that do not exhibit formal variation for case, e.g. neuter nouns ending in -Ø, which can be both NOM and ACC. The table in (23) illustrates the distributional analysis of the case markers among learners, structures and stages. The learners are listed horizontally from the least proficient to the most advanced one.

The structures are listed vertically as in our PT-based hypotheses, and the numbers in the same row indicate their occurrences. Furthermore, for evidence of progress to a stage we follow Pienemann, Di Biase & Kawaguchi (2005), who require one instance of a structure, provided we are convinced that our case-marked GF is processed online in a non-formulaic way; and Pallotti (2007), who requires evidence of systematic and productive use of the target structure.

All our learners can produce preverbal Ns marked as NOM. This is not surprising, as NOM is the unmarked default case. Ten of them can also mark postverbal Ns as ACC in a convincing number of structures as in (24), and hence they have safely reached the category procedure stage for morphology and the canonical word order stage for syntax.

(24)	JO:	*ona*	*uvidet*	*babušk-u*
		she-NOM	see-3SG	grandmother-ACC

As expected, the least proficient learners are more inaccurate in marking the postverbal N as ACC. As the example in (25) shows, inaccuracy comes about by the use of the default NOM marker.

(25)	EL:	*babušk-a*	*smotret*	**volk*
		grandmother-NOM	watch-3SG	*wolf-NOM

Less convincing is the number of occurrences for INST semantic case. In fact, only two learners (AL and MT) attempt to produce it, and only MT, who is among the most proficient ones, can mark it correctly by INST, as exemplified in (26), whereas AL falls back on the default NOM.

(23) The development of Russian case – cross-sectional data

PT Stages	Case Assignments	Structures	EV	AL	JO	MA	EL	CA	LI	CR	AB	MT	BI	BB
Sentence procedure	*Grammatical Functions*	**$\mathbf{OBJ}_{ACC}$** V (SUBJ)	-4	-4	-3	-4	-4	-4	-5	+3-1	+4	+4	+5	+8
Phrasal procedure		ADJ SUBJ_{NOM} V (OBJ)	/	/	/	/	/	+4	+10	+5	+16	+6	+14	+5
	lexical	V **$\mathbf{OBJ}_{INST}$**	-1	-2	-2	-2	+1 -1	+1 -1	+2	+1-1	+2	+2	+1	+2
	configurational	N **$\mathbf{N}_{GEN}$**	-3	-1	/	+2	+1-1	+1	+9-1	+1	+5	+5	+7-2	+3
	lexical	P **$\mathbf{N}_{GEN/ACC/...}$**	-13	-25	+11	+4-8	+14-12	+15-13	+18-5	+27-3	+39-13	+17-4	+22-1	+43-1
Category procedure	*semantic*	**$\mathbf{N}_{INST}$**	/	-1	/	/	/	/	/	/	/	+2	/	/
	proto-configurational & semantic	V **$\mathbf{N}_{ACC}$**	-9	-14	+12	+5-2	+6-5	+3-1	+11-2	+10-2	+7-6	+10-2	+11-2	+13
		$\mathbf{N}_{NOM}$ V	(+30)	(+26)	(+31)	(+32)	(+40)	(+25)	(+32)	(+37)	(+45)	(+28)	(+33)	(+42)

+ = correctly case-marked   - = incorrectly case-marked   / = lack of context

Numbers in brackets are irrelevant for determining the learners' progress

(26)	MT:	*oni*	*režut*	*život*	*volk-a*	*nož-om*
		they-NOM	cut-PL	stomach	wolf-ACC	knife-INST

Thus, although statistically irrelevant for this structure, our data would seem to suggest that this instance of semantic case assignment tends to be acquired late. However, this would not contradict our developmental hypothesis because, as we have discussed in § 4.2, we are inclined to ascribe its apparently late acquisition to reasons other than structural complexity.

These ten learners also show evidence of having reached the next stage up, which for morphology involves lexical case within PP, configurational case within NP, and lexical case within VP. There is, however, significant variation in the distribution of the different constructions belonging to this second stage. They can all produce lexical case assignment as required by P, even though some inaccuracy remains also among the more advanced learners, as shown in (27). This can be explained by the complex and many-to-many relationship between Ps and the cases they require.

(27)	AB:	*volk*	**prišlo*	*k*	**dom-a*
		wolf-NOM	*arrived-NEUT.SG	at	*home-GEN

k 'at' PREP <OBJ>
(↑OBJ CASE) = DAT

Nine of the ten learners can also produce configurational case assignment within NP, as exemplified in (28).

(28)	LI:	*cvet*	*stul-a*
		colour-NOM	chair-GEN

Only eight of them can also produce lexical case assignment in VP. In our corpus, this structure requires OBJ to be marked by INST, as in (29). The four learners who fail to mark OBJ by INST either produce a default NOM or mark the OBJ by ACC, thus relying on semantic and proto-configurational strategies.

(29)	MT:	*ona*	*zanimaetsja*	*muzyk-oj*
		she-NOM	does-3SG	music-INST

The distribution of these three structures among the ten learners seems to reveal further steps within the stage, unfolding in the following sequence: lexical case within PP, configurational case within NP, and lexical case within VP. It should be noted, however, that this further sequence is by no means assumed to be universal. In fact, it is both language-specific, since configurational and lexical case assignments vary across languages, and somewhat ‘learner-specific’, since lexical case assignment also depends on the attribute-value pairs that learners must annotate in their lexicon with respect to Ps, Vs and Ns – a less systematic and generalisable component.

With regard to syntactic development at this stage, it is interesting to note that only the seven more advanced learners introduce a topicalised ADJ, as in (30). Needless to say, they correctly mark SUBJ as NOM even if it occurs in the sentence second position.

(30)	MT:	z*des'*	*ona*	*ne slyšala*	*sovet-u*
		here	she-NOM	not heard-FEM.SG	advice-ACC

Five learners (CR, AB, MT, BI, and BB) have also reached the last stage of development and are thus able to produce GF case assignment irrespectively of word order. Hence, they can produce sentences like (31), where OBJ marked as ACC is in preverbal position.

(31)	BB:	*vilk-u*	*prinesla*	*balerin-a*
		fork-ACC	brought-FEM.SG	dancer-NOM

As we have remarked earlier, OBJ topicalisation in these constructions was deliberately prompted by one of our five tasks, which forced the learners to begin their utterances with the <theme> role. What happens, then, when the learners who have not yet acquired the morphological resources of the last stage are asked to perform this task? The most common solution is to overextend NOM on both the preverbal N and the postverbal N as in (32).

(32)	AL:	**vilk-a*	*prines*	*balerin-a*
		fork-NOM	brought-MASC.SG	dancer-NOM

There is however a second less common solution. MA and JO, for example, often tend to mark postverbal SUBJ as ACC, as shown in (33), which is evidence of case assignment only by position.

(33)	MA:	**vilk-a*	*prines*	*balerin-u*
		fork-NOM	brought- MASC.SG	dancer-ACC

Both solutions would seem to suggest that when learners have not reached the last stage of development, and more complex syntactic structures are triggered by discourse-pragmatic requirements, proto-configurationality would tend to override semantics in the case-marking process.

7 Conclusion

In this study we have shown how a theoretical model like LFG can be useful in setting hypotheses for second language development, and how it can contribute in shaping and pushing forward SLA research. First, in a general way, LFG provides PT with a solid and cognitively-founded model for language description, which can be successfully used also to account for the learners' interlanguage. Secondly, the interface we have proposed between our PT-based developmental hypotheses and King's types of case assignment enhances our understanding of the staged development of Russian case by revealing further interesting patterns. The results of our cross-sectional study indicate that learners at different PT stages resort to different strategies to assign case. Specifically, the learners at the category procedure stage tend to assign case on the basis of semantically-motivated and proto-configurational strategies; further up, the procedural resources of the phrasal procedure stage allow learners to produce lexical and configurational case assignments; and finally, only the learners who have safely reached the sentence procedure stage are able to produce GF assignment regardless of word order constraints. Furthermore, when learners attempt to produce structures belonging to stages they have not reached yet, they resort to simpler strategies, such as semantic and proto-configurational case assignments.

Our data confirm the implicational scalability of our developmental hypothesis, and suggest a hierarchical reading of King's classification, as shown in (34), from the easiest to the most cognitive costly type of case assignments.

(34) Proto-configurational > Semantic > Lexical in PP > Configurational > Lexical in VP > Grammatical Functions

As this hierarchy is based on PT stages, which have been validated cross-linguistically, we assume it to be universal and thus applicable to any language, with the only exception of Configurational case, which happens to be highly language-specific. However, cross-linguistic evidence would be required to generalise our findings. Further investigation is thus needed in several directions, as well as more substantial proof on more diverse structures in a wider corpus. A fuller developmental hypothesis based on King's (1995) types of case assignment should, first, include the third case-marked argument function, namely the dative OBL_{GOAL}, and secondly, the interface between PT's Discourse Functions Hypothesis and Lexical Mapping Hypothesis, which are two unexplored areas in Russian L2. Finally, we hope that further work on Lexical Mapping Theory will help PT to formulate clearer and wider developmental hypotheses for case.

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OPTIMAL AGREEMENT AT M-STRUCTURE: PERSON IN DARGWA

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Abstract

The rules of person agreement in languages of the Dargwa group (North-East Caucasian) are complex and based on the relative prominence of the core arguments on the personal and grammatical function hierarchies. The rules are also subject to much cross-dialectal variation. I argue that this variation can best be captured by assuming that the agreement marker specifies the person and number of an m-structure function called TH, which can be identified with either of the core arguments. The choice of agreement controller is determined not by functional annotations, but by four OT constraints: TH-1, TH-2, TH-$\widehat{\text{GF}}$ and TH-ABS. Thus the same f-structure maps to different c- and m-structure pairs in different Dargwa varieties based on variation in constraint orderings. This allows us to capture cross-dialectal variation in a uniform way while providing generalizations about which of the logically possible agreement systems are actually attested.

1 Dargwa: an overview

Dargwa (or Dargi) is a subgroup of the Nakh-Daghestanian language family. In the Soviet period, a single standard language was created based on the dialect of Aqusha. This is the only Dargwa variety that has official status, but it is not intelligible for the speakers of most other dialects (Koryakov & Sumbatova 2007).

Most of the key features of Dargwa are shared with other Daghestanian languages. These are ergative alignment (at least morphologically), SOV basic word order, a rich system of nominal spatial cases and a complex verbal morphology. Like in other North-East Caucasian languages that possess it, gender agreement is always controlled by the absolute argument of the clause:

(1) Shiri

a. $\boxed{\text{pat'imat}}$ **r**-ax-ul ca‹**r**›i
Patimat.F F-go.IPFV-PRS-CVB COP‹F›
'Patimat[1] is walking.'

b. murad-li $\boxed{\text{pat'imat}}$ **r**-uc-ib-li ca‹**r**›i
Murad.M-ERG Patimat.F F-catch.PFV-PRET-CVB COP‹F›
'Murad has caught Patimat.'

An outstanding feature of Dargwa is the existence of person agreement, which is rare for North-East Caucasian (apart from Dargwa, it is only found in Udi and Tabasaran). Person agreement is not tied to a particular thematic role or grammatical function, but is determined based on relative prominence of the arguments on the person and grammatical function hierarchies:

[1]From here on, the agreement controller will be put inside a frame for clarity.

(2) Ashti

a. di-l ʔaˤli us-a-d
1Sg-ERG Ali [M]catch.PFV-PRET-1
'I caught Ali.'

b. ʔaˤli-dil u us-a-t:i
Ali-ERG 2Sg [M]catch.PFV-PRET-2
'Ali caught you.'

The points that I would like to make regarding person agreement are the following[2]:

1. Controllers of both gender and person agreement occupy dedicated structural positions.
2. The controller of gender agreement is PIV in Falk's (2006a) terms.
3. Person agreement cannot be assigned to any dedicated f-structure position.
4. Rather, there is a dedicated position (TH) in the m-structure of the clause (Frank & Zaenen 2004) that the projection of the controller of person agreement occupies.
5. Optimality theory acts as a filter that selects the correct c- and m-structure pair for a given f-structure based on a set of constraints; differences in constraint ranking explain differences between languages.

My analysis will concern twelve varieties for which sufficient data is available: Aqusha, Urakhi, Tanti, Kubachi, Ashti, Shiri, Icari, Khuduts, Qunqi, Kaytag, Chirag and Mehweb (see map[3] in Appendix).

2 Agreement rules

When applied to Dargwa, the terms "gender" and "person" agreement are simply convenient labels: "gender" markers also express number and (in a limited way) person, while "person" markers also express number.

2.1 Gender

There are three genders in the singular: masculine (M), feminine (F) and neuter (N); and two genders in the plural: human (HPL) and nonhuman (NPL). The assignment of nouns to these classes is purely semantic.

The only exception are 1st and 2nd person plural controllers which trigger the gender marker *d* (identical to nonhuman plural)[4].

The set of gender markers is the same in all varieties, barring phonological differences. A typical one (found e.g. in Shiri and Icari) is shown in the following

[2]The data of Shiri and Ashti come from my fieldwork in Daghestan; the data of other dialects come from published sources, in particular the general summaries in Sumbatova (2011a,b). I am thankful to Nina Sumbatova, Miriam Butt, Tracy Holloway King, the anonymous reviewers, and the audience of LFG13 for their comments on earlier versions of this paper. I would also like to thank my Ashti consultants, in particular Murad Gadžimuradov and Abdul Bakhmudov, and my Shiri consultants, in particular Magomed Gasanov, Abdulkadir Khulabekov, Akhmed Rabadanov, and Ibragim Rabadanov. All errors are mine.
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[3]The original map has been provided by Yuri Koryakov and is used with his permission. I have added circles representing the varieties surveyed in this paper.

[4]Some analyse this as 1st and 2nd person plural pronouns belonging to a separate gender; see Corbett (2013) for a discussion of why such an analysis is problematic.

table:

	Singular	Plural
M	*w*	*b*
F	*r*	
N	*b*	*d*

Gender agreement is marked by prefixes found with most verb stems, by suffixes on essive and allative-marked nouns and on some adverbs. The copula also contains a gender morpheme, which is an infix in some dialects and a suffix in others: cf., e.g. Shiri *ca‹**w**›i* (COP‹M›), *ca‹**b**›i* (COP‹N›), and Ashti *sa-**w*** (COP-M), *sa-**b*** (COP-N).

Clause-level elements (verbs, adverbs, and the copula) agree with the argument that carries Absolutive case, as shown in (1) above[5].

2.2 Person

There are several sets of person markers in Dargwa, which are distributed among different clause types and tense-aspect-mood series. The most widely used is the clitic set, which has the following structure (the forms shown are found in southern varieties):

	SG	PL
1	=da	
2	=di	
3	(ca‹b›i)	

The form *ca‹b›i* (where *‹b›* is the neuter marker) is the copula (which has slightly different form in different varieties, see above). It is used to mark the 3rd person in clauses with non-verbal predicates and in some tense-aspect-mood series; in other series that use the clitic set 3rd person is zero-marked.

The clitic markers are used in analytic verb forms and in clauses with nominal or adjectival predicates:

(3) Icari (Sumbatova & Mutalov 2003: 139–140)

a. murad tuχtur=ca-w
Murad doctor=COP-M
'Murad is a doctor.'

b. du tuχtur=da
1Sg doctor=1
'I am a doctor.'

There are also a few synthetic sets of person markers. The only set that will figure in my examples is the preterite set:

	SG	PL
1	-di	-d-a
2	-t:i	-t:-a
3	-aj, -i	

[5] In some dialects, adverbs and the copula can, under special circumstances, agree with the Ergative or Dative subject (Sumbatova 2010). The nature of this type of agreement is as yet unclear, and I will ignore it in this paper.

(4) Shiri
ʔaˤli meq b-arq’-aj
Ali wedding N-do.PFV-PRET.3
‘Ali married.’

In Mehweb, there is just one person marker in each of the sets (⊠*ra* in the clitic set), which marks 1st person in declarative sentences and 2nd person in interrogative sentences, cf. the examples for declaratives in (12).

Notably, none of the person marker sets has a number distinction in the 3rd person, thus there is no way to determine the agreement controller when both arguments are 3rd person.

In intransitive clauses, person agreement is always controlled by S (the only core argument). In transitive clauses, the controller is chosen between A (the subject) and P (the direct object). It is important to demonstrate that the choice of controller is dependent on grammatical function, not on case. Dative subjects can control agreement as well as ergative subjects:

(5) Shiri
dam murad či-w-ag-a-**di**
1Sg.DAT Murad SUPER[LAT]-M-see.PFV-PRET-1
‘I saw Murad.’

The rules that determine the choice of A vs. P in transitive clauses are complex and show considerable variation. All the Dargwa varieties can be broadly divided into two classes: those where the controller is predominantly determined by the person hierarchy, and those where subject control is dominant.

2.2.1 Speech act participant-dominated control

The first group is the largest and consists of **Icari**, **Qunqi**, **Khuduts**, **Kaytag**, **Aqusha** (and Standard Dargwa), **Tanti**, **Ashti**, **Urakhi**, **Chirag** and certain idiolectal variants of **Shiri**. In these dialects, the agreement rules are the following (cross-dialectal variation shown wherever present):

1. If one of the arguments is 3rd person, and the other is 1st or 2nd person, agreement is controlled by the speech act participant:

(6) Shiri
a. A = 1, P = 3
du-dil ʔaˤli us-a-**di**
1Sg-ERG Ali [M]catch.PFV-PRET-1
‘**I** caught Ali.’

b. A = 3, P = 1
ʔaˤli-dil **du** us-a-**di**
Ali-ERG 1Sg [M]catch.PFV-PRET-1
‘Ali caught **me**.’

2. If both arguments are speech act participants, there are differences among varieties. In **Icari**, **Qunqi**, **Khuduts** (Amuq) and **Kaytag**, agreement is controlled by the 2nd person argument:

(7) Icari (Sumbatova & Mutalov 2003: 79–80)

a. A = 1, P = $\boxed{2}$

du-l **u** uc-ib=**di**

1Sg-ERG 2Sg [M]catch.PFV-PRET=2SG

'I caught **you**.'

b. A = $\boxed{2}$, P = 1

u-l du uc-ib=**di**

2Sg-ERG 1Sg [M]catch.PFV-PRET=2SG

'**You** caught me.'

In **Aqusha**, **Tanti**, **Ashti**, **Urakhi**, and for some speakers of Shiri (**Shiri-1**), agreement in this case is controlled by P:

(8) Ashti

a. A = 1, P = $\boxed{2}$

di-l **u** j-us-a-**t:i**

1Sg-ERG 2Sg F-catch.PFV-PRET-2

'I caught **you** (fem.).'

b. A = 2, P = $\boxed{1}$

u-dil **du** us-a-**d**

2Sg-ERG 1Sg [M]catch.PFV-PRET-1

'You caught **me** (masc.).'

In **Chirag**, it is controlled by A:

(9) Chirag

a. A = $\boxed{1}$, P = 2

dic:e ʕu r-iq:an-**da**

1Sg.ERG 2Sg F-lead.IPFV-1

'**I** am leading you.'

b. A = $\boxed{2}$, P = 1

ʕic:e du r-iq:an-**de**

2Sg.ERG 1Sg F-lead.IPFV-2SG

'**You** are leading me.'

For some speakers of Shiri (**Shiri-2**), both A and P can control agreement in this case:

(10) Shiri

a. A = $\boxed{1}$, P = 2

du-dil ʔu r-uc-a-**di**

1Sg-ERG 2Sg F-catch.PFV-PRET-1

b. A = $\boxed{2}$, P = 1

ʔu-dil du r-uc-a-**t:i**

2Sg-ERG 1Sg F-catch.PFV-PRET-2

a′. A = 1, P = $\boxed{2}$

du-dil **ʔu** r-uc-a-**t:i**

1Sg-ERG 2Sg F-catch.PFV-PRET-2

'I caught **you** (fem.).'

b′. A = 2, P = $\boxed{1}$

ʔu-dil **du** r-uc-a-**di**

2Sg-ERG 1Sg F-catch.PFV-PRET-1

'You caught **me** (fem.).'

3. The 3rd person marker (or zero, or copula) is only used when both arguments are 3rd person:

(11) Ashti

A = $\boxed{3}$, P = $\boxed{3}$

pat'imat-li rasul us-**aj**

Patimat-ERG Rasul [M]catch.PFV-PRET.3

'**Patimat** caught **Rasul**.'

2.2.2 Subject control

There are only three varieties where subject control dominates: **Mehweb**, which has subject agreement as the only possibility, and **Kubachi** and some idiolectal variants of **Shiri**, where subject control is always possible, but can be overridden by the person hierarchy.

Mehweb only has dedicated agreement markers for the first person (in declarative sentences), most frequently =*ra.* These markers only appear with 1st person subjects (S/A), thus the person hierarchy does not seem to play any role in this variety:

(12) Mehweb (Magometov 1982)

a. A = $\boxed{1}$, P = 2
nu-ni ħu w-arz-ur=**ra**
1Sg-ERG 2Sg M-praise.PFV-PRET=1
'**I** praised you (masc.).'

b. A = 2, P = 1
ħu-ni nu w-arz-ur
2Sg-ERG 1Sg M-praise.PFV-PRET
'You praised me (masc.).'

---

c. A = $\boxed{1}$, P = 3
nu-ni it
1Sg-ERG DemDist
w-arz-ur=ra
M-praise.PFV-PRET=1
'**I** praised him.'

d. A = 3, P = 1
it-iʔi-ni nu
DemDist-OBL-ERG 1Sg
w-arz-ur
M-praise.PFV-PRET
'S/he praised me (masc.).'

For some speakers of Shiri (**Shiri-3**), A can always control agreement, but P may optionally become the controller if it is higher than A on the hierarchy 2 > 1 > 3:

(13) Shiri-3

a. A = $\boxed{1}$, P = 2
du-dil ʔu r-uc-a-**di**
1Sg-ERG 2Sg F-catch.PFV-PRET-1

a′ A = 1, P = $\boxed{2}$
du-dil **ʔu** r-uc-a-**t:i**
1Sg-ERG 2Sg F-catch.PFV-PRET-1
'I caught you (fem.).'

b. A = $\boxed{2}$, P = 1
ʔu-dil du r-uc-a-**t:i**
2Sg-ERG 1Sg F-catch.PFV-PRET-2
'**You** caught me (fem.).'

---

c. A = $\boxed{1}$, P = 3
du-dil pat'imat r-uc-a-**di**
1Sg-ERG Patimat F-catch.PFV-PRET-1
'**I** caught Patimat.'

d. A = $\boxed{3}$, P = 1
pat'imat-li du uc-**aj**
Patimat-ERG 1Sg [M]catch.PFV-PRET-3

d′. A = 3, P = $\boxed{1}$
pat'imat-li **du** uc-a-**di**
Patimat-ERG 1Sg [M]catch.PFV-PRET-1
'Patimat caught me.'

In **Kubachi**, the subject can always control agreement, but speech act participant P may optionally become the controller if A is 3rd person:

(14) Kubachi (Magometov 1963: 274–275, 282)

a. A = $\boxed{1}$, P = 2
du-dil u w-i:t-u-l=**da**
1Sg-ERG 2Sg M-beat.IPFV-PRS-CVB=1
'**I** am beating you (masc.).'

b. A = $\boxed{2}$, P = 1
u-dil du
2Sg-ERG 1Sg
w-i:t-u-l=**di**
M-beat.IPFV-PRS-CVB=2SG
'**You** are beating me (masc.).'

c. A = $\boxed{1}$, P = 3
du-dil id
1Sg-ERG DemDist
w-i:t-u-l=**da**
M-beat.IPFV-PRS-CVB=1
'**I** am beating him.'

d. A = $\boxed{3}$, P = 1
id-dil du
DemDist-ERG 1Sg
w-i:t-u-l=**sa-w**
M-beat.IPFV-PRS-CVB=COP-M

d′. A = 3, P = $\boxed{1}$
id-dil **du**
DemDist-ERG 1Sg
w-i:t-u-l=**da**
M-beat.IPFV-PRS-CVB=1
'He is beating me.'

The data of various dialects is summarized in the following table:

person		agreement marker					
A	P	Ic	Aq	Sh2	Kub	Sh3	Mhw
1	2	2	2	1/2	1	1/2	1
2	1	2	1	1/2	2	2	∅
1	3	1	1	1	1	1	1
3	1	1	1	1	3/1	3/1	∅
2	3	2	2	2	2	2	∅
3	2	2	2	2	3/2	3/2	∅
3	3	3	3	3	3	3	∅

Legend: Ic = Icari, Aq = Aqusha, Sh2 = Shiri-2, Kub = Kubachi, Sh3 = Shiri-3, Mhw = Mehweb.

3 Analysis

In this section, I will propose an LFG account of agreement in Dargwa that makes extensive use of m-structure projected from f-structure (Frank & Zaenen 2004) and Optimality Theory (Prince & Smolensky 1993, Bresnan 2000). I will assume that all agreement features are found at m-structure, thus the entries for nouns and pronouns are like the following:

murad N $(\uparrow \text{ PRED}) = \text{'Murad'}$
$(\uparrow_{\mu} \text{ PERS}) = 3$
$(\uparrow_{\mu} \text{ NUM}) = \text{SG}$
$(\uparrow_{\mu} \text{ GENDER}) = \text{M}$

du N $(\uparrow \text{ PRED}) = \text{'me'}$
$(\uparrow_{\mu} \text{ PERS}) = 1$
$(\uparrow_{\mu} \text{ NUM}) = \text{SG}$

3.1 Gender

Gender agreement in Dargwa is syntactically ergative as it is controlled by the S/P (absolutive) argument. The question is whether this is a purely morphological fact, or Dargwa is syntactically ergative. This, in turn, must be established based on the behaviour of other constructions.

It appears that different constructions have different pivots. As an example, I will provide the data of Ashti. In Ashti, simple reflexives can be both S/A- and S/P-oriented, but complex ones are always S/A-oriented:

(15) Ashti
a. rasul-li sin-na sa-w waqˤ-aqˤ-ip:i
Rasul-ERG Refl-GEN Refl-M hit-hit.PFV-PERF[3]
b. * sin-na sin-dil rasul waqˤ-aqˤ-ip:i
Refl-GEN Refl-ERG Rasul hit-hit.PFV-PERF[3]
'Rasul has hit himself.'

This type of complex reflexive is a sequence of two forms of the reflexive pronoun: the genitive form and the form bearing the case assigned to the position that the pronoun occupies. Thus in (15a) the pronoun stands in the Absolutive while in (15b) it stands in the Ergative.

In addition, the simple converb in Ashti can only be center-embedded if it is same-subject, where subject is understood as the S/A argument (Belyaev 2011).

At the same time, some constructions are strictly S/P oriented. These include, apart from gender agreement, for example, reciprocals. The antecedent may only be Ergative if the pronoun is in some oblique case form; if the antecedent and the pronoun correspond to positions where ergative (or dative, with experiencer verbs) and absolutive are assigned, the antecedent always receives Absolutive case[6] (reciprocal pronouns consist of two numerals *sa* 'one', the first of which stands in the antecedent's case while the second carries the case of the pronoun):

(16) a. rasul-li ʔali gap-w-a:q'-aj
Rasul-ERG Ali praise-M-do.PFV-PRET.3
'Rasul praised Ali.'
b. i. rasul=ba ʔali **sa-l** **sa** gap-b-a:q'-aj
Rasul=and Ali one-ERG one praise-HPL-do.PFV-PRET.3
ii. * rasul=ba ʔali-**dil** **sa-l sa** gap-b-a:q'-aj
Rasul=and Ali-ERG
'Rasul and Ali praised **each other**.'

(17) a. ʔali-**dil** rasul-li-**j** paltar d-ik:-aj
Ali-ERG Rasul-OBL-DAT clothes NPL-give.PFV-PRET.3
'Ali gave clothes to Rasul.'
b. i. ʔali=ba rasul-**li** sa-li-j sa paltar dik:aj
Ali=and Rasul-ERG one-OBL-DAT one
ii. * ʔali=ba rasul-**li-j** sa-li-j sa paltar dik:aj
Ali=and Rasul-OBL-DAT
iii. * ʔali=ba rasul salij sa paltar dik:aj
'Ali and Rasul gave clothes to each other.'

Thus, to describe the data of Ashti, both an f-structure position that reflects S/A and an f-structure position that reflects S/P are required. An appropriate framework that captures this is found in Falk (2006a):

- The traditional grammatical function SUBJ is split into two: $\widehat{\text{GF}}$ and PIV.

[6]The case marker in coordinating constructions which use the conjunction *=ba* undergoes suspended affixation.

- $\widehat{\text{GF}}$ (the "most prominent argument", or subject proper) is always identical to the subject in the classical sense (S/A).
- PIV (the pivot) gets language-specific assignment:
  - in accusative languages, it is always identified with $\widehat{\text{GF}}$;
  - in syntactically ergative languages, it is identified with $\widehat{\text{GF}}$ of intransitive verbs and with OBJ of transitive verbs;
  - other languages may employ more complex ways of determining the value of PIV.

Thus, Ashti can be analyzed as a syntactically ergative language, identifying PIV with $\widehat{\text{GF}}$ in intransitive clauses and with OBJ in transitive ones. As a preliminary generalization, Ashti reflexives and converbs are $\widehat{\text{GF}}$-oriented (Falk's theory actually predicts this for anaphora), while reciprocals[7] and gender agreement are PIV-oriented.

The definitions for gender morphemes are thus straightforward:

$$\textit{b-}\quad ((\uparrow\ \text{PIV})_{\mu}\ \text{NUM}) =_{c} \text{SG}$$
$$((\uparrow\ \text{XCOMP}*\ \text{PIV})_{\mu}\ \text{GENDER}) =_{c} \text{N}$$

Note the functional uncertainty expression $(\uparrow\ \text{XCOMP}*\ \text{PIV})$. It expresses the possibility of long-distance gender agreement with S/P of a subordinate clause:

(18) Shiri

a. pat'imat-li-ž **ħulk-ni** **d**-arq'-iž b-uχ:-u
Patimat-OBL-DAT chudu-PL NPL-do.PFV-INF N-know.IPFV-HAB.3
(verb agrees with the subordinate clause/default gender, neuter)

b. pat'imatliž **ħulkni** **d**arq'iž **d**-uχ:-u
NPL-know.IPFV-HAB.3
(verb agrees with direct object / PIV of the subordinate clause)

'Patimat can make *chudu*.'

Falk's *Pivot Condition* requires for any functional uncertainty path crossing a clause boundary to terminate in PIV. If one accepts this condition, the existence of such a type of long-distance agreement is a clear argument in favour of syntactic ergativity.

3.2 Person

3.2.1 An f-structure position?

In the previous section, it has been established that gender agreement is determined by the PIV function. It is thus plausible to assume that person agreement is also connected to some fixed grammatical function, which gets variable assignment depending on the person hierarchy. Since one cannot freely introduce *ad hoc* f-structure functions, such an analysis amounts to stating that the subject ($\widehat{\text{GF}}$) gets variable assignment in Dargwa (although this is in contradiction with Falk's theory).

It can be clearly seen that this is not the case. Syntactic constructions that

[7]Presumably, reciprocals in Ashti are not subject to the standard constraints on anaphora. Why this is so is a question for further inquiry.

are subject (S/A)-oriented behave in the same way regardless of whether A or P controls agreement in a transitive clause. For example, secondary predicates marked by *-mu:til* 'when' are S/A-oriented, and do not switch reference if the verb agrees with the patient:

(19) Ashti

a. milic:a-dil us-ip:i qilgu **kep-mu:til**
policeman-ERG [M]catch.PFV-PERF[3] thief drunk-when
'The policeman$_i$ caught the thief$_j$ when he$_{i,*j}$ was drunk.'

b. milic:a-dil du us-ip:i=da **kep-mu:til**
policeman-ERG 1Sg [M]catch.PFV-PERF=1 drunk-when
'The policeman$_i$ caught me$_j$ when he$_i$ / *I$_j$ was drunk.'

Thus, the subject position is filled by the S/A argument regardless of verb agreement.

In general, the person agreement controller appears to play no role in any other area of grammar. This means that person agreement in Dargwa is syntactically irrelevant and should not be tied to a particular f-structure function.

3.2.2 Listing the alternatives?

Staying within f-structure, the most obvious way of dealing with person agreement is to simply list the rules for each of the cases. For example, the definitions for **Ashti** person markers will be like the following:

$$\textit{=da}\quad \left\{ \begin{array}{lcl} ((\uparrow\ \text{PIV})_\mu\ \text{PERS}) =_c 1 & \mid & ((\uparrow\ \widehat{\text{GF}})_\mu\ \text{PERS}) =_c 1 \\ & & ((\uparrow\ \text{PIV})_\mu\ \text{PERS}) =_c 3 \end{array} \right\}$$

$$\textit{=di}\quad \left\{ \begin{array}{lcl} ((\uparrow\ \text{PIV})_\mu\ \text{PERS}) =_c 2 & \mid & ((\uparrow\ \widehat{\text{GF}})_\mu\ \text{PERS}) =_c 2 \\ & & ((\uparrow\ \text{PIV})_\mu\ \text{PERS}) =_c 3 \end{array} \right\}$$

The former definition can be paraphrased as "either S/P is 1st person or A is 1st person while P is 3rd person", the latter as "either S/P is 2nd person or A is 2nd person while P is 3rd person". These definitions are descriptively adequate, but do not seem to have much explanatory value. More importantly, they do not allow us to capture cross-dialectal variation in a regular way. For example, the corresponding definitions for **Icari** would have the following form:

$$\textit{=da}\quad \left\{ \begin{array}{lcl} ((\uparrow\ \widehat{\text{GF}})_\mu\ \text{PERS}) =_c 1 & \mid & ((\uparrow\ \widehat{\text{GF}})_\mu\ \text{PERS}) =_c 3 \\ ((\uparrow\ \text{PIV})_\mu\ \text{PERS}) =_c 3 & & ((\uparrow\ \text{PIV})_\mu\ \text{PERS}) =_c 1 \end{array} \right\}$$

$$\textit{=di}\quad \left\{ ((\uparrow\ \widehat{\text{GF}})_\mu\ \text{PERS}) =_c 2 \mid ((\uparrow\ \text{PIV})_\mu\ \text{PERS}) =_c 2 \right\}$$

The meanings of these agreement markers in Kubachi, Ashti, and Chirag would be again different. While the definitions are similar, it seems to be hard to come up with a parametric way of capturing the differences and similarities between them.

3.2.3 Optimality-theoretic constraints

The analysis that I would like to propose is based on the following idea. Dargwa provides a fixed structural position for the person agreement controller, which functional annotations freely identify with S, A or P ($\widehat{\text{GF}}$ or PIV). The task of picking out the appropriate controller is then relegated to Optimality Theory which filters the possible candidates.

According to Bresnan (2000), I take (possibly underspecified) f-structure as the input. The candidate set is a set of quadruples consisting of c-structures, f-structures, m-structures and their correspondence functions (Lee 2004).

Since, as discussed above, the controller of person agreement is syntactically irrelevant, I assign it to a specialized function that I will call TH, which is found in the m-structure projected from the f-structure of the clause (Frank & Zaenen 2004). This allows us to have the same f-structure map to different c- and m-structure pairs in different Dargwa varieties.

This function can be freely filled by either $\widehat{\text{GF}}$ or PIV, via a rule like the following (where f is any clausal f-structure):

$$\{(f_\mu \ \text{TH}) = (f \ \widehat{\text{GF}})_\mu \mid (f_\mu \ \text{TH}) = (f \ \text{PIV})_\mu\}$$

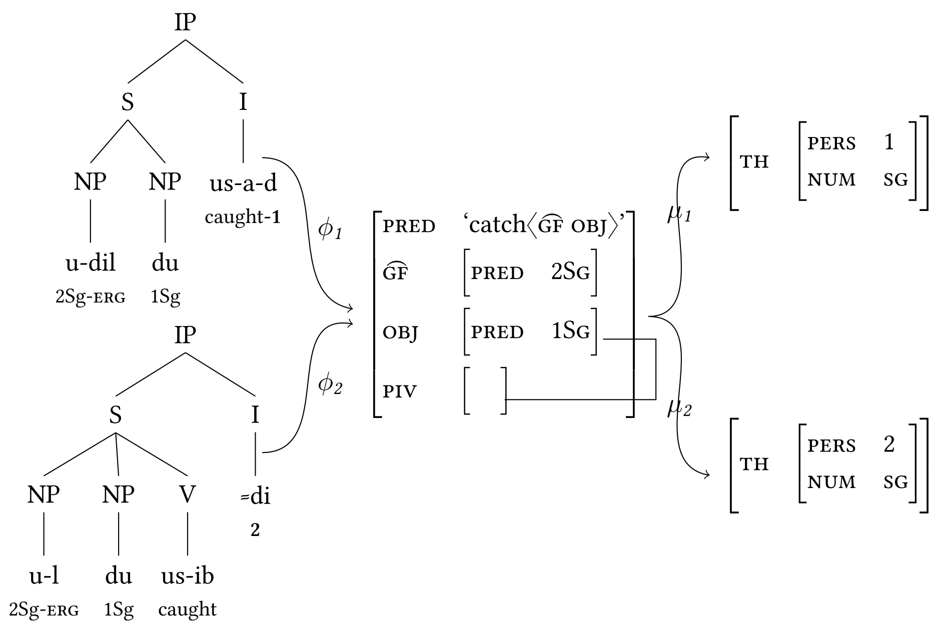
The entry for a person agreement marker is also uniform across dialects:

$$\text{=}da \quad \text{I} \quad (\uparrow_\mu \ \text{TH PERS}) = 1$$

The assignment of TH is evaluated in OT by the following four constraints that are evaluated for every m-structure m:

1Th	$(m \ \text{TH PERS}) =_c 1$	[TH is 1st person]
2Th	$(m \ \text{TH PERS}) =_c 2$	[TH is 2nd person]
Th-piv	$(\ \text{PIV}(m \ \text{TH})^{-1})$	[TH is S/P]
Th-$\widehat{\text{GF}}$	$(\ \widehat{\text{GF}}(m \ \text{TH})^{-1})$	[TH is A/S]

Variation between various agreement patterns (and between languages) boils down to the c- and m-structure pairs that correspond to the same f-structure, cf. the following illustration of the difference between Ashti (8b, upper c- and m-structures) and Icari (7b, lower c- and m-structures):



The projections ϕ_1 and μ_1 correspond to **Ashti**, while ϕ_2 and μ_2 are for **Icari**. In the following paragraphs, I will show how different constraint rankings give rise to the attested surface patterns.

A similar approach to agreement involving g-structure (grammatical marking structure) has been proposed in Falk (2006b). But I do not see the need to introduce an additional level of representation when m-structure already exists for capturing similar phenomena.

Second-person dominance. Systems where the 2nd person dominates have the most straightforward constraint ranking:

$$2\text{Th} \ggg 1\text{Th} \ggg \text{Th-piv},\ \text{Th-}\widehat{\text{gf}}$$

Th-piv and Th-$\widehat{\text{gf}}$ are neutralized because they are only relevant when both A and P are speech act participants. The following tableaux illustrate how this ranking operates (I will provide analogous tableaux for other rankings below):

(20) Icari, Khuduts, Qunqi, Kaytag

a.

A = 1, P = 2	2Th	1Th	Th-piv	Th-$\widehat{\text{gf}}$
a. th = 1	*!		*	
☞ b. th = 2		*		*

b.

A = 2, P = 1	2Th	1Th	Th-piv	Th-$\widehat{\text{gf}}$
a. th = 1	*!			*
☞ b. th = 2		*	*	

c.

A = 3, P = 1	2Th	1Th	Th-piv	Th-$\widehat{\text{gf}}$
☞ a. th = 1	*			*
b. th = 3	*	*!	*	

Speech act participant-dominance. The 1st and 2nd person have the same rank, and the choice between them is carried out according to who occupies the piv position. This can be captured by allowing a disjunctive constraint 1Th ∨ 2Th (Crowhurst & Hewitt 1997).

$$1\text{Th} \vee 2\text{Th} \ggg \text{Th-piv} \ggg \text{Th-}\widehat{\text{gf}}$$

(21) Aqusha, Tanti, Shiri-1, Ashti

a.

A = 1, P = 2	1Th ∨ 2Th	Th-piv	Th-$\widehat{\text{gf}}$
a. th = 1		*!	
☞ b. th = 2			*

b.

A = 2, P = 1	1Th ∨ 2Th	Th-piv	Th-$\widehat{\text{gf}}$
☞ a. th = 1			*
b. th = 2		*!	

In Chirag, A and P are ordered in the opposite way:

$$1\text{Th} \vee 2\text{Th} \ggg \text{Th-}\widehat{\text{gf}} \ggg \text{Th-piv}$$

(22) Chirag

a.

A = 1, P = 2	1Th ∨ 2Th	Th-$\widehat{\text{GF}}$	Th-piv
☞ a. th = 1			*
b. th = 2		*!	

b.

A = 2, P = 1	1Th ∨ 2Th	Th-$\widehat{\text{GF}}$	Th-piv
a. th = 1		*!	
☞ b. th = 2			*

Subject control. In Mehweb, the only variety where only subject control is possible, Th-$\widehat{\text{GF}}$ dominates the hierarchy:

Th-$\widehat{\text{GF}}$ $\gg$ 1Th, 2Th, Th-piv

In Kubachi and Shiri-3, the situation is more complicated. The controller is *either* the subject or the absolutive if it outranks the subject on the person hierarchy.

This means that the person hierarchy and the grammatical function hierarchy have an equal status in these varieties. This can be captured by allowing underspecified constraint orderings (Anttila & Cho 1998). The ordering for Shiri will be:

Th-$\widehat{\text{GF}}$ $\gg$ Th-piv

2Th $\gg$ 1Th

This produces two alternative constraint orderings for each case[8]:

(23) Shiri-3

a.

A = 1, P = 2	2Th	1Th	Th-$\widehat{\text{GF}}$	Th-piv
a. th = 1	*!			*
☞ b. th = 2		*	*	

A = 1, P = 2	Th-$\widehat{\text{GF}}$	Th-piv	2Th	1Th
☞ a. th = 1		*	*	
b. th = 2	*!			*

b.

A = 3, P = 1	2Th	1Th	Th-$\widehat{\text{GF}}$	Th-piv
☞ a. th = 1	*		*	
b. th = 3	*	*!		*

A = 3, P = 1	Th-$\widehat{\text{GF}}$	Th-piv	2Th	1Th
a. th = 1	*!		*	
☞ b. th = 3		*	*	*

[8]Technically, orderings like "Th-$\widehat{\text{GF}}$ $\gg$ 2Th $\gg$ 1Th $\gg$ Th-piv" are also possible, but the surface effects of this ranking are equivalent to those of any other ranking where Th-$\widehat{\text{GF}}$ dominates. This also applies to the domination of 2Th, 1Th, or Th-piv over all other constraints.

c.

A = 2, P = 1	2Th	1Th	Th-$\widehat{\text{GF}}$	Th-piv
a. th = 1	*!		*	
☞ b. th = 2		*		*

A = 2, P = 1	Th-$\widehat{\text{GF}}$	Th-piv	2Th	1Th
a. th = 1	*!		*	
☞ b. th = 2		*		*

This means that when A = 1, P = 2 (23a), or when A = 3, P = 1 (23b), both arguments can control agreement, but when A = 2, P = 1 (23c), or A = 1, P = 3, only A can be the controller, because it outranks P in both orderings.

Kubachi has the same overall system, but 1Th and 2Th are disjunctive, which leads to different results when A = 1 and P = 2 or vice versa:

Th-$\widehat{\text{GF}}$ $\gg$ Th-piv

1Th $\vee$ 2Th

(24) Kubachi

a.

A = 1, P = 2	1Th $\vee$ 2Th	Th-$\widehat{\text{GF}}$	Th-piv
☞ a. th = 1			*
b. th = 2		*!	

A = 1, P = 2	Th-$\widehat{\text{GF}}$	Th-piv	1Th $\vee$ 2Th
☞ a. th = 1		*	
b. th = 2	*!		

b.

A = 2, P = 1	1Th $\vee$ 2Th	Th-$\widehat{\text{GF}}$	Th-piv
a. th = 1		*!	
☞ b. th = 2			*

A = 2, P = 1	Th-$\widehat{\text{GF}}$	Th-piv	1Th $\vee$ 2Th
a. th = 1	*!		
☞ b. th = 2		*	

Variable control by speech act participants. In Shiri-2, both the 1st and 2nd person arguments can control agreement regardless of their f-structure function.

The disjoint constraint 1Th $\vee$ 2Th dominates both Th-$\widehat{\text{GF}}$ and Th-piv, but the ordering of the latter two is unspecified:

1Th $\vee$ 2Th $\gg$ Th-$\widehat{\text{GF}}$

1Th $\vee$ 2Th $\gg$ Th-piv

(25) Shiri-2

a.

A = 1, P = 2	1Th $\vee$ 2Th	Th-$\widehat{\text{GF}}$	Th-piv
☞ a. th = 1			*
b. th = 2		*!	

A = 1, P = 2	1Th ∨ 2Th	Th-piv	Th-$\widehat{\text{gf}}$
a. th = 1		*!	
☞ b. th = 2			*

b.

A = 2, P = 1	1Th ∨ 2Th	Th-$\widehat{\text{gf}}$	Th-piv
a. th = 1		*!	
☞ b. th = 2			*

A = 2, P = 1	1Th ∨ 2Th	Th-piv	Th-$\widehat{\text{gf}}$
☞ a. th = 1			*
b. th = 2		*!	

3.2.4 Summary

1	Icari, Khuduts, Qunqi, Kaytag	2Th ≫ 1Th ≫ Th-piv, Th-$\widehat{\text{gf}}$
2	Aqusha, Tanti, Urakhi, Ashti, Shiri-1	1Th ∨ 2Th ≫ Th-piv ≫ Th-$\widehat{\text{gf}}$
3	Chirag	1Th ∨ 2Th ≫ Th-$\widehat{\text{gf}}$ ≫ Th-piv
4	Shiri-3	Th-$\widehat{\text{gf}}$ ≫ Th-piv 2Th ≫ 1Th
5	Kubachi	Th-$\widehat{\text{gf}}$ ≫ Th-piv 1Th ∨ 2Th
6	Mehweb	Th-$\widehat{\text{gf}}$ ≫ 1Th, 2Th, Th-piv
7	Shiri-2	1Th ∨ 2Th ≫ Th-$\widehat{\text{gf}}$ 1Th ∨ 2Th ≫ Th-piv

4 Enumerating the alternatives

Given the four constraints above, and assuming that they should all be ranked with respect to each other, there are $4! = 24$ possible rankings. The real number is much lower, however, since some groups of rankings are equivalent in terms of surface effects (neutralization known from much work in OT):

- When the ranking starts with 1Th ≫ 2Th ≫ ... or 2Th ≫ 1Th ..., the relative ranking of Th-$\widehat{\text{gf}}$ and Th-piv is neutralized.
- The same concerns 1Th/2Th ≫ Th-piv ≫ ... and 1Th/2Th ≫ Th-$\widehat{\text{gf}}$ ≫ ...
- If the hierarchy is dominated by either Th-$\widehat{\text{gf}}$ or Th-piv, the order of everything else is irrelevant.

With this in mind, the overall number of possible unique orderings is only 8:

2Th ≫ 1Th ≫ Th-$\widehat{\text{gf}}$, Th-abs	(Icari, Qunqi, Khuduts, Kaytag)
1Th ≫ 2Th ≫ Th-$\widehat{\text{gf}}$, Th-abs	(**not attested**)
Th-$\widehat{\text{gf}}$ ≫ 1Th, 2Th, Th-piv	(Mehweb)
Th-piv ≫ 1Th, 2Th, Th-$\widehat{\text{gf}}$	(**not attested**)
2Th ≫ Th-piv ≫ 1Th, Th-$\widehat{\text{gf}}$	(**not attested**)
1Th ≫ Th-piv ≫ 2Th, Th-$\widehat{\text{gf}}$	(**not attested**)
2Th ≫ Th-$\widehat{\text{gf}}$ ≫ 1Th, Th-piv	(**not attested**)
1Th ≫ Th-$\widehat{\text{gf}}$ ≫ 2Th, Th-piv	(**not attested**)

Allowing disjunction of features does not significantly increase the number of variants. Allowing 1Th $\vee$ 2Th creates only 6 additional logically possible orderings; four of them are identical with those that were present before (Th-$\widehat{\text{gf}}$ $\gg$ . . . and Th-piv $\gg$ . . .), thus leaving us with two possibilities, both of which are attested:

1Th $\vee$ 2Th $\gg$ Th-$\widehat{\text{gf}}$ $\gg$ Th-piv (Chirag)

1Th $\vee$ 2Th $\gg$ Th-piv $\gg$ Th-$\widehat{\text{gf}}$ (Aqusha, Urakhi, Tanti, Ashti, Shiri-1)

Allowing underspecified orderings is another matter, as this vastly increases the range of possibilities. However, most of them are, apparently, either equivalent to the ones previously listed or boil down to "anything goes". For example, if 2Th is ranked higher than 1Th while there are no other orderings specified, any argument can serve as the controller (although the probabilities will not be equal, as per Anttila & Cho (1998)). The variants that really matter in terms of grammaticality are:

2Th $\gg$ 1Th; Th-$\widehat{\text{gf}}$ $\gg$ Th-piv	(Shiri-3)
2Th $\gg$ 1Th; Th-piv $\gg$ Th-$\widehat{\text{gf}}$	(**not attested**)
1Th $\gg$ 2Th; Th-$\widehat{\text{gf}}$ $\gg$ Th-piv	(**not attested**)
1Th $\gg$ 2Th; Th-piv $\gg$ Th-$\widehat{\text{gf}}$	(**not attested**)
1Th $\vee$ 2Th; Th-$\widehat{\text{gf}}$ $\gg$ Th-piv	(Kubachi)
1Th $\vee$ 2Th $\gg$ Th-piv; 1Th $\vee$ 2Th $\gg$ Th-$\widehat{\text{gf}}$;	(Shiri-2)

The unattested cases are regular and allow the formulation of the following principles:

- **Do not mix person and gf**. A gf constraint can never stand between two person constraints, and vice versa.
- **No first-person domination**. In no dialect does the 1st person dominate the 2nd person.
- **Avoid domination of gf over person**. There is only one variety where agreement is fully controlled by grammatical function — Mehweb, which has a very reduced agreement system to begin with (and is in general quite peripheral). Those who come closest are Shiri-2 and Kubachi, where subject agreement is in free variation with agreement controlled by the person hierarchy.

The first requirement may be a general principle not specific to Dargwa.

The other two requirements may reflect the diachronic evolution of person marking. In Sumbatova (2011a), it is proposed that person marking in Dargwa may have developed from an original allocutive marker, which marked the grammatical features of the listener. This means that the dominance of the 2nd person was the original situation, and all the other systems are innovative.

The whole variety of constraint orderings can be represented via a set of three parameters:

Parameter	Possible values		
Person hierarchy	2TH $\ggg$ 1TH	1TH $\vee$ 2TH	
GF hierarchy	TH-PIV $\ggg$ TH-$\widehat{\text{GF}}$	TH-$\widehat{\text{GF}}$ $\ggg$ TH-PIV (only Mehweb, Kubachi)	no ordering (only Shiri-2)
Relation between hierarchies	PERS $\ggg$ GF	GF $\ggg$ PERS (only Mehweb)	no ordering (only Kubachi, Shiri)

5 Conclusions

The analysis given herein provides an adequate account of hierarchical agreement in Dargwa and in its microvariation within this group of closely related idioms. It also provides an argument in favour of m-structure as an additional level of linguistic representation, where language-specific features that are not directly relevant for the syntactic structure of the language are located. The distinction between f- and m-structure allows us to treat cross-dialectal variation as stemming from the same f-structure being mapped to different c- and m-structure pairs based on different rankings of OT constraints.

At the same time, there are still several questions that have to be explored in more detail:

Other similar systems. Though rare, agreement systems like the one in Dargwa are attested in different languages of the world (Comrie 2003). For example, Tangut (Tibeto-Burman) seems to have had a system that is almost identical to that found in e.g. Ashti (1,2 > 3; PIV > $\widehat{\text{GF}}$) (Kepping 1981). Thus the analysis provided herein seems to be fully applicable to Tangut, if it is established that the person hierarchy indeed has no bearing on other syntactic phenomena in this language. It remains to be seen whether my analysis transfers as easily to other languages exhibiting hierarchical agreement.

Direct-inverse systems. Hierarchical agreement systems like the one in Dargwa are closely related to (though distinct from) direct-inverse systems (Payne 1999). Curiously, some Dargwa languages do have a kind of inverse, found in a limited number of verb forms that utilize so-called thematic vowels *-i-* and *-u-*. In Icari, for example, *-i-* is used when A is higher than P on the hierarchy 2 > 1 > 3, while *-u-* is used in all other cases (Sumbatova & Mutalov 2003: 83). In Ashti, however, the situation is different: either *-i-* or *-u-* can be used when both A and P are speech act participants, with the choice depending on various factors such as telicity (Belyaev in press). It is possible that this difference between Icari and Ashti is related to the fact that only the former displays the 2 > 1 > 3 hierarchy, while the latter makes no distinction between the 1st and 2nd persons. If this intuition is confirmed, then perhaps this analysis could be extended to cover Dargwa “direct-inverse” systems, too. If not, such systems will have to be accounted for by a separate mechanism.

Universality. The set of OT constraints is supposed to be universal. Yet agreement systems like this one are quite rare. It remain an open question whether this analysis can be extended to cover other morphosyntactic phenomena that depend on the animacy/person hierarchy (Silverstein 1976), such as split ergativity and plural agreement. Such an extension would provide theoretical credibility for the analysis, which in its present form simply uses OT as a filtering mechanism based on constraints that have been devised specifically for Dargwa.

Correlation between agreement rules and genealogical classification. Even though the genealogical groupings within Dargwa are still unclear, it can be seen that the groups displayed in 3.2.4 do not correspond well to the preliminary lexicostatistical classification developed in Koryakov (2013). Neither is a straightforward explanation through language contact always plausible. The position of Ashti is especially striking, as it is a dialect that is very closely related to Kubachi (the ancestors of Ashti speakers migrated from Kubachi several hundred years ago); yet it has neither retained the Kubachi system nor borrowed the system of the neighbouring Qunqi and Khuduts. The Ashti agreement pattern could perhaps be explained by partial parametric change (the person hierarchy and PIV started to dominate, but 1TH ∨ 2TH remained).

List of glosses

COP: copula, CVB: converb, DAT: dative, Dem: demonstrative, Dist: distal deixis, ERG: ergative, F: feminine, GEN: genitive, HAB: habitual, HPL: human plural, INF: infinitive, IPFV: imperfective, LAT: lative, M: masculine, NPL: neuter plural, OBL: oblique, PERF: perfect, PFV: perfective, PL: plural, PRET: preterite, PRS: present, Refl: reflexive, SG/Sg: singular, SUPER: localization 'above'

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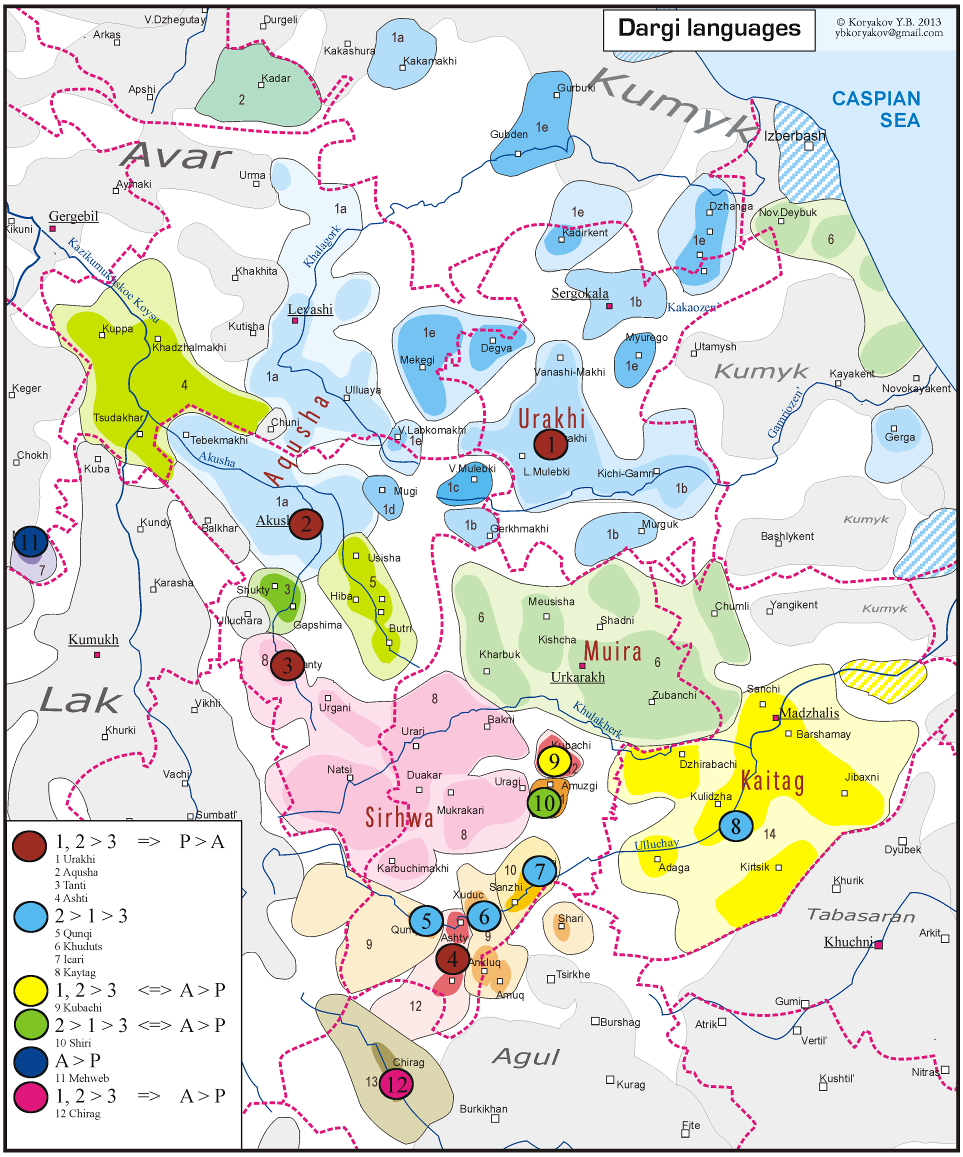
Appendix. The Dargwa varieties analyzed in the paper, classified according to the constraint rankings



THE REPRESENTATION OF SETSWANA DOUBLE OBJECTS IN LFG

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Abstract

Setswana is a Bantu language in the south eastern zone of Bantu languages and is one of the eleven official languages of South Africa. The technological development of Setswana includes the development of a parser that covers all the salient characteristics of Setswana morphology and syntax. One such characteristic is the occurrence of two objects, both of which may be represented in the verb by object agreement morphemes. After discussing relevant typological features of Setswana, we focus on the syntactic structure of Setswana sentences with double objects and double object agreement morphemes and on how the implementation of two Setswana objects can be modelled in XLE.

1. Introduction

Setswana is a Bantu language in the south eastern zone (zone S in Doke's classification) of Bantu languages (Cole, 1959; Guthrie, 1971) and one of the eleven official languages of South Africa. The work reported on in this article forms part of a larger project aimed at the technological development of Setswana. Previous work includes the development of a finite state morphological analyser and tokeniser (see, for example, Pretorius *et al.*, 2010). The present work also forms part of a subproject for developing a computational grammar and parser for Setswana, making use of LFG and XLE (Berg *et al*., 2012).

Under consideration are simple declarative sentences that are in the indicative mood, present tense, positive and have more than one object. More specifically, we ask the question: 'How may such sentences and their syntactic structure be modelled in LFG and implemented in XLE?'

The structure of the article is as follows: Section 1 briefly contextualises and states the research question. Section 2 discusses specific typological features of Setswana that are relevant for addressing the research question. In section 3 we discuss in some detail the occurrence of double object and object agreement morphemes and their modelling with LFG, while the XLE implementation is touched upon in section 4. Section 5 concludes the article.

2. Setswana typological features

Setswana is an agglutinative language with a rich system of verbal inflections (Nurse, 2008: 28). Words in sentences are arranged in an SVO order. Nouns in Setswana are classified into 20 noun classes and agreement is prominent in the language.

2.1 Orthography and morphology

Verbal prefixes are written disjointly, while verbal suffixes are written conjoined to the verbal root. This disjunctive writing style has significant consequences for tokenisation in that Setswana verbs cannot be tokenised on white space only. Due to the disjunctive orthography the word as unit of morphological description needs further clarification. We follow Kosch (2006), who distinguishes between an orthographic word (a unit which is separated by spaces from other units in the sentence) and a linguistic word (a unit which functions as a member of a word category, such as a noun, pronoun, verb and adverb).

As is characteristic of agglutinative languages, Setswana verbal prefixes and suffixes provide essential information regarding type, mood, tense, aspect, and polarity (Cole, 1955:242-267; Krüger, 2006:198-243). Prefixes include negative morphemes, subject agreement morphemes, object agreement morphemes, aspectual morphemes and the temporal morpheme. The most frequently used suffixes include the causative, applicative, reciprocal, perfect and passive. Verbs can also take less frequently used suffixes while they always take a verbal ending (Cole, 1955:192-211; Krüger, 2006:257).

Example (1) illustrates both the disjunctive orthography and the agglutinative morphology. The linguistic word (verb) *ba tla thusana* 'they will help each other' comprises a verbal root -*thus*- to which the subject agreement morpheme *ba* of noun class 2 and the future tense morpheme *tla* have been prefixed, while the reciprocal suffix -*an*- and the verbal ending -*a* are suffixed to this verbal root.

(1) *ba tla thusana*
ba-tla-thus-an-a
SC2-FUT-help-RECP-VEND
'they will help each other'

In (2) the Setswana sentence only consists of two linguistic words. The two words are the noun *basimane* 'boys' and the verb *ba tla re thusa* 'they will help us'. The verb consists of the subject agreement morpheme *ba* of noun class 2, the future tense morpheme *tla*, the object agreement morpheme *re* of the first person plural, the verbal root *thus*- 'buy' and the verbal ending -*a*. The English equivalent of this sentence consists of five linguistic words. Notice that the determiners 'the' and 'a' do not appear in Setswana.

(2) *Basimane ba tla re thusa.*

basimane	ba tla re thusa
boys	they will us help
ba-simane	*ba-tla-re-thus-a*

N2-boys SC2-FUT-OCP1PL-help-VEND
'The boys will help us.'

The verbal prefixes and suffixes of Setswana are integral parts of the morphological structure of verbs and have morphological status in the c-structure of LFG (Bresnan, 2001:150), as shown in the following c-structure (Figure 1):

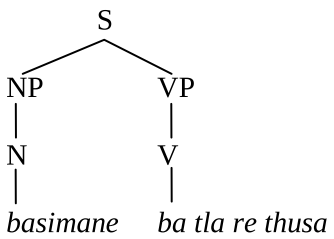

Figure 1: The c-structure for (2)

2.2 Word order

Setswana employs the SVOX word order, where 'S' represents the subject, 'V' the verb, 'O' the object and 'X' the adjuncts (Creissels, 2000:250-252; Watters, 2000:196-205).

In a simple transitive sentence in Setswana the subject appears before the verb. The object follows the verb. This is illustrated in (3) where the subject *bana* 'children' precedes the verb *ba bua* 'they speak' and an object *Setswana* 'Setswana' appears post verbally.

(3) *Bana ba bua Setswana.*

bana	ba bua	Setswana
children	they speak	Setswana
ba-ana	*ba-bu-a*	*se-tswana*
N2-children	SC2-speak-VEND	N7-tswana

'The children speak Setswana.'

The object *Setswana* 'Setswana' in (3) may be replaced by the object agreement morpheme *se* which acts as an object marker. The object agreement morpheme is placed in the verbal morphology where it is prefixed immediately preceding the verbal root (further explained in section 3.2). The basic word order is then altered as illustrated in (4). This sentence consists of a subject *bana* 'children' and a verb *ba a se bua* 'they speak it'.

(4) *Bana ba a se bua.*

bana	ba a **se** bua
children	they **it** speak
ba-ana	*ba-a-**se**-bu-a*

N2-children SC2-PresPre-**OC7**-speak-VEND
'The children speak it.'

Sentences in Setswana may include verbs which can take two objects. The object immediately following the ditransitive verb is the indirect object and it is followed by the direct object as illustrated in (5).

(5) *Mosimane o harakela mosadi matlhare.*

mosimane	o harakela	mosadi	matlhare
boy	he rakes for	woman	leaves
mo-simane	*o-harak-el-a*	*mo-sadi*	*ma-tlhare*
N1-boy	SC1-rake-APPL-VEND	N1-woman	N6-leaves

'The boy rakes the leaves for the woman.'

Both the indirect object *mosadi* 'woman' and the direct object *matlhare* 'leaves' in (5) may be replaced by their respective object agreement morphemes. The object agreement morpheme of the indirect object is followed by the object agreement morpheme of the direct object. The basic word order of this sentence is illustrated in (6) where the sentence consists of a subject *mosimane* 'boy' and a verb *o a mo a harakela* 'he rakes it for her'.

(6) *Mosimane o a mo a harakela.*

mosimane	o a **mo a** harakela
boy	he **her it** rake for
mo-simane	*o-a-**mo-a**-harak-el-a*
N1-boy	SC1-PresPre-**OC1-OC6**-rake-APPL-VEND

'The boy rakes it for her.'

As seen in (3), (4), (5) and (6), simple sentences in Setswana may take intransitive, transitive and ditransitive verbs. Al these sentences can be modified with one or more than one adjunct referring to place, time, manner, instrument, etc.

Intransitive verbs do not have a valency for object but they may take adjuncts which would then follow the verb. In (7) the adverb of time *jaanong* 'now' is the adjunct.

(7) *Bana ba se bua jaanong.*

bana	ba **se** bua	jaanong
children	they **it** speak	now
ba-ana	*ba-**se**-bu-a*	*jaanong*
N2-children	SC2-**OC7**-speak-VEND	ADV

'The children speak it now.'

Transitive verbs may take one object which may be followed by an adjunct. In (8) the locative noun phrase *kwa gae* ‘at home’ is the adjunct.

(8) *Bana ba bua Setswana kwa gae.*

bana	ba bua	Setswana	kwa	gae
children	they speak	Setswana	at	home
ba-ana	*ba-bu-a*	*se-tswana*	*kwa*	*gae*
N2-children	SC2-speak-VEND	N7-tswana	DEM	N5-home

‘The children speak Setswana at home.’

Ditransitive verbs may take an indirect and a direct object (double objects) which may be followed by an adjunct. In (9) the adverb of manner *sentle* ‘properly’ is the adjunct.

(9) *Mosimane o harakela mme matlhare ka haraka sentle.*

mosimane	o harakela	mosadi	matlhare	sentle
boy	he rakes for	woman	leaves	properly
mo-simane	*o-harak-el-a*	*mo-sadi*	*ma-tlhare*	*sentle*
N1-boy	SC1-rake-APPL-VEND	N1-woman	N6-leaves	ADV

‘The boy rakes the leaves for the woman properly.’

A distinct word order is also followed in Setswana noun phrases (NP) where the head appears in initial position and it may be followed by different modifiers (determiners) (Creissels, 2000:232). Examples of modifiers for Setswana nouns are demonstrative pronouns (see (10)), a possessive phrase consisting of a possessive particle and a complement (see (11)), and a qualificative phrase consisting of a qualificative particle and an adjective (see (12)).

(10) bana ba

bana	**bao**
children	**those**
ba-ana	**bao**
N2-children	**DEM**

‘those children’

(11) bana ba rona

bana	**ba**	**rona**
children	**of**	**us**
ba-ana	**ba**	**rona**
N2-children	**PossPart2**	**PossPron**

‘our children’

(12) bana ba bagolo

bana	**ba**	**bagolo**
children	**who are**	**big**

ba-ana	**ba**	**ba-golo**
N2-children	**QualPart2**	**ADJ2-big**

'the big children'

The focus in this article is the simple sentences taking double objects as well as the sentences where these objects are both replaced by their respective object agreement morphemes and how these structures can be handled in LFG. This is elaborated on in section 3.

2.3 Nominal classification and concordial agreement

Two outstanding characteristics of the Bantu language family are the phenomena of nominal classification and concordial agreement (see, for example, Poulos and Louwrens, 1994). Nouns are grouped together into classes in a grammatically significant way. Nouns generate grammatical agreement by means of class prefixes. The numbering system used in this article distinguishes between 20 noun classes for Setswana.

Noun class agreement is observed in all parts of the sentence which are linked to the noun. The noun is the element in the sentence which controls the concordial agreement with other word categories such as verbs, (Kosch, 2006). Verbs in simple sentences in the indicative mood, present tense, positive include an obligatory subject agreement morpheme (see (3), for example).

Agreement markers referring to the subject in a sentence can have the status of (i) incorporated pronouns or (ii) agreement markers or (iii) forms that are ambiguous between the two (Dalrymple, 2001:132). In Setswana the obligatory subject agreement morpheme is considered either an agreement marker or an incorporated pronoun. In instances where the overt subject is present, the subject agreement morpheme is an agreement marker. As illustrated in (13), the subject agreement morpheme *o* of class 1 shows agreement with the class prefix *mo* of the class 1 noun *mosadi* 'woman'. In this instance Kosch (2006) explains that the class 1 noun controls the concordial agreement with the verb through the class 1 subject agreement morpheme.

(13) ***Mo**sadi* **o** *reka ditlhako.*

mosadi	o reka	ditlhako
woman	she buys	shoes
***mo**-sadi*	***o**-rek-a*	*di-tlhako*
N1-woman	**SC1-**buy-VEND	N8-shoes

'The woman buys shoes.'

In instances where the overt subject NP is omitted, the subject agreement marker acts as an incorporated pronoun (Bresnan, 2001:177). This process regarding Setswana is illustrated in (14) where the subject agreement morpheme *o* of noun class 1 acts as an incorporated pronoun as no overt subject appears.

(14) *O reka ditlhako*.

o reka	ditlhako
she buys	shoes
o-*rek-a*	*di-tlhako*
SC1-buy-VEND	N8-shoes

'She buys shoes.'

The object agreement in Setswana is different from subject agreement in that object agreement morphemes cannot co-occur with overt objects. For example, the sentence in (15) is ungrammatical because the object agreement morpheme *di* cannot co-occur with the object *ditlhako* 'shoes'.

(15) Mosadi o **di** reka **ditlhako**.

mosadi	o di reka	ditlhako
woman	she it buys	shoes
mo-sadi	*o-a-di-rek-a*	*di-tlhako*
N1-woman	SC1-PresPre-OC8-buy-VEND	N10-shoes

An object agreement morpheme replaces the overt object NP in Setswana. In other words, either the object or the object agreement morpheme is present. Therefore, the object agreement morpheme has pronominal status. Verbs that include an object morpheme contain an incorporated pronoun, which acts as the object. In (16) *di* is the object agreement morpheme of noun class 8 and it acts as an incorporated pronoun (it).

(16) *Mosadi o a di reka*.

mosadi	o a **di** reka
woman	she **it** buys
mo-sadi	*o-a-**di**-rek-a*
N1-woman	SC1-PresPre-**OC8**-buy-VEND

'The woman buys it.'

Bresnan (2001:177) indicates that "pronoun incorporation involves the incorporation of the function of a pronoun within an inflected word, not the incorporation of the phrase structure of a pronoun into a word". This is also applicable to Setswana. In LFG incorporated pronouns are modelled by accepting that they provide a pronominal PRED value for the subject and object functions (Dalrymple, 2001:276).

The sentence in (17) consists of only one linguistic word, a verb. This verb includes information on its subject and its object. Here both the subject agreement morpheme (*o* of noun class 1) and the object agreement morpheme (*di* of noun class 8) are incorporated pronouns. The subject agreement morpheme *o* conveys a meaning coincident with that of the pronouns ‘he’ or ‘she’ in English, while the object agreement morpheme *di* conveys a meaning coincident to that of the pronoun ‘it’.

(17) ***O*** *a* ***di*** *reka*.
she it buys
o-*a*-***di***-*rek*-*a*
`SC1-PresPre-OC8-buy-VEND`
‘She buys it.’

The correspondence between the c- and f-structures of (17) is illustrated in Figure 2:

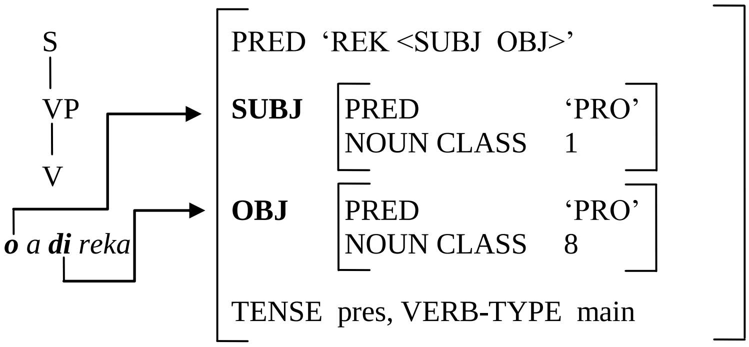

Figure 2: The correspondence between the c- and f-structure for (17)

3. Double objects and object agreement morphemes

Under certain linguistic circumstances, verbs in Setswana sentences may take two objects. The indirect object (restricted object (OBJ-TH)) is followed by the direct object (unrestricted object (OBJ)). This phenomenon was discussed in some detail by Pretorius *et al.* (2012:201-218).

Double objects may appear in the following sentence constructions (Pretorius *et al.*, 2012:208-211):

- *Verbs allowing indirect objects based on their meaning*

The meaning of Setswana verbs such as *go fa* ‘to give’, *go tshasa* ‘to spread’, *go kopa* ‘to ask’ and *go ruta* ‘to teach’ can take an indirect and a direct object. In (18) the verb *go fa* ‘to give’ subcategorises for the indirect object *bana* ‘children’ and the direct object *dimonamona* ‘sweets’.

(18) *Ke fa bana dimonamona.*

*k*e fa	bana	dimonamona
I give	children	sweets
ke-f-a	*ba-ana*	*di-monamona*
SCP1PL-give-VEND	N9-children	N10-sweets

‘I give the children sweets.’

Both of the objects in (18) can be replaced with an object agreement morpheme. In (19) the indirect object *bana* ‘children’ is replaced with the object agreement morpheme *ba* and the direct object *dimonamona* ‘sweets’ with the object agreement morpheme *di*.

(19) *Ke a **ba di** fa.*
I **them it** give
*ke-a-**ba-di**-f-a*
SCP1PL-PresPre-**OC2**-**OC10**-give-VEND
‘I give them it.’

- *Verbs with the causative suffix*

The causative suffix conveys the meaning of ‘to let’ (Cole, 1955:203-208; Krüger, 2006:216). This suffix allows the verb to take an indirect object in addition to the direct object. In (20) the indirect object is *bana* ‘children’ and the direct object is *merogo* ‘vegetables’.

(20) *Mosadi o jesa bana merogo.*

mosadi	o jesa	bana	merogo
teacher	she eat to let	children	vegetables
mo-sadi	*o-j-is-a*	*ba-ana*	*me-rogo*
N1-woman	SC1-eat-CAUS-VEND	N2-children	N4-vegetables

‘The woman lets the children eat vegetables.’

As indicated in (21) *bana* ‘children’ and *merogo* ‘vegetables’ (in (20)) can also be replaced with object agreement morphemes in the morphological structure of the verb.

(21) *Mosadi o a ba e jesa.*

mosadi	o a **ba e** jesa
woman	she **them it** eat to let
mo-sadi	*o-a-**ba-e**-j-is-a*
N1-teacher	SC1-PresPre-**OC2**-**OC4**-eat-CAUS-VEND

‘The woman lets them eat it.’

- *Some possessive constructions*

Double objects also appear in instances where sequences of nouns appear in an object position. Here the first noun represents a possessor affected by the action of the verb (Pretorius *et al.*, 2012:210). In Setswana the possession occurs in initial position in a possessive group, for example in (22) the possession is *seatla* ‘hand’ and the possessor is *mosimane* ‘boy’.

(22) *seatla sa mosimane*

seatla	sa	mosimane
hand	of	boy
se-atla	*sa*	*mo-simane*
N7-hand	PossPart7	N1-boy

‘the boy’s hand’

The possessive group can also be inversed (Simango, 2007:928-049; Lødrup, 2009:420-440). In (23) the possessive group in (22) is inversed and the possessive particle is not used. In this instance the possessive construction appears as multiple objects. The indirect object in (23) is *mosimane* ‘boy’ and the direct object is *seatla* ‘hand’.

(23) *Ntšwa e lomile mosimane seatla*.

ntšwa	e lomile	mosimane	seatla
dog	he bit	boy’	hand
ne-tšwa	*e-lom-il-e*	*mo-simane*	*se-atla*
N9-dog	SC9-bite-PERF-VEND	N1-boy	N7-hand

‘The dog bit the boy’s hand.’

Both of the objects in (23) can be replaced with object agreement morphemes. In (24) *mosimane* ‘boy’ is replaced by *mo*, the object agreement morpheme of noun class 1 and *seatla* ‘hand’ with *se*, the object agreement morpheme of noun class 7.

(24) Ntšwa *e mo se lomile.*

ntšwa	e **mo se** lomile
dog’	he **him it** bit
ne-tšwa	*e-**mo**-**se**-lom-il-e*
N9-dog	SC9-**OC1**-**OC7**-bite-PERF-VEND

‘The dog bit his.’

- *Verbs with the applicative suffix*

The applicative suffix conveys the meaning of ‘for’ or ‘to’ (Cole, 1955:199-202; Krüger, 2006:232-239). The applicative suffix extends the transitivity of the Setswana verb by introducing a new object apart from the direct object (Pretorius *et al.*, 2012:211).

The treatment of Setswana double objects and double object agreement morphemes is similar for all instances mentioned above. In this paper we only illustrate the treatment of verbs with the applicative suffix by providing the c- and f-structures of these sentences.

In (25) the indirect object *mosetsana* ‘girl’ is followed by the direct object *ditlhako* ‘shoes’.

(25) *Mosadi o rekela mosetsana ditlhako.*

mosadi	o rekela	mosetsana	ditlhako
woman	she buys for	girl	shoes
mo-sadi	*o-rek-el-a*	*mo-setsana*	*di-tlhako*
N1-woman	SC1-buy-APPL-VEND	N1-girl	N8-shoes

‘The woman buys the girl shoes.’

The c-structure of (25) is:

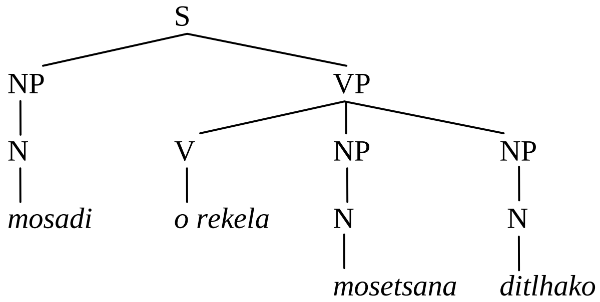

Figure 3: The c-structure for (25)

The f-structure of (25) is:

$$\left[\begin{array}{ll} \text{PRED ‘REK <SUBJ OBJ-TH OBJ>’} & \\ \text{SUBJ} & \left[\begin{array}{ll}\text{PRED} & \text{‘SADI’}\\ \text{NOUN CLASS} & 1\end{array}\right] \\ \text{OBJ-TH} & \left[\begin{array}{ll}\text{PRED} & \text{‘SETSANA’}\\ \text{NOUN CLASS} & 1\end{array}\right] \\ \text{OBJ} & \left[\begin{array}{ll}\text{PRED} & \text{‘TLHAKO’}\\ \text{NOUN CLASS} & 8\end{array}\right] \\ \text{APPL +, CLASS 1, TENSE pres, VERB-TYPE main} & \end{array}\right]$$

Figure 4: The f-structure for (25)

Both the indirect and direct objects in Setswana sentences with an applicative verb may be represented in the verb by object agreement morphemes. In such cases both object agreement morphemes would be prefixed to the verb.

The applicative verb *o rekela* ‘she buys for’ in (26) takes two object agreement morphemes. The indirect object *mosetsana* ‘girl’ (in (25)) is replaced with the object agreement morpheme *mo* of noun class 1 and the direct object *ditlhako* ‘shoes’ (in (25)) is replaced with the object agreement morpheme *di* of noun class 8.

(26) *Mosadi o a mo di rekela.*

mosadi	o a **mo di** rekela
woman	she **her it** buy for
mo-sadi	*o-a-**mo-di**-rek-el-a*
`N1-woman`	`SC1-PresPre-`**`OC1-OCl8`**`-buy- APPL-VEND`

‘The woman buys her it.’

The c-structure of (26) is:

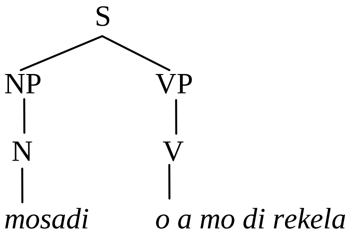

Figure 5: The c-structure for (26)

The f-structure of (26) is:

PRED ‘REK <SUBJ OBJ-TH OBJ>’		
SUBJ	PRED	‘SADI’
	NOUN CLASS	1
OBJ-TH	PRED	‘PRO’
	NOUN CLASS	1
OBJ	PRED	‘PRO’
	NOUN CLASS	8
APPL +, CLASS 1, TENSE pres, VERB-TYPE main		

Figure 6: The f-structure for (26)

As mentioned before, the object agreement morphemes cannot co-occur with the corresponding objects. Sometimes only one of the objects is replaced by an object agreement morpheme. When the applicative verb includes an object agreement morpheme that represents the indirect object, the verb will be followed by the direct object. The direct object in (27) is *ditlhako* ‘shoes’.

(27) *Mosadi o mo rekela ditlhako*.

mosadi	o **mo** rekela	ditlhako
woman	she **her** buys for	shoes
mo-sadi	*o-**mo**-rek-el-a*	*di-tlhako*
N1-woman	SC1-**OC1**-buy-APPL-VEND	N8-shoes

‘The woman buys (for) her shoes.’

When the applicative verb includes an object agreement morpheme that represents the direct object, the verb will be followed by the indirect object, for example in (28) the indirect object is *mosetsana* ‘girl’.

(28) *Mosadi o di rekela mosetsana*.

mosadi	o **di** rekela	mosetsana
woman	she **it** buys for	girl
mo-sadi	*o-**di**-rek-el-a*	*mo-setsana*
N1-woman	SC1-**OC8**-buy-APPL-VEND	N1-girl

‘The woman buys the girl it.’

In (27) and (28) the word order is SVO:

- Subject + Verb + Direct object (27) or
- Subject + Verb + Indirect object (28).

The c-structure of (27) is:

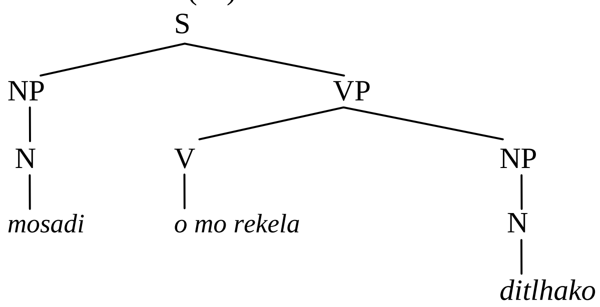

Figure 7: The c-structure for (27)

The f-structure of (27) is:

PRED ‘REK <SUBJ OBJ-TH OBJ>’

SUBJ [PRED ‘SADI’
NOUN CLASS 1]

OBJ-TH [PRED ‘PRO’
NOUN CLASS 1]

OBJ [PRED ‘TLHAKO’
NOUN CLASS 8]

APPL +, CLASS 1, TENSE pres, VERB-TYPE main

Figure 8: The f-structure for (27)

The c-structure of (28) is:

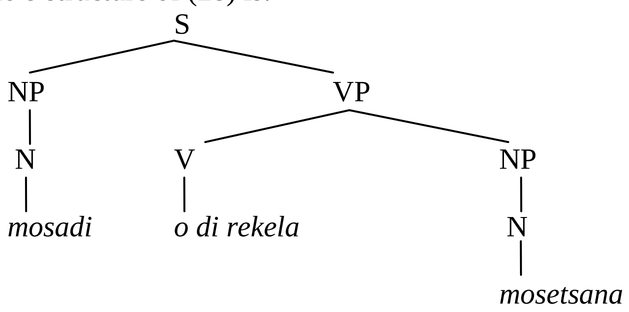

Figure 9: The c-structure for (28)

The f-structure of (28) is:

PRED ‘REK <SUBJ OBJ-TH OBJ>’

SUBJ [PRED ‘SADI’
NOUN CLASS 1]

OBJ-TH [PRED ‘SETSANA’
NOUN CLASS 1]

OBJ [PRED ‘PRO’
NOUN CLASS 8]

APPL +, CLASS 1, TENSE pres, VERB-TYPE main

Figure 10: The f-structure for (28)

4. Modelling double objects in XLE

In order to present the parsed c- and f-structures of (22) and (23) we make use of XLE (Crouch *et al.*, 2008). In this section we consider Setswana sentences where the verb includes the applicative suffix and give a short overview of some of the Setswana entries in XLE.

In (25) the applicative verb is followed by an indirect object and a direct object. In the rules section in XLE we have written a rule to model the structure of a simple declarative sentence in the indicative mood, present tense, positive. This rule states that the sentence consists of a phrase (NP) followed by a verb phrase (VP) and that this VP consists of a verb followed by a NP which is the indirect object (OBJ-TH) and another NP which is the direct object (OBJ). This rule is further expanded by stating that in order for the sentence to include two objects the verb must be applicative and the verb cannot include a present tense morpheme *a*. The present tense morpheme *a* is only prefixed in the verbal morphology when the verb is in the present tense but when there is no object or adjunct following the verb (see (26)).

We have also elaborated on the rule that presents the structure of a simple declarative sentence in the present tense, positive, by stating that the VP of these types of sentences may only consist of an applicative verb (see (26)). This verb will include two object agreement morphemes. When two object agreement morphemes are prefixed to the verbal root we handle both of them as inflectional objects by "lifting" the morphological information, available in the morphological tag of the object agreement morpheme, to the syntactic level. In XLE we handle the first object agreement morpheme as the inflectional indirect object (INFLOBJ-TH) and the second object agreement morpheme as the inflectional direct object (INFLOBJ). In this instance a present tense morpheme *a* (PresPre) must also be included to represent a grammatical sentence.

The syntactic analyses of (25) and (26) require the prior tokenisation of the sentences and the morphological analysis of the tokens which is a standard approach in computational grammars. The Setswana verbal orthography forced us to do the tokenisation of verbs in a unique way which we elaborated on in Pretorius *et al.*, (2010). Sentences are then parsed with the XLE grammar. The morphological analysis of Setswana is based on a finite-state computational approach, using the natural language independent Xerox Finite-State tools (Beesley and Karttunen, 2003). The Xerox Finite-State tools can be incorporated in XLE.

To follow we give the output of the tokeniser, morphological analyser as well as the XLE parsed sentences of (25) and (26) as presented in Figures 11, 12, 13 and 14.

Output of the tokeniser

```
mosadi@o_rekela@mosetsana@ditlhako@
mosadi@o_a_mo_di_rekela@
```

(`@` denotes token boundaries and _ represents whitespace)

Output of the morphological analyser

mosadi:	`sadi+NPre1`
o_rekela:	`rek+Pres+SC1+APPL+VEND`
mosetsana:	`setsana+NPre1`
ditlhako:	`tlhako+NPre8`
o_a_mo_di_rekela:	`rek+Pres+SC1+PresPre+OC1+OC8+ APPL+VEND`

Parsed sentences in XLE

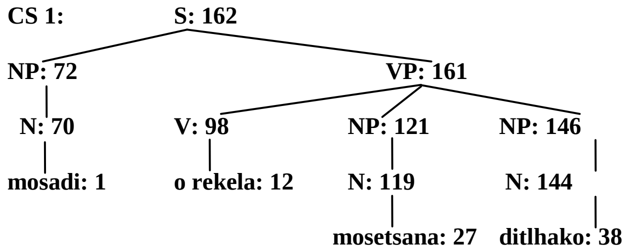

Figure 11: The c-structure for (25)

"mosadi o_rekela mosetsana ditlhako"

```
       PRED          ' REK < [1:sadi] , [27:setsana] , [38:tlhako]  > '
       SUBJ        1 [ PRED    ' sadi '
                  70   CLASS 1, NOUN-TYPE ord
                  72 ]
       OBJ-TH     27 [ PRED    ' setsana '
                 119   CLASS 1, NOUN-TYPE ord
                 121 ]
    12 OBJ        38 [ PRED    ' tlhako '
    98           144   CLASS 8, NOUN-TYPE ord
   161           146 ]
   162 APPL +, CLASS 1, TENSE pres, VERB-TYPE main
```

Figure 12: The f-structure for (25)

In Figure 12 the features of the verb indicate that the verb is applicative, takes a class 1 subject agreement morpheme, is in the present tense and is a main verb. It is necessary to give the class information because the verb *o_rekela* "she buys for' must agree with the noun mosadi 'women' which is also a noun in class 1. If there is not agreement between the subject noun and the verb, an inconsistent structure will be formed.

```
CS 1:             S: 103

NP: 57                         VP: 88
 |                               |
 N: 55                          V: 86
 |                               |
mosadi: 1                o_a_mo_di_rekela: 12
```

Figure 13: The c-structure for (26)

```
"mosadi o_a_mo_di_rekela"

    PRED            ' REK <  [1:sadi] ,  [12-OBJ-TH:PRO] ,  [12-OBJ:PRO]   > '
    SUBJ          1 [PRED    ' sadi '
                 55  CLASS  1,  NOUN-TYPE  ord
                 57 ]
    OBJ             [PRED    'PRO '
 12                  CLASS  8]
 86 OBJ-TH          [PRED    ' PRO '
 88                  CLASS  1]
103 APPL  +,  CLASS  1,  INFLOBJ  +, INFOBJ-TH  +,  PRESPRE +,
    TENSE  pres,  VERB-TYPE  main
```

Figure 14: The f-structure for (26)

In Figure 14 the features of the verb indicate that the verb is applicative and takes a class 1 subject agreement morpheme. This main verb also has the present tense morpheme (PresPre) because the verb is in the present tense and it takes a feature of inflected indirect object and inflected direct object. The inflected objects are the corresponding object agreement morphemes which replaced the indirect and the direct object.

5. Conclusion

Setswana verbs may take two objects in certain linguistic instances, one being verbs with the applicative suffix. Both of these objects can be replaced with object agreement morphemes in the verb. They are incorporated pronouns and thus have a pronominal status. Although the object agreement morphemes of Setswana also have morpheme status in the c-structure when they are prefixed to the verbal root they act as indirect and direct objects.

It is shown that double objects and double object agreement morphemes in verbs where verbs have the applicative suffix can be accurately modelled in LFG and implemented in XLE. Future work includes a comprehensive treatment of Setswana syntax and the development of a broad coverage parser for Setswana using LFG and XLE.

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Appendix: Tags in the text

Tag	**Meaning**
1, 2, 3 … 20	Class 1 to class 20
ADJ	Adjective
ADV	Adverb
APPL	Applicative suffix
CAUS	Causative suffix
DEM	Demonstrative
FUT	Future tense morpheme
INFLOBJ	Inflectional direct object
INFLOBJ-TH	Inflectional indirect object
LOC	Locative suffix
N	Noun
NPre	Noun prefix
OC	Object agreement morpheme
P1, P2, P3	First person, Second person, Third person
PERF	Perfect suffix
PL	Plural
PossPart	Possessive particle
PossPron	Possessive pronoun
Pres	Present tense
PresPre	Present tense morpheme a
QualPart	Qualificative particle
RECP	Reciprocal suffix
SC	Subject agreement morpheme
VEND	Verbal ending

A PROSODIC RESOLUTION OF GERMAN CASE AMBIGUITIES

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Proceedings of the LFG13 Conference

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Abstract

Previous work shows that speakers and listeners can use prosodic information to clarify the meaning of syntactically ambiguous sentences. For German case ambiguities, earlier experiments reveal a significant effect of fundamental frequency, segmental duration and pause duration. This paper reports on an experiment with fully ambiguous sentences caused by case ambiguities in the German determiner system. Its purpose is to find generalisations over the different prosodic cues, thus providing the attributes and their values, which are responsible for the prosodic disambiguation of the German case phenomenon. The resulting data is integrated into the p-diagram, which allows for a fine-grained representation of the speech signal and corresponds with the syntactic module via LFG's parallel projection architecture. The information stored in the p-diagram is extracted in the respective syntactic rules via OT-like phrase structure constraints, which allow for a detailed interpretation of the rather complex results.

1 Introduction

Discourse context usully calls for a single reading and previous work shows that speakers and listeners can use prosodic information to clarify the meaning of syntactically ambiguous sentences. Based on the assumption that the prosodic and the syntactic component are parallel, but interacting modules of grammar (O'Connor 2005, Bögel et al. 2009), I investigate how the interaction between the syntactic and the prosodic component can be formalized to account for the exchange between syntactically ambiguous structures and the corresponding prosodic cues that can resolve this ambiguity.

In their paper, Gollrad et al. (2010) investigate how and to which degree different prosodic cues are used by speakers to disambiguate German genitive and dative case constructions. Their findings reveal a significant effect of the fundamental frequency, of segmental duration and pause duration. However, their experimental material was only partly ambiguous in that the ambiguity was always resolved by the choice of the clause final verb. Furthermore, their data set involved three DPs for each sentence, adding a neutral object before the clause final verb. This paper, on the other hand, reports on an experiment that extends and modifies the experiment conducted by Gollrad et al. (2010), in that the data set also includes fully ambiguous sentences containing only two DPs as in (1).

(1)	Überraschend	antwortete	[der Diener]	[der Gräfin]
	Surprisingly	answered	the.MASC.NOM servant	the.FEM.GEN/DAT duchess

'Surprisingly, the duchess's servant answered // the servant answered the duchess.'

[†]I would like to thank Bettina Braun, Miriam Butt, Tracy H. King, Aditi Lahiri and Frans Plank for valuable comments on various aspects of this paper. Furthermore, I would like to thank the LFG audience for their numerous questions and comments, especially Mary Dalrymple, John Lowe and Louise Mycock.

The aim of this experiment was to identify relevant prosodic cues that could, in principle, be used from a machine processing perspective. Speakers usually apply several prosodic cues in combination to express a certain case construction. For a grammar to cover as many speakers as possible, the less frequent cues (i.e., the ones usually not prominent enough to have a significant result over all speakers of a sample) should be taken into consideration as well.

The results give a clear indication as to which attributes of a speech signal are relevant for a thorough interpretation. In section 4, these attributes are integrated into the p-diagram, first introduced by Bögel (2012), which allows for a fine-grained representation of the speech signal and provides an easily accessible structure from which the relevant cues can be extracted via LFG's parallel projection architecture (e.g. Kaplan 1987, Asudeh 2006) (section 5). This information extraction is accomplished via OT-like phrase structure constraints, which allow for a detailed and satisfying interpretation of the rather complex results (section 6).

2 German case ambiguities

German case is mainly encoded by the determiner system. In Table 1, the determiners for the three genders and four cases of German are listed.

	masculine	**feminine**	**neuter**
nominative	der	die	das
genitive	des	***der***	des
dative	dem	***der***	dem
accusative	den	die	das

Table 1: The German determiner system.

Note that there is a syncretism between the feminine form of the dative and the genitive[1], which leads to the type of ambiguity illustrated in (2), where the ambiguity in the subordinate clause is caused by the ambiguous feminine article of the second DP, which could either be dative or genitive.

(2) Alle waren überrascht dass
Everyone was surprised that

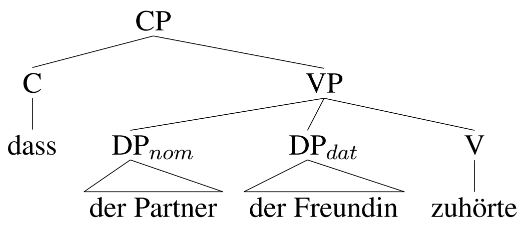
[der Partner]$_{\text{DP1}}$ [der Freundin]$_{\text{DP2}}$ zuhörte
the.ART.MASC.NOM partner the.ART.FEM.GEN/DAT friend listened

'Everyone was surprised that [the friend's partner listened // the partner listened to the friend].'

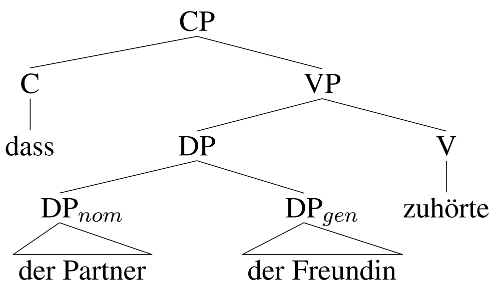
The sentence in (2) is fully ambiguous, because the final verb is intransitive, but optionally allows for a dative object as well. This full-sentence ambiguity results in two possible c-structures: In (3a), the two DPs are independent daughters of the VP, while in (3b), the two DPs form a possessive construction.

[1]The syncretism is also true for the masculine nominative form. However, this fact has no impact on the ambiguity of the construction analysed in this paper.

(3) a. **Dative**: The partner listened to the friend



b. **Genitive**: The friend's partner listened



While the purely syntactic analysis of ambiguous structures leads to multiple representations, the structures can be distinguished with the help of prosodic cues. One major cue that has been mentioned in previous studies (Gollrad et al. 2010, a.o.) is the position of the phonological phrase boundary. With the dative construction, this phrase boundary would be after the first DP (4a), while its position would be after the second DP in the genitive construction (4b).

(4) a. ... dass der Partner$)_{\text{PhP}}($ der Freundin ...

b. ... dass der Partner der Freundin$)_{\text{PhP}}($...

The following experiment aims to evaluate the importance of the phonological phrase boundary and to establish further prosodic indicators for each condition.

3 An experiment on German case ambiguities

In their paper, Gollrad et al. (2010) identified prosodic cues which can be used for disambiguating between genitive and dative constructions. However, their study did not involve completely ambiguous structures; instead, the sentences consisted of three determiner phrases, always involving an object and a disambiguating final verb. While their results stated the overall significant indicators for each condition in their data set, they did not report on subgroups, i.e., prosodic cues only used by a subset of the speakers, which are not significant for all the speakers and are thus usually not reported on. From an automatic processing perspective, however, those cues are of interest as well, as they can be integrated via ranked constraints, weighting the single prosodic cues in accordance to their overall frequency of occurence.

In order to investigate these subgroups, to gain information on fully ambiguous sentences consisting of only two noun phrases and to gather the absolute values of the different prosodic cues, an experiment similar to the one in Gollrad et al. (2010) was conducted.

Allbritton et al. (1996) state that subjects will not consistently use prosodic cues to indicate a certain interpretation of syntactically ambiguous sentence, even if the context disambiguates the intended meaning. However, they find that if the speakers were aware of the ambiguity and were asked to pronounce the sentence according to a certain interpretation, the prosodic cues were much more distinct for each condition. In order to control for these findings as well, the experiment involved several types of constructions:

1. Ambiguous and unambiguous constructions hidden in a larger text, where the ambiguous structures were disambiguated by the context.
2. Unambiguous structures, where the two DPs were masculine.
3. Fully ambiguous structures, where the speaker was made aware of the intended meaning.

The sentence types were presented to the participants in this order; full awareness of the ambiguity and a demand for a distinct pronunciation, however, was only given with group three sentences. While I agree with Allbritton et al. on the fact that speakers do not consistently use one set of prosodic cues (this being a statement which is supported by the findings in this paper), for the here presented experiment I could not find any significant differences between the three groups and thus for the influence of speaker awareness on prosodic pronunciation.[2]

For the experiment, 15 female participants produced a total of 480 sentences. Recordings took place in a sound proof chamber.[3] All resulting 480 sentences were hand-annotated using the Praat software (Boersma and Weenink 2013) for the fundamental frequency, the duration of the syllables and for the length of pauses. Statistical analysis was done with a linear mixed effects regression model (LMER) with subject and item as crossed random factors and the two conditions (genitive and dative) as fixed factors. The statistical analysis for the whole group of speakers showed the following results:

- A significant drop in fundamental frequency from the first DP to the determiner of the second DP in the dative condition (DAT: 32.5 Hz, GEN: 23.2, β=-9.31, SE=2.64, t=-3.53).
- A significant pause between the first and the second DP in the dative condition: (β=-2.35, SE=0.92, t=-2.55).
- The duration of the last syllable of the first DP was significantly longer in the dative condition than in the genitive condition (β=-2.8, SE=0.79, t=-3.58).

[2] A discussion of possible reasons goes beyond the scope of this paper.

[3] I would like to thank Bettina Braun and Nicole Dehé for the opportunity to use the phonetics laboratory.

While these indicators are well known (Gollrad et al. 2010, a.o.), other prosodic cues are only significant for a smaller subgroup of speakers. For this reason, the statistical analysis was also performed for each individual – only then is it possible to identify smaller subgroups and to make sure that there are not two opposing groups of prosodic cues (i.e., one group shows a drop and one group a rise within the same position and in the same condition).

Figure 1 shows a 'prototypical dative' as viewed in Praat. The top part shows an oscillogram of the signal, which takes time and amplitude (sound pressure) into account. The middle part is a spectrogram in which energy is displayed by time (horizontally) and various frequencies (vertically). The darker a phasis in the spectrogram, the higher the energy density. Below the spectrogram, another level has been added. This consists of hand-annotated reference syllables (the gloss) and a GToBI annotation (Grice and Baumann 2002), indicating High and Low pitch accents and boundary tones (for more on GToBI see section 4.3).

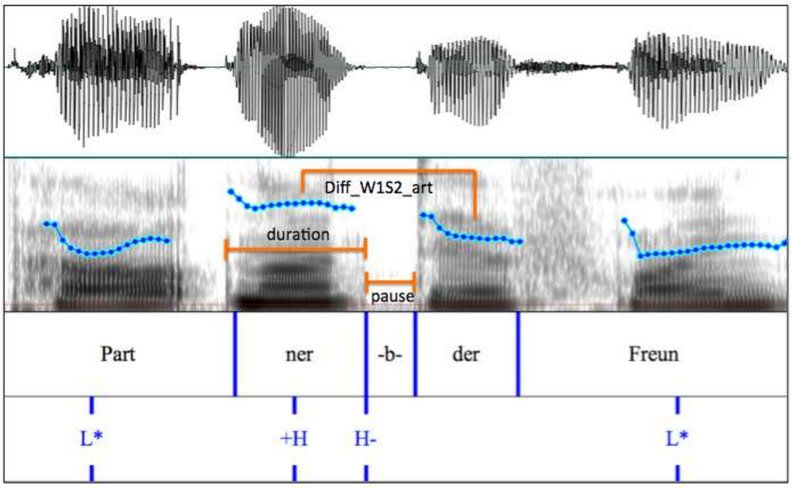


Figure 1: A prototypical **dative**.

The blue dotted lines in Figure 1 represent the (discontinuous) fundamental frequency, which shows the speech melody of the speaker. The orange solid lines have been added by hand and indicate the three most frequently used prosodic cues for the dative construction.[4]

1. **Pause**: 40% of the speakers use a statistically significant pause to indicate a prosodic break between the two DPs.
2. **Duration**: 47% of the speakers lengthen the last syllable of the first DP in a dative construction.

[4]The labels are abbreviations for the specific prosodic cue they indicate. **diff_W1S2_art**, for example, stands for the **diff**erence of the fundamental frequency between the second syllable **S2** of the first noun **W1** and the **art**icle.

3. **Diff_W1S2_art**: 40% of the speakers have a significant drop in the fundamental frequency from the last syllable of the first DP to the following determiner of the second DP.

While all of these indicators are significant if measured for all participants, they are certainly not true for each individual. Participants used different indicators and combinations thereof to indicate the dative construction. The same is true for the genitive construction.

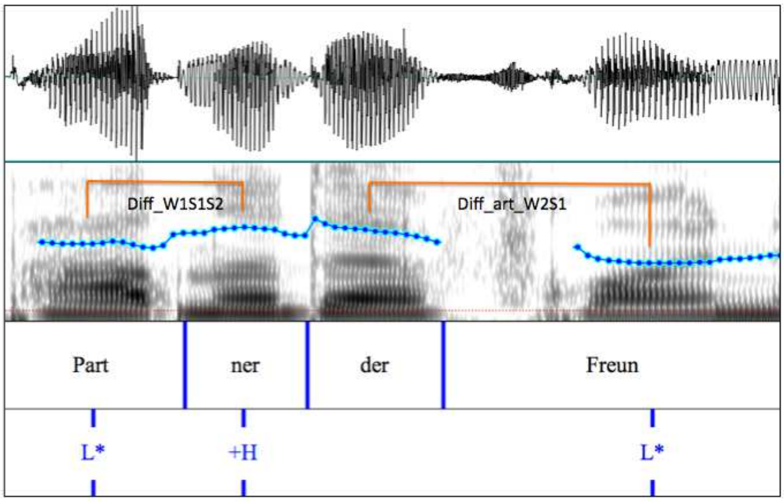


Figure 2: A prototypical **genitive**.

First of all, all of the above mentioned ('dative') indicators are significant for the genitive as well in that they are *not* present. Indicators visible in the genitive speech signal are

1. **Diff_W1S1S2**: 27% of the participants show a smaller difference in fundamental frequency between the first and the second syllable of the first noun.[5]
2. **Diff_art_W2S1**: 20% show a drop from the fundamental frequency value of the determiner *der* to the first syllable of the following noun.

The results found in the study show more prosodic cues, but these failed to satisfy the following constraints which were introduced to ensure a certain significance in the overall strategies on the one hand and to avoid strategies which excluded each other on the other hand. Thus, for a certain speech signal phenomenon to be considered as a subgroup, the following constraints had to be met:

1. The phenomenon must be statistically significant for at least 20% of the speakers. As a consequence, prosodic cues that were only applied by, e.g., 10% of the speakers were ruled out.

[5]It is not clear if the L*+H GToBI annotation is justified here, but I left it in to indicate that there still is a rise in fundamental frequency from the first to the second syllable.

2. No phenomenon that is contrasted by the phenomenon of another subgroup may be used. This excludes subgroups, who for example used a High tone on syllable X in the genitive condition if another subgroup used a Low tone on the same syllable X in the genitive condition as well.

From a machine processing perspective, all of the above described phenomena should be included in the grammar in order to cover as many speakers as possible. After an introduction to the p-diagram (Bögel 2012), which allows for a detailed analysis of the speech signal, I will introduce the necessary attributes used to indicate the different prosodic cues. The speech signal information encoded in the p-diagram can then be retrieved by c-structure annotation rules via LFG's correspondence architecture (section 5). In order to measure up to the frequency of occurence of the different prosodic cues discussed in this section, OT-like phrase structure constraints will be applied (section 6).

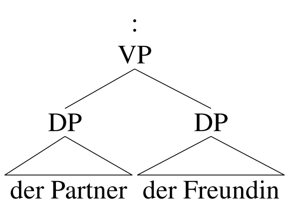
4 The p-diagram

Building on the proposal made by Bögel (2012), the p-diagram allows for a fine-grained representation of the speech signal. Following Dalrymple and Mycock (2011) with the additions in Bögel (2012), I assume that each string has (at least) two representations: The p-string is the abstract (IPA-encoded) representation of the speech signal which is, by definition, a sound wave and thus not visible to the eye. The s-string is the functional-morphological representation. The p-string/the speech signal is encoded in the p-diagram within p-structure and the s-string is part of the syntactic module.

The information provided by the p-diagram for a certain string can be further processed by the syntactic module, allowing, for example, for a distinction between syntactically ambiguous structures based on prosodic cues. The lexicon functions as a look-up instrument and includes syntactic, phonological and semantic information on each word and is thus at the interface between s-string and p-string

Figure (3b) shows part of the p-diagram representation of a typical dative construction with the respective c-structure representation in (3a):

a.



b.

...	...	...	...	...
DURATION	0,12	0,22	0,16	0,058
FUND_FREQ	178	165	218	-
STRESS	-	prim	-	-
VALUE	/deʁ/	/paʁt/	/nɐ/	-
VECTORINDEX	$\mathbf{S_1}$	$\mathbf{S_2}$	$\mathbf{S_3}$	$\mathbf{S_4}$

Figure 3: c-structure and (reduced) p-diagram of *der Partner der Freundin* (dative).

The speech signal is interpreted horizontally syllable by syllable, which allows a linear representation of phonemes (forming the p-string), pauses, duration and other attributes. However, the signal is also represented vertically attaching the different layers of the speech signal to each syllable, e.g. the duration and the fundamental frequency.

Each syllable and each pause receives a vector S which encodes the speech signal information on the one hand, i.e., the different aspects of the speech signal and their respective value at the time the syllable in question is uttered. On the other hand, the lexical information (phonological information and information on lexical stress) are also stored in the vector. For example, for the first syllable of the word ‘Partner’, the corresponding vector is as in (5):[6]

(5)

$$\text{S: } \begin{pmatrix} value \\ stress \\ F_0 \\ duration \\ ... \end{pmatrix} \text{(n)} \quad \text{which would yield, e.g.,} \quad \text{S: } \begin{pmatrix} /pa^{\text{ʁ}}t/ \\ prim \\ 165Hz \\ 0,22s \\ ... \end{pmatrix} \text{(2)}$$

These vectors are then merged into the p-diagram (Figure 4), enabling a fine-grained representation of the original speech signal. Once encoded in the p-diagram, the information can be easily extracted; for example, the function (S2 DURATION) = 0,22 refers to the second vector’s value for the attribute ‘duration’ which is 0,22 seconds.

...	...	...	...	...	INTERPRETATION
SEMIT_DIFF	..	-1.3	4.8	-	↓
GToBI	-	L*	+H H-	-	
BREAK_IND	-	-	-	3	
PHRASE	-	-	-	PhP	
DURATION	0,12	0,22	0,16	0,058	SIGNAL
FUND. FREQ.	178	165	218	-	↓
STRESS	-	prim	-	-	LEXICON
VALUE	/de$^{\text{ɐ}}$/	/pa$^{\text{ʁ}}$t/	/nɐ/	-	↓
VECTORINDEX	$\mathbf{S_1}$	$\mathbf{S_2}$	$\mathbf{S_3}$	$\mathbf{S_4}$	... →

Figure 4: The p-diagram of */de$^{\text{ɐ}}$ˈpa$^{\text{ʁ}}$tnɐ/* (‘the partner’)

The p-diagram itself is divided into several parts, which draw on different aspects of the speech signal as explained in the following sections.

[6]Note that for a pause vector, most values will be empty, except for the duration attribute.

4.1 The lexical level

This paper follows the work by Levelt et al. (1999), who divide lexical access into three aspects: concept, lemma and form. The lexical entry as proposed by this paper also divides the lexical string into three aspects: concept, s-form and p-form.

concept	**s-form**	**p-form**
[partner]	Partner	/ˈpaʶt.nɐ/
...	...	...

(6) shows the lexical entry associated with the s-form 'Partner' as it is encoded in the lexical section of an (XLE) LFG grammar.

(6) Partner N (↑ PRED) = 'Partner'
(↑ GEND) = masc

While this is a standard LFG entry, the information associated with the p-form requires further explanation. If dealing with isolated words, the syllables are clearly set in our mind. However, if the context changes, the syllables' clear boundaries may be lost during runtime. Resyllabification might take place, where the coda of the previous syllable is drawn to the onset of the next syllable.

This is one of the reasons why Levelt et al. (1999) propose that the lexicon stores the segments of a morpheme, but does not group these segments into syllables. Instead, a metrical frame is stored along with the segments,[7] which contains information on the number of syllables and the distribution of stress. This stress distribution can change with a morphological process triggering lexical phonology, e.g., if a specific derivational affix is added.[8]

During runtime, the metrical form and the segments are merged, respecting postlexical phonological rules like, e.g., syllabification. For the word 'Partner', the p-form entry would thus look like the following:

(7) <partner> SEGMENTS /p aʶ t n ɐ/
METRICAL FRAME $(\overset{x}{\sigma}\sigma)$

Depending on the context (i.e. the following segments and metrical frames) and according to the rules which form a syllable, the segments are then merged into the frame. For the word 'Partner', the respective p-form would be /ˈpaʶt.nɐ/. Since *tn is an illegal consonant cluster in the onset of a German syllable, the /t/ becomes part of the coda of the first (stressed) syllable while /n/ occupies the onset position of the second syllable.

[7]Note that the segments here merely represent phonological feature bundles as described by Lahiri and Reetz (2010). However, for the purpose of this paper, each segment is represented as an IPA representation.

[8]A widely known example, e.g. discussed in Gussenhoven (1991), is the stress difference between 'Japan' and 'Japanese'.

The information gathered in the lexicon is then encoded within the lowest levels of the p-diagram; VALUE represents the syllable in runtime[9] and STRESS the lexical stress assignment, which can be either primary or secondary (or unspecified).

STRESS	-	prim	-	-	...
VALUE	/deɐ/	/paʁt/	/nɐ/	-	...
VECTORINDEX	$\mathbf{S_1}$	$\mathbf{S_2}$	$\mathbf{S_3}$	$\mathbf{S_4}$	... →

Figure 5: The lexical level of the p-diagram of */deɐ ˈpaʁtnɐ/* (‘the partner’)

Note that ‘stress’ here refers to *lexical* stress, i.e., the syllable of a word which carries the stress, in contrast to ‘sentence stress’ (pitch accent), which refers to high and low points in the fundamental frequency. Traces of lexical stress can be seen in the signal and pitch accents are usually connected to a syllable that also carries primary lexical stress.[10]

4.2 The signal information

Information on different aspects of the speech signal (here: DURATION and FUNDAMENTAL FREQUENCY; a possible addition could be INTENSITY) is directly transferred into the p-diagram.

DURATION	0,12	0,22	0,16	0,058	
FUND. FREQ.	178	165	218	-	
...	...	...	...	...	
VECTORINDEX	$\mathbf{S_1}$	$\mathbf{S_2}$	$\mathbf{S_3}$	$\mathbf{S_4}$	...

Figure 6: The signal information of */deɐ ˈpaʁtnɐ/* (‘the partner’)

In Figure 6, DURATION measures the length of a syllable or a pause in seconds. The values under FUNDAMENTAL FREQUENCY refer to the maximum Hertz value

[9]The syllable in runtime is, in fact, not really part of the p-diagram’s lexical level as the syllabification may change due to postlexical phonological processes. The contrast between lexical and postlexical syllabification can offer valuable clues to the determination of, e.g., the size of the prosodic word. However, for now I leave the depiction of that contrast and the resulting implications to further research.

[10]However, this is not always the case, as the pitch accent can move to a syllable with secondary stress if the primarily stressed syllable is next to another primarily stressed syllable. For English, this phenomena has been described as ‘rhythm rule’ (e.g., Gussenhoven 1991, Shattuck-Hufnagel et al. 1994) and accounts for the stress shift in words like ‘thirteen’ in the combination ‘thirteen men’. Note also that an assignment of the pitch accent to an unstressed syllable as in ‘Are you thirteen years old?’ – ’No, I am thirty years old’ can be an indication for contrastive focus. For now, the interaction between the GToBI encoding of pitch accents (section 4.3) and lexical stress is left for further research.

of the corresponding syllable, where the Hertz value was strictly measured at the middle part of the syllable nucleus.[11]

4.3 The interpretation level

The interpretation level does not include direct information from the speech signal, but rather interprets the information gathered at the lower levels. Since this information is partly calculated on the basis of the neighbouring syllables' values, this level of the p-diagram cannot be part of the initial vector, but is added after the basic p-diagram is created.

SEMIT_DIFF	..	-1.3	4.8	-	
GTOBI	-	L*	+H H-	-	
BREAK_IND	-	-	-	3	
PHRASE	-	-	-	PhP	
...	...	...	...	...	
VECTORINDEX	$\mathbf{S_1}$	$\mathbf{S_2}$	$\mathbf{S_3}$	$\mathbf{S_4}$	...

Figure 7: The interpretation level of */de^{ɐ}ˈpa^{ʁ}tnɐ/* ('the partner')

It is the analyst's decision which information should be gathered and interpreted in the p-diagram. For an adequate interpretation of the speech signal in the genitive-dative variation, four attributes are of use, which are described below:

1. SEMIT_DIFF refers to semitone difference and describes the difference between the fundamental frequency value between two syllables. The semitone scheme is used instead of absolute Hertz values, because the higher two Hertz values are, the smaller is the difference between them from a listener perspective; i.e., the difference between 100 and 150 Hertz is much more significant than the difference between 400 and 450 Hertz. For this reason, semitones are calculated, which measure the relative (and not the absolute) difference between two Hertz values. The formula in (8) calculates the semitone value for a Hertz-value.[12]

   (8) $\text{f0max(St)} = 12*\log_2(\frac{f0max(Hz)}{f0min(Hz)})$

[11]This way, measuring irregularities which are quite common in Praat at the border of syllables, especially if non-sonorant consonants are involved, can be avoided.

[12]There are several possibilities to calculate semitones: First, the maximum value of the current syllable relative to the minimum value of the fundamental frequency of the utterance. This will apply for all subjects, independently of their pitch range. Second, the semitones can be calculated relative to, e.g., a 100 Hz, in case the minimum value cannot be determined. A 100 Hz will be sufficient for female participants; for male participants, the value should be set to 50 Hz or lower. However, while the absolute semitone values differ with the two formula options, the p-diagram only encodes the difference between two semitone values. This difference value is the same with both options.

12 semitones form an octave. For the above example, the semitone difference between 100 and 150 Hertz will be ca. 7, while the semitone difference between 400 and 450 Hertz will be ca. 2. This difference between semitones gives a better indication of how significant a drop/rise in the fundamental frequency is from a listener perspective. The attribute semit_diff thus does not encode the semitone value for this specific syllable, but the semitone difference with respect to the previous syllable, i.e., the semitone value has to be subtracted from the semitone value of the previous syllable. Consequently, a negative value indicates a drop in the fundamental frequency, while a positive value indicates a rise, a representation that allows for a quick overview on significant drops/rises in the speech melody.

2. GToBI is a set of conventions for labelling High and Low tones and break indices in German intonation, thus modelling the pitch contour of a speech signal. The GToBI inventory includes two monotonal and four bitonal pitch accents as well as boundary tones (Grice and Baumann 2002).

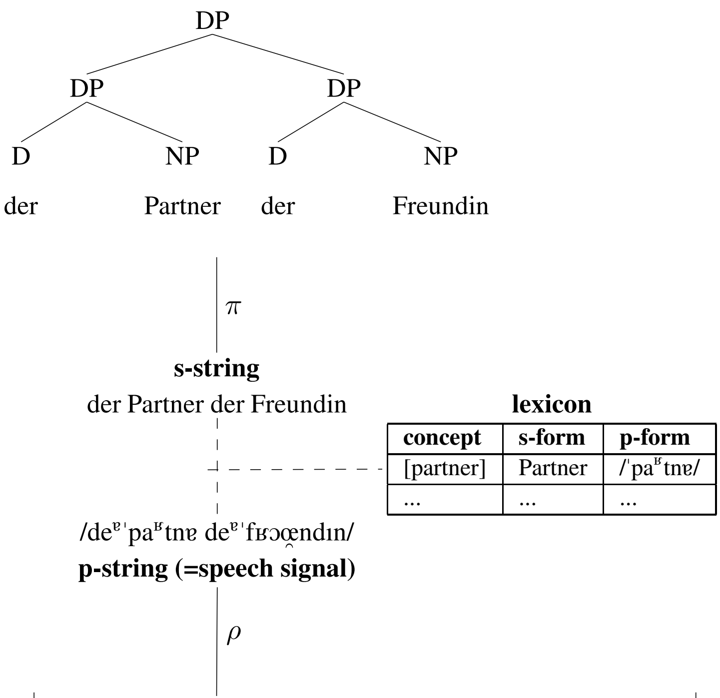
3. BREAK_IND refers to break indices, which indicate the value of the perceived degree of disjuncture between two words (Beckman et al. 2005). The break indices are connected to the GToBI level in that that they are also part of the annotation conventions. Break indices range from 0 (clitic boundary) to 4 (intonational phrase), thus grouping segments of speech hierarchically. For the current version of the p-diagram, only break indices 3 (phonological phrase) and 4 are taken into account.

4. PHRASE indicates larger (and thus more easily identifiable) prosodic phrasing boundaries, i.e., the phonological phrase and the intonational phrase. These are calculated on different parameters, e.g. the break indices, the boundary tones or the duration of the previous syllable.

While all attributes of the interpretation level could, in principle, be of use for the interpretation of speech signal phenomena by c-structure annotations, this paper will only refer to SEMIT_DIFF and PHRASE to retrieve the necessary information.

5 The P-diagram's position within the LFG architecture

Based on the assumption that the prosodic and the syntactic component are parallel, but interacting modules of grammar (O'Connor 2005, Bögel et al. 2009), I assume the string to be the central link between the two components (cf. Dalrymple and Mycock 2011). Figure 8 shows the p-diagram's integration into LFG as exemplified by a dative construction.



...	...	...	...	...	...	...	
SEMIT_DIFF	...	-1,3	4,8	-	-1,7	-2,4	3,3
GToBI	-	L*	+H H-	-		L*	+H
BREAK_IND	-	-	-	3	-	-	-
PHRASE	-	-	-	PhP	-	-	-
DURATION	0,12	0,22	0,16	0,058	0,12	0,36	0,14
FUND. FREQ.	178	165	218	-	198	172	208
STRESS	-	prim	-	-	-	prim	-
VALUE	/deɐ/	/paʁt/	/nɐ/	-	/deɐ/	/fʁɔœ̯n/	/dɪn/
VECTORINDEX	$\mathbf{S_1}$	$\mathbf{S_2}$	$\mathbf{S_3}$	$\mathbf{S_4}$	$\mathbf{S_5}$	$\mathbf{S_6}$	$\mathbf{S_7}$

Figure 8: The prosody-syntax interface.

The p-string is the string's abstract representation of the speech signal; the s-string is the string's morphosyntactic representation. P- and s-string are two sides of one coin, connected via the reference to the lexicon, which includes s-form and p-form of each concept unit (see section 4.1).
Two modules are connected to the string: The π-relation connects c-structure to the (s-)string on the one side, while the ρ-relation connects the p-diagram to the (p-)string on the other side.

Following Kaplan (1995), I assume a structural correspondence π which maps the string elements to c-structure. The inverse relationship, that is, the mapping from c-structure to the string can thus be defined as π^{-1}. As Asudeh (2009) states, the π-relation projects only from string to terminal nodes. It is thus crucial to formulate further definitions for the inverse mapping from non-terminal nodes to the string.

Here, I follow (with small adjustments) Mycock and Lowe (2013) who define the terminal nodes projected from a current c-structure node $*$ as $T(*)$.[13] The projection from a c-structure node to the corresponding string is thus defined as $\pi^{-1}(T(*))$, which returns an ordered set of s-string-elements. This morphosyntactic string chunk has a corresponding p-string section identified via the reference to the lexicon, where the p- and s-form are stored for every lexical item. The p-string represents the speech signal via an IPA-transcription. It is mapped to the p-diagram in p-structure via the relation ρ, which maps the speech signal syllable-wise to the p-diagram (as described in section 4).

In this model, the prosody-syntax interface is the string itself. The correspondence between c-structure and p-diagram can be defined as the composition (Kaplan 1995, Asudeh 2006) of the inverse relation of the s-string and the c-structure and the relation of the p-string and the p-diagram: $\rho(\pi^{-1}(f))$. In order to simplify the reference to this relation within the phrase structure rules, the following abbreviation is used:[14]

$$\rho(\pi^{-1}(f)) \equiv \natural(f)$$

This relation allows c-structure annotation rules to refer to information which is relevant for a specific c-structure analysis, but which is encoded in p-structure in the p-diagram. The relevant values are then retrieved by means of the vector index and the attributes of interest, e.g. *(S2,* STRESS*)* (i.e., the attribute STRESS of the second vector 'S2') returns *primary* (i.e., has the value 'primary').

6 Disambiguating c-structure via ranked constraints

As has been shown in section 3, the prosodic indications are numerous, but ranked by frequency in that some of them are applied by almost 50% of the speakers, while others are only used by 20% of the speakers. While theoretical papers usually only consider the prosodic cues used by a *significant* number of speakers, other cues are ignored. However, from a machine processing perspective, we also want to know which strategies are applied by (at least) 20% of the speakers, albeit ranked as less frequent.

The grammar writing platform XLE (Crouch et al. 2013), in which these phenomena are to be implemented, works with 'hard' constraints in that a constraint

[13] While Mycock and Lowe focus on the definition of right- and leftmost terminal nodes (driven by their edge-based approach), the function $T(*)$ used in this paper will return all terminal nodes attached to a certain c-structure node.

[14] I chose the musical $\natural$ symbol, because it actually represents the relation between c- and p-structure visually with two horizontal lines and two vertical lines in the middle representing the two sides of the string.

usually either allows or prohibits a certain analysis. For phenomena as described in the previous section, Optimality Theory (Prince and Smolensky 1993, Bresnan 2000) is thus a useful extension to classical LFG theory, because it allows for constraints to be ranked. For this reason, the c-structure annotations in this paper use OT-like constraints when referring to p-structure cues. 'OT-like' in this context means that the notion of constraints is not understood as in the original Optimality Theory and that the implementation into XLE allows for several extensions, as originally proposed by Frank et al. (1998) and extended and modified in the current XLE documentation (Crouch et al. 2013). In contrast to OT, for example, which only allows for negative constraints, XLE also enables the user to mark a certain condition as being preferred via so-called preference marks. This system enables the user to soften the standard constraints provided by XLE and allows for the implementation of phenomena, whose analysis is not easily divided into 'good' and 'bad' as is the case with the prosodic cues described in section 3.

Assuming that we would like to identify a dative analysis, we can rely on the three indicators introduced in section 3: The pause between the two DPs, the duration of the DP's last syllable and the drop in fundamental frequency between the first DP and the following determiner of the second DP. All of these are reliable indicators of a phonological phrase boundary; and, as stated before in section 2, such a boundary is expected to be present between the two DPs in a dative construction. Thus, instead of writing three rules ranking each of the three prosodic cues according to their frequency in speaker production, we can use the p-diagram's interpretation level and its PHRASE attribute, which is calculated on the combination of these three cues.[15] Since the three prosodic indicators for the dative are applied by at least 40% of the speakers, the phrase boundary cue should take up an important position in a (positive) ranking.

On the other hand, if we want to implement the drop in fundamental frequency from the determiner of the second DP to the first syllable of the following noun (diff_art_W2S1), then this prosodic cue should be ranked lower than the phrase boundary cue, because only 20% of the speakers apply it. Again, it is not meaningful to measure the drop in the fundamental frequency value itself for reasons explained in section 4.3; in this case, it is the SEMIT_DIFF value at the p-diagram's interpretation level which is of interest because it normalizes the absolute Hertz values of the fundamental frequency.

In the following implementation, these two attributes (phrase and semitones) are ranked according to their frequency of occurence in spoken data. (9) shows the algorithm to express this relationship where **PHPbreak** is the OT-marker for phonological phrase break (indicating a dative) and **DiffArtW2S1** is the marker for a significant difference in the fundamental frequency between the determiner and the first syllable of the following noun (indicating a genitive).

[15]Note that even only one of the indicators is already a reliable cue for a prosodic phrase boundary.

(9)

If **PHPbreak**, then Case=dat
If **DiffArtW2S1** and **not PHPbreak**, then Case=gen
If **not PHPbreak** and **not DiffArtW2S1**, then Case=dat OR Case=gen

XLE allows a choice between preference and dispreference marks. Dispreference marks coincide with the original idea of OT and are generally used on rare, yet grammatical constructions. Preference marks on the other hand are unique to the XLE implementation and are applied if one reading is preferred.[16]

From the starting point of this paper and the implementation into LFG, it does not really matter if we set preference or dispreference marks. For the implementation here I chose preference marks, which are not in line with classical OT, but save an addition of the prosodically unmarked case (i.e., an expression which has neither distinct prosodic dative nor genitive cues) to the optimality order as the most dispreferred case. This would be necessary because otherwise the unmarked case would always be the preferred case. (10) shows the optimality order via preference marks, indicated by +.[17] Here, the unmarked case would only be the preferred analysis, if none of the constructions with preference marks apply. An extra marking of the unmarked case is thus unnecessary.

(10) OPTIMALITYORDER +PHPBREAK +DIFFARTW2S1
$\rightarrow$ where PHPBREAK is preferred over DIFFARTW2S1, and if none of the marks are present, the unmarked analysis applies.

In (11), an implementation of the phrase structure rule annotation referring to the dative construction with the optimality order as described in (10) is shown.

(11) XLE implementation for the **dative** construction:

VP $\rightarrow$ DP DP V

$\{(\natural(T(*))\ S_{max+1}\ \text{PHRASE}) =_c \text{PhP}$
$(\downarrow \text{CASE}) = \text{dat}$
$\text{PHPBREAK} \in \text{o*}$
$\mid (\natural(T(*))\ S_{max+1}\ \text{PHRASE}) \neq \text{PhP}$
$(\downarrow \text{CASE}) = \text{dat}\}$

The first DP rule annotation is a disjunction, indicated by the {x | y} annotation. The $\natural(T(*))$ in the first line of part 1 refers to the (set of) terminal nodes connected with the DP and the projection between c-structure and p-structure as described in

[16]Note that both methods have problematic issues in that they can lead to preference/dispreference analysis between completely unrelated constructions (for more on this topic see Frank et al. 1998). Thus, an implementation with OT marks should always carefully consider other possible, but unintended, interactions.

[17]The representation is as it would appear in the XLE grammar configuration section.

section 5. (S_{max+1} PHRASE) $=_c$ PhP is a reference[18] to the last vector of the set of DP terminal nodes (i.e., the one with the maximum value, which is the last syllable of the first DP) plus one, i.e., the vector *following* that last vector.[19] That vector applied to the attribute PHRASE must yield the value PhP, indicating a phonological phrase boundary. If this is the case, then the dative case is assigned and the construction receives a preference mark PHPBREAK, indicated by PHPBREAK $\in$ o*[20]. The second part of the rule refers to the case where the attribute PHRASE does not yield the value PhP. In that case, the dative is still assigned. However, if there is another analysis in competition and this analysis carries a preference mark as well, then this default analysis is overruled.
(12) shows an implementation of the phrase structure rule annotation referring to the genitive construction with the optimality order as described in (10).

(12) XLE implementation for the **genitive** construction:

$$
\begin{array}{llc}
\text{DP} \;\rightarrow & \text{DP} & \text{DP} \\
 & & \{(\natural(T(*))\ S_{min+1}\ \text{SEMIT\_DIFF}) < \text{-2} \\
 & & (\downarrow \text{CASE}) = \text{gen} \\
 & & \text{DIFFARTW2S1} \in \text{o*} \\
 & & |(\natural(T(*))\ S_{min+1}\ \text{SEMIT\_DIFF}) \geq \text{-2} \\
 & & (\downarrow \text{CASE}) = \text{gen}\ \}
\end{array}
$$

This rule works similar to the one described in (11). The main difference is that it refers to a different attribute-value pair, that of semitone difference. The first part of the rule assigns a preference mark named DIFFARTW2S1 to the analysis iff the semitones value at the second position (mimimum+1, i.e., the second syllable of the DP, which is the first syllable of the noun) is smaller than -2, indicating a significant drop from the determiner to the following noun. In the second part of the rule, the default is again a genitive assignment.

This rule set in combination with the optimality order stated under (10) leads to the following possibilities:

1. An analysis, which has been assigned a PHPBREAK preference mark will be preferred over all other analyses, whether they carry a DIFFARTW2S1 preference mark or none at all.

2. An analysis, which has been assigned a DIFFARTW2S1 preference mark will be preferred if no PHPBREAK is present in another analysis.

[18]Note that LFG's modular architecture and its correspondence functions allows for the interaction between the otherwise separated prosodic and syntactic modules via this constraining equation, which looks up relevant information stored in the prosodic module in order to approve or disapprove of the f-structure CASE annotation in the syntactic module.

[19]The S_{max+1} vector can be either the first syllable of the next word or, as it is the case here, a pause vector.

[20]This rule annotation is translated as 'the mark PHPBREAK is element of the o(ptimality)-structure', thus indicating that this part of the rule is carrying the optimality mark PHPBREAK.

3. If none of the preference marks are present, then the two default options will apply. This will cause the syntactic ambiguity that we first started with, but since in that case there are no prosodic cues disambiguating the structure, it is an ambiguity that should be present.

Figure 9 shows an example for a dative speech signal encoded into a p-diagram (a reduced version of the p-diagram in Figure 5, with only the relevant information present).

...	...	...	...	...	...	...	
SEMIT_DIFF	...	-1,3	4,8	-	-1,7	-2,4	3,3
PHRASE	-	-	-	PhP	-	-	-
DURATION	0,12	0,22	0,16	0,058	0,12	0,36	0,14
...	...	...	...	...	...	...	
VALUE	/deɐ̯/	/paʁt/	/nɐ/	-	/deɐ̯/	/fʁɔœ̯n/	/dɪn/
VECTORINDEX	$\mathbf{S_1}$	$\mathbf{S_2}$	$\mathbf{S_3}$	$\mathbf{S_4}$	$\mathbf{S_5}$	$\mathbf{S_6}$	$\mathbf{S_7}$

Figure 9: Parts of the p-diagram for the dative version of *der Partner der Freundin*.

This p-diagram shows how important it is to rank the different constraints, as it is quite common for speakers to mix indicators. While the speaker indicates the dative with the strong prosodic cue of a phonologcial phrase break, in this case calculated on the basis of a very long pause between the two DPs (0,58s), she also applied a prosodic cue for the genitive, the semi-tone difference between S5 and S6. However, since the phrase boundary is ranked higher than the semitones difference, the optimal analysis will be the (correct) dative one.

7 Conclusion

In this paper I have introduced the possibility to include ranked prosodic cues into phrase structure annotations to help resolving c-structure ambiguities caused by the German dative/genitive case alternation. The case alternation is caused by syncretism between the feminine article of the dative and the genitive, leading to two possible c-structures. As previous studies have shown (Gollrad et al. 2010), German speakers disambiguate dative and genitive constructions by means of prosody. The relevant prosodic cues for each condition were established with the help of an experiment conducted for this paper. These cues were then ranked according to the overall percentage of speakers that applied that specific strategy to express one of the two conditions, dative or genitive.

These findings require an interaction between the syntactic and the prosodic component. The formalization of this interaction and the p-diagram approach first introduced by Bögel (2012) allows for a thorough and compact depiction of the speech signal and an interpretation via c-structure annotation rules. In this paper, the p-diagram was extended by further attributes (e.g., the semitone difference) encoding the relevant prosodic cues in an easily accessible way.

The ranking between the different prosodic cues has been satisfied by means of OT-like constraints as they are used in the current XLE documentation.

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DIMENSIONS OF VARIATION IN THE EXPRESSION OF FUNCTIONAL FEATURES: MODELLING DEFINITENESS IN LFG

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Abstract

The exponents of functional features show a range of variation that cannot be captured even by dichotomies such as the clitic-affix distinction, not even when extended to include categories such as phrasal affix. A multidimensional parallel correspondence theory such as Lexical-Functional Grammar is eminently suited to dealing with the full range of variation. However, some of the patterns we find in languages involve extensions to the standard constructional formalism of LFG. In this paper we look at some challenging patterns of distribution exemplified by the definiteness feature and compare analyses expressed in terms of standard LFG formalism with those captured in a specification language approach.

1 Introduction

Functional features can find exponence in a great many ways across languages. Traditionally, the focus has been directed at distinctions such as whether exponents take the form of words, clitics or affixes. This aspect of the variation in exponence is well explored, and has led to the postulation by linguists such as Zwicky and Pullum (1983), Lapointe (1990, 1992), Miller (1992), Miller and Halpern (1993) and a number of others to the postulation of further categories (phrasal affixes or edge-marking morphology) that combine properties of both clitics and affixes. The diversity in exponence may go beyond what can be captured even by this more subtle approach to morpho-syntactic categories (see for instance Börjars (2003), Spencer and Luís (2012) and Börjars et al. (2013)). A parallel correspondence theory like LFG, which represents dimensions of linguistic information separately and links them with mapping functions which permit many-to-one relations would seem eminently suited to capturing this kind of variation.

In this paper, we will consider the feature DEFINITENESS and explore the range of ways in which it can be manifested. Definiteness is a complex phenomenon, depending on properties such as identifiability and uniqueness. We will ignore these semantic subtleties here and simply assume that there are elements that can be described as (in)definite. We will capture this with a feature [DEF $\pm$]. Many languages do not mark definiteness specifically, but whether a noun phrase is interpreted as definite or not is left to pragmatics. Often definiteness arises as a by-product of some other element; for instance a possessor or a demonstrative may yield a definite interpretation or a particular word order give rise to a definite interpretation. However, in this paper, we will consider only elements which mark definiteness specifically. We will use the following abbreviations:

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Dedicated definiteness marker (DDM)

a morphological or syntactic element which marks only definiteness [DEF $\pm$] (and possibly PERS/NUM/GEND features)

Functional definiteness marker (FDM)

a DDM whose presence is sufficient to make a noun phrase functionally definite: that is it will induce the presence of an f-structure feature [DEF $\pm$].

A noun phrase which has a value for the feature [DEF] in its f-structure will have the potential to function as a referential noun phrase, and in the cases we are considering here, the feature value will have originated from an FDM.

A cross-linguistic study of DDMs reveals different types of mismatches between form and function: in Dutch DDM finds exponence in the syntax — *de hond* 'DEF dog' — whereas in Icelandic it is part of a word — *hundinn* 'dog.DEF'. Danish has a prosodically independent DDM — *det* (*hus*) 'the house / it' — but in English it is prosodically dependent — *the house*.

In what follows, we will explore two cases which involve greater complexity than the mapping of definiteness from a syntactic DDM, as Dutch, Danish and English, or from a morphological DDM marked on a head noun, as in Icelandic. Both of the latter mappings allow the straightforward application of up and down designators in effect to pass the definiteness feature up the c-structure tree to the noun phrase node where it will map to an attribute in that noun phrase's f-structure. The two more complex cases are (i) definiteness marking on adjectives — as in Latvian, Hebrew and Swedish, and (ii) definiteness marking on a left edge — as in Ossetic, where the DDM is prosodic, and Bulgarian, where it is morphological. In interesting ways, both of these cases require extensions to the basic constructional notation of LFG. We therefore compare two different ways of formalising the mappings involved: standard LFG notation (with the aforementioned extensions), and a specification language approach. The former is familiar, but the latter may require some explanation. Blackburn and Gardent (1995, 39) argue that the elegant intuitions underlying the general LFG architecture are not captured in standard formalisations, in the sense that 'they make a detour via the LFG *construction algorithm*' (see also discussion in Kaplan (1995)). The specification language essentially describes the mapping between c-structure and f-structure directly: it is a propositional language enriched with operators ("modalities") which define the transitions between c-structure nodes, the transitions between f-structure attributes and their values, and the transitions between c-structure nodes and the corresponding f-structure attributes. The propositions which are needed for a particular language are then the axioms of that language

2 A specification language for LFG

Blackburn and Gardent (1995) demonstrate the construction of a basic specification language for LFG. The ontology of LFG is defined as a triple $<\mathcal{T}, \mathcal{F}, \mathcal{M}>$ where

$\mathcal{T}$ is the mathematical picture of c-structure, $\mathcal{F}$ is the mathematical picture of f-structure, and the function $\mathcal{M}$ defines the mapping between the two.[1] C-structures are modelled as standard trees in which each node is labelled with a category symbol and any applicable morphosyntactic features. Particularly relevant here will be the morphosyntactic feature *def*, which we assign to nouns, adjectives and other lexical categories which are morphologically marked as definite. F-structures are modelled as tree-like (properly multidominance) structures in which attributes are modalities associated with functions from one node to another node, and the symbol values of attributes are the labels of terminal nodes. Potts (2002) further specifies $\mathcal{M}$, the mapping between c-structure nodes and f-structure nodes, by pairing it with the binary modality <M> and assigning a unique name from the set {n1, n2, … } to each node in a given c-structure, and a unique name from the set {n′1, n′2, … } to each node in a given f-structure. We will henceforth adopt Potts' notation.

This ontology will obviously need to be expanded if we wish to model other LFG dimensions. In particular, we will need a quintuple $<\mathcal{T},\mathcal{F},\mathcal{P},\mathcal{M},\mathcal{S}>$ if we wish to include p-structure.[2] In this case, $\mathcal{P}$ will be the mathematical picture of p-structure and $\mathcal{S}$ the function which defines the mapping between c-structure and p-structure. We leave open the question as to whether p-structures are to be modelled as prosodic trees (Dalrymple and Mycock, 2011; Mycock and Lowe, 2013), or as AVMs (Butt and King, 1998): either route is compatible with the particular statement we will suggest for definiteness marking in Ossetic. If the AVM route proves to be optimal, then a similar mathematical construction can be employed as for $\mathcal{F}$. Extending Potts's treatment of $\mathcal{M}$, we will then pair $\mathcal{S}$, under either a tree or feature-structure model, with the binary modality <S> which links c-structure nodes with p-structure nodes.

The specification language L itself then consists of propositions which hold of each node in the structures defined by $\mathcal{T}$, $\mathcal{F}$ and $\mathcal{P}$. Examples of basic propositions are given in (1).

(1)	a.	*NP*	the category label NP is true of this c-structure node
	b.	<DEF> +	the modality <DEF> maps this f-structure node to a terminal f-structure node labelled +

The clumsy English glosses are deliberate, and reflect the propositional nature of L. As a propositional language, L is also naturally defined to contain the standard Boolean connectives, so that a conjunction of basic propositions can hold of a given node. We might then have propositions such as (2)

[1]Blackburn and Gardent (1995) refer to $\mathcal{M}$ as *zoomin*.

[2]The need for a quintuple, rather than a triple, is pointed out by Potts (2002, 31, fn 14).

(2) *NP* ∧ <M><DEF> + the category label NP is true of this c-structure node and this node is mapped by the modality <M> to an f-structure node which is mapped by the modality <DEF> to a terminal node labelled +

In addition to defining the notion of c-structure head, Potts (2002) also defines a useful set of c-structure modalities. The ones we will need are found in (3).[3]

(3)
a. <d_1> map this node to its leftmost daughter
b. <d> map this node to any of its daughters
c. <d_1*> map this node to the leftmost terminal node it dominates
d. <d*> map this node to any terminal node it dominates

If we wish to indicate the name of a node which is the value of such a modality, we will abbreviate the naming convention defined by Potts and simply attach a subscript to the modality itself. In other words, <d*$_k$>Φ will stand as an abbreviation for <d*>($n_k \wedge \Phi$), i.e. map this node to any terminal node it dominates which is named n_k and of which the proposition Φ holds. We use *italics* for propositions, categories and features associated with c-structure and SMALL CAPS for those associated with f-structure.

There is a considerable literature on the potential advantages of specification languages as a mode of description, as well as their potential expressive power in comparison to other formalisms (see in particular Pullum, 2013). One important result is that of Rogers (2003), who shows that the complexity of languages described by quite a rich specification language, that of weak monadic second-order logic (wMSO), depends essentially on the dimensions of the ontology. Thus tree-adjoining grammars can be defined in the wMSO theory of certain three-dimensional tree-like structures. It remains to be explored how this kind of approach to formal language complexity might extend to the multidimensional architecture of LFG, but we see no prima facie grounds to be pessimistic.

3 Definiteness marking on adjectives

It is not uncommon for definiteness to be marked on the adjective, three examples can be found in (4).[4]

(4) a. lielais koks (Latvian)
big.DEF tree

[3]Similar definitions can be provided for righnmost daughter and rightmost terminal node, but these are not needed here.

[4]The adjectival ending in Swedish is sometimes assigned a separate feature [WEAK/STRONG]. However, this distinction between the feature on adjectives and that on determiners and nouns is not warranted in modern Swedish. In earlier forms of the language, there was not a complete correlation between [WEAK/STRONG] and [DEF +/–] (Delsing, 1994), but in modern Swedish there is.

'the big tree'

b. ha-sefer ha-gadol (Hebrew)
DEF-book DEF-big
'the big book'

c. den stora boken (Swedish)
DEF big.DEF book.DEF
'the big book'

As the data illustrate, languages which mark definiteness on the adjective vary as to whether it is also marked on other elements of the noun phrase, Swedish and Hebrew show agreement across other categories, whereas Latvian does not. Though as the example in (5) shows, if there is more than one adjective in a noun phrase in Latvian, all adjectives need to be marked.

(5) lielais skaistais koks (Latvian)
big.DEF beautiful.DEF tree
'the big beautiful tree'

There is a further distinction with respect to the definiteness marking on the adjective. Since only the adjective is marked for definiteness in (4-a), it is clear that in Latvian, the marking on the adjective is functional in nature: it makes the noun phrase as a whole functionally definite. No other element can be marked for definiteness, so that a noun on its own is ambiguous; *koks* can mean 'tree', 'a tree' or 'the tree'. In Hebrew and Swedish, other elements within the noun phrase are also marked for definiteness, but the adjective marking in the two languages turns out to behave quite differently. As (6-a) illustrates, the definiteness marking on the adjective in Hebrew is a functional feature in this sense, the *ha-* is an FDM, whereas (6-b) shows it is not in Swedish. A definite adjective in Swedish requires the presence of another definiteness marker to form a noun phrase, as in (6-c).[5]

(6) a. ha-gadol (Hebrew)
DEF-big
'the big one'

b. stora (Swedish)
big.DEF
*'the big one' (just means 'big')

c. den stora (Swedish)
DEF big.DEF
'the big one'

The conclusion for Swedish is that the feature DEF feeds into the f-structure of the noun phrase when it finds exponence on a determiner or a noun, but not when it occurs on an adjective. We seem to have variation in two dimensions: firstly, the

[5]For dialects of Swedish which have a different adjectival ending which does allow the definite adjective to function as a referential noun phrase, see Delsing (2003).

definiteness feature on the adjective can form part of an agreement pattern across the noun phrase, or it can be the sole exponent of definiteness; secondly it may or it may not feed into the f-structure of the phrase.

Discussions of agreement in the literature tend to see it as a relation between two elements within a phrase, but they differ as to the nature of the relation. Under one view, there is a directional relation, so that one of the elements is the SOURCE or the CONTROLLER, and the agreement is directed at a TARGET (see for instance Corbett, 2003). On the other view, agreement is non-directional, and the agreeing elements are assumed to CO-VARY (for example Pollard and Sag, 1994, 60–7). Agreement can also be viewed as a relation between an element and the phrase which contains it. For instance, Lehmann (1982, 204) says about definiteness, number and case that they are 'on the semantic level, categories of the nominal or NP and not of the noun'.

With the possible exception of gender, directional agreement does not provide the best way of accounting for noun phrase internal agreement. In the examples already considered, it is not clear what the Swedish adjective would agree with under a directional approach, or which of the two adjectives in (5) would be the source and which the target.

Furthermore, we think there are arguments in favour of taking a phrasal approach to agreement. In Hebrew construct state nominals, as exemplified by (7), the head noun is not marked for definiteness, so that even though the noun phrase is unambiguously definite, the head noun cannot have the definiteness marker *ha-*. Still, the elements within the phrase normally considered to be the complement of the noun must be marked for definiteness. It would then seem that the obligatory definiteness marker on *gadol* can only reasonably be attributed to agreement with the phrase as a whole.

(7) beyt Sophie ha-gadol (Hebrew)
house(M).CON Sophie DEF-big.M
'Sophie's big house'

Agreement in LFG is conceived of as an f-structure phenomenon.[6] Since an unbounded number of adjectives are in principle permitted within a noun phrase, the value of the grammatical function feature ADJ is a set. Following standard conventions within LFG, we would get the description in (8-a) for an ADJ. However, Dalrymple (2001) suggests the alternative convention in (8-b), where $\in$ is treated as the value of the attribute ADJ.

(8) a. $\downarrow \in (\uparrow \text{ADJ})$

b. $(\uparrow \text{ADJ} \in) = \downarrow$

[6]Falk (2006) argues that a separate dimension is required since aspects of agreement cannot be expressed satisfactorily in terms of f-structure. However, this proposal appears not to have been taken up by others.

These yield identical set-valued f-structures, but the latter formulation is a more convenient equivalence for 'writing constraints on set members, particularly in expressions involving *inside-out functional uncertainty*' (2001, 154). An account of the definiteness markers we have considered here would involve inside-out functional uncertainty: 'the f-structure within which the ADJ feature of which I am the value is embedded is definite'. Since each ADJ is embedded within a set, the approach used by Nordlinger (1998) cannot be straightforwardly derived from (8-a). However, from (8-b), we can derive the equation in (9), following standard definitions of inside-out functional uncertainty (e.g. Dalrymple, 2001, 145).

(9) $(\text{ADJ} \in \uparrow)$

Taking the Swedish adjectives first, since the definiteness marking on them does not make a functional contribution to the phrase, a natural LFG approach would involve the use of a constraining equation. The equation in (10) is constraining and hence does not build f-structure, but will ensure that when a definite determiner or definitely marked noun induces a functional definiteness feature in the f-structure of the moun phrase, then the adjectives must agree. Indefinite determiners and indefinite adjectives will not be able to occur in the same noun phrase as definite adjectives, since the presence of any element with the feature value [DEF –] would mean that the constraint is not satisfied. We will return to a discussion of constraining equations shortly. This constraining equation also predicts the ungrammaticality of (6-b) as a referential noun phrase.

(10) *stora* $(\uparrow\text{PRED}) = \text{'big'}$
$((\text{ADJ} \in \uparrow)\ \text{DEF}) =_c +$

The definiteness feature on the adjectives in Hebrew and Latvian, on the other hand, does make a functional contribution to the noun phrase and hence it needs to be expressed in terms of constructive morphology in the sense of Nordlinger (1998). We then get the equation in (11-a), which constructs the f-structure in (11-b).

(11) a. *lielais*/*ha-gadol* $(\uparrow\text{PRED}) = \text{'big'}$
$((\text{ADJ} \in \uparrow)\ \text{DEF}) = +$

b.

$$\begin{bmatrix} \text{DEF} & + \\ \text{ADJ} & \begin{bmatrix} \text{PRED} & \text{'big'} \end{bmatrix} \end{bmatrix}$$

The f-structure in (11-b) will be associated with the mother of the AP, presumably an N′, and through structure sharing with the phrase as a whole. On the assumption that a referential noun phrase is any nominal whose f-structure contains the feature value [DEF +], this equation will allow the adjective to form a referential noun phrase on its own and hence predict the grammaticality of (6-a) and its

Latvian equivalent.[7]. It will permit other elements in the noun phrase to be marked for [DEF +], but it will not require them to be so. It will of course rule out elements marked for [DEF –]. Agreement would then be enforced by the assumption that adjectives lacking the definiteness marking have the feature [DEF –] and that there are no adjectives unmarked for definiteness.

The difference between Latvian and Hebrew would lie in the feature properties of other elements within the noun phrase. In Latvian, as (4-a) showed, nouns are unmarked for [DEF] and can occur in both definite and indefinite noun phrases. As (4-b) illustrated, definite noun phrases in Hebrew require the noun also to be marked for definiteness. Again, we can assume that this is down to a potential feature clash because the noun without the definite *ha-* is marked as [DEF –]. The matter is however not as straightforward as with the Latvian adjectives since the bare noun also forms the stem with which *ha-* combines. Furthermore, the unmarked noun can occur in definite noun phrases such as (7); this is a fact to be dealt with as a property specific to the construct state constructions.

Within an LFG approach, adjectival agreement can thus be modelled as a feature with exponence on an adjective being co-specified as a feature of the noun phrase as a whole. This would seem to mean that the equations regulating adjectival agreement have the effect of non-directional phrasal agreement. To our minds, this is a desirable outcome.

We turn now to an account formulated within specification language. We consider the agreement in Scandinavian first. This is captured by (12).

(12) $(NP \wedge <\mathrm{M}><\mathrm{DEF}>+ \wedge <\mathrm{d}*_k> (Adj \wedge <\mathrm{M}><\mathrm{ADJUNCT}>)) \rightarrow <\mathrm{d}*_k>\ def$

If a node labelled NP maps to the f-structure attribute DEF with value + and it dominates a node k which is an adjective which maps to an f-structure attribute ADJUNCT, then this node k is labelled definite. Or in a very simplified form 'if a noun phrase is definite and it contains an adjective, this adjective must be definite'; the adjective agrees with its phrase. (12) ignores the fact that the value of ADJUNCT is set-valued, formally, $<\mathrm{d}*_k>(Adj \wedge <\mathrm{M}><\mathrm{ADJUNCT}>)$ should be $<\mathrm{d}*_k>(Adj \wedge <\mathrm{M}>\mathrm{n}'_k \wedge \mathrm{n}'_k \in \{\mathrm{ADJUNCTS}\})$, so rather than referring to 'a node which maps to an f-structure attribute ADJUNCT' we need to refer to 'a node which maps onto an f-structure n'_k which is in the **ADJUNCT**s set'. This simplification is just for exposition.

The constructive definiteness in Hebrew and Latvian, on the other hand is captured by (13) (with a similar simplification to that in (12)).

(13) $(NP \wedge <\mathrm{d}*> (Adj \wedge def \wedge <\mathrm{M}><\mathrm{ADJUNCT}>)) \rightarrow <\mathrm{M}><\mathrm{DEF}>+$

If an NP node dominates a node which is an adjective, is definite and maps to an f-structure attribute ADJUNCT, then this NP node maps to an f-structure attribute DEF with value +. In a sense this is then the inverse of (12) 'if a noun phrase

[7] It will of course also be necessary to invoke some mechanism which creates a PRED value for the noun phrase as a whole.

contains a definite adjective, then the noun phrase is definite'; the feature works constructively.

The specification in (12) holds for a language in which there is agreement for definiteness. For a language with constructive definiteness on an adjective, (13) holds. In languages that have constructive definiteness on the adjectives and also agreement on the adjectives, both (12) and (13) hold.

Comparing the two approaches now, both can account for the data accurately. The fact that the value of ADJUNCT is set valued causes some inelegance in the specification language approach and requires an otherwise unwarranted notational convention. The LFG approach requires the use of constraining equations, a standard feature of LFG, but as Blackburn and Gardent (1995, 43–4) point out, constraining equations involve a departure from the declarative model generally central to LFG. A constraining equation provides a check on an attribute-value pair and hence requires the relevant f-structure already to have been built. The specification language cannot capture this notion, but Blackburn and Gardent suggest this may not be a drawback.

4 Definiteness on the edge

4.1 Prosodic marking

In Ossetic (Iron variety, Abaev (1959); Bagaev (1965)), the core noun phrase has phrasal stress which falls either on the first or second syllable:

- if the vowel of the first syllable is strong (/i, e, a, o, u/), then stress is on the first syllable
- if the vowel of the first syllable is weak (/æ, ə/), then stress is on the second syllable

There is no segmental marker of definiteness, but definiteness is indicated by a shift of stress to the noun-phrase initial syllable.[8]

Consider (14), in which the noun phrase consists just of the head noun *læppu* 'boy'.

(14) læp**pú** ∼ **lǽ**ppu (Ossetic)
boy boy.DEF
'a boy' 'the boy'

Noun phrases in Ossetic correspond to phonological phrases. The phonological phrase */læppu/* consists of two syllables, the first of which contains a weak vowel. Phrasal stress will therefore by default fall on the second syllable, giving */læpppú/*.

[8]This is similar to Tongan, but Tongan also marks definiteness with an element which can be described as an article, see Poser (1985) and also Anderson (1992, 212–5) and (2005, 94–99).

If stress by default does not fall on the first syllable of the phrase, then stress on the first syllable indicates that the noun phrase is definite. If on the other hand a noun phrase consists just of a word such as *áxoræn* 'paint', whose first syllable contains a strong vowel, then stress will anyway fall on the first syllable and stress shift cannot apply. The noun phrase is in this case contextually interpreted as either definite or indefinite.

In (15), we see the operation of these principles at phrasal level.

(15) a. c'æx **á**xoræn (Ossetic)
blue paint
'blue paint'

b. **c'ǽx** axoræn
blue.DEF paint
'the blue paint'

In (15-a), the noun phrase consists of an adjective modifying a head noun. Since the adjective *c'ǽx* 'blue' consists of a single syllable with a weak vowel, phrasal stress will by default fall on the first syllable of he following noun. Shifting the stress to the adjective triggers a definite interpretation, as in (15-b). Note that phrasal stress does not always by default fall on the second syllable. Unassimilated Russian loan words, as in (16) can have the stress on some subsequent syllable even if the first one has a strong vowel and hence the stress shift can apply:

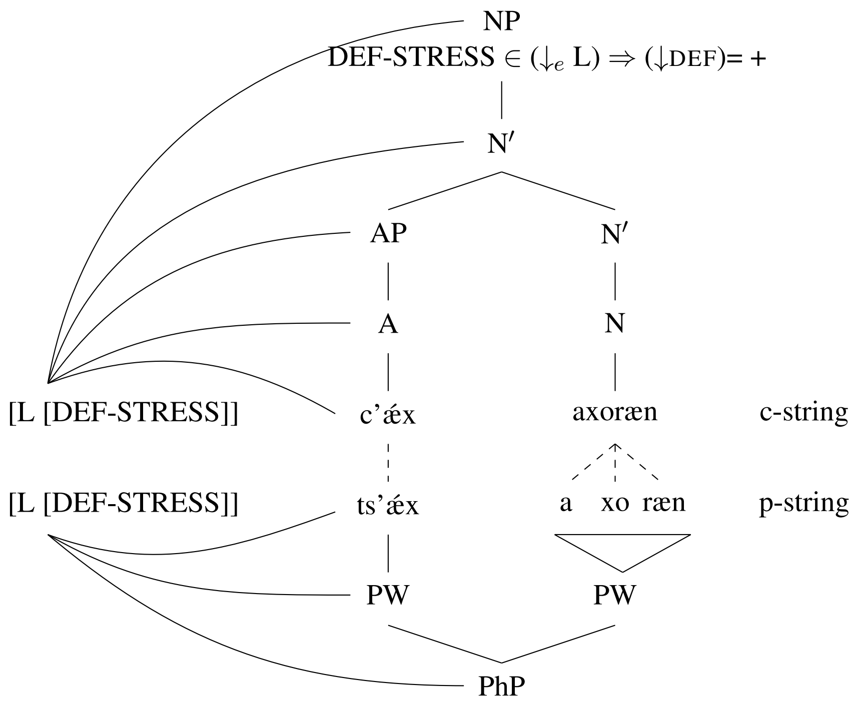
(16) specia**líst** ∼ **spé**cialist (Ossetic)
'a specialist' 'the specialist'

The origin of the stress shift rule appears to be the former presence in Ossetic of an initial syntactic definite article consisting of a sugle vowel. This definite article is still attested in the more archaic Digor variety of Ossetic (Abaev (1959, 20), Isaev (1966, 33–4)).

In order to model definiteness marking in Ossetic, we require the f-structure feature DEF to be associated with a stress shift in the phonological phrase which corresponds to the noun phrase that maps to that attribute, i,e. reference needs to be made to both c-structure and p-structure.

A set of mechanisms for achieving this has been proposed by Dalrymple and Mycock (2011) and by Mycock and Lowe (2013). These proposals are in essence similar, and both require extensions to the standard LFG architecture. The basic idea is that a meaning-related feature projected from a c-structure phrase can be passed down the categories on the left or right edge of that phrase, landing ultimately on the leftmost or rightmost word. This word will in turn form part of a pairing between an s-string (syntactic string) and p-string (phonological string). The same meaning-related feature is also passed down the left or right edge of the corresponding prosodic structure from the level where it is operative to the leftmost

(17) Mapping for (15-b)



or rightmost prosodic word in the p-string. An interface harmony principle then ensures that the leftmost or rightmost elements in the c-string and p-string share the relevant feature. In the above-mentioned works, semantic features such as polar interrogation are passed down the right edge of c-structure and match the corresponding right-edge intonation pattern in p-structure. But the same mechanisms can equally apply to f-structure features.

In (17), we give a simplified representation of the various mappings we need for the definite interpretation illustrated by (15-b). This follows the proposals in Dalrymple and Mycock (2011), and uses a tree structure for the representation of prosody rather than an AVM.

The NP node will be associated with a conditional equation which says that if the epsilon structure (e-structure) corresponding to NP has a feature which we name DEF-STRESS in its set of L(eft) attirbutes, the f-structure corresponding to NP is valued + for the feature DEF. e-structure is a distinct dimension in which edge-features are gathered and shared with the categories along the edge of the phrase, ultimately including the adjective *c'æx* 'blue'. A parallel chi-structure operates to pass the DEF-STRESS feature associated with the phonological phrase down the left-edge of the prosodic structure, where it will be manifested on the first syllable. Rules internal to the prosodic structure will determine that DEF-STRESS can only be assigned to a syllable which is not stressed by default. Consequently, the f-structure DEF feature is not, by these mechanisms, assigned to an NP in which the first word would carry stress by default. Finally, the interface harmony principle ensures that the leftmost elements in the paired c-string and p-string share the DEF-STRESS feature. Mycock and Lowe (2013) suggest an alternative to the location of edge features in separate e-structures and chi-structures, whose role is solely to pass the feature information down the relevant edges. Instead, they propose that the edge nodes in c-structure and p-structure be treated as AVMs, in which case the L and R attributes can be included alongside category information in the representation of these nodes. The basic mechanism of passing the interface features to the c-string and p-string is however essentially the same.

There are two striking aspects to these extensions to the basic LFG model, Firstly, as Mycock and Lowe make explicit, they involve the passing of feature information DOWN the edge of a tree. This is the reverse of the basic construction algorithm, which builds structure upwards. In fact, we note that it is probably useful to have features passing along edges in both directions. Whilst it makes sense to think of a feature such as polar interrogation originating on a clausal node and passing down to the right edge of the c-structure where it is eventually realised phonologically as a nuclear rise, it would make more sense to think of DEF-STRESS as originating at a p-structure edge and being passed upwards to the NP node in a manner analogous to the upward construction of the DEF feature by syntactic or morphological DDMs.

Secondly, the interface harmony principle which requires c-structure and p-structure features to harmonise has affinities with constraining equations. The only difference is that it applies to enforce agreement between nodes in different dimensions rather than between nodes in the same dimension. It gives rise therefore to the same conceptual concern: namely that structures are created which must then be ruled out by a principle which requires access to multiple representations in order to decide which are the acceptable ones. The specification language is in principle unable to state such principles, since it must state declaratively what the well-formed structures are.

As a specification language statement of definiteness marking in Ossetic, we propose (18). The new modality <σ_1> will have the obvious interpretation: it will denote a transition from a phonological node to the node representing the first syllable dominated by that node.

(18) (NP $\wedge$ <S><σ_1><STRESS>+ $\wedge$ <d_1*><S><σ_1><STRESS>–) $\rightarrow$
<M><DEF>+

If an NP node which maps onto a phonological unit (phrase) whose first syllable is stressed and this NP dominates a leftmost node which maps onto a phonological unit (word) whose first syllable is unstressed, then this NP node maps to an f-structure attribute DEF with value +.

4.2 Segmental marking

The Bulgarian FDM appears to be a second position prosodically dependent element ("special clitic" according to Anderson (2005, 111)):

(19) a. knigi-te (Bulgarian)
books-DEF
'the books'

b. interesni-te knigi
interesting-DEF books
'the interesting books'

c. mnogo-to interesni knigi
many-DEF interesting books
'the many interesting books'

However, there are two major problems with this characterization. Firstly, the Bulgarian FDM shows morphophonological irregularities not predicted by this approach. The form of the FDM is dependent on partially arbitrary lexical, morphological and phonologic criteria and the FDM can trigger stem allomorphy (see Bermúdez-Otero and Payne (2011, 74–5) and Stojanov (1964)). A small subset of these irregularities is illustrated in (20).[9]

(20) a. grăk ∼ gărk-ăt vs. străk ∼ străk-ăt
Greek Greek-DEF stalk stalk-DEF (Bulgarian)

b. gnjav ∼ gnev-ằt vs. bljan ∼ bljan-ăt
anger anger-DEF dream dream-DEF

In (20-a) the addition of the FDM triggers metathesis in *grăk*, and in **??** iy triggers a syllable nucleus alternation in *gnjav*. The forms *străk* and *bljan* remain unaffected.

Secondly, as (21) illustrates, the positioning cannot be defined straightforwardly with respect to 'first word' (or even 'first phrase').

(21) a. naj-blizka-ta do pošta-ta kăšta (Bulgarian)
SUPERL-close-DEF to post office-DEF house
'the house closest to the post office'

b. tvărde interesna-ta kniga
very interesting-DEF book
'the very interesting book'

In (21), we see the placement of the FDM when we have a phrasal rather than lexical dependent of the noun as the leftmost category. In this example the leftmost category is an adjective phrase, but the same would apply to other phrasal dependents in this position, e.g. numeral phrases. In (21-a), the FDM must be located

[9] In contemporary Bulgarian there is some levelling in the case of (20-a), with some speakers preferring *grăk-ăt* (Bozhil Hristov, p.c.).

on the adjectival head, and not to the right of the phrase on the PP. In (21-b), it must likewise be marked on the adjectival head, and not on the preceding adverb modifier. An account of the FDM in Bulgarian needs therefore not only to account for the irregular morpho-phonological interaction with the host, but also to be able to make reference to the notion of 'head of leftmost daughter' for placement. This is not straightforward in any theory.

Morphosyntactic edge phenomena, in contrast to prosodic edge phenomena, appear to have been somewhat neglected in LFG, and there appears to be no off-the-peg solution even for a straightforward case in which the first word of a phrase is targeted. We could in such straightforward cases hijack the L(eft) attribute proposed by Dalrymple and Mycock (2011) for semantic-prosodic interface phenomena, and allow the membership of L in principle to include morphosyntactic features such as *def* which would be passed down the edge of the noun phrase, either in e-structure or as part of the AVM extension to left-edge categories. But then it would be necessary to somehow distinguish such features from the interface features such as DEF-STRESS which are subject to the interface harmony principle. Assume this can be done, perhaps by having two types of L(eft) attribute, one of which contains morphosyntactic features and the other interface features. We could then attach a conditional equation to NP of the form: $def \in (\downarrow_e \text{L}) \Rightarrow (\downarrow\text{DEF}) = +$. Such an equation would ensure that if *def* were in the set of left-edge morphosyntactic features, the f-structure of the NP would contain the value + for the DEF feature. But there is still a problem, since this would not account for the head marking of adjective phrases in examples like (21-b). Possibly there are fixes which would work, e,g, by forcing L features in languages like Bulgarian to pass to the head rather than the edge whenever they encounter a phrasal node on the edge. This would entail an extension to the chi-structure or AVM model of L features.

The specification language alternative is given in (22).

(22) $(NP \wedge < \text{d}_1 > def \vee < \text{d}_1 >< \text{d}^* > (\text{head} \wedge def)) \rightarrow < \text{M} >< \text{DEF} > +$

If an NP node has either a first daughter labelled definite or a first daughter whose head is labelled definite, then this NP node maps to an f-structure attribute DEF with value +. The first clause within the parenthesis in the antecedent will allow definiteness marking on the head noun, if this happens to be the first element in the phrase, and the second clause will allow definiteness marking on the head of any initial phrasal dependent. The two clauses will never both be satisfied: since the exponents of definiteness marking in Bulgarian are words and not phrases, we cannot have a situation is which definiteness is marked both on an initial phrase and on its head.

Note however that (22) works constructively: only the left edge feature constructs definiteness. It does not however specifically exclude the possibility of multiple definiteness marking. Subsequent elements in the noun phrase, for example multiple adjectives, might optionally be marked with definiteness non-constructively. In order to block this possibility, we impose the further requirement (assuming binary branching) as in (23).

(23) $(\mathit{NP} \wedge <\mathrm{M}><\mathrm{DEF}>+ \rightarrow \sim (< \mathrm{d}_2>\mathit{def} \vee < \mathrm{d}_2><\mathrm{d}^*>\mathit{def})$

If an NP maps to a DEF attribute with value +, then neither its second daughter nor any terminal node that its second daughter dominates is marked definite. This is the negative counterpart of (12), blocking definiteness agreement rather than requiring it. We would only expect such clauses in edge-marking cases.

5 Conclusions

In this paper, we have used definiteness marking in noun phrases to illustrate two different approaches to the formalisation of constraints in LFG. In many cases, the basic construction algorithm with up and down designators straightforwardly accounts for the mapping between c-structure exponents of definiteness and the f-structure feature DEF. This is the case for example when the exponent of definiteness is a syntactic definiteness marker such as an article, or a morphological marker of definiteness on a head noun. In more complex cases, such as when definiteness is marked on adjectives, or is marked on an edge, the basic construction algorithm has to be augmented with a variety of further mechanisms. In particular, we need constraining equations to enforce the non-constructive definiteness agreement found in languages like Swedish. We need additional structures such as e-structure and chi-structure to provide a home for features which are passed along edges, or alternatively an alternative conception of c-structure nodes as AVMs which can contain such features. These features need, at least in some cases, to be passed down an edge, in the opposite direction to the standard construction algorithm. And finally, semantic or functional features which have an exponent in prosodic structure require an interface harmony principle which enforces the presence of this semantic or functional feature at the same position in the c-string and p-string.

These mechanisms may do the trick, but they look in some respects anomalous within the LFG architecture. The specification language which we have used to formulate the generalisations involved in these more complex cases is relatively perspicuous, but it also serves to highlight the anomalies which some of the augmentations involve. As Blackburn and Gardent (1995) note, constraining equations cannot be stated in the specification language format since they require access to multiple structures, some of which will be discarded. As we have noted, the interface harmony principle is a similar beast: it acts in effect as a constraining equation on c-strings and p-strings.

Our purpose in this article is therefore to suggest that the specification language approach to LFG might be an approach worth exploring in greater detail. It might have a particular advantage, for example, in cases where the analyst might be tempted to employ constraining mechanisms, or where it is necessary to pass features in ways which the standard construction algorithm does not allow, for example downwards rather than upwards, or from one dimension into another where there is no direct construction involved.

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AN EMPHATIC AUXILIARY CONSTRUCTION FOR EMOTIONS IN COPALA TRIQUI

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Abstract

Many verbs of emotion in Copala Triqui occur in a construction in which an auxiliary verb and copy of the subject appear after the initial Verb-Subj of the clause. This paper sketches an implementation in term of the constructional analysis formalism of Asudeh, Dalrymple, and Toivonen (2008).

1 Orientation and word order[1]

Copala Triqui is an Otomanguean language spoken in Oaxaca, Mexico and by immigrants to other parts of Mexico and the United States.

Like most other Otomanguean and Mesoamerican languages, it is a head-initial language. VSO is the most basic word order and most adverbs of manner and quantity appear after the verb:

1 I extend my sincere thanks to three Copala Triqui speakers – Román Vidal López, José Fuentes, and Irma Fuentes – who have helped me in in learning about this language. I thank Steve Wechsler, Ashwini Deo, Mary Dalrymple, and Louisa Sadler for helpful comments on this paper.

Examples are shown in both practical and linguistic orthography. The practical orthography is used to preserve the original format of the examples drawn from the corpus of Copala Triqui text. But since the practical orthography does not show all the relevant phonemic contrasts of the language, an additional gloss line shows the examples in the linguistic orthography. The practical orthography uses the following conventions: <x> = /ʃ/ or /ʒ/, <xr> = [s̢] (a retroflex alveopalatal sibilant), <ch> = [tʃ], <chr> = [ts̢], <c> = [k] (before front vowels), <qu> = [k] before back vowels, <s> = /s/ or /z/, <v> = [β] and <j> = [h]. <Vn> represents a nasalized vowel.

Copala Triqui has eight phonemic tones: three low-register tones (1, 2, 12) and five high-register tones (3, 32, 31, 4, 5). The practical orthography does not show all the phonemic distinctions, but marks low register tones with an underscore and tones 4 and 5 with an acute accent. See Hollenbach (1984) for more details of the tonal system.

(1)	A'níí	ndo'o	Mariá	chraa	rá	yoó	a.
	a'nii^{5}	ndo'o^{32}	Maria^{4}	chraa^{3}	ra^{4}	yoo^{4}	a^{32}
	put	much	Maria	tortilla	in	tenate	decl

‘Maria puts a lot of tortillas in the tenate (straw container).’

In addition to simple verbs like *a'níí* 'put', there are also many verbs that are made up of more than one word:

(2)	Ru'maan	che'e̱	Mariá	man	nij	xcuaa.
	ru'maan^{3}	che'e^{1}	Maria^{4}	man^{3}	nij^{3}	xcuaa^{3}
	stomp	stomp	Maria	ACC	pl	ant

'Maria stomped on the ants.'

In the example (2), *ru'maan che'e̱* 'stomp on' is made up of two parts. The first part *ru'maan* means 'press down on' and the second part *che'é* means 'foot'. The combination of these two parts yields a single compound verb with the meaning 'stomp'.

Many emotion verbs in Copala Triqui belong to the class of compound verbs, and the second part of the compound is often the particle *rá*.[2] In order to understand many of the textual examples that follow, it is necessary to account for the fact that the two parts of a compound verb are frequently separated by adverbial material. For example, the verb *me rá* 'want' appears in the following example with the adverb *ndo'o* 'much, many times' between the two parts:

Glosses use the following abbreviations: caus = causative, COM = completive aspect, decl = declarative, du = dual, emph = emphatic, indef = indefinite, m = masculine gender, n = neutral gender (used for inanimates and deities), neg = negative, p = possessed form, pl = plural, poss = possessed, POT = potential aspect, q = question particle, rel = relative marker, rep = repetitive, sg = singular, wh = interrogative.

2 Historically, *rá* comes from a body part term meaning 'heart, interior'. Synchronically, compounds with *rá* must be listed in the lexicon.

(3)

(3)	Me	ndo'o	rá	Marií	chraa.
	me^{3}	$ndo'o^{32}$	ra^{4}	$Marii^{4}$	$chraa^{3}$
	want	much	PART	Maria	tortilla

'Maria wants a tortilla very much.'

I treat the first word of such compounds as V and the second part as a non-projecting N^0.

The problem of getting the adverb in the correct position in such sentences motivates an analysis of Copala Triqui c-structure which uses the idea of extended heads (Bresnan 2001, Sells 2001). The following phrase structure rules posit a simple S has the following structure:[3]

(4)	**S -->**	**V**	**(N^0)**	**NP**	**({CaseP|NP})**
		$\uparrow = \downarrow$	$\uparrow = \downarrow$	$(\uparrow SUBJ) = \downarrow$	$(\uparrow OBJ) = \downarrow$
	PP*		**(CP)**		
	$(\uparrow OBL_\theta) = \downarrow$		$(\uparrow COMP) = \downarrow$		

In addition, the following two additional PS-rules will allow us to account for the position of adverbs. Here Aspect acts as an extended head of V.[4] *Illoc* is the position for sentence-final particles of illocutionary force.

(5)	**AspP -->**	**Asp**	**S**	**(Illoc)**
		$\uparrow = \downarrow$	$\uparrow = \downarrow$	$\uparrow = \downarrow$
	S -->	**(Adv)**		**S**
		$\downarrow \in (\uparrow ADJ)$		$\uparrow = \downarrow$

The trees shown below illustrate the c-structures that are posited for examples (1) and (3), and the position shown as ~~V~~ in the tree is the

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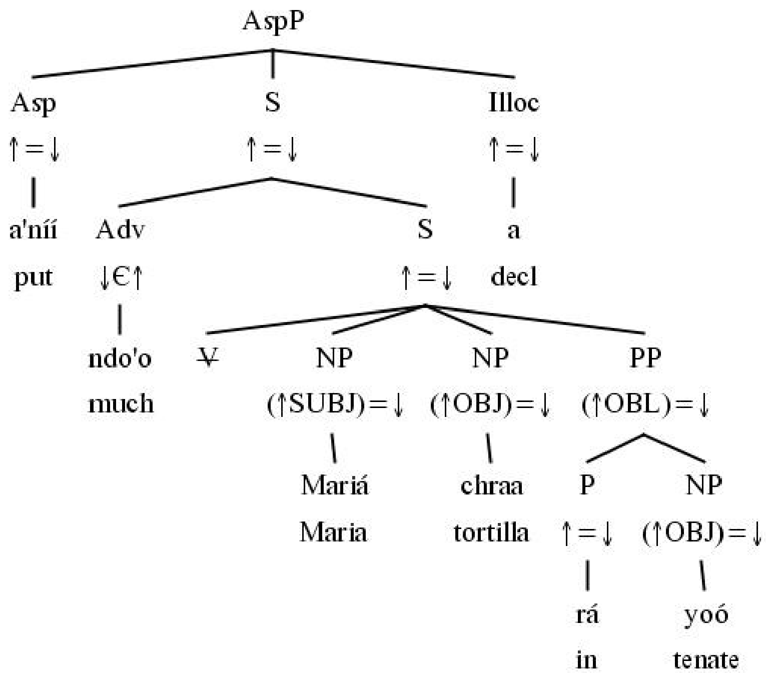
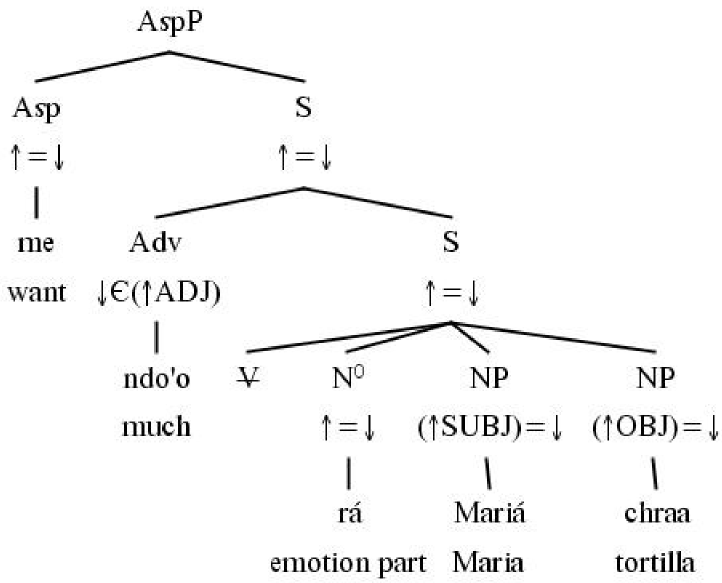
3 Accusative case is introduced by a case particle *man*, which is argued to head a CaseP in Broadwell (2008).

4 The head position could also be called Infl(ection), as in many LFG works. Inflection is a cover term for whatever inflectional categories are relevant for language under investigation. Since aspect is the only overt inflectional category for verbs in Copala Triqui, the label Aspect is intended to convey the morphological content of this category with more specificity.

unrealized head position for the S.



1: C-structure for (1)



C-structure for (3)

2 The Emotion Auxiliary Construction

2.1 Basic overview

Emotion predicates may appear with the ordinary syntax of transitive clauses, as in (3) above or (6) below:

(6)	**Man**	**yuvii**	**aran' rá**	**sa'anj**	...
	maa^{4}	yuvii^{31}	aran'^{3} ra^{4}	sa'anj^{32}	
	exist, live;	people	like PART	money	

There are some people who like money ... (1 Timothy 6:10)

(7)

tzaj ne	**nachri'**	**uxrá**	**so'**	**chrej**	**chi'ii**	**ei**	.
tzaj^{2} ne^{2}	nachri'^{3}	uxra^{4}	zo'^{1}	chrej^{32}	chi'ii^{31}	ei^{32}	
but	hate	very	you	path	bad	EMPH	

'..but you have hated the path of wickedness very much.' (Hebrews 1:9)

However, in addition to the standard syntax of a transitive clause, Copala Triqui also has an unusual construction in which many verbs and adjectives with meanings like 'love', 'hate', and 'envy' are followed by an additional verb meaning 'see' or 'look at'. I will refer to this as the Emotion Auxiliary Construction. Consider the following examples, where the relevant lexical items are highlighted:

(8)

Nachri'	**nii**	***ni'yaj***	**nii**	**man**	**núj**
nachri'^{3}	nii^{3}	ni'^{3}yaj^{2}	nii^{3}	maa^{3}	nuj^{5}
hate, disrespect	INDEF	look´	INDEF	ACC	we (exclusive)

"People hate us' (1 Corinthians 4:12)

(9)

ne	***caran' rá***		**Diose**	***ni'yaj***	**so'**	**man**
ne$^{2}_{1}$	c-$_{1}$	aran'^{3} ra^{4}	Dio^{3}se^{1}	ni'^{3}yaj$^{2}_{1}$	zo'^{3}	maa$^{3}_{1}$
and	COM	like PART	God	look´	3SGM	ACC

Moisés
Moises^{4}
Moses

'And God liked (favored) Moses.' (Acts 7:20)

(10)	**'u̲nj**	***aran'***	**ndo'o**	***ráj***	***ne'ej***	**chra'**
	'unj^{1}	aran'^{3}	ndo'o^{32}	ra=j^{4}	ne'e=j^{3}	chra'^{32}
	I	like	much	PART=1sg	see'=1sg	music

' I like the music very much.'

(8) shows a simple verb *nachri'* 'hate', while (9) and (10) show the compound emotion verb *aran' rá* 'like'. In (10) the two portions of the emotion verb are separated by adverbial material. Additionally, these examples show the auxiliary is also followed by a pronominal copy of the subject. The comparison of (8, 9, 10) with (6, 7) shows that the same verbs can appear either with or without the auxiliaries.

2.2 The meaning of the emotion auxiliary construction

What is the difference between the regular transitive construction and the construction that uses the look'/see' auxiliary? Our principal language consultant finds it hard to explain the difference between the two, other than to say that a person who uses the auxiliary is speaking the language 'very fluently, the way people really used to do it.' Thus it seems that the potential semantic or rhetorical effect of the auxiliary is subtle, and not easily accessible to intuition.

Nearly all of our examples are from older texts in our corpus, but this construction is fully productive for our speaker as well. In his dialect, however, *ne'en* 'see' is the basic auxiliary used with all emotion verbs; he recognizes *ni'ya̲j* 'look' as another possibility, but does not volunteer sentences with this verb as auxiliary.[5] In this respect, the Copala Triqui of these texts seems to represent the language of an older generation, where there was a predominance of *ni'ya̲j* 'look' as the auxiliary used in emotion constructions has changed to a preference for *ne'en 'see'* as the basic auxiliary.

5 There is one additional phonological difference; the dialect represented in the New Testament translation has *ne'en* for 'see', while in our consultant's dialect, it is pronounced *ne'e*.

Although speaker intuitions were not able to identify the meaning of the construction, a corpus search revealed the following patterns:

- When verbs of emotion have specific human or divine objects, the auxiliary is nearly always used.
- When verbs of emotion have inanimate objects, they typically do not use the auxiliary. Use of an auxiliary in this situation appears to have an emphatic function.[6]
- When verbs of emotion have generic objects (e.g. *people, one's brother*) they are typically used without the auxiliary.
- Our corpus does not have enough examples of non-human animate objects with verbs of emotion to make a generalization about the use of the auxiliary.

A tentative conclusion is that the auxiliary plays (or played) some role in indicating emphasis, but that this has become conventionalized for most animate objects. The likely semantic process is *inflation*, whereby conventionalization works to diminish the emphatic value of linguistic expressions over time (Dahl 2001).

Dahl (2001) discusses a potentially parallel case in Mandarin. In Mandarin, scalar predicates such as *kuài* 'fast', now conventionally occur with the modifier *hěn*, whose traditional meaning is 'very'. Use of such scalar predicates with *hěn* has become conventionalized and quasi-obligatory, and thus it is felt to be odd when omitted, signalling some special distinction.

In the same way, the Copala Triqui auxiliary appears to be conventional with specific human objects of emotion predicates, more notable for its rare absences. The auxiliary is conventionally omitted for emotion verbs with inanimate objects, and its presence in such contexts seems to mark a special emphasis.

Although the semantic value of the construction is still under investigation, there are many clear syntactic restrictions of the use of the auxiliaries with emotion verbs, and these restrictions are the focus of this paper.

6 The volunteered example in (10) shows the auxiliary with 'music' as its object, accompanied by the adverb *ndo'o* 'very much'.

2.3 Predicates which appear in the emotion auxiliary construction

The following is a list of the verbs and adjectives that may appear with the emotion auxiliary construction:

Triqui	Category	Gloss
'anj rá	verb	be startled, be surprised by
'e̱e̱ rá	adj	love, hold in esteem, take care of
a'maan rá	verb	be angry, upset about
a'nga' naco̱o̱	verb	mock
amán rá	verb	believe in, have faith in
aran' rá	verb	like
aráya'a̱nj	verb	be amazed with, worried about, preoccupied with
chu'vi'	verb	be worried about
chumán rá	verb	believe in, have confidence in
me rá	verb	want, love[7]
na'a̱j	adj	be embarrassed about
nachri'	verb	hate, disrespect
niha̱' rá	verb	be happy about
nucua̱j rá	verb	have confidence in
táá ri'yunj	verb	hate, oppose, be in disagreement with
uun rá	verb	love, desire
uun xco̱j rá	verb	be envious
xco̱j ruva̱a̱ rá	adj	be envious, be hateful

7 The Triqui verb includes both a sense close to English 'love' as well as senses more like 'want (to have)' and 'want (to do)'. Only the first sense occurs with the auxiliary construction.

Many of the emotion words contain the particle *rá*, approximately 'heart, center of emotions, self'. *Rá* is not exclusive to the emotions, however, since it is used in a wide range of mental states, including thinking, permitting, suspecting, and allowing.

2.4 Restrictions on parts of the emotion construction

2.4.1 The special syntax of emotion constructions

Predicates of emotion which occur with the auxiliaries *look'* and *see'* show an unusual set of restrictions which are not characteristic of other clauses in Copala Triqui. In order to capture these restrictions, I will suggest that they are part of an emotion construction, and that this emotion construction is licensed by a special PS-rule. The PS-rule for sentences with the emotion construction contains restrictions on the initial predicate, the auxiliary, and the subject which follows the auxiliary.

2.4.2 The initial emotion predicate — lexical and transitivity restrictions

The initial emotion predicate has to come from the set of verbs and adjectives listed above. To be used in the emotion auxiliary construction, the predicate must also be used in the subcategorization in which it takes a NP object.

For example, c*humán rá* 'believe' is a verb with a few different options for complement type. When used with no object (as in *nij síí chumán rá* 'the ones who believed') or with a clausal object (as in *chumán rá nij so' se vaa Diose̱ me so'* 'they believed that he was God'), the auxiliary never appears. Only cases where the predicate takes a NP object occur with the auxiliary.

2.4.3 The initial subject can be any size

There is no constraint on the subject of the first emotion verb; it can be arbitrarily large, as in the following example:

(11)

Ga̱a ne̱	***nachri'***	**Herodes**	**do̱'**	,	**nij**	**tanuu**	
gaa^{13} ne^{2}	nachri'^{3}	Herodes	do'^{1}		nij$^{3}{}_{1}$	tanuu^{3}	
then	hate, disrespect	Herod	and		PL	soldier	
nu̱u̱	**rihaan**	**so'**	**do̱'**	,	***ni'ya̱j***	**nij so'**	**man**
nuu^{31}	riaan$^{32}{}_{1}$	zo'^{3}	do'$^{1}{}_{1}$		ni'^{3}yaj$^{2}{}_{1}$	nij^{3} zo'^{3}	maa^{3}
belong	to	3SGM	and		look´	they	ACC
Jesucristó	,	**ne̱**	**ca'nga' naco̱o̱**		**nij so'**	**ni'ya̱j**	
Jesucristo^{4}		ne$^{2}{}_{1}$	c-$_{1}$ a'nga'^{3} nacoo^{1}		nij^{3} zo'^{3}	ni'^{3}yaj$^{2}{}_{1}$	
Jesus Christ		and	COM mock		they	look´	
nij so'	**man**	**Jesucristó**	**a**	.			
nij^{3} zo'^{3}	maa$^{3}{}_{1}$	Jesucristo^{4}	a^{32}				
they	ACC	Jesus Christ	part.				

'Then Herod and the soldiers that belonged to him hated Jesus and they mocked him.' (Luke 23:11)

2.4.4 The auxiliary

The auxiliary is subject to extensive constraints on its aspect, which are the subject of section 5 below.

2.4.5 The subject after the auxiliary

The subject after the auxiliary has only two options. It is usually a pronoun, as in the example above. In a few examples, it is a repetition of the preceding proper noun, usually *Diose̱* 'God'. The pronoun has to match the preceding subject in person, number, and gender. Proper nouns match exactly.

2.5 The morphosyntax of the ni'ya̱j and ne'en auxiliaries.

Although *ni'ya̱j* and *ne'en* have lost their usual semantics as perception verbs, they are still verbs. This is shown by a characteristic morphosyntactic property — the aspectual and tonal morphology of verbs. The aspect and tonal morphology is important to the nature of the agreement between the verb of emotion and the 'look' or 'see' auxiliary that follows it.

2.5.1 High and low register stems

Copala Triqui has a complex morphophonological system. (See Hollenbach 1984, 2004 for a complete overview of the system.)

Copala Triqui verbs do not show very much productive segmental morphology but have some rather complex tonal changes. Each verb has two tonal stems, one in the high-register and one in the low-register. In the practical orthography used here, the low-toned stem is shown with an underscore on the final syllable of the verb stem. In the gloss line, I have indicated the lowered stem with the gloss LOW.

2.5.2 Aspectual affixes; full and defective paradigms

The primary aspectual affix is a /k(V)-/ prefix which signals completive aspect when used with the high-register (HR) stem. The /k(V)-/ prefix signals potential aspect when it is used with low-register (LR) stem.[8] The verb stem with no prefix is the continuous aspect:

(12) a. Ne'en Juán man so'. *Continuous = Ø + HR*

ne'en^{3} Juan^{4} man^{3} zo'^{3}

see Juan ACC him

Juan sees him.

b. Que-ne'en Juán man so'. *Completive = kV + HR*

que-ne'en^{3} Juan^{4} man^{3} zo'^{3}

COM-see Juan ACC him

'Juan saw him.'

c. Que-ne'e̲n Juán man so'. *Potential = kV + LR*

que-ne'en^{13} Juan^{4} man^{3} zo'^{3}

POT-see:LOW Juan ACC him

'Juan will see him.'

About two-thirds of the verbs in Copala Triqui show a pattern like *ne'en,*

8 The vowel after /k/ is not predictable, and must be listed in the lexical entry of the verb. For vowel-initial monosyllabic stems, the prefix is /g-/ instead of /k-/. /K/ is <c> or <qu> in practical orthography.

with use of the /kV-/ prefix plus the shift of tone register to signal change of aspect. These verbs show the *full paradigm.* The remainder of the verbs show the *defective paradigm*, which does not use the prefix, but shows aspect change only through the tone change. *Chá* 'eat', is a verb like this:

(13) a. Chá Juán. *Continous/Completive = HR*

cha^4 Juan^4

eat Juan

'Juan eats/ate.'

b. Cha̲ Juan. *Potential =LR*

cha^2 Juan^4

eat:LOW Juan

'Juan will eat.'

Of the two verbs which function as auxiliaries, *ne'en* shows the full paradigm, while *ni'ya̲j* has the defective paradigm. It shows its potential aspect solely through its low register form, *ni̲'yaj.*

2.5.3 Negatives

Use of a negative particle — *ne* (for completive or continous aspect) or *se̲* (for potential aspect) triggers an unusual toggle effect on the register of the following verb. As Hollenbach (1976) showed, the relationship between high and low register stems and aspect is reversed after these particles. Thus we can compare the affirmative statements above with their negative counterparts, observing the effect on the tone register of the verb stem:

(14)

a. Ne'en Juán man so'.	Ne ne'en Juán man so'.
ne'en^{3} Juan^{4} man^{3} zo'^{3}	ne^{3} ne'en^{3} Juan^{4} man^{3} zo'^{3}
see Juan ACC him	neg see Juan ACC him
'Juan sees him.'	'Juan does not see him.'
b. Que-ne'en Juán man so'.	Ne que-ne'e̱n Juán man so'.
que-ne'en^{3} Juan^{4} man^{3} zo'^{3}	ne^{3} que-ne'en^{13} Juan^{4}man^{3} zo'^{3}
COM-see Juan ACC him	neg COM-see:LOW Juan ACC him
'Juan saw him.'	'Juan did not see him.'
c. Que-ne'e̱n Juán man so'.	Se̱ que-ne'en Juán man so'.
que-ne'en^{13} Juan^{4} man^{3} zo'^{3}	ze^{2} que-ne'en^{3} Juan^{4} man^{3} zo'^{3}
POT-see:LOW Juan ACC him	neg:POT POT-see Juan ACC him
'Juan will see him.'	'Juan will not see him.'

2.5.4 Aspect matching in auxiliaries

When either of these verbs functions as an auxiliary, it continues to show aspect inflection which matches the aspect of the emotion verb. The first example shows *ne'en* in the completive aspect. This is triggered by the occurrence of the preceding verb *chumán rá* which is in the completive.

(15)	… **ne̱**	***cuchumán rá***		**ta'a̱j**	**nij so'**	***quene'en***	
	ne$^{2}{}_{1}$	cu-	chuman^{4} ra^{4}	ta'aj^{2}	nij^{3} zo'^{3}	que-	ne'e^{3}
	and	COM	believe:in PART	some	they	COM-	look'

nij so'	**man**	**so'**	**a**	.
nij^{3} zo'^{3}	maa$^{3}{}_{1}$	zo'^{3}	a^{32}	
they	ACC	3sM	part.	

'… and some of them believed in him.' (1 Timothy 3:16)

The next example shows *ne'en* in the potential aspect:

(16) …	**ne̱**	**ve'é**	**na'mi̱i̱**	**sa̱'**	**so̱'**	**ga̱**	**so'**	,
	ne$^{2}_{1}$	ve'e^{4}	na'mii^{2}	za'^{1}	zo'^{1}	ga^{2}	zo'^{3}	
	and	well	be reconciled	good	you	with	3SGM	

ne̱	**da̱j se**	**uun rá**	**so̱'**	**ne'én**	**so̱'**	**manj**		**ro'**
ne$^{2}_{1}$	daj^{1} se^{32}	uun^{3} ra^{4}	zo'^{1}	ne'e^{3}	zo'^{1}	maa$^{3}_{1}$	=j$_{1}$	ro'^{3}
and	like	love PART	you	see	you	ACC	1sg	topic

,	**da̱nj**	**gu̱un rá**		**so̱'**	**que̱ne'én**	**so̱'**	**man**
	daj$^{13}_{2}$	g-	uun^{3} ra^{4}	zo'^{1}	que^{1}-ne'e^{3}	zo'^{1}	maa^{3}
	thus	POT	love:LOW PART	you	POT-look:LOW	you	ACC

so'	**ei**
zo'^{3}	ei^{32}
3SGM	emphatic

'… and you are reconciled with him, so just as you love me, think of him (in the same way).' (Philemon 1:17)

In this example, the second emotion verb is *uun rá*, appearing in the potential form as *gu̱un rá.* The potential form on this verb then triggers the potential on the corresponding auxiliary, *que̱ne'én.*

Example (16) shows *ni'yaj* in the potential aspect while functioning as an auxiliary and example (17) also shows the low-register form of the auxiliary *ni'ya̱j*, this time in a negative context:

(16) ...	**ne̱**	**nano̱'**	**ní'**	**da̱j**	**qui'ya̱j**
	ne$^{2}_{1}$	nano'^{3}	ni'^{4}	daj^{1}	qui-$_{2}$ 'yaj$^{13}_{1}$
	and	look for	we (incl.)	how	POT make, do:LOW

ní'	,	**ga̱a ne̱**	***ca'ma̱an rá***	**Diose̱**
ni'^{4}		gaa^{13} ne^{2}	c-$_{1}$ a'maan^{13} ra^{4}	Dio^{3}se^{1}
we (incl.)		then	POT angry:LOW PART	God

ni̱'yaj	**Diose̱**	**man**	**ní'**	**na'**	.
ni̱'yaj	Diose̱	man	ní'	na'	
ni'^{2}yaj$^{32}_{1}$	Dio^{3}se^{1}	maa$^{3}_{1}$	ni'^{4}	na'^{3}	
look':low	God	ACC	we (incl.)	yes/no part	

'…are we looking for a way to make God angry at us?' (1 Corinthians 10:22)

(17)	**Tza̱j ne̱**	**ne**	***gu̱un***	**niha̱'**	**uxrá**	**rá**
	tzaj^{2} ne^{2}	ni^{3}	g- uun^{13}	nia'^{1}	uxra^{4}	ra$^{4}_{1}$
	but	negative	COM become:LOW	happy	very	PART

Diose̱	***ni̱'yaj***	**Diose̱**	**man**	**que'e̱e**	**nij so'**	**ma'**
Dio^{3}se^{1}	ni'^{2}yaj$^{32}_{1}$	Dio^{3}se^{1}	maa$^{3}_{1}$	que'ee^{1}	nij^{3} zo'^{3}	ma'^{3}
God	look':LOW	God	ACC	many	they	NEG

.

'But God was not happy with most of them ...' (1 Corinthians 10:5)

Notice that in this last case the first verb in the emotion sequence *gu̱un niha̱' .. rá* has become low register not due to any semantics of the aspect of the event, but purely due to the morphological requirement that a verb following the negative particle ne must appear in low register tone.

Nevertheless, the auxiliary appears in the same low-register tone, suggesting that the aspect matching requirement is a morphological property of the auxiliary construction.

3 The syntax of the emotion auxiliary construction

The Copala Triqui sentences seem to show a sentence that has the following surface properties:

(18)				
Verb$_i$ or Adjective$_i$ [from a particular set of predicates]	Full NP$_j$ [can be conjoined, negated, etc.]	Aux$_i$ [must match aspect of Vor Adj]	Det$_j$ [Pronominal copy or repeated Proper N]	NP or CaseP [the verb must have an object]

To license the S shown in this tree, we will need a special phrase structure rule, which we can write as follows:

(19)	**S-->**	**(V|Adj)**	**(N^0)**	**NP**	**Aux**
		$\uparrow=\downarrow$	$\uparrow=\downarrow$	$(\uparrow\text{SUBJ})=\downarrow$	$\uparrow=\downarrow$
		[EMOTION +]			
	@TRIQ-EMOT(↑PRED FN)				
	Det			**{CaseP |NP}**	
	$(\downarrow\text{INDEX})=(\uparrow\text{SUBJ INDEX})$			$(\uparrow\text{OBJ})=\downarrow$	

This contrasts with the ordinary rule for S in the language which is as follows:

(20) **S -->**	**V**	**(N^0)**	**NP**	**({CaseP|NP})**
	$\uparrow=\downarrow$	$\uparrow=\downarrow$	$(\uparrow\text{SUBJ})=\downarrow$	$(\uparrow\text{OBJ})=\downarrow$
	PP*	**(CP)**		
	$(\uparrow\text{OBL}_\theta)=\downarrow$	$(\uparrow\text{COMP})=\downarrow$		

This rule describes a special kind of S, not licensed by the usual PS-rules of the language. In contrast to most PS-rules, nearly all of the items on the right side of the rule are obligatory. The V or Adj will typically be realized in the Asp higher in the tree, and the appearance of the particle is dependent on the main verb.

The S must be headed by a Verb or Adjective with a special feature [EMOTION +], and in this construction, the verb is obligatorily transitive. The first element has the notation @TRIQ-EMOT(↑PRED FN). This is a convention from Asudeh, Dalrymple, and Toivonen (2008) which is intended to treat special semantic and pragmatic effects associated with constructions. TRIQUI-EMOTION is the name of the template associated with this construction, and the @ symbol calls on a template of special interpretation for the elements named in this rule.

As it stands, this analysis accounts for the special syntax of emotion predicates associated with 'look' and 'see' auxiliaries. But because the semantics and pragmatics of the construction are not completely understood, this part of the template is not fully specifiied. However, it should include the special pragmatic and rhetorical associations of fluency and possibly emphasis discussed above.

After the verb and subject, there must be an auxiliary, and its aspect must be equal to the aspect of the main verb. After the auxiliary, there must be a pronoun or proper noun (Det), and its INDEX must be equal to that of the SUBJ. The pronoun must satisfy this constraint on its index value, but otherwise does not contribute to the feature structure of the sentence.

4 *Conclusion*

Clauses with the Emotion Auxiliary Construction display a syntax quite unlike that of other clauses in Copala Triqui, with several construction-specific properties. An approach such as that of Asudeh, Dalrymple, and Toivonen (2008) which allows construction-specific rules and templates, allows LFG to successfully account for the grammar of this construction.

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DEPENDENCY-BASED SENTENCE SIMPLIFICATION FOR INCREASING DEEP LFG PARSING COVERAGE

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Abstract

Large scale deep grammars can achieve high coverage of corpus data, yet cannot produce full-fledged solutions for each sentence. In this paper, we present a dependency-based sentence simplification approach to obtain full parses of simplified sentences that failed to have a complete analysis in their original form. In order to remove the erroneous parts that cause failure, we delete phrases from failed sentences by utilising their dependency structure, and reprocess the remaining shorter sentences with XLE to get full analyses. We ensure the grammaticality and preserve the core argument structure of simplified sentences by defining the deletion scheme only on a set of modifier phrases. We apply our approach on German data and retrieve full parses of simplified sentences for 52.37% of the failed TIGER sentences. With the combination of original and simplified sentences, the full XLE parses derived from the TIGER Treebank increases from 80.66% to 90.79%.

1 Introduction

Over the last two decades, the LFG community has witnessed the development of wide-coverage, deep, hand-crafted grammars for several languages (Butt et al., 2002). These grammars can typically parse over 90% of corpus data, yet cannot produce a full-fledged solution for each sentence. The difficulty of achieving 100% coverage on unrestricted text with a deep parsing approach lies in two aspects: missing lexical items, idiosyncrasies and rare constructions on one hand and ungrammatical material and spelling errors in real language use on the other. One natural solution to overcome such cases is to extend the grammar in question with manual rules for uncovered instances or to relax the existing rules to handle ungrammatical cases. However, such modifications on a large-scale, with an already high-coverage grammar is very labour-intensive and requires a high level of linguistic expertise. Moreover, the flexibility needed to handle erroneous inputs is hard to predict and employ during grammar development due the wide range of possible ungrammaticalities. In this work, we instead pursue an automatic way of dealing with failed sentences.

(1) exemplifies a TIGER sentence [1], a real corpus example that contains an agreement mistake. The article *des* 'of the' and the adjective *japanischen* 'Japanese', both in genitive case, give the hint that it is a genitive construction, but the noun *Außenministerium* 'foreign ministry' is in nominative case and therefore doesn't agree with the surrounding words.

(1) *Ein Sprecher* ***des japanischen Außenministerium*** *verkündete daraufhin*
A speaker of the Japanese foreign ministry proclaimed then
, man werde Jelzins Aussage " vorsichtig analysieren " , bevor
, one would Yeltsin's statement " carefully analyze " , before

[1] The TIGER Treebank (Brants et al., 2002) consists of over 50,000 sentences of German newspaper text. All sentences are syntactically annotated and each token contains lemma, POS tag, and morphological information.

man	*sie*	*kommentiere*	*,*	*aber*	*:*
one	it	comment	,	but	:

'A speaker (of the Japanese foreign ministry) then proclaimed that Yeltsin's statement would be " carefully analyzed " , before commenting on it , but :'

The German ParGram Grammar outputs only fragmented analyses for this sentence as given in Figure 1. Fragments, together with skimming, is a method XLE uses in dealing with robustness (Riezler et al., 2002). Fragmenting allows XLE to output chunk or partial analyses in cases where it cannot produce a complete parse. Skimming, on the other hand, handles time and memory problems. When parsing a sentence exceeds a certain time and memory threshhold XLE spends a limited amount of effort for the remaining constituents, which might lead to suboptimal or partial analyses. It is not possible to avoid such analyses unless we take into consideration parsing the closest well-formed sentence of the original problematic case.

A closer look at Figure 2 depicts the problems in the analysis of (1) more clearly. Both the c-structure and the f-structure of the partial phrase *Ein Sprecher des japanischen Außenministerium verkündete* 'A speaker of the Japanese foreign ministry proclaimed' are fragmented. In the c-structure, *Ein Sprecher des japanischen* 'a speaker of the Japanese' and *Außenministerium verkündete* 'foreign ministry proclaimed' form incorrect phrases. In the corresponding f-structure, *Sprecher* 'speaker' does not get any grammatical role and *Ministerium* 'ministry' is incorrectly analysed as the subject of *verkünden* 'proclaim'.

Such a fragmented analysis is not favorable for our research purposes. Full parses are crucial, for instance, in XLE parse disambiguation (Forst, 2007) and generation reranking (Cahill et al., 2007; Zarrieß et al., 2011) as well as deep syntactic analyses of raw text. This fact motivates investigations into how to gain the sentences we lose due to fragmented parses. For recovery, we have to locate and correct the problem.

The problematic part in (1) is the missing genitive marker 's' at the end of *Außenministerium* 'foreign ministry'. When this word is corrected to *Außenministeriums* the German ParGram Grammar outputs a fully connected c-structure and an f-structure with correct arguments. However automatically correcting this particular problem is not as easy as manual correction. Without 's' *Außenministerium* is a valid word in nominative case; there are no lexical level errors. The error emerges at the syntactic level where the nominative-marked noun prevents a genitive adjunct construction. Deciding how to correct an error is a much harder goal than locating it.

Removing the erroneous part of the sentence instead of correcting it could be an acceptable trade-off for an automatic solution. Full parses including the core argument structure of a sentence is our main interest in parsing a sentence. If the problem is located in some modifier phrase its removal does not harm grammaticality and the full parse of the remaining part is still useful for our purposes. For instance, in parse disambiguation (Forst, 2007), the training data consists of

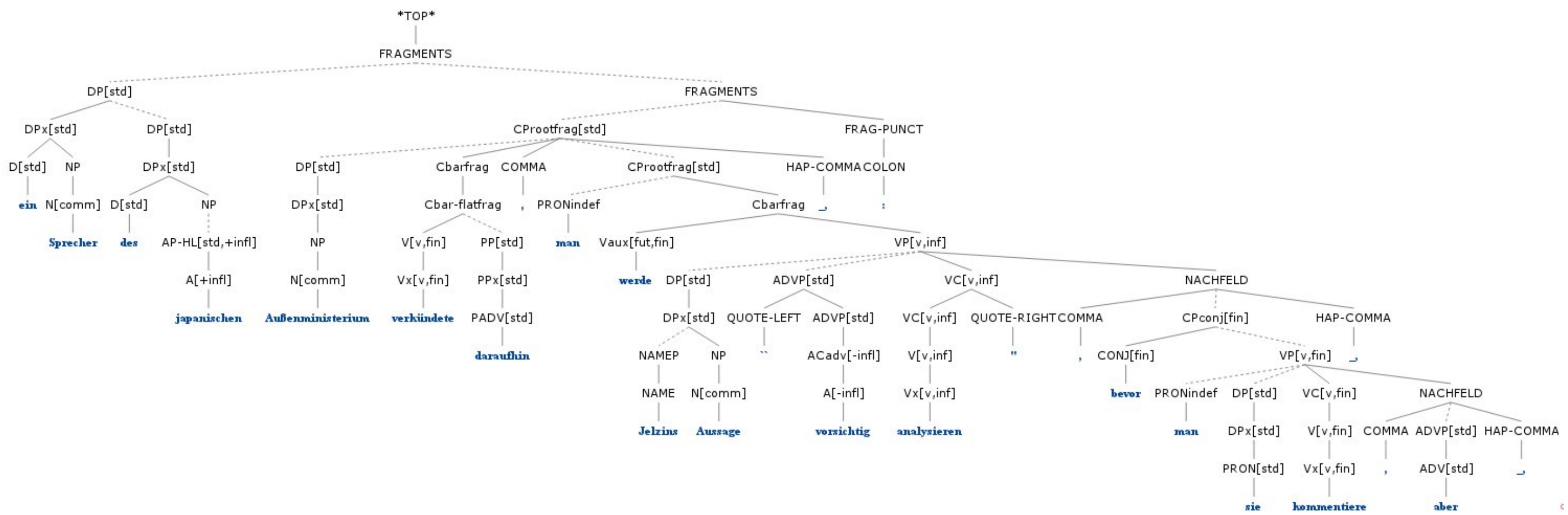

Figure 1: The c-structure of the sentence in (1), processed by the German ParGram Grammar.

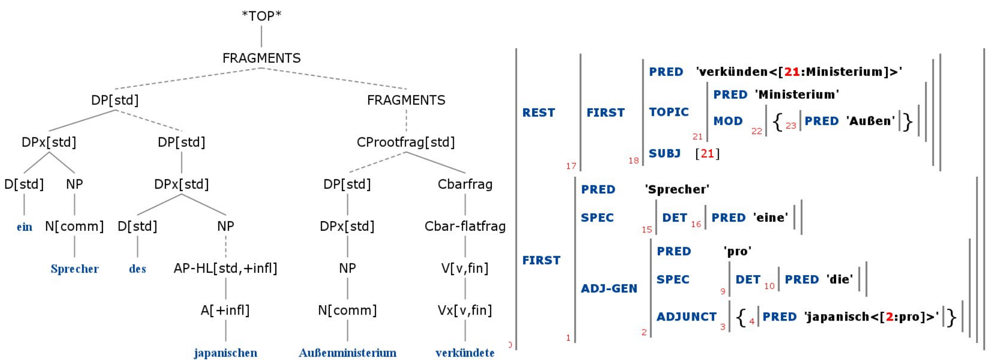

Figure 2: The c- and f-structure of the partial phrase *Ein Sprecher des japanischen Außenministerium verkündete* ‘A speaker of the Japanese foreign ministry proclaimed’, processed by the German ParGram Grammar.

sentence-full parse pairs. The gold LFG parse of a sentence is determined automatically by matching it to its gold TIGER representation.[2] When a modifier is removed from a sentence, its representation is removed from the gold TIGER tree. The LFG analyses of the simplified sentence are then matched against the simplified TIGER representation to find the gold LFG parse. The deleted parts or meaning changes do not cause the complete withdrawal of the simplified sentence as training data because our main purpose in this application is to identify which LFG parse is the gold one among alternatives for a given sentence.[3]

Employing such a simplification aproach reduces the task of recovering failed sentences to the automatic identification of modifiers. This brings us to the question of how to identify modifiers. Actually, the problematic modifier in sentence (1) can easily be identified by using a dependency tree. Figure 3 depicts the dependency representation of the first six tokens of our example sentence. *Außenministerium* is the head of the genitive adjunct (AG) with dependants *des* and *japanischen*.

We can get the dependency representations of sentences we want to simplify by using dependency parsers. They are easy and fast to train and parse with, and with

[2]Section 4 details the matching.

[3]Our goal is not so much to identify material that can be dropped without changing the meaning of a sentence, but rather material for which we can assume with great confidence that it does not affect the grammaticality of the material that we leave in: e.g., dropping the direct object of a transitive verb will in some cases be unproblematic (like in John sings a song → John sings), but in many cases it will. The simplified sentences can then be safely used as the skeleton to which a full LFG analysis can be attached – and of course, the fact that they are not original corpus material, but have undergone modification, has to be listed with them. The dependency tree information can even be used to indicate the missing material in the LFG structure (an aspect which we do not address in the present paper).

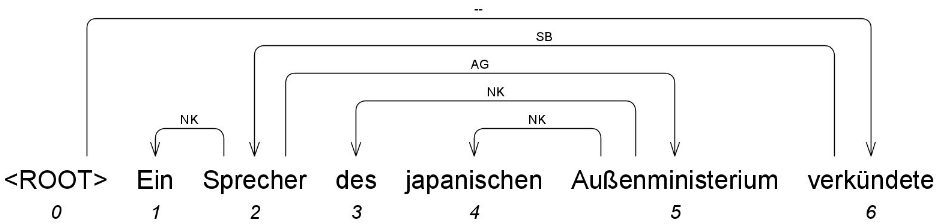

Figure 3: The dependency tree of the partial phrase *Ein Sprecher des japanischen Außenministerium verkündete* 'A speaker of the Japanese foreign ministry proclaimed'.

their robust nature they do not pose coverage problems. Moreover, they are less sensitive to the type of input errors in Figure 3. The dependency parser correctly identifies the phrases and assigns correct labels despite the missing 's' in *Außenministeriums*. When we remove the genitive adjunct (subtree with the head AG) from the dependency tree of the sentence in (1), the German ParGram Grammar fully and correctly parses the remaining sentence. Figure 4 displays the f-structure of the simplified sentence. *Sprecher* 'speaker' is correctly analysed as the subject of *verkünden* 'proclaim' and the complement clause with the head *analysieren* 'analyse' is correctly identified.

This approach can be generalised to a simplification scheme on all sentences an LFG grammar fails to output a full parse. The guiding idea is the following: a state-of-the-art statistical dependency parser is run on any sentence that doesn't receive a full analysis from XLE. Its coverage is 100%, and although the labelled dependency tree analysis that it produces will not be perfect, we can use it as a fairly reliable indication of "non-core" parts of the sentence: appositions, relative clauses, etc. We generate modified versions of the input string in which these parts are deleted and try to reparse them with the original LFG grammar. By using a conservative scheme of deletions, we try to ensure that grammaticality and the core argument structure of the sentences are preserved. Depending on the context of application, the resulting simplified f-structure can be used directly (e.g. as training data), or a synthesized analysis for the original string can be constructed (e.g. for feature extraction in a dependency parsing scenario).

We apply the scheme on German data and achieve full parses of simplified sentences on 52.37% of the failed TIGER sentences. This increases the full XLE parses derived from the TIGER Treebank from 80.66% to 90.79%. We evaluate the accuracy of the simplified f-structures by matching them against the gold TIGER trees and observe that the simplified f-structures match with the gold syntactic structure of the simplified input sentences for the 48.50% of the successfully reparsed cases. We also experiment with the simplification scheme in a non-gold

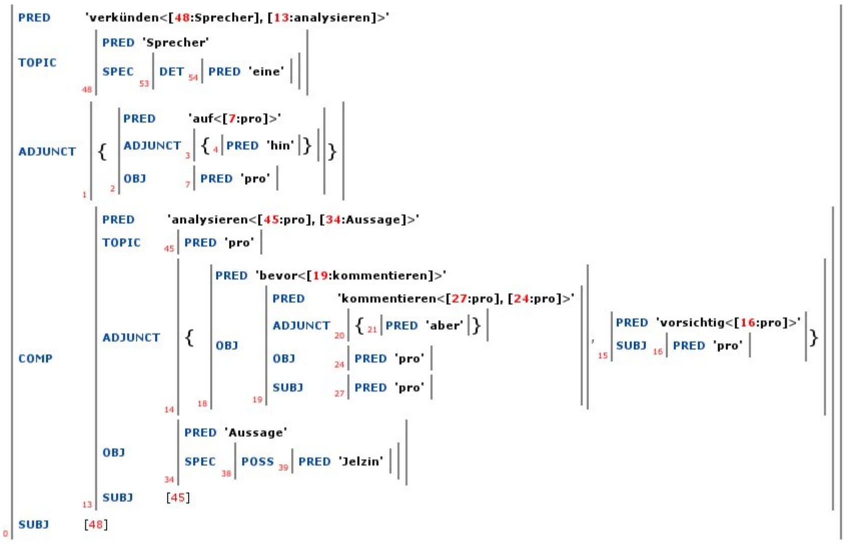

Figure 4: The f-structure of the simplified sentence *Ein Sprecher verkündete daraufhin , man werde Jelzins Aussage “ vorsichtig analysieren ” , bevor man sie kommentiere , aber :* ‘A speaker then proclaimed that Yeltsin’s statement would be “ carefully analyzed ” , before commenting on it , but :’

setting. Parsing results on raw data proves it is possible to apply the proposed system beyond the gold TIGER data.

The remainder of the paper is structured as follows: We look into related work in Section 2. We describe and experiment with sentence simplification in Section 3. We evaluate the accuracy of our system in Section 4 and extend it to parsing raw text in Section 5. An error analysis in Section 6 is followed by conclusion and future work in Section 7.

2 Related Work

Achieving high parsing coverage of LFG grammars has been in the scope of several researchers. Riezler et al. (2002) parse the Wall Street Journal with the English ParGram Grammar. They reach 100% coverage at the expense of fragmented and skimmed analyses. Rohrer and Forst (2006) also make use of skimming and fragmenting in parsing the TIGER Treebank with the German ParGram Grammar. Besides these standard mechanisms, they implement additional rules for linguistic phenomena that cause non-full analyses. Coordination, parentheticals, subject gaps, reported speech clauses are among the refined constructions. Dost and King

(2009) parse and analyse a large set of Wikipedia articles to determine lexical and syntactic gaps in the ParGram English grammar, and improve the grammar coverage by incorporating their findings.

An alternative approach for handling coverage problems is to generate f-structures by annotating statistical phrase-structure parser output with f-structure constraints and by solving those constraints (Cahill et al., 2004). After all, the statistical parsers they are based on are robust. Although the approach is applied to several languages, only the English system's output comes close to XLE f-structure duplicates, which also cannot reach 100% coverage (Hautli et al., 2010).

Sentence simplification in LFG systems has been studied before (Riezler et al., 2003; Crouch et al., 2004), in a different context than ours, paying attention to meaning preservation. Riezler et al. (2003) carry out sentence simplification on English computer news articles by converting parsed f-structures to reduced ones with transfer rules. They then disambiguate and generate from reduced f-structures to obtain shorter sentences. Crouch et al. (2004) further describes the type of rules used in the transfer system.

Although utilising dependencies in sentence simplification is a novel approach in LFG research, dependency-based sentence simplification is an accepted method, often used to extract the important information out of the data in applications such as summarisation (Vanderwende et al., 2006) and spoken language understanding (Tür et al., 2011). Vanderwende et al. (2006) pays attention to grammaticality of simplified sentences whereas Tür et al. (2011) can ignore it, as the simplified dependency structures are used as features in a statistical classifier. Both systems work on English data.

On the German front, there has been research on deep parsing systems that utilise dependencies, mainly by developing hybrid approaches. Schiehlen (2003) parses the NEGRA Treebank with a combination of a shallow approach based on machine learning and a cascaded finite state parser. Frank et al. (2003) bring together a topological fields parser with a wide-coverage HPSG parser. Our system differs from those in making use of dependencies in sentence simplification decisions.

3 Sentence Simplification

We employ two different approaches to simplify sentences. The first one utilises the dependency representation of sentences to be simplified. We initially remove only one subtree at a time and then further simplify the trees with multiple subtree removal. As an alternative to dependency-based simplification we introduce an n-gram-based approach, which constitutes our baseline system.

3.1 Implementation Setup

We use the TIGER treebank (Brants et al., 2002) 2.1 as our data set in our experiments. We leave out sentences 8000 to 10000 as test and development sets following the TiGerDB split (Forst et al., 2004) and work on the training set which corresponds to the remaining 48471 sentences. We parse our corpus with a version of the German ParGram grammar (Rohrer and Forst, 2006) and use the dependency version of the TIGER Treebank which is converted by Seeker and Kuhn (2012). The edge labels used in the conversion are taken from the STTS tag set (Schiller et al., 1999).

3.2 Dependency-based Simplification

For our simplification process we manually define a set of deletable dependency subtrees that would not harm the grammaticality of a sentence and preserve the core argument structure. Table 1 gives the list of edge labels that correspond to the heads of deletable subtrees. In most of the cases, all instances of an edge label are deletable. However there are some conditional deletions. For instance a noun kernel (NK), which is an umbrella label for various relations inside of the nominal phrase including the head relations, is deletable only when it functions as an adjunct. Datives are reasonable candidates for deletion because they may be free datives, like *ihm* 'him' in the example *Sie backte ihm einen Kuchen* 'She baked him a cake'.[4]

The simplification script traverses the dependency tree of a sentence to be simplified and looks for a deletable subtree. Once a subtree is removed from the original tree, its yield is deleted from the original sentence. The shorter sentence we get out of the deletion might need punctuation adjustments. The TIGER Treebank does not necessarily attach all punctuation to a relevant node. The TIGER-to-dependency conversion tool assigns its previous token as the head of a punctuation mark. This approach might clash with the phrase boundaries, that is, there could be dangling punctuation tokens after simplification. Such cases are handled with a set of rules within the simplification script. The outcome of the script is a candidate sentence for reparsing with the German ParGram Grammar.

3.2.1 One Subtree Deletion

As our initial experiment, the simplification script goes through the list of deletable labels and removes only one deletable subtree at a time from a sentence. The number of candidates generated for each sentence varies depending on the number of deletable dependencies it contains. This procedure produces 52867 candidates, that is, 5.6 candidates per sentence on average. We process all the candidates with the German ParGram Grammar.

[4]In order to capture free datives, we deviate from our conservative deletion scheme that preserves core arguments. This rule might cause the deletion of datives that are part of a subcategorisation frame.

AG	genitive adjuncts
APP	appositions
JU	discourse marker-like
MNR	PP adjuncts (in noun phrases)
MO	modifiers
NG	negation
PAR	head of parenthesis
PG	possessive PP adjuncts
PH	placeholders (e.g. German Vorfeld *es*[5])
PNC	proper noun components
RC	relative clauses
RE	infinite clauses attached to nominals
SBP	PP subjects in passive
UC	inside foreign language phrases
VO	vocatives
NK	noun kernels
DA	datives

Table 1: Edge labels of deletable subtrees that are used in the dependency-based sentence simplification system.

3.2.2 Multiple Subtree Deletion

Failure in parsing a sentence might stem from problems in multiple subtrees. Hence, removing only one subtree is not sufficient to obtain a full parse in some cases. In order to simplify sentences even further, we let the simplification script generate all possible subtrees by deleting all combinations of deletable dependencies. This approach brings an overhead: the number of candidates grows very high for longer sentences. It can reach up to 608,255 candidates for a sentence and the average number of candidates per sentence is 924. Hence, the total number of candidates is not feasible for parsing. As a solution, we take only the 10 shortest candidates into account when a sentence has more than 10 candidates. We also remove the punctuation of the shortest candidate and include it as the 11th candidate. The average number of candidates per sentence drops down to 8.1 this way.

(2) marks all deletable subtrees for the sentence in (1). In the one subtree deletion setting, five candidates are produced out of this sentence. In the multiple subtree deletion setting, there are 63 alternatives; we only take the shortest 10. (3) shows the correctly parsed candidates among those 10 sentences. The deleted subtrees are represented with the edge labels of their heads.

[5] If a Vorfeld modifier is deleted, the sentence becomes ungrammatical due to word order. It is possible to reorder the sentence by using a lineariser (Bohnet et al., 2012) to achieve a grammatical order again.

(2) *Ein Sprecher [$_{AG}$ des japanischen Außenministerium] verkündete [$_{MO}$*
A speaker of the Japanese foreign ministry proclaimed
daraufhin] , man werde Jelzins Aussage “ [$_{MO}$ vorsichtig]
then , one would Yeltsin’s statement “ carefully
analysieren ” , [$_{MO}$ bevor man sie kommentiere ,] [$_{MO}$ aber] :
analyze ” , before one it comment , but :

‘A speaker [of the Japanese foreign ministry] [then] proclaimed that Yeltsin’s statement would be “ [carefully] analyzed ” , [before commenting on it ,] [but] :’

(3)
a. Ein Sprecher [$_{AG}$] verkündete [$_{MO}$], man werde Jelzins Aussage “ [$_{MO}$] analysieren ” [$_{MO}$] [$_{MO}$]:
b. Ein Sprecher [$_{AG}$] verkündete daraufhin , man werde Jelzins Aussage “ [$_{MO}$] analysieren ” [$_{MO}$] [$_{MO}$]:
c. Ein Sprecher [$_{AG}$] verkündete [$_{MO}$], man werde Jelzins Aussage “ vorsichtig analysieren ” [$_{MO}$] [$_{MO}$]:

3.3 N-gram Based Sentence Simplification

One might argue that a dependency-based simplification system is costly due to parsing times and resources to train parsers. We pursue the question if it is possible to benefit from a simpler simplification system in regaining failed sentences. Our baseline simplification technique is based on n-grams. We utilise van Noord’s (2004) parsability metric, which is mainly designed for error mining purposes. Parsability of a word is defined as the ratio of a word’s occurrence in successful parses $C(w|OK)$ to its occurrence in all sentences $C(w)$:

$$P(w) = \frac{C(w|OK)}{C(w)}$$

The metric is extendable to word sequences. When the sequence is represented as $w_i \dots w_j$, the parsability of a word sequence is:

$$P(w_i \dots w_j) = \frac{C(w_i \dots w_j|OK)}{C(w_i \dots w_j)}$$

In order to incorporate the parsability concept into our sentence simplification system, we extract the n-grams (n=1,2,3) of failed sentences.[6] We then calculate the number of occurrences of those n-grams in failed sentences and in the whole treebank, hence their parsability scores. We delete the n-grams with zero parsability to obtain the simplified candidates. If there are no n-grams with zero parsability scores in the sentence we delete the n-gram with the lowest parsability. We apply a set of punctuation correction rules to this approach too. We achieve a set of 26822 candidates after the simplification and we reparse all these sentence with the German ParGram Grammar. Note that this approach does not ensure the grammaticality of a simplified sentence or the preservation of argument structure.

[6] We limit ourselves to small numbers of n due to our small corpus size.

For the sentence in (1), the simplified sentences are given in (4), showing the deletion of unigrams, bigrams, and trigrams respectively. None of the simplifications in this example leads to a grammatical sentence, therefore no full analyses are obtained after reprocessing. Note that *Außenministerium* that causes the parse failure is not among the deleted n-grams, since its occurrences as a nominative noun have full analyses that increase its overall parsability score. No full analyses and no correct identification of the problem in the given sentence indicate the n-gram based model can fail in cases the dependency-based model achieves success.

(4)
a. Ein Sprecher des japanischen Außenministerium verkündete daraufhin , man werde Jelzins Aussage “ vorsichtig analysieren ” , bevor man sie ~~kommentiere~~ , aber :

b. Ein Sprecher des japanischen Außenministerium verkündete daraufhin , man werde Jelzins Aussage “ vorsichtig ~~analysieren ”~~ , bevor man sie kommentiere , aber :

c. Ein Sprecher des ~~japanischen Außenministerium verkündete daraufhin ,~~ man ~~werde Jelzins Aussage “ vorsichtig analysieren ” , bevor man sie kommentiere ,~~ aber :

3.3.1 Coverage Results

Table 2 gives the overview of coverage statistics. 80.66% of the TIGER training set has full XLE parses. The remaining 9373 sentences constitute the set to be simplified.

Our baseline n-gram system can generate fully parsed simplified sentences for 2893 (30.87%) of the cases. When only one subtree is deleted, 3367 (35.92%) sentences have at least one simplified form with a full parse. When all possible candidates are created and 10 shortest are chosen, the number of sentences with at least one simplified full parse increases to 4607 (49.83%). We also create a combination of full parses where all full parses with one subtree deletion are taken and the set of candidates that one subtree deletion failed but multiple subtree deletion succeeded to produce full parses are added. This combination increases the number of full parses to 4909 with a coverage of 52.37%.

Note that the upper limit of simplified sentences with a full parse is 8462 (90.28%) because 911 sentences are not simplifiable at all. 58.02% of the simplifiable sentences achieve a full parse in the combination system.

4 Accuracy of the Simplification System

The full f-structure output of a simplified sentence exhibits valid syntactic structures for that sentence. But it is possible that the syntactic structures the grammar produces do not match the underlying syntactic structure of the corresponding simplified sentence.

In evaluating the parses we achieve, we can take advantage of the gold TIGER Treebank trees. They represent the gold syntactic structure of a given sentence

System	sent.	full parses
TIGER Training	48471	39098 (80.66%)
n-gram deletion	9373	2893 (30.87%)
1 subtree shorter	9373	3367 (35.92%)
10 shortest	9373	4607 (49.83%)
1 subtree shorter + 10 shortest	9373	4909 (52.37%)

Table 2: Full parse statistics when the original training sentences are used, n-gram simplification is used in failed sentences, only one subtree is deleted in simplification, and 10 shortest candidates are parsed in the multiple subtree simplification.

in TIGER XML representation; we can compare the XLE parses with these gold structures. However, this comparison is not straightforward. LFG and TIGER represent the same sentence in different structures. The correspondence neither between functions nor between features is one-to-one. There are ambiguous mappings such as modifiers (MO) in the TIGER Treebank. In LFG, they could be realised as an ADJUNCT, a directional oblique (OBL-DIR), a locative oblique (OBL-LOC), or a manner oblique (OBL-MANNER), depending on the context. There are also structural dissimilarities, for instance, the treatment of auxiliary verbs. In TIGER trees the main verb is dependent on the auxiliary as its clausal object (OC), whereas in LFG the main verb is the head and the auxiliary contributes to tense and aspect features.

Forst (2007) introduces a matching system that compares XLE parses with TIGER trees by converting the TIGER XML representation to f-structures through XLE's tranfer rules. We apply his approach to simplified sentences and check if XLE parses are compatible with TIGER trees as our accuracy evaluation. This comparison, at the same time, produces a set of XLE parses that have gold f-structures. Later these so called TIGER-compatible f-structures are used in parse disambiguation and generation reranking.

The TIGER-compatible f-structures are given in Table 3. In the TIGER training set 11,931 (30.53%) sentences have a gold f-structure. When one subtree is removed in the simplification of failed sentences, 665 out of 3367 sentences get a TIGER-compatible f-structure. The accuracy increases to 50.90% with a set of 2345 sentences in the multiple subtree simplification. When one and multiple subtree simplification are combined, the number of full parses increases to 4909 from 4607. But not as many of the additional sentences have TIGER-compatible parses, hence the accuracy of the system drops to 48.50%.

System	sent.	full parses	TIGER-compatible
TIGER Training	48471	39098	11931 (30.53%)
1 subtree shorter	9373	3367	665 (19.75%)
10 shortest	9373	4607	2345 (50.90%)
1 subtree shorter + 10 shortest	9373	4909	2381 (48.50%)

Table 3: TIGER-compatible f-structure statistics. The percentages show the ratio of TIGER-compatible parses to full parses.

5 Getting Dependencies from Raw Text

Our experiments so far are conducted on the gold TIGER trees. Working on gold trees is crucial to obtain training material for the disambiguation/reranking systems. Another reason we want to improve the coverage of LFG parsing is to utilise the features derived from deep analyses in dependency parsing. There could be two approaches to follow in feature integration: The LFG features of each input sentence are used by the dependency parser during parsing time or the LFG features can be used as hard or soft constraints during training time. In either case the accuracy and high coverage of LFG parses facilitate dependency parsing.

Approaches on integrating deep LFG analyses into dependency parsing are realistic only when we do not limit ourselves to gold representations. To see if our system is extendable to real-world scenarios, we simulate such a system in a predicted setting. We use predicted lemma, POS, and morphological features[7] and parse the TIGER sentences with a statistical dependency parser (Bohnet, 2010). All systems are trained on the TIGER training data by using 10-fold cross-validation. The results of the predicted setting are given in Table 4. It can be observed that for all systems the difference between the predicted and gold setting is quite low (1.66%, 3.46%, 1.82% absolute for 1 subtree shorter, 10 shortest, and the combination system respectively). This proves that the simplification approach we employ can easily be applied to realistic, non-gold scenarios too.

6 A Closer Look into Failed Sentences

Our work mainly focuses on ways of recovering the sentences lost during parsing. As a byproduct it gives us insight into the weak and strong points of the modules we employ. The parsability metric we used in n-gram-based simplification also lists the word sequences that cannot be parsed, as originally used in error detection. Table 5 lists the 10 most frequent n-grams with zero parsability. The

[7]all processed with mate lemmatiser, POS tagger, and morphological analyser: http://code.google.com/p/mate-tools/.

Data	System	sent.	full parses
Predicted	1 subtree shorter	9373	3211 (34.26%)
	10 shortest	9373	4346 (46.37%)
	1 subtree shorter + 10 shortest	9373	4738 (50.55%)
Gold	1 subtree shorter	9373	3367 (35.92%)
	10 shortest	9373	4607 (49.83%)
	1 subtree shorter + 10 shortest	9373	4909 (52.37%)

Table 4: TIGER coverage statistics for predicted and gold systems.

sign denotes sentence boundaries. It can be observed that lowercase abbreviations of news agencies such as AFP, DPA, and RTR are among the most frequent sources of error. These abbreviations are often used in a template `venue, date (agencies)`, e.g., *AUCKLAND, 9. November (dpa/rtr)*, which is not handled well by the German ParGram Grammar. *ski* is a one-word sentence, tagged as a non-word (XY) in the TIGER Treebank. *90/Die* comes from the political party *Bündnis 90/Die Grünen* 'Allience 90/The Greens', and similarly *CDU/CSU* is referred to as the union of two political parties. Those tokens have high parsability on their own but when combined into a coordination with a slash as the conjunction, the German ParGram Grammar cannot parse them. *Befreiungstiger von Tamil* is part of a longer multiword *Befreiungstiger von Tamil Eelam (LTTE)* 'Liberation Tigers of Tamil Eelam'. Actually *Befreiungstiger von Tamil* 'Liberation Tigers of Tamil' can be correctly parsed by the German ParGram Grammar. What it fails is to combine *Tamil* and *Eelam* as a phrase. As a consequence, the analysis of the whole phrase consists of two fragments *Befreiungstiger von Tamil* and *Eelam (LTTE)*.

Parsability	Count	n-gram
0.000	11	Befreiungstiger von Tamil
0.000	11	CDU / CSU
0.000	17	# ski #
0.000	29	90 / Die
0.000	31	/ dpa /
0.000	34	afp / dpa
0.000	38	# (...
0.000	40	# (rtr
0.000	41	dpa / rtr
0.000	95	# (dpa

Table 5: 10 most frequent n-grams with zero parsability, derived from 9373 failed sentences.

Another way of analysing problematic cases is looking into the phrases that enabled full parses after their deletion. The most frequent such phrases are given in Table 6 in the one subtree simplification setting. The most frequent phrase *sich* 'oneself' is used in reflexive verbs. Most German reflexive verbs have a non-reflexive version too, and it seems when *sich* is dropped from the sentence the German ParGram grammar can parse the sentences in the non-reflexive form. The second most frequent phrase that deletion helps is the negation adjunct *nicht* 'not', to our surprise. Negation is well handled in a hand-crafted large-scale grammar after all. An investigation into sentences fully parsed after removing *nicht* reveals that the word order of *nicht* is not canonical in such cases. (5) exemplifies such a sentence with *nicht* intervening between the predicative adjective and the finite copula. *ihm* is the third person masculine or neutral personal pronoun in dative case, and its deletion helps due to free datives (cf. section 3.2). The remaining frequent phrases that prevent full parses in the original sentences are adverbs *so* 'so', *auch* 'too', *immer* 'always', *rund* 'around'[8], *nur* 'only', and *aber* 'but'.

Count	Phrase
189	sich
82	nicht
40	so
34	auch
22	ihm
18	Immer
16	rund
15	nur
15	aber

Table 6: The most frequent (count $>$ 15) deleted phrases that enable their simplified sentences to have full parses.

(5) *Daß es so einfach* ***nicht*** *ist , weiß natürlich auch der*
That it so easy **not** is , knows naturally also the
CDU-Politiker .
CDU politician .
'Of course the CDU politician also knows it is **not** so easy.'

The top 21 entries of the deleted phrases list is one-token phrases. The highest ranked multiple-token phrase is *von Bündnis 90/Die Grünen* 'from Allience 90/The Greens' with 10 occurrences, which comfirms our findings in Table 5. The length of deleted phrases goes up to 91 tokens. Figure 5 displays the distribution of phrase lengths in the scenario where deleting one subtree solves the failure problem and the shorter sentence achieves a full parse. Deleting only one token is enough for

[8]Modifying numerals in these occurrences.

a full parse in 1732 of the cases. Deleting 2, 3, 4 tokens helps 770, 525, 371 sentences respectively. For 2205 of the sentences, omitting phrases of 5 or more tokens are necessary for a full parse.

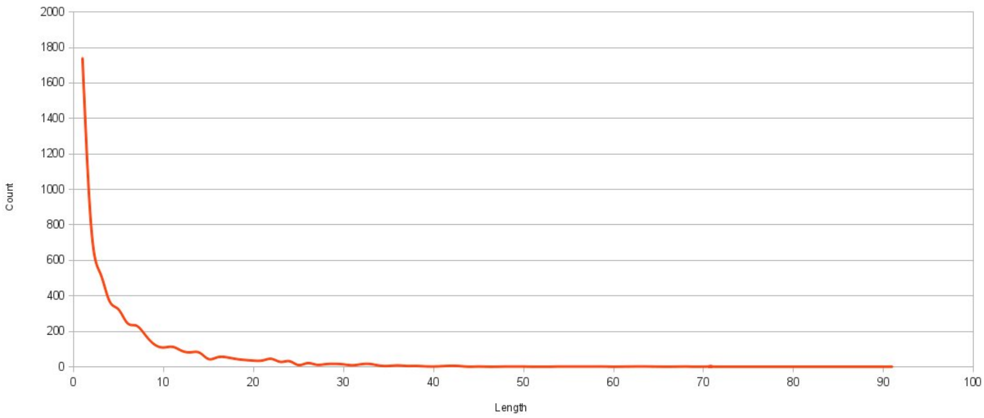

Figure 5: The distribution of phrase lengths that are deleted in the one subtree simplification and enabled full parses in the simplified sentence.

7 Conclusion and Future Work

We have presented a dependency-based simplification approach that increases the coverage of full LFG parses of the TIGER Treebank for German. Our approach is based on the idea of removing the modifiers from a sentence with no full analyses and reparsing the shorter sentence with the German ParGram Grammar. If the problematic part that caused a parse failure is in the removed modifier, we achieve a full parse of the simplified sentence. This method ensures grammaticality while it preserves the core parts. We utilise the dependency representations of sentences to identify modifiers. A simplification script traverses the dependency tree of a sentence and deletes subtrees based on a manually collected list of deletable functions. The outcome is a set of candidate sentences to be reparsed.

Experiments on the TIGER Treebank show 52.37% of the failed sentences achieve at least one full parse in their simplified form. And among those simplified full sentences 48.50% of the analyses are compatible with the underlying analyses of simplified versions of the original sentences. As a comparison we experiment with an n-gram-based simplification system and observe that the dependency-based system clearly outperforms the n-gram one, in addition to its superiority in grammatical simplifications. In order to test the reliability of our system in a real-world scenario we repeat the simplification experiments in predicted settings. The results we achieve are comparable to the gold settings, showing that we can apply simplification on dependency parser outputs too.

An error analysis on the simplified sentences shows there are some systematic failures in the German ParGram Grammar due to domain-specific tokens or constructions (e.g., news agencies, venue-date boilerplates). Some commonly used adverbs also prevent the sentences from having full parses when they are used in non-canonical ways.

The simplification method we proposed in this paper can be a basis to future research in several directions. XLE parse disambiguation (Forst, 2007) and generation reranking (Cahill et al., 2007; Zarrieß et al., 2011) are among our initially motivating applications. We plan to revisit both systems by investigating the effect of using the extended set of TIGER-compatible f-structures. An additional application of sentence simplification which we can pursue is to simplify fully parsed sentences that TIGER-compatibles f-structures cannot be extracted from. This could provide extra training material for parse disambiguation and generation reranking.

Another natural extension to the current work is incorporating the deep syntactic representations XLE grammars output as features of a dependency parser. Øvrelid et al. (2009) converts the LFG output into dependencies to allow parser stacking. Experiments show features extracted from deep LFG structures help improve parser accuracies both for English and for German. As our future work, we aim at investigating more ways of integration.

Both systems using the f-structures directly and systems using them as features would benefit from even more improvements in coverage. We aim to advance the simplification system both in terms of coverage of failed sentences and in terms of the content of the full reparses.

0.97% of the failed TIGER sentences are not simplifiable with the existing simplification scheme. It means the errors that prevent full parses reside in the core arguments of those sentences and it is not possible to delete them. In such cases a paraphrasing approach can replace a simplification approach. For instance, nominal phrases can be replaced with easier-to-parse nominals, e.g. pronouns, or coordinations can be replaced with one of their conjucts. Obviously, this paraphrasing technique can be used within the set of the simplifiable sentences too.

When there are too many candidates to parse in the multiple subtree simplification setting, we choose 10 shortest candidates. That simple criterion prevents us from finding longer fully parsed candidates. We can improve the criterion by paying attention to parsability scores of subtrees to be parsed. If we eliminate the subtrees including word sequences with zero or low parsability, we reduce the number of candidates in an earlier step, and further include longer sentences into the candidate list.

The simplification technique we propose is language independent except for the manual selection of deletable subtrees. Therefore, it is possible to apply it to several existing LFG grammars with relatively little effort. Especially for grammars under development, simplification both handles coverage issues and points out areas to improve. We are specifically interested in Turkish, as we possess the requirements for its application: native speaker knowledge for deletable subtree identification, a

ParGram grammar (Sulger et al., 2013), and a state-of-the-art dependency parsing system (Çetinoğlu and Kuhn, 2013).

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RESULT XPS AND THE ARGUMENT-ADJUNCT DISTINCTION

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Abstract

In this paper I discuss the English resultative and its status in terms of the argumenthood of the result phrase. By utilizing 8 tests for argumenthood, I will show that the result phrase is an added or derived argument, as discussed in Needham and Toivonen (2011), which, although syntactically optional, acts in most other ways as an argument of the verb.

1 Introduction

In this paper I will discuss the argument status of the result phrase in the English resultative (*flat* in (1), *solid* in (2)) based on eight tests for argumenthood: syntactic obligatoriness, core participants, VP preposing, fixed preposition, prepositional content, pseudocleft, uniqueness/iterativity and VP anaphora. Evaluating the argument status of the result phrase will allow us to determine what the analysis of the phrase should be: *argument*, *adjunct* or *added argument*. The tests can give us insight into how the result phrase behaves both syntactically and semantically, which will allow us to gain insight into how we understand such phrases. I will investigate the resultative using the semantic categorizations laid out in Goldberg and Jackendoff (2004), specifically along the dimensions of property/path and agentive/non-agentive[1].

(1) Kim hammered the metal flat.

(2) The river froze solid.

Before we can discuss the status of the result phrase according to the tests, we must first discuss what is meant by the terms *argument* and *adjunct*. These two terms have been discussed at length in the literature, however, no consensus has been reached as to the exact formal definition. For example, given the textbook definitions below, we could define arguments[2] as either the frequently obligatory elements (3), the elements which are closely associated with the main predicate (4), the minimally involved elements (5), the elements which denote the properties of or are involved in the predicate (6), the elements which participate in the predicate relation (7) or the elements which are directly involved in the predicate (8).

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[1]The agentive/non-agentive distinction is termed causative/non-causative in Goldberg and Jackendoff (2004). The terms agentive/non-agentive were chosen here because all resultatives are causative in nature.

[2]The verb's *arguments* can be further sub-divided into its *subject* and its *complements*. The textbook definitions given in (3)–(8), describe both *arguments* and *complements*, and it is important to note that both of these concepts fall under the umbrella term *arguments* in this paper.

(3) “Adjuncts are always optional, whereas complements are frequently obligatory. The difference between them is that a complement is a phrase which is selected by the head, and therefore has an especially close relationship with the head; adjuncts, on the other hand, are more like bolt-on extra pieces of information and don’t have a particularly close relationship with the head.” (Tallerman, 2005, p. 98)

(4) “This distinction between arguments and adjuncts is important, but not always easy to make. The basic difference is that arguments are closely associated with the meaning of the predicate itself, while adjuncts are not.” (Kroeger, 2004, p. 10)

(5) “The arguments are the participants minimally involved in the activity or state expressed by the predicate.” (Haegeman, 1994, p. 44)

(6) “Verbs and adjectives, and some nouns, express properties of things [...] or relationships between things [...]. The arguments are the phrases that denote the things that have such properties or are involved in such relationships.” (Culicover, 1997, p. 16)

(7) “The entities (which can be abstract) participating in the [predicate] relation are called arguments.” (Carnie, 2007, p. 51)

(8) “From a semantic perspective, subjects and complements share in common the fact that they generally represent entities directly involved in the particular action or event described by the predicate: to use the relevant semantic terminology, we can say that subjects and complements are arguments of the predicate with which they are associated. [...] An expression which serves to provide (optional) additional information about the time or place (or manner, or purpose etc.) of an activity or event is said to serve as an adjunct.” (Radford, 2004, pp. 3–4)

According to these definitions, adjuncts could be defined as the optional elements (3), the elements which are not closely associated with the main predicate (4), the elements added to a predicate (5), the elements which are not involved in the predicate (6) and (8), or the elements which do not participate in the predicate relation (7). The basic definition of adjuncts would then be “the things which are not arguments,” but this is not without its issues.

The distinction between arguments and adjunct has been seen as tenuous over the years, and many options have be put forward to deal with this difficult concept, including completely discarding the distinction (Vater, 1978; Przepirkowski, 1999), changing where the lines between the two concepts occur (Borgonovo and Neeleman, 2000; Zaenen and Crouch, 2009), and proposing a third category for phrases (Kay, 2005; Needham and Toivonen, 2011). This paper proposes to utilize the third method, as it maintains the differences which are noted by speakers of the language, while also allowing for some flexibility within the categorization of phrases.

Researchers have noted that another category of phrase exists, one that is not exactly an argument, but also not exactly an adjunct (Jackendoff, 2002; Zaenen and Crouch, 2009; Needham and Toivonen, 2011). This category, referred to as *derived arguments* by Needham and Toivonen (2011) (*added arguments* by Kay (2005)), is usually either optional or not normally or necessarily associated with the predicate, but nonetheless behaves like arguments when other syntactic or semantic behaviour is considered. An example of this type of category is optional arguments like *a sandwich* in (9) and *the kitchen* in (10).

(9) Kelly ate a sandwich.

(10) Kim cleaned the kitchen.

The result phrase, as we shall see below, is another phrase which can be considered an added argument, as it is syntactically optional and not core to the meaning of the verbal event, and yet it acts in the same manner as arguments when syntactic behaviour is considered. Previous work on the resultative has generally treated the result phrase as an argument (Simpson, 1983; Carrier and Randall, 1992), but there have been exceptions to that generalization, with some researchers noting that the resultative can exhibit adjunct-like behaviour on occasion (Ernst, 2002; Iwata, 2006; Mateu, 2011). The argument-like behaviour of the result phrase follows from the previous treatments of the resultative including Simpson's (1983) XCOMP addition rule and MacGregor's (2009) template approach.

Examples for this paper have been constructed as well as taken from the web, existing literature on both resultatives and argumenthood tests and the Corpus of Contemporary English (COCA) (Davies, 2008). Additionally, the judgements have come from the previous literature, the authors intuition as well as a pilot questionnaire study involving 7 native speakers of English.

This paper is structured as follows: section 2 will discuss the argumenthood tests, and what behaviour is more argument- or adjunct-like; section 3 will discuss the categorizations of the resultative as laid out in Goldberg and Jackendoff (2004); section 4 will discuss how the result phrase patterns on the argumenthood tests discussed in section 2; and section 5 will present some conclusions and future work.

2 Tests for argumenthood

This section will discuss the eight tests for argumenthood to be utilized in this paper: syntactic obligatoriness, core participants, VP preposing, fixed preposition, prepositional content, pseudocleft, uniqueness/iterativity and VP anaphora. These tests all provide insight into the status of the phrase in question, however, none of them is without its drawbacks and no test can be considered a final ruling on the status of a given phrase.

2.1 Syntactic Obligatoriness

Syntactic obligatoriness, along with the core participants test (see subsection 2.2), is one of the most cited ways to distinguish arguments from adjuncts in syntax textbooks (Dalrymple, 2001; Carnie, 2002; Kroeger, 2004). These two tests form the backbone of the definition of what an argument or an adjunct can be.

The syntactic obligatoriness test states that the arguments of a verb are only those elements which are syntactically required, with optional elements being more likely to be considered adjuncts (Jackendoff, 1990; Dalrymple, 2001; Carnie, 2002; Kroeger, 2004; Needham and Toivonen, 2011; Asudeh and Giorgolo, 2012). Thus, given the example in (11), the sentence is grammatical if *on Tuesday* is removed (12), but becomes ungrammatical if *Sam* is removed (13). In this manner, we can say that *Sam* is an argument and *on Tuesday* is an adjunct.

(11) Kelly prodded Sam on Tuesday.

(12) Kelly prodded Sam.

(13) *Kelly prodded on Tuesday.

This test, however, is not without its issues. Like many of the tests for argumenthood, syntactic obligatoriness can only identify one type of phrase some of the time, and does not directly address the other type of phrase. For this test, if an element is obligatory, then it must be an argument, but arguments can also be optional. So, the reverse of this test cannot be stated decisively: if an element is optional, then it *might* be an adjunct.

2.2 Core Participants (Semantic Selection)

As mentioned above, the core participants test (also known as the semantic selection test) is another test which is used to define in general terms what an argument or adjunct is in works on syntax (Dalrymple, 2001; Koenig et al., 2003; Kroeger, 2004). The test relies on the basic judgement of the speaker as to whether or not something is an argument, and is often used hand-in-hand with the syntactic obligatoriness test (see section 2.1). For this test, the speaker decides what elements of an event are semantically required by, or core to the meaning of, the verb (Dowty, 1982; Levin and Rappaport Hovav, 1995; Boland and Blodgett, 2006; Tutunjian and Boland, 2008; Needham and Toivonen, 2011). For instance, in the event described by (14) the verb *kiss* takes two elements to describe a complete event: an agent (or *kisser*) and a patient (or *kissee*), which are considered arguments. Conversely, the time and location mentioned in (14) are not specifically required by the verb *kiss* to describe a complete event, and thus are considered adjuncts.

(14) Sam kissed Rory on Tuesday in the park.

The test is not sufficient on its own to define what should be considered an argument or adjunct, as it can sometimes be too generous. For example, all events take place at some *time* and in some *place* (Dalrymple, 2001, among others), so one could make the argument that these things are core to the meaning of an event. However, time and location are usually considered to be adjuncts, as they are not specifically tied to a single type of event, making them more general than arguments.

Additionally, even though the core participants test may be difficult to apply, as it relies only on the intuition of the speaker, it is nonetheless an important part of the discussion on how to determine if a given phrase is an argument or an adjunct. Each of the textbook definitions in (3)–(8) use the core participants test (and sometimes the syntactic obligatoriness test) to define what should be considered an argument or an adjunct (see also Goldberg (1995), p. 43; Dalrymple (2001); Needham and Toivonen (2011), section 2; and, Toivonen (2013), p. 3, among others.). Furthermore, each time that a verb is referred to as having x number of arguments, the core participants test has been applied without further use of extensive argument-adjunct tests. Thus, the core participants test utilizes "the most basic intuition behind the argument-adjunct distinction" (Needham and Toivonen, 2011, p. 4). Even though this test is cannot give consistent results for either arguments or adjuncts, it does describe what is done by both researchers and users of the language when asked to determine what the arguments of a verb are.

2.3 VP preposing

The VP preposing test states that an argument must always be moved with a preposed verb, but adjuncts can be left behind (Emonds, 1970; Baltin, 2006; Needham and Toivonen, 2011; Toivonen, 2012). For example, in (15), the argument phrase *a picture* is left behind when the verb is preposed, and the sentence is ungrammatical. While in (16), the adjunct phrase *on Tuesday* is left behind in but the sentence remains grammatical.

(15) *Kylie wanted to draw a picture, and draw she did a picture.

(16) Kelly wanted to run on Tuesday, and run she did on Tuesday.

Thus, the VP preposing test is a good test for determining which elements of a sentence should be considered arguments and adjuncts.

2.4 Fixed preposition

The fixed preposition test posits that argument phrases are more likely to have a fixed preposition, and adjunct phrases are more likely to allow for any number of prepositions to head the phrase (Pollard and Sag, 1987; Wechsler, 1991; Carnie, 2002; Tutunjian and Boland, 2008; Needham and Toivonen, 2011). For instance, in (17) the argument PP must be headed by *on*, while in (18) the adjunct PP can be headed by any of several prepositions.

(17) Kim relies on/*near/*over/*along Kelly.

(18) Kim jogs on/near/over/along the hill.

However, there are notable exceptions to this test, namely locative phrases for verbs like *put*. For instance, in (19), we would expect the locative phrase to be an argument, as it is both a core participant (semantically selected) and syntactically required, passing the two most basic argumenthood diagnostics. However, according to the fixed preposition test, it would less likely be considered an argument, as the preposition is not fixed.

(19) Kelly put the book in/on/beside the box.

In conclusion, this test can aid in correctly identifying arguments, but does not completely define which elements are arguments and which are adjuncts. Although having a fixed preposition is a hallmark of argumenthood, not having one does not mean that the phrase in question is an adjunct.

2.5 Prepositional content

The prepositional content test posits that argument phrases are less likely to utilize the core or basic meaning of the preposition (Pollard and Sag, 1987; Wechsler, 1991; Needham and Toivonen, 2011). For instance, the argument phrase preposition *on* in (20) can be seen as a place holder which does not denote a relationship of being located physically on top of another thing. While the adjunct phrase preposition *on* in (21) does denote being physically on top of something during the verbal action, namely *the sofa*.

(20) Kim turned on the radio.

(21) Kim jumped on the sofa.

However, this test may be problematic, as it can be difficult to discern what the core or basic meaning of a preposition is. For instance, according to the Oxford English Dictionary, the preposition *into* could be defined in many ways, two of which being “in the process of being placed inside of another object” as in (22), and “in the process of being transformed” as in (23) (“into”, 2013). However, if only those phrases which have a core or basic meaning for their preposition should be considered arguments, then we would expect *into the box* to be an argument, and *into a butterfly* to be an adjunct, as the location changing meaning of *into* is listed higher in the dictionary entry, and is related to more of the definitions. Additionally, like with the fixed preposition test, there may be issues with locative arguments, like those of the verb *put*, which according to other tests (like the Syntactic Optionality and Core Participants tests) would be considered an argument, but here would be classed as adjuncts.

(22) Kim put the book into the box.

(23) Kelly turned into a butterfly.

In conclusion, this test can aid in correctly identifying arguments, but it does not yield a clear division between arguments and adjuncts. The prepositional content test is only able to state that a lack of content in the preposition means that the phrase is question is likely an argument, but utilizing the semantic content of the preposition does not mean the phrase is an adjunct.

2.6 Pseudocleft

The pseudocleft test posits that adjuncts, but not arguments, can appear after *do* in a VP-focused pseudocleft (Hedberg and DeArmond, 2009; Needham and Toivonen, 2011). For example, in (25) the argument phrase *on Rory* cannot appear after *do*, while the adjunct phrase *at the side of the road* can appear after *do* in (27).

(24) Kim relies on Rory.

(25) *What Kim does on Rory is rely.

(26) Kelly stands at the side of the road.

(27) What Kelly does at the side of the road is stand.

This test is excellent for two reasons: first, it elicits strong intuitions from speakers (Hedberg and DeArmond, 2009, p. 11), allowing for the collection of good judgement data; and second, it demonstrates a clear and definite difference between arguments and adjuncts.

2.7 Uniqueness/Iterativity

The uniqueness/iterativity test posits that argument positions must be filled by one and only one phrase, while adjuncts can be iterated multiple times (Fillmore, 1968; Bresnan, 1982; Pollard and Sag, 1987; Dalrymple, 2001; Zaenen and Crouch, 2009; Needham and Toivonen, 2011). For example, the object argument position cannot be filled by two phrases (*the boy* and *the girl*) (29), but the locative adjunct position in (30) can be filled by multiple phrases (*in the park* and *on the red bench*).

(28) Kelly kissed the boy.

(29) *Kelly kissed the boy the girl.

(30) Kelly kissed the boy in the park on the red bench.

This test can be understood in terms of the principle of Coherence in Lexical Functional Grammar (LFG) (Kaplan and Bresnan, 1982). In LFG, a f(unctional)-structure is coherent if and only if the elements (specifically, argument functions) which are required by the predicate are the only elements found in the f-structure (Kaplan and Bresnan, 1982, pp. 211-212).Since arguments are the elements which are required by the predicate, we can see that these two principles can be combined to demonstrate both this test and the semantic selection/core participants test. According to the Principle of Coherence argument positions can only be filled once, as they are only required once. Thus, the argument positions must be unique and cannot be iterated.

2.8 VP anaphora (Do-So)

The VP-anaphora, or "do-so," test states that argument phrases cannot be added to verb phrase anaphoric "do-so" clauses, while adjuncts can (Lakoff and Ross, 1966; Baker, 1978; Radford, 1988; Hedberg and DeArmond, 2009; Needham and Toivonen, 2011). For example, if we attempt to add *the wall* to the sentential anaphor in (31) the sentence becomes ungrammatical. However, if the added phrase is an adjunct, as in *on Wednesday* in (32), the sentence remains grammatical.

(31) *Cathy kicked the ball and Kelly did so the wall.

(32) Kelly swam on Tuesday and Rory did so on Wednesday.

The do-so test, along with the pseudocleft test, is extremely effective for getting naive judgements from participants (Hedberg and DeArmond, 2009). However, it is not without its detractors, including Miller (1991) as well as Przepirkowski (1999), who dedicates an entire chapter of his thesis to discussion of the test and its benefits and shortcomings, including the nonparallelism of *do so* in the passive as well as other languages.

3 Classes of English Resultatives

The English resultative can be divided into four classes using the semantic criteria laid out in Goldberg and Jackendoff (2004): agentive property (33), non-agentive property (34), agentive path (35) and non-agentive path (36).

(33) Bill watered the tulips flat.

(34) The pond froze solid.

(35) Bill rolled the ball down the hill.

(36) The ball rolled down the hill.

Goldberg and Jackendoff (2004) use these four categories to describe what they call the "resultative family of constructions", a collection of related constructions which fall loosely under the umbrella of the resultative. All of the resultative family members can be interpreted as a main action occurring and a secondary condition coming to be because of that action. However, the addition of the transition to location (or path) resultatives is a departure from the usual set of sentences considered in the resultative literature, adding a layer to the investigation that is useful to consider.

One major element of the definition of the resultative is the requirement that the main predicate causes the secondary predicate to occur. Kratzer (2005) discusses this at length, noting that the causation not only must be there, but must also be direct, with no intervening states occurring between the main event and the result. For example, Kratzer (2005) discusses a German version of the sentence in (37) (but the arguments are still valid in English) and states that if Kelly drinks all the available water earlier in the day, then she cannot be considered to have *drunk the teapot dry*. What matters for the resultative is that the main event, the *drinking* in this instance, directly cause the secondary event. Thus the only way that one can *drink the teapot dry* is to drink all the tea, and thus directly cause the teapot to become empty.

(37) Kelly drank the teapot dry.

All of the classes of the resultative above comply to this restriction: the tulips became flat because Bill watered them; the pond became solid because it froze; and, the ball ended up at the bottom of the hill because it rolled (whether Bill did the rolling, or it just happened to start rolling on its own). In this way, they can all be considered resultatives. However, there are differences between the property and path resultatives, and, as we shall see below, there is a difference between the two categories which is visible in their syntactic behaviour and which may lead us to treat them differently when we devise a complete treatment of all forms of the resultative.

4 The resultative and the argumenthood tests

Three types of test results must be discussed: those which classify the resultative in all forms as an adjunct, those which classify the resultative in all forms as an argument, and those which classify the property and path resultatives differently. The adjunct-type test is the syntactic obligatoriness test. The argument-type tests are the VP preposing, pseudoclefting, and do-so tests. Finally, the group of tests which classify the path and property resultatives differently from each other are the fixed preposition, prepositional content and uniqueness tests.

4.1 Core Participants (Semantic Selection)

Before the other groups of tests can be discussed, we must first discuss the inconsistent results for the core participants test. For this test, the resultative seems to pattern inconsistently overall. We can come up with one verb that entails a change in state or location and one that does not for three of the four categories: agentive property (38) and (39), agentive path (41) and (42), and, non-agentive path (43) and (44) resultatives. Only the non-agentive property resultatives (40) seem to be the exception to this rule.

(38) Kim hammered the metal flat. [AgProp: ADJ]

(39) Sam broke the vase into pieces. [AgProp: ARG]

(40) The river froze solid. [NonAgProp: ARG]

(41) Bill rolled the ball down the hill. [AgPath: ARG]

(42) Bill pushed the ball down the hill. [AgPath: ADJ]

(43) The truck rolled into the garage. [NonAgPath: ARG]

(44) Kelly floated into the lagoon. [NonAgPath: ADJ]

In these examples, the verbs *hammer, push, knead* and *float* do not seem to entail a result state/location, thus marking these result phrases as more adjunct-like. Conversely, the verbs *roll, break* and *freeze* do seem to entail an end state/location, thus marking these result phrases as more argument-like. The only result phrase which seems to pattern consistently is the unaccusative. The reason for this is unclear, but we theorize that it may have to do with the class of unaccusative verbs used in the resultative all being change-of-state verbs, which necessarily encode a change, and would then be considered argument-like. However, we will leave finding the exact nature of this encoded change to future research.

4.2 Syntactic Obligatoriness

The syntactic obligatoriness test classifies the result phrase, in all forms, as an adjunct. The result phrase is optional in all of the types discussed here, and optionality is the hallmark of adjuncts according to this test. Looking at each type individually, we can see that the agentive property (45), non-agentive property (46), agentive path (47) and non-agentive path (48) resultatives all remain grammatical whether or not the result phrase is present.

(45) Kim hammered the metal (flat). [AgProp: ADJ]

(46) The river froze (solid). [NonAgProp: ADJ]

(47) Bill rolled the ball (down the hill). [AgPath: ADJ]

(48) The truck rolled (out of the garage). [NonAgPath: ADJ]

4.3 VP preposing

For the VP preposing test, the resultative patterns with arguments in all its forms: agentive property (49) and (50), non-agentive property (51), agentive path (52) and non-agentive path (53).

(49) *Kim wanted to hammer the metal flat, and hammer the metal she did flat. [AgProp: ARG]

(50) *Kim wanted to break a pot into pieces, and break a pot she did into pieces. [AgProp: ARG]

(51) *The river needed to freeze solid, and freeze it did solid. [NonAgProp: ARG]

(52) *Bill wanted to kick the ball into the net, and kick the ball he did into the net. [AgPath: ARG]

(53) *The truck needed to roll into the garage, and roll it did into the garage. [NonAgPath: ARG]

Overall, this test places the resultative firmly in the argument category, showing the opposite pattern to the syntactic obligatoriness test.

4.4 VP anaphora (Do-So)

For the VP anaphora test, the resultative patterns with arguments in all its forms: agentive property (54) and (55), non-agentive property (56), agentive path (57) and non-agentive path (58).

(54) *Kim wiped the counter clean and Sam did so dry. [AgProp: ARG]

(55) *Kim broke his cup into shards and Sam did so in half. [AgProp: ARG]

(56) *The vase broke into 6 pieces and the pot did so in half. [NonAgProp: ARG]

(57) *Bill pushed a friend into the house and Sammy did so into the garage. [AgPath: ARG]

(58) *The truck rolled into the garage and the bus did so down the street. [NonAgPath: ARG]

Like the VP preposing test, the VP anaphora test shows the opposite pattern to the syntactic obligatoriness test, classifying the result phrase in all four types of resultative as an argument.

4.5 Pseudocleft

For the pseudocleft test, the resultative patterns with arguments in all its forms: agentive property (59) and (60), non-agentive property (61), agentive path (62) and non-agentive path (63).

(59) *What Kim did flat was hammer the metal. [AgProp: ARG]

(60) *What Kim did into pieces was break the vase. [AgProp: ARG]

(61) *What the river did solid was freeze. [NonAgProp: ARG]

(62) *What Bill did into the goal was kick the ball. [AgPath: ARG]

(63) *What the truck did into the garage was roll. [NonAgPath: ARG]

Like the VP preposing and VP anaphora tests, the pseudocleft test classifies the result phrase in all four types of resultative as an argument, demonstrating an opposition to the syntactic obligatoriness test

4.6 Fixed preposition

For the fixed preposition test, the resultative patterns differently for property and path resultatives. For property resultatives (agentive property (64), non-agentive property (65)), the pattern is one of argumenthood. For path resultatives (agentive path (66) and non-agentive path (67)), however, the pattern is more adjunct-like.

(64) Kim kneaded the dough into a ball/*onto a square. [AgProp: ARG]

(65) The vase broke into pieces/to bits/*across pieces. [NonAgProp: ARG]

(66) Bill rolled the ball down the hill/across the road. [AgPath: ADJ]

(67) The truck rolled out of the garage/into the garden. [NonAgPath: ADJ]

The difference between path and property resultatives here, however, may be a consequence of the difference between properties and paths in general. There are very few English prepositions which can encode a stative interpretation, but there are many prepositions which can encode a location or path. Given this, it is unsurprising that paths would lack fixed prepositions, as it is the preposition which is encoding the type of path under consideration, and there are many different types of paths to encode.

4.7 Prepositional content

Like the fixed preposition test, the pattern for the prepositional content test is different for property and path resultatives. For property resultatives (agentive property (68), non-agentive property (69)), the pattern is one of argumenthood. For path resultatives (agentive path (70) and non-agentive path (71)), however, the pattern is more adjunct-like.

(68) Kim kneaded the dough into a ball/*onto a square. [AgProp: ARG]

(69) The vase broke into pieces/to bits/*across pieces. [NonAgProp: ARG]

(70) Bill rolled the ball down the hill/across the road. [AgPath: ADJ]

(71) The truck rolled out of the garage/into the garden. [NonAgPath: ADJ]

Also like the fixed preposition test, this difference between property and path result phrases may have more to do with the difference between properties and paths in general than the difference between the two types of resultative. These two tests both focus on the fixed elements which come with phrasal verbs like *depend on* or *rely on*, but do not take into account the fact that locational arguments do exist, like the second post-verbal argument of *put*. For these locational arguments, there must be semantic content in the preposition, as that is one way English encodes location: *into the garden* is necessarily different from *across the garden* because the prepositions encode a locational difference.

4.8 Uniqueness/Iterativity

Uniqueness is another test in which the property and path resultatives pattern differently. Both agentive (72) and non-agentive (73) property resultatives do not allow for multiple results to be specified. However, agentive (74) and non-agentive (75) path resultatives do seem to allow for multiple results to be specified at first glance, thus making them more adjunct-like.

(72) *Sally hammered the metal flat into a disc. [AgProp: ARG]

(73) *The jar burst open into flames. [NonAgProp: ARG]

(74) Sally pushed the cup off the table onto the floor. [AgPath: ADJ]

(75) The ball bounced down the hill along the path. [NonAgPath: ADJ]

However, the story is not as straight-forward as it would seem at first glance, as there may be an explanation which has more to do with the type of phrase in general rather than the type of resultative we are considering. The difference between property and path resultatives in this case may come down to the difference between properties and paths in general. It is generally true of properties that there cannot be two of them at the same time, but a path can continue to be further specified by additional information, and it is this continued specification that we are seeing in (74) and (75). In fact, if we restrict ourselves the interpretation that the path is multiply specified and not further specified, then we cannot accept the examples in (74) and (75) as grammatical.

Additionally, there are situations where a property can be further specified, and in those cases multiple examples of attested resultative sentences are available on the web. For example, if the property of being flat can be further specified by the shape it becomes, then (76) is acceptable, while (77) is not, as the shape cannot be further specified by the state (as a circle is a two-dimensional object which cannot be anything but flat).

(76) Kim rolled the dough flat into a circle. [AgProp: ADJ]

(77) *Kim rolled the dough into a circle flat. [AgProp: ARG]

4.9 Summary

Overall, there were three ways in which the resultative patterned on the argumenthood tests, as shown in table 1. If we set aside the inconsistent core participants test, we are left with one test which classifies the result phrase as an adjunct (syntactic obligatoriness), three tests which classify all types of result phrase as arguments (VP preposing, VP anaphora and pseudocleft), and three tests which, at least marginally, demonstrate a difference between property and path result phrases (prepositional content, fixed preposition and uniqueness/iterativity).

Table 1: Argument-Adjunct test results by Semantic Type

Test	Agentive Property	Non-agentive Property	Agentive Path	Non-agentive Path
Core Participants	inconsistent	Arg	inconsistent	inconsistent
Syntactic Obligatoriness	Adj	Adj	Adj	Adj
VP preposing	Arg	Arg	Arg	Arg
VP anaphora	Arg	Arg	Arg	Arg
Pseudocleft	Arg	Arg	Arg	Arg
Fixed Preposition	Arg	Arg	Adj	Adj
Prepositional Content	Arg	Arg	Adj	Adj
Uniqueness / Iterativity	Arg	Arg	Adj	Adj

However, as discussed above and in the next section, the differences between the property and path resultatives may have more to do with the differences between properties and paths in general than a resultative-specific difference.

5 Path and property resultatives

Together, these tests demonstrate a possible difference between property and path resultatives. However, the behaviour of the result phrase for the group of tests which seem to demonstrate a difference between properties and paths can be explained by the properties of both the tests themselves and path phrases in general. The fixed preposition and prepositional content tests both are designed to test for the status of prepositions in phrasal verbs, and not for general prepositions, so they expect the preposition to be both fixed and semantically bleached. Since path phrases denote the direction of travel using their preposition, there is both semantic content and variability in the PP no matter what kind of sentence the path is being used in. Additionally, both of these tests state that a phrase is more likely to be an argument/adjunct, not that the phrase in question should definitely be considered an argument/adjunct (Needham and Toivonen, 2011) and failing them does not mean that the phrase in question is not an argument, only potentially an adjunct.

6 Conclusions and Future Work

In conclusion, this paper has shown that the result phrase of the English resultative should be considered an derived (or added) argument of the verb, as it fails the tests quoted in definitions of argumenthood (like those in (3)–(8)), but patterns like an argument on all of the other tests. Additionally, a potential difference between property and path result phrases was explored. However, that difference was not specific to the resultative, and stemmed rather from the general differences between properties and paths as well as the expectations of the tests themselves.

Within the LFG framework, this research opens the door for continued research into the ways that added arguments can be treated. This work will create a principled was to determine which constructions should be treated with a lexical rule or LFG template (Dalrymple et al., 2004; Asudeh, 2012; Asudeh et al., 2013), and which should be placed in the set of all ADJ functions in the f-structure. Future projects could include different methods of dividing the resultative for application these tests, determining the most effective method for incorporating the added elements and designing LFG templates for the resultative which will reflect the differences between arguments and added arguments while still demonstrating their common properties.

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VALENCY CHANGE AND COMPLEX PREDICATES IN WOLOF: AN LFG ACCOUNT

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Abstract

This paper presents an LFG-based analysis of Wolof valency-changing suffixes found in applicative and causative constructions. The analysis addresses the particular issue of applicative-causative polysemy in this language. Similar to the work for Indonesian (Arka et al., 2009), I adopt an LFG-based predicate composition approach of complex predicate formation (Alsina, 1996; Butt, 1995), and extend it to handle the Wolof data. However, the present work does not propose a unified argument-structure to handle applicative-causative polysemy. It rather postulates an a-structure for each derivation (applicative and causative) by analyzing polysemous suffixes as carrying their own PRED(ICATE) argument structure which they share with other suffixes of the same derivation type.

The proposed analysis is integrated into an implementation of an existing computational grammar using the XLE grammar development environment. The relevant system components include a finite-state morphology, annotated phrase structure and sub-lexical rules. The implementation makes use of the restriction operator (Kaplan and Wedekind, 1993; Butt et al., 2003).

1 Introduction

This paper presents an analysis of Wolof applicative and causative suffixes (Comrie, 1985; Voisin-Nouguier, 2002, 2006) within the Lexical-Functional Grammar (LFG) framework (Kaplan and Bresnan, 1982). In Wolof, valency changes may be encoded by different suffixes, and the same suffix (e.g. -*al* and -*e*) may encode different valency changes, giving rise to applicative-causative polysemy (1-4).

(1)

Faatu	*togg-**al***	*Móodu*	*jën*	*wi*.
Faatu	cook-APPL	Móodu	fish	the

"Faatu cooked the fish for Móodu."

(2)

Faatu	*daw-**al***	*woto*	*bi*.
Faatu	run-CAUS	car	the

"Faatu made the car run."

The suffix -*al* can appear as an applicative (1), allowing for coding different semantic roles such as beneficiary, comitative or recipient. It may also appear as a causative (2), implying a direct involvement of the causer in the caused event.[1]

Similar to -*al*, the suffix -*e* has an applicative (3) or a causative (4) reading. In its applicative use, -*e* licenses objects with a semantic role of instrumental (3), locative or manner (see section 2.1.2). As a causative suffix, it is lexicalized and limited to a handful of intransitive verbs. It may attach to some unergative verbs (Voisin-Nouguier, 2002), i.e. those verbs with an agent subject like *génn* (4).

(3)

Faatu	*togg-**e***	*jën*	*wi*	*diw*.
Faatu	cook-APPL	fish	the	oil

"Faatu cooked the fish with oil."

(4)

Faatu	*génn-**e***	*jën*	*wi*.
Faatu	go.out-CAUS	fish	the

"Faatu let/made the fish go out."

[1]Causative -*al* only attaches to intransitive verbs, e.g. unaccusative verbs (which have a patient subject) to express transitive causative counterparts, e.g. *bax* 'be boiled' / *bax*-al 'to boil'.

A co-occurrence of the applicative and causative suffixes is seen in Wolof when there is an applicative reading associated with the causative construction (5). As Comrie (1985, p. 330) noted, “one specially interesting feature of Wolof is that it is possible to increase the valency of a basic verb by two, using the suffix *-al* twice, so that one can combine, for instance, causative and benefactive”.

(5) *Faatu daw-al-al Móodu woto bi.*
Faatu run-CAUS-APPL Móodu car the
Lit. “Faatu made the car run for Móodu.”
“Faatu drove for Móodu.”

Besides the suffixes *-al* and *-e*, causative in Wolof can also be expressed by means of *-loo*,[2] *-lu* and *-le* which attach to all verbs with an agent subject, intransitive or transitive verbs, as in (6). Examples (6a), (6b) and (6c) show causative constructions derived with *-loo*, *-lu* and *-le*, respectively.

(6) a. *Faatu togg-**loo** ko jën wi.*
Faatu cook-CAUS O3S fish the
“Faatu made him cook the fish.”

b. *Faatu togg-**lu** jën wi.*
Faatu cook-CAUS fish the
“Faatu let (someone) cook the fish.”

c. *Faatu togg-**le** ko jën wi.*
Faatu cook-CAUS O3S fish the
“Faatu helped him cook the fish.”

The suffix *-loo* may attach to unergative and to transitive verbs, as in (6a). As such, it carries a meaning of indirect causation. The suffix *-lu* only attaches to transitive verbs, as in (6b), leading to an important valency change: (i) it introduces a new argument (the causer) in subject position, (ii) but reduces the object position by removing the former subject (the causee). Finally, *-le* combines with unergative and transitive verbs, as in (6c), to license a new argument in the subject position. Causatives derived with *-le* have a relatively rare meaning, forming exclusively an associative causation (Voisin-Nouguier, 2006).

We may note in passing that Wolof has the basic word order Subject-Verb-Object (SVO). The language lacks a true passive and morphological case-marking for the object arguments, using word order as a means of overt marking. Wolof has object markers which may signal direct, indirect, instrumental, or benefactive objects or object controllers (Torrence, 2003). Unlike the Bantu languages, object agreement in Wolof does not permit an object marker to co-occur with a DP object. Furthermore, like Kichaga (Bresnan and Moshi, 1990), Wolof is a ‘symmetrical object language’ which allows both objects to express the same syntactic properties.

[2] The suffix *-loo* is the most common causative derivation.

In both ditransitive and applicative constructions, it “allows either of the two NPs (or both) to pronominalize as clitics” (Dunigan, 1994, p. 6).

Valency-changing suffixes in Wolof are extensively discussed in the literature (see e.g. Voisin-Nouguier, 2002), yet their precise linguistic analysis from a computational point of view has not been investigated in detail until now. Also, there is a lack of computational analysis addressing the issue of applicative-causative polysemy. As a way of satisfying this need, this paper proposes a linguistically motivated analysis based on the LFG model integrated into an implementation of an existing computational grammar.

The structure of this paper is as follows. Section 2 briefly reviews the applicative formation in general and gives a tentative definition for this construction for Wolof. Section 3 presents the LFG-based analysis proposed for Wolof applicatives and causatives. Section 4 shows the computational implementation of this approach and provides parsing samples. Section 5 concludes the discussion.

2 The applicative construction

Applicative formation is defined differently by different linguistic frameworks (see Comrie, 1985). Baker’s (1988) work within Government and Binding sees applicatives, cross-linguistically, as an instance of preposition incorporation. In LFG, the applicative can be accounted for by a morpholexical operation on the argument structure. More particularly, “the applicative construction arises from a derived verb form (the ‘applied verb’) that introduces a new object argument to the base verb” (Bresnan and Moshi, 1990, p. 148). The LFG account of applicative formation “emphasizes the role of the applied predicate which by virtue of the applicative suffix is subcategorized for an applied object” (Kifle, 2012, p. 105).

The definitions discussed above mainly focus on the morphosyntactic aspects of applicative constructions. There are also other studies which highlight the semantic and discourse properties of these constructions (Peterson, 1999; Donohue, 2001; Dalrymple and Nikolaeva, 2011). Such studies seem to indicate that the use of the applicative derivation to express a given semantic role as an oblique is motivated by the discourse salience of the referents, i.e. applicatively expressed arguments have higher discourse salience than their oblique counterparts. This property of applicative constructions has been observed for Wolof (Creissels, 2004).

Due to the different definitions of applicative, we need to define first what this term refers to in this work. For Wolof, the applicative is associated with morphosyntactic, semantic and discourse aspects and is defined, similar to Kifle (2012, p. 106) as “a grammatical expression that morphosyntactically codes an altered construal of an event”. This construction involves a verb marked with an applicative morpheme by virtue of which an object argument which may bear the semantic role beneficiary, recipient, comitative, instrumental, locative, manner is subcategorized for. The resulting applied argument may have a greater discourse salience.

Following Creissels (2004), the typology of applicative presented in this work distinguishes between canonical and non-canonical, valency-increasing vs. valency-preserving applicatives. Thus, a canonical applicative is defined as a construction that "involves a derived verb form combined with a subject semantically identical to that of the non-derived form of the same verb," and with an applied object "representing a participant that cannot be encoded as a core argument of the same verb in its nonderived form" (Creissels, 2004, p. 3). In contrast, non-canonical applicatives refer to constructions in which the derived verb forms "cannot be analyzed as licensing the presence of a direct object with a semantic role that the same verb in its non-derived form cannot assign to a direct object" (Creissels, 2004, p. 5). Furthermore, canonical applicatives can be obligatory or optional. Obligatory applicatives refer to constructions where the use of the applicative form of the verb is the only way to code this participant as a term of the construction of the verb. In optional applicatives, in contrast, the same participant can be coded as an oblique argument in the construction of the same verb in its non-applicative form.

Having defined the properties of the applicative construction relevant for this work, let us now see in more details how such a construction works in Wolof.

2.1 Applicative constructions in Wolof

In general, Wolof allows applicatives to be formed out of intransitive, transitive and ditransitive base verbs. Applicative forms derived from intransitive verbs are valency-increasing by definition, since they license the presence of an additional core-term with the syntactic role of object (i.e. an applied object). Similarly, applicative forms derived from transitive verbs increase the number of core-terms in Wolof which has double object constructions. Applied verbs of a ditransitive verbs like *jaay* 'sell' can lexicalize up to four semantic arguments (Voisin-Nouguier, 2006): agent, theme, recipient and beneficiary, in their argument structure. As discussed above, applicative verb forms are recognizable by the presence of the polysemous suffixes *-al* or *-e*. In the following, applicative clauses derived with *-al* and *-e* are discussed and their different properties highlighted.

2.1.1 Applicatives derived with *-al*

In Wolof, the suffix *-al* is used to derive canonical applicatives which allow for the coding of a comitative (7b), beneficiary (8a) or recipient (8b) semantic role.

(7) a. *Faatu wax ak Móodu.*
Faatu talk to Móodu
"Faatu talked to Móodu."

b. *Móodu la Faatu wax-al.*
Móodu FOC.3 Faatu talk to-APPL
"Faatu talked to MÓODU."

(8) a. *Faatu togg-al Móodu jën wi.*
Faatu cook-APPL Móodu fish the
"Faatu cooked the fish for Móodu."

b. *Faatu def-al ko béjjén.*
Faatu make-APPL 3sg horn
"Faatu made horn for him."

The comitative applicative is optional. Thus, in (7a), the preposition phrase *ak Móodu* ‘with Móodu’ is an oblique term in the construction of the intransitive verb *wax* ‘talk’. In (7b), *Móodu* is syntactically an object argument of the applied verb *wax-al* ‘talk to’. In this case, the use of the applicative is motivated by focalization: the applicative makes it possible to apply to *Móodu* “a focalizing device” that cannot be applied to the complement of the preposition *ak* (Creissels, 2004). Moreover, unlike the beneficiary or recipient, the comitative applied argument must be involved in a construction which contains discourse functions (DF), i.e. must be topicalized or focused. This follows the general tendency for applicativisation to be triggered by topicality (or focus) of the applied argument (Dalrymple and Nikolaeva, 2011). Thus, the neutral clause (9c) becomes ungrammatical because Wolof only allows the comitative applicative to appear in constructions related to focalization (e.g. (7b) and (9b)) or to topicalization (e.g. relative clauses (9a)).

(9) a. *Góor gi mu wax-al.*
man REL 3sg talk to-APPL
“The man she talked to.”

b. *ku mu wax-al?*
who 3sg talk to-APPL
“To whom did she talk?”

c. * *wax-al na Móodu.*
talk to-APPL 3sg Móodu
For: “She talked to Móodu.”

Unlike the comitative applicative, the beneficiary/recipient applicative is obligatory in Wolof. Thus, in (8a) for instance, there is absolutely no possibility of having a term representing a beneficiary in the construction of the Wolof verb *togg* ‘cook’ in its non-derived form; such a term must be treated as the direct object of an applied verb. Obligatory applicative is a widespread phenomenon found in Tigrinya (Kifle, 2012), in Bantu languages like Tswana (Creissels, 2004), etc.

As noted above, applicative derivation with ditransitive verbs leads to constructions with four arguments (Voisin-Nouguier, 2006). An example of such constructions is shown in (10).

(10) *Faatu jaay-al ma ko jën.*
Faatu sell-APPL 1sg 3sg fish
“Faatu sold him fish for me.”

2.1.2 Applicatives derived with *-e*

Similar to the comitative argument, applicative expressions derived by means of *-e* are optional and allow for coding of either instrumental, e.g. *diw* ‘with oil’, or locative, e.g. *ci waañ wi* ‘in the kitchen’, or manner, e.g. *nii* ‘in this manner’, as shown in (12). In the non-derived construction, instrumental or locative semantic roles can be coded as a prepositional phrase (PP) headed by *ak* ’with’ or *ci* ’on/at/in’ (11).

Manner roles are expressed by means of manner adverbs. Example (11) illustrates a non-derived construction, while (12) shows applicatives derived with *-e*.

(11)

Faatu	*togg*	*jën*	*wi*	(*ak*	*diw*/*ci*	*waañ*	*wi*/*nii*).
Faatu	cook	fish	the	(with	oil/in	kitchen	the/MAN.ADV)

"Faatu cooked the fish (with oil/in the kitchen/in this way)."

(12)

Faatu	*togg-**e***	*jën*	*wi*	*diw*/*ci*	*waañ*	*wi*/*nii*.
Faatu	cook-APPL	fish	the	oil/in	kitchen	the/MAN.ADV

"Faatu cooked the fish with oil/in the kitchen/in this way."

The applicative with *-e* has some specific syntactic, semantic and discourse properties. Thus, in (11), the instrumental, locative and manner phrases are optional, as indicated by the parentheses. In contrast, in (12), these phrases are arguments, i.e. obligatory, and are selected by the derived verb. Omitting these phrases would result in an ungrammatical clause. Furthermore, the applicative construction becomes obligatory if these semantic roles are put into non-subject focus, as the examples (13-14) from Voisin-Nouguier (2006, p. 166) show.

(13)

Gal	*lañu*	*ko*	*liggéey-**e***.
white.gold	FOC.3pl	3sg	work-APPL

"It is with the white gold they have made it."

(14) * *Gal lañu ko liggéey*.

Instrumental applicatives have a canonical use, while locative referents are usually represented by locative phrases in a non-canonical applicative construction. A similar phenomenon has been observed for Tswana applicative verb forms in connection with locative phrases (Creissels, 2004). In this language, as in Wolof, the canonical and non-canonical use have in common that the applicative derivation is necessary to license the presence of a term with a particular semantic role in the construction of the verb. The non-canonical use "departs however from the canonical use in that the term in question is not a noun phrase in the syntactic role of object, but a locative phrase showing no evidence of a syntactic status different from that of ordinary obliques" (Creissels, 2004, p. 10). Also, note the crucial difference between beneficiary/recipient/comitative (i.e. derived with *-al*) and instrumental (i.e. derived with *-e*) applicatives in word order. Similar to Chichewâ (Alsina and Mchombo, 1993), in Wolof, the beneficiary object must appear immediately after the verb. However, unlike Chichewâ, in Wolof instrumental applicatives, the applied instrumental cannot be adjacent to the verb. Following on from this, it will be assumed in this work that the beneficiary/recipient/comitative objects are unrestricted objects which precede the restricted object — the theme object in (8a). In contrast, the instrumental object is assumed to be restricted and therefore to always follow the theme. Table 1 summarizes properties of the Wolof applicative suffixes.

<table>
<tr><th>Suffix</th><th>APPL type</th><th>Semantic role</th><th>Optionality</th><th>Valency change</th><th>DF required</th></tr>
<tr><td rowspan="3">-al</td><td rowspan="3">canonical</td><td>beneficiary</td><td>obligatory</td><td>syntax</td><td></td></tr>
<tr><td>recipient</td><td>obligatory</td><td>syntax</td><td></td></tr>
<tr><td>comitative</td><td>optional</td><td>syntax</td><td>x</td></tr>
<tr><td rowspan="3">-e</td><td>canonical</td><td>instrument</td><td>optional</td><td>syntax</td><td></td></tr>
<tr><td rowspan="2">non-canonical</td><td>manner</td><td>optional</td><td>syntax</td><td></td></tr>
<tr><td>locative</td><td>optional</td><td>semantic or discourse</td><td></td></tr>
</table>

Table 1: Basic properties of Wolof applicative suffixes *-al* and *-e*

To sum up, the suffixes *-al* and *-e* can take roots of different categories with applicative and/or causative functions. In addition, the suffixes *-loo*, *-lu* and *-le* are used to derive constructions with an unambiguous causative function. An analysis of the nature of these functions is proposed in the next section.

3 Analysis

This section presents the analysis of the Wolof affixes discussed so far. Based on complex predicate formation (Alsina, 1996; Butt, 1995), which is applicable to Wolof, the approach particularly focuses on the following patterns of alternations.

1. Syntax
   (a) valency-increase (i.e. the change occurs strictly at syntactic level)
      - intransitive -> transitive
      - monotransitive -> ditransitive
      - ditransitive -> tritransitive (4 arguments)

   (b) no valency-increase (the change occurs at syntactic but also semantic level, e.g. *-e* applicative with locative)
2. Semantics
   (a) beneficiary, recipient, comitative applicative
   (b) instrumental, manner, locative
3. Discourse: constructions involving discourse functions (topic or focus)

In line with work on causativisation and applicativisation (Arka et al., 2009), I propose the a-structure-based analysis in (15) with the following key points.

The first key point is that applicative (15a) and causative (15b) have a similar, but not identical a-structure. I assume that both derivation types trigger a complex predicate composition with an a-structure consisting of a matrix and an embedded predicate. Thus, the applied/causative verb is analyzed as a two-place predicate with its own argument structure (a-structure), as given in (15). The %PRED notation from XLE stands for a variable to be filled in by a predicate's a-structure of the non-derived verb. This predicate could be intransitive, transitive, and ditransitive.

(15) a. Applicative a-structure

‘PRED$_1$<%PRED, ARG >’

ARG: any semantic role
introduced by the applicative

b. Causative a-structure

‘PRED$_1$<ARG, %PRED >’

(A)

Central to this analysis is that the matrix argument for each derivation type involves a specific argument referred to as ARG. For the applicative a-structure (15a), there is a further distinction between canonical and non-canonical applicatives. In canonical applicatives, ARG is assumed to bear the matrix's second argument and be underspecified for a comitative, a beneficiary/recipient or an instrumental argument. In non-canonical applicatives, ARG is thematically a locative (LOC) or manner (MAN)-related argument. In contrast, with the causative a-structure (15b), ARG is assumed to link to an agent-like participant (A) and therefore thematically higher than the embedded predicate %PRED. Accordingly, ARG is assumed to bear the matrix's first argument, thus the subject position of causative clauses. Sections 3.1 and 3.2 give more details about the proposed a-structures using examples.

3.1 Applicative a-structure

According to the verb transitivity and the semantic role expressed in the applicative construction, four types of structures are defined for Wolof applicatives. These types are respectively given in section 3.1.1 - 3.1.4.

3.1.1 Type 1

The first type involves two-place intransitive predicates found in canonical applicatives such as *wax* ‘speak’ and *séy* ’marry’. Such predicates generally code a comitative semantic role as an oblique argument, e.g. PP headed by *ak* ‘with’ as in (7a). In the applicative construction in (16a), the object of the former oblique argument (7a) syntactically bears the role of the applied object of the derived transitive verb form. The event described by the verb is assumed to involve an agent and a comitative participant, respectively expressed as SUBJ and OBJ. As shown in (16b), the comitative is linked to OBJ in the applied construction, whereas it is also possible that the comitative is linked to the oblique argument without the applicative. This follows from the fact that the applicative “allows a role that would be expressed as an oblique, if at all, to be expressed as a direct argument” (Alsina and Mchombo, 1993, p. 28).

(16) Type 1

a. *Móodu la Faatu wax-al.*
Móodu FOC.3sg Faatu talk-APPL
“Faatu talked to MÓODU.”

b.

		Faatu	*Móodu*
-al comitative		SUBJ	OBJ
		|	|
	‘appl< ‘wax	< _ >’,	ARG >’
		agt	com

3.1.2 Type 2

The second applicative type involves three-place predicates found in canonical (obligatory or optional) applicative constructions. These predicates are divided into two subtypes: 2a and 2b. The reason underlying this classification is the crucial difference in the argument mapping between the two types, as shown in Table 2.

Ditransitive			
	NP_{SUBJ}	NP_{OBJ}	NP_{OBJ-TH}
	ARG1	ARG2	ARG3
-al	agt	ben/rec/com	th
-e	agt	pt/th	instr

Table 2: Subcat frames and associated semantic roles for the ditrans. applied verb

The first subtype 2a) represents those applied verbs derived with *-al* and which typically introduce a beneficiary, a recipient or a comitative semantic role. As Table 2 shows, the subcategorization frame of such verbs is seen as having an individual clause which contains a displaced theme (for instance X_{ag} *togg-al* ‘cook for’ Y_{ben} Z_{th}). A theme is ranked low in the thematic hierarchy (Bresnan and Moshi, 1990), and fits well as the least prominent core argument among the three core arguments that make up a ditransitive structure. As exemplified by (17b), the displaced theme can only be mapped to the OBJ-TH function, since the other prominent arguments are respectively realized as SUBJ and OBJ.

(17) a. *Faatu togg-al Móodu jën wi.* (beneficiary)
Faatu cook-APPL Móodu fish the
“Faatu cooked the fish for Móodu.”

b.

		Faatu	*jën*	*Móodu*
-al beneficiary		SUBJ	OBJ-TH	OBJ
		|	|	|
	‘appl < ‘togg <	_ ,	_ >’,	ARG >’
		agt	pt	ben

The second subtype 2b) involves applied verbs which code an instrumental argument, i.e. derived by means of the suffix -*e*. These verbs have a subcategorization frame with a patient/theme bearing its canonical argument position. Double object applicative constructions (18) involve two object functions which are associated with a patient and an instrumental semantic role. As shown in Table 2, applied instrumentals in Wolof are analyzed as arguments which have an objective function, i.e. applied objects. As noted above, the instrumental object is assumed to be thematically restricted, therefore bearing the OBJ-TH function.

(18) Type 2b

a. *Faatu togg-e jën wi diw*. (instrumental)
Faatu cook-APPL fish the oil
"Faatu cooked the fish with oil."

b.

		Faatu	*jën*	*diw*
-*e* instrumental		SUBJ	OBJ	OBJ-TH
		|	|	|
	'appl< 'togg	< _ ,	_ >',	ARG >'
		agt	pt	instr

3.1.3 Type 3

The third applicative type is concerned with non-canonical applicatives in which a non-argument function of the verb in its non-derived form becomes an obligatory non-core argument (e.g. OBL) in the applicative construction. This is exemplified by (19) and the corresponding mappings in (19c). Wolof verbs which are of the same type as *togg* 'cook' such as *jël* 'take', *tanx* 'fetch', etc. can be represented as having an a-structure involving an agent, a patient/theme and an event location indicating where the cooking event happens. As illustrated by the optionality marker in (11), the concept of event location (as opposed to participant location) may be expressed by adjuncts (i.e. a non-argument function). In (19a) however, the location concept is identified as a participant location, thus an oblique argument which the applied verb subcategorizes for. Omitting the PP would result in an ungrammatical clause, as shown in (19a). The same treatment applies for manner applicatives.

(19) a. *Faatu togg*-**e** *jën wi* *(*ci waañ wi*).
Faatu cook-APPL fish the *(in kitchen the)
"Faatu cooked the fish *(in the kitchen)."

b. *Ci waañ wi la Faatu togg*-**e** *jën wi*.
In kitchen the FOC.3 Faatu cook-APPL fish the
"In the kitchen, Faatu cooked the fish."

<table>
<tr><td>c.</td><td></td><td>Faatu</td><td>jën</td><td>waañ</td></tr>
<tr><td>-e locative</td><td></td><td>SUBJ</td><td>OBJ</td><td>OBL-LOC</td></tr>
<tr><td></td><td></td><td>|</td><td>|</td><td>|</td></tr>
<tr><td></td><td>‘appl< ‘togg</td><td>< _ ,</td><td>_ >’,</td><td>ARG >’</td></tr>
<tr><td></td><td></td><td>agt</td><td>pt</td><td>loc</td></tr>
</table>

3.1.4 Type 4

The fourth type involves a class of prototypical ditransitive verbs such as *jaay* ‘sell’ and *jox* ‘give’, describing a scene in which an agent participant causes an object to pass into the possession of a recipient. Thus, after derivation, such verbs code three object arguments, as shown in (20a). However, since a maximum of two object arguments can be coded as core object functions in a clause, the beneficiary argument is mapped to OBJappl, i.e. the applied object. With the assumption that the concepts of recipient and patient object arguments are inherently present in the meaning of the verb, these arguments are considered to bear their canonical function, respectively as OBJ and OBJ-TH of the (non)applied verbs. The proposed mapping for prototypical ditransitive verbs is given in (20b).[3]

(20) Type 4

a. *Faatu jaay-al ma ko jën.*
Faatu sell-APPL 1sg 3sg fish
“Faatu sold him fish for me.”

<table>
<tr><td>b.</td><td></td><td>Faatu</td><td>3sg</td><td>jën</td><td>1sg</td></tr>
<tr><td>-al beneficiary</td><td></td><td>SUBJ</td><td>OBJ</td><td>OBJ-TH</td><td>OBJappl</td></tr>
<tr><td></td><td></td><td>|</td><td>|</td><td>|</td><td>|</td></tr>
<tr><td></td><td>‘appl< ‘jaay</td><td>< _ ,</td><td>_ ,</td><td>_ >’,</td><td>ARG >’</td></tr>
<tr><td></td><td></td><td>agt</td><td>rec</td><td>pt</td><td>bene</td></tr>
</table>

3.2 Causative a-structure

Unlike the applicative constructions, causative introduces a new agent-like participant (ARG) which bears the function of subject prior to the causative derivation. For the different causative suffixes found in Wolof, two analysis types (type 1 and type 2) are proposed.

3.2.1 Type 1

The first type includes one-place predicates that combine with the polysemous suffixes *-al* and *-e*. Example (21b) shows the mapping for the sentence (21a).[4]

[3]Due to lack of space, the applicative derivation with ditransitive verbs will not be discussed in more details in this paper.

[4]The sentence (4) is treated in a similar way.

(21) Type 1: polysemous causative suffix -*al*

a.

Faatu	*daw-**al***	*woto*	*bi*.
Faatu	run-CAUS	car	the

“Faatu made the car run.”

b.

		Faatu	*woto*
-*al* causative		SUBJ	OBJ
		|	|
	‘caus <	ARG, ‘daw <	_ >’ >’
		causer	causee

3.2.2 Type 2

The second configuration for causatives is divided into two subtypes. This is because the causative types involved here differ in the way the internal arguments are mapped to grammatical functions. The first subtype provides an a-structure for indirect and associative causation (i.e. -*loo* and -*le*) which maps the causer, the causee and the theme/patient into SUBJ, OBJ and OBJ-TH, respectively. The a-structure is given in (22b). In this type, the causee must overtly appear in the clause.

(22) Type 2a: indirect and associative causation with -*loo*/-*le*

a.

Faatu	*togg-**loo***	*Móodu*	*jën*	*wi*.
Faatu	cook-CAUS	Móodu	fish	the

“Faatu made Móodu cook the fish.”

b.

		Faatu	*Móodu*	*jën*
-*loo* causative		SUBJ	OBJ	OBJ-TH
		|	|	|
	‘caus <	ARG, ‘togg <	_ ,	_ >’ >’
		causer	causee	pt

In the second type (i.e. causative derived by means of ‘-*lu*’), the causee is implied, i.e. not syntactically realized. The absence of this argument is indicated by the *NULL* symbol in the a-structure in (23b).

(23) Type 2b: direct implied causation with -*lu*

a.

Faatu	*togg-**lu***	*jën*	*wi*.
Faatu	cook-CAUS	fish	the

“Faatu let (someone) cook the fish.”

b.

		Faatu		*jën*
-*lu* causative		SUBJ		OBJ
		|		|
	‘caus <	ARG, ‘togg <	NULL,	_ >’ >’
		causer	causee	pt

4 Implementation

4.1 Annotated phrase structure and sub-lexical rules

The LFG-analysis for Wolof applicative and causative constructions proposed in this work makes use of annotated c-(onstituent) structure and sub-lexical rules. The c-structure rules regulate the clause structure, operating on the surface level. The basic c-structure rules are given in (24).[5]

(24) a. S $\rightarrow$ (NOM) VP b. VP $\rightarrow$ V' NOM (NOM)

c. V' $\rightarrow$ V CL*

Unlike the c-structure rules, the sub-lexical rules operate word internally, therefore on a deeper level. They regulate the morpheme hierarchy within a given word structure. Accordingly, Wolof verbs convey various morphological information including the verb stem (V-S_BASE), part-of-speech tag (V-TAG_BASE), further optional suffixes (V-SFX_BASE) and also relevant information referring to the f-structure embedded under subject (e.g. person and number as indicated by V-PersNum-F_BASE). This information is provided by the Wolof Morphological Analyzer (WoMA) described in Dione (2012). The analyzer has been developed using the Xerox finite-state tool *fst* (Beesley and Karttunen, 2003). Thus, the Wolof finite-state tool is interfaced with XLE by means of sublexical rules (see Kaplan et al., 2004). The sub-lexical rules used for the analysis are shown in (25).

(25) V $\rightarrow$ { V-S_BASE: (↑ PRED) ~(↑ CAUS) ~(↑ APPL)
| VCaus: (↑ CAUS)=$_c$ +
| VApplAL: (↑ APPL)=$_c$ + (↑ CHECK _APPL-FORM) =$_c$ al
| VApplE: (↑ APPL)=$_c$ + (↑ CHECK _APPL-FORM) =$_c$ e
}
V-TAG_BASE
(V-SFX_BASE)+
(V-PersNum-F_BASE: (↑ SUBJ)=↓).

The rule in (25) specifies that the verb stem can be analyzed in two different ways: either it is non-derived, i.e. contains no particular information ~(↑ CAUS) ~(↑ APPL); or it is an applied/causative verb. In the latter case, this stem is treated as a complex morpheme which consists of a root and one or more suffixes conveying applicative/causative information. Accordingly, one of the rules VCaus, VApplAL or VApplE applies, depending on the derivation type and form.[6]

[5]NOM is a meta-category that permits certain kinds of cross-categorial generalizations to be expressed. In Wolof, it may be associated with any of the nominal constituents NAMEP, DP, NP, etc. CL describes the grammatical category of subject, object and locative clitics (see Dione, 2013).

[6]Other sub-lexical rules dealing with voice and valency-changing operations like antipassive, medio-passive, etc. not shown in this work may apply as well.

To capture relevant information within a sub-lexical rule and make sure that the correct rule is called, standard XLE notations (disjunction, constraining equality, negation, etc.) and ParGram CHECK features (i.e. grammar internal features) are used. The internal structure of an applicative derived stem is represented as shown in Fig. 1. The implementation of the analysis is shown in sections 4.1.1 and 4.1.2.

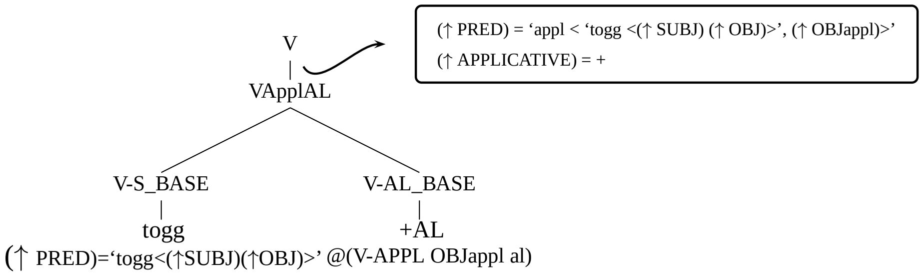


Figure 1: Representation of the internal structure of applicative stems

4.1.1 Applicative suffixes

The applicative suffixes are treated differently due to the non-identical grammatical functions (GF) involved in the alternations triggered by each suffix. Using the restriction operator (Kaplan and Wedekind, 1993; Butt et al., 2003), both suffixes are analyzed as given in (26) and (27), respectively.

(26) VApplAL → V-S_BASE:
↓\PRED\OBJ\OBJ-TH\OBL-TH = ↑\PRED\OBJ
\OBJ-TH\OBJappl
(↓ PRED) = (↑ PRED ARG)
{ ~(↓ OBJ)
(↓ OBL-TH) = (↑ OBJappl) Type 1: Vintr → Vtr
(↑ DF)
(↑ CHECK _INTRANS)=$_c$ + |
(↓ OBJ)
(↓ OBJ)=(↑ OBJ-TH) Type 2: Vtr → Vditr
(↑ CHECK _TRANS)=$_c$ + |
(↓ OBJ)=(↑ OBJ) Type 4: Vditr → Vtritr
(↓ OBJ-TH)=(↑ OBJ-TH)
(↑ CHECK _DITRANS)=$_c$ + }
}; V-AL_BASE.

In XLE, the restriction applies as part of the ‘syntactic composition of two predicates’ (Butt et al., 2003). In (26-27), restriction allows for manipulating f-structures and predicates in a controlled fashion. Given the f-structure of the non-derived verb ↓, these rules restrict out original information (e.g. OBJ, OBJ-TH and OBL-TH in (26)), in order to assign new information, e.g. OBJappl, OBL-LOC, to the f-structure of the derived verb form ↑. The restricted f-structure is identical to the original f-structure except that it does not contain the restricted attributes. The use of the restriction operation instead of simple lexical rules has a good motivation. The XLE implementation of lexical rules allows for basic modifications of predicates, and this might be sufficient for some languages to handle some phenomena; for example, the English passive: argument grammatical functions could be renamed or deleted. However, lexical rules are not sufficient to account for operations over predicate-argument structure where arguments are added, as it is the case with the Wolof applicative and causative constructions.

```
(27)  VApplE   →  V-S_BASE:
                  ↓\PRED\OBL-TH = ↑\PRED\OBJappl\OBL-LOC\OBL-MAN
                  (↓ PRED) = (↑ PRED ARG)
                  { (↑ OBJappl)
                    (↓ OBL-TH) = (↑ OBJappl)              Type 1: Vintr → Vtr
                      { (↑ CHECK _INTRANS)=c + |
                      (↑ CHECK _TRANS)=c + |              Type 2: Vtr → Vditr
                      (↑ CHECK _DITRANS)=c +}             Type 2: Vditr → Vtritr
                  | (↑ OBL-LOC) | (↑ OBL-MAN)             Type 3: val. preserving
                  }; V-E_BASE.
```

4.1.2 Causative suffixes

Unlike the applicative, the causative suffixes are not treated by separate rules.

```
(28)  VCaus → V-S_BASE:
              ↓\PRED\SUBJ\OBJ\OBJ-TH = ↑\PRED\SUBJ\OBJ\OBJ-TH
              (↓ PRED) = (↑ PRED ARG)
              {   (↓ SUBJ) = (↑ OBJ)                  Type 1: Vintr → Vtr
                (↑ CHECK _INTRANS)=c +
                 { (↑ CHECK _CFORM)=c e               Type 1: caus -e
                | (↑ CHECK _CFORM)=c al} |            Type 1: caus -al
                (↓ SUBJ) = (↑ OBJ)                    Type 2a: strictly trans
                (↓ OBJ) = (↑ OBJ-TH)
                (↓ CHECK _TRANS) =c + |
                ~(↑ OBJ-TH)                           Type 2a: Vintr or Vditr
                (↓ SUBJ) = (↑ OBJ)
                ~(↓ CHECK _TRANS) |
                (↓ SUBJ) = NULL                       Type 2b: implied causee
                (↓ OBJ) = (↑ OBJ)
                (↓ CHECK _TRANS) =c +
                (↑ CHECK _CFORM)=c lu
              };
              {V-AL_BASE|V-E_BASE|V-LOO_BASE|V-LU_BASE |V-LE_BASE}.
```

The linguistic motivation behind this assumption is that all causative suffixes contribute to the valency change in a similar way, meaning that they commonly affect the core grammatical functions SUBJ, OBJ and OBJ-TH. However, there is an essential distinction between the possible derivation suffixes. This is expressed in a disjunctive way: the branching of a causative derived verb may involve a verbal root and at least one of the causative suffixes, i.e. V-AL_BASE, V-E_BASE, V-LU_BASE, etc. The implementation of the causative suffixes is given in (28).

4.2 Tags and Lexical entries

A central part of the analysis of Wolof valency changing suffixes and complex predicates is the lexicon. This encodes information of diverse types, including for instance: (i) the base form of the words; (ii) the grammatical category (part-of-speech) associated with these words; (iii) semantic information expressed in term of PRED; (iv) and a list of relevant functional annotations, including information structure. Sample lexical entries used for this analysis are given in (29).

(29) Sample entries: free forms

Faatu	NAME-S	XLE	(↑ PRED)=‘faatu’.
Móodu	NAME-S	XLE	(↑ PRED)=‘móodu’.
togg	V-S	XLE	(↑ PRED)=‘togg<(↑ SUBJ)(↑ OBJ)>’.
jën	N-S	XLE	(↑ PRED)=‘jën’.

The lexical entries for the applicative and causative suffixes are listed in (30). As (30a-30b) show, the grammatical category is shared between suffixes with the same morphological form, rather than having different category for each polysemous suffix. Thus, *-al* in (30a) for instance, has a unique part-of-speech category, i.e. *V-AL*, introduced by the morphological tag *+AL*. This tag contains lexical specifications with either applicative or causative information. Applicative-causative polysemy is captured by means of a disjunction. Moreover, common properties of the suffixes within the same derivation type (e.g. applicative suffixes) are encoded via templates (31a-31b) as a means of generalization.

(30) Sample entries: bound forms

a.	+AL	V-AL	XLE	{	@(V-APPL OBJappl al) |	Applicative
					@(V-CAUS direct al)	Causative
					(↑ CHECK _INTRANS)$=_c$ +	
				}.		
b.	+E	V-E	XLE	{	@(V-APPL OBJappl e) |	Instrumental
					@(V-APPL OBL-LOC e) |	Locative
					@(V-APPL OBL-MAN e) |	Manner
					@(V-CAUS direct e)	Direct causation
				}.		

c. +LU V-LU XLE @(V-CAUS direct lu).
d. +LOO V-LOO XLE @(V-CAUS indirect loo).
e. +LE V-LE XLE @(V-CAUS indirect le).

(31) a. Template for applicative suffixes

V-APPL(_GF _AF) = (↑ PRED)='appl<%ARG (↑ _GF)>'
(↑ APPLICATIVE)= +
(↑ CHECK _APPL-FORM)= _AF.

b. Template for causative suffixes

V-CAUS(_CS _CF) = (↑ PRED)='caus<(↑ SUBJ) %ARG>'
(↑ CAUSATIVE)= +
(↑ CAUSE)= _CS
(↑ CHECK _CAUS-FORM)= _CF.

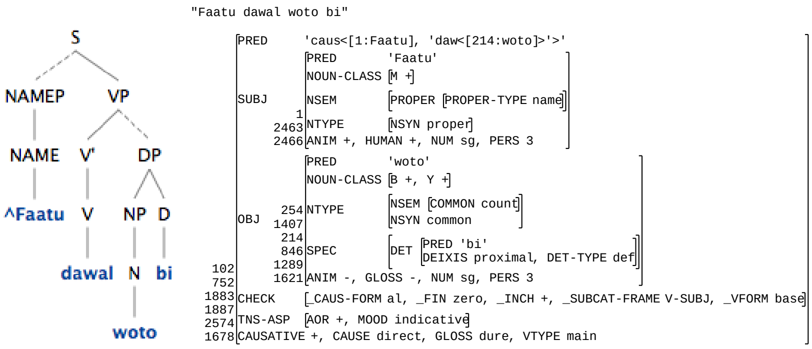
The templates in (31a) and (31b) are respectively defined for applicatives and causatives. As can be seen from the definition in (31a), the a-structures for the applicative suffixes have common properties. Both structures have a predicate and an embedded argument. The semantic form 'appl' represents the base PRED as a result of the contribution on the applicative suffix. The embedded arguments consists of %ARG and an additional (core or non-core) argument. %ARG represents the argument structure of the non-derived verb and is identified with the subject argument of the matrix predicate (i.e. the matrix's first argument). The parameter _GF will be instantiated by an applied object OBJappl or oblique argument, e.g. OBL-LOC. OBJappl, in turn, is underspecified for the semantic roles with which it is associated. All applied object arguments found in canonical applicatives (i.e. those introducing a beneficiary, recipient, comitative or an instrumental semantic role derived with -*al* or -*e*) are identified as OBJappl. In contrast, applied arguments found in non-canonical applicatives such as locative and manner are coded as an applied oblique argument locative (OBL-LOC) or manner (OBL-MAN), respectively. In addition, the template supplies the information that the clause is an applicative construction (↑ APPLICATIVE)=+. Finally, the equation (↑ CHECK _APPL-FORM)= _AF captures the morphological form of the derivation suffix.

Similarly, causative information, e.g. (↑ CAUSATIVE)=+, is encoded in the generic template @V-CAUS (31b), which is defined for all causative suffixes. As with applicatives, the template definition includes a common semantic PRED 'caus' and the subcategorization frame for the causative verb. Note, however, that in (31b) %ARG represents the embedded predicate, which is treated as the secondary argument of the causative predicate; hence following the subject of the complex predicate. Finally, the precise causative semantic (direct, indirect, associative) and form (i.e. the derivation morpheme) are captured by the equations (↑ CAUSE)= _CS and (↑ CHECK _CAUS-FORM)= _CF, respectively.

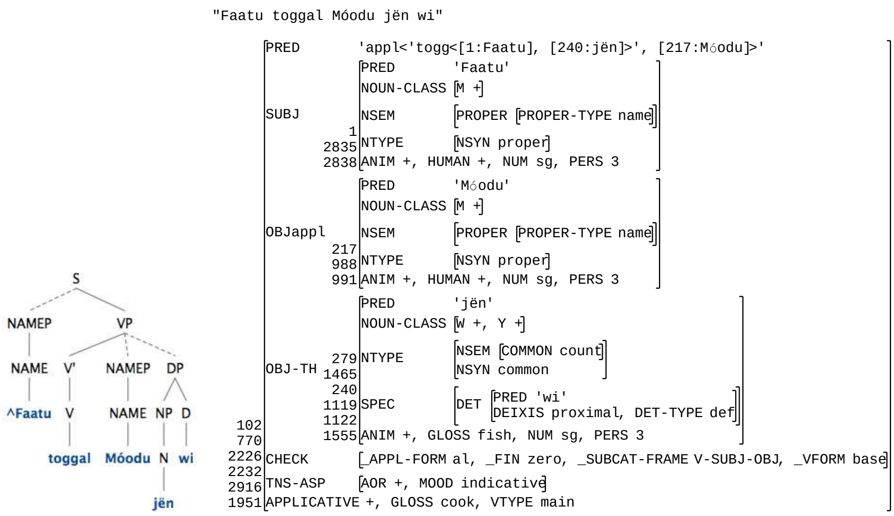
4.3 Parsing and sample parses

This section provides a few output parses to illustrate how the applicative and causative sentences can be parsed.[7] Examples (32) and (33) show the output parse for the sentences in (21a) and (8a), respectively. The input text is first divided into tokens. The output is then fed into the Wolof morphological analyzer which assigns PoS tags, e.g. (NAME, N, V, etc.), and morpheme tags to (morphologically complex) words such as *togg-al*, *daw-al*, etc., as shown in (1).

(32) C-structure and f-structure for the causative sentence (21a)



(33) C-structure and f-structure for the applicative sentence (8a)



[7] The c-structure output was done via the XLE Web Interface (see http://clarino.uib.no).

5 Conclusion

This paper has presented an LFG-based analysis of Wolof applicative and causative suffixes, focusing on the applicative-causative polysemy of *-al* and *-e*. This analysis has highlighted different properties of these suffixes, including their morphosyntactic, valency-increasing and valency-preserving as well as semantic and discourse properties. Building on earlier work in LFG, this proposal has argued for a predicate composition analysis which involves an underspecified argument structure, allowing different types of argument structure for the applicative and causative construction. The proposed analysis has been implemented in XLE by means of the restriction operator (Kaplan and Wedekind, 1993; Butt et al., 2003) and standard LFG notations. The XLE-based computational grammar correctly identifies the different linguistic aspects triggered by the Wolof valency-changing suffixes.

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NON-VERBAL PREDICATES IN K'ICHEE' MAYAN
AN LFG APPROACH

Lachlan Duncan

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Although the most important types of non-verbal predicates (NVP) are outlined in the descriptive grammars of the K'ichee'an languages, no encompassing typology let alone a formal analysis of NVPs has ever been published. This paper is an attempt to remedy this using K'ichee' Mayan as the data source with original data. The core types of NVPs are presented and constituent structures are proposed. The grammatical function, function theta, is proposed to account for the complements of monovalent, intransitive NVPs.

1 Introduction

Although the most important types of non-verbal predicates (NVP) are outlined in the descriptive grammars of the K'ichee'an languages (cf. Dayley 1985, Larsen 1988, Mondloch 1978), no encompassing typology let alone a formal analysis of NVPs has ever been published.[1,2] My paper attempts, in part, to remedy this by using K'ichee' Mayan as a primary data source. NVPs in the K'ichee'an languages are the equivalent of copula ('to be') constructions in English. So a K'ichee' NVP such as *nim lee jaa* is the equivalent of 'The house is big,' while *ee tz'ib'anelaab'* is the equivalent of 'They are writers.'

The organizing generalization argued for in this paper is that K'ichee' finite verbs and K'ichee' finite NVPs each correlate with their own distinct syntactic configurations. Whereas the K'ichee' verb consists, in general, of a single agglutinated constituent (1)–(2), the NVP consists at a minimum of an absolutive agreement marker (AM), which instantiates the intransitive subject, along with the predicate variable, either a noun or gerund, (participial) adjective, or adverb. I contend that it is not morphology that ultimately differentiates K'ichee' verbs and NVPs from each other. Rather it is syntax. Accordingly it is this contention that motivates a robust syntactic analysis of K'ichee'an NVPs.

It is assumed that finiteness in K'ichee' verbs involves the inflection of prefixed aspect markers and subject/ergative and object/absolutive AM. Finiteness in

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[1] Orthographic x = [−voi] alveopalatal fricative, j = [−voi] velar fricative, and ' = glottalized occlusive / glottal stop; Interlinear gloss: first / second / third person = 1 / 2 / 3, absolutive / ergative agreement marker = ABS/ERG, antipassive = AP, attributive = ATT, clefting particle = CLEFT, completive aspect = COM, determiner = D/DET, emphatic = EMPH, enclitic = ENC, focus = FOC/FOCUS, gerund = GER, grammatical function = GF, incompletive aspect = INC, independent pronoun = PRO, interrogative = INT, irrealis = IRR, negative = NEG, nominalizer = NOML, participle = PART, genitive possessor = POSS, positional = POSN, independant pronoun = PRO, transitive/intransitive phrase final marker = TPF/IPF, plural = PL, preposition = P/PREP, singular = S/SG, status suffix = SS, thematic = THEM

[2] Aissen (1999) using generic Government & Binding Theory (Chomsky 1981) is an exception.

NVPs, on the other hand, involves only the hosting of non-bound absolutive/subject AMs. Crucially there is no prefixed inflectional aspect marking on NVPs, which, with regards to morphology, is the feature that principally differentiates K'ichee' NVPs from verbs (cf. Larsen 1988:152). If and when NVPs host subjects, however, remains a complex matter and will be addressed in detail. Following Larsen (1988:105, 135, cf. 152), I contend that K'ichee' does not have a verbal copula.[3] It is argued in this paper that a 'non-verbal copula' (Falk 2004, Nordlinger and Sadler 2007) is employed instead. I suggest that the K'ichee' non-verbal copula is the stative positional participle *k'oolik* 'existing.'

It is argued that adjectival predicates are similar to verbs in that both categories select for subjects.[4] Nominal predicates, however, are more nuanced than adjectives in terms of if and when they host subjects. The most important feature that bears on this is the definiteness quotient of the nominal, with the determining factor being how the nominal is realized grammatically. That is, is the nominal a DP or not a DP?[5] This differentiation based on definiteness is fundamental in determining if nominals are predicative or not. The determination rests primarily on the contention that there is little if any interpretative or semantic difference and no grammatical or syntactic difference between the so-called indefinite determiner *jun* 'a' and the cardinal *juun* 'one.' The indefinite determiner is thus understood to be simply a short form of the cardinal. I argue that the short root vowel of indefinite *jun* represents an unstressed morphophonemic alternation of the long root vowel of cardinal *juun*.

As a result, I argue that a nominal marked with indefinite *jun* should be syntactically recategorized as numeral phrase (NumP), and not DP. Importantly only nominals marked with the definite determiner are considered DPs in the analysis advanced in this paper. It is assumed that prehead demonstratives are also determiners. Demonstratives are proposed to be a higher projection of DP such that DP is the complement of demonstrative phrase (DemP). Similarly NP is the complement of DP or of NumP. Consequently it is shown that nominals that are not DPs may select for subjects. But nominals that are DPs are not permitted to select for subjects.

K'ichee' NVPs are inflected only with intransitive absolutive AMs, never with transitive ergative AMs. Thus NVPs are morphologically monovalent, single value intransitive constructions. Consequently only the soletary token SUBJ is allowed in the semantic form of the f-structure of the K'ichee' NVP. This suggests that the PREDLINK analysis is not tenable for K'ichee' NVPs. To account for the complement of the intransitive NVP, I propose a grammatical function called function theta (FN_Θ). Function theta is a hybrid argument-adjunct grammatical function that is not syntactically-selected for but is thematically selected for.

For presentation and analysis of data, the architecture of Lexical Functional Grammar (LFG) is used. The projection of constituent structure, based on the standard LFG realization of X-bar Theory, illustrates the K'ichee' data.

[3] The standard argument is that *prefixed* inflectional TAM morphology does not occur on NVPs.
[4] Recall that K'ichee'an verbs do not project a VP, but a non-endocentric S(entence).
[5] Based on an idea from Laczkó (p. c.).

The paper is organized in the following manner. Basic typology is introduced in section 2, followed in section 3 by a presentation of K'ichee' data and their proposed constituent structures. An extended discussion on nominal predicates and on function theta follows in section 4. The paper concludes in section 5.

2 Typology

Excluding periphrastic modals, finite verbs are composed of a single agglutinating constituent. Verbs inflect with obligatory prefixed aspect markers, person- and number-marking absolutive (ABS) and ergative (ERG) AMs, and, when required, suffixed tense-aspect-mood (TAM) and valency-sensitive phrase-final morphology:

(1) x-ee-w-il-o Transitive verb
COM-3PLABS-1SERG-see-TPF
'I saw them.'

(2) k-ix-biin-ik Intransitive verb
INC-2PLABS-walk-IPF
'You all walk.'

Structurally NVPs configure differently from verbs in that they use minimally a non-bound absolutive AM, the non-verbal copula *k'oolik* (if required), and a predicate variable. Let us examine each of the elements of the NVP in turn. The absolutive AM, I argue, is a free morpheme, completely non-bound syntactically, and references the intransitive subject *exclusively*. The predicate variable is either a (possessed) noun or gerund, (participial) adjective, or a locative adverb.[6]

Typologically NVPs fall into two broad groupings. The first is the zero copula group, which includes both adjectival and nominal NVPs.[7] The second is the non-verbal copula group, which—in addition to the obligatory use of the non-verbal copula *k'oolik*—includes the existential, possessive, and locational NVPs.

Zero copula adjectival and nominal predicates Let us consider the first group, the zero copula adjectival and nominal predicates.

Adjectival predicates use non–pre-head, non-attributive adjectives for property attribution (3), (4). Because K'ichee' is structurally a predicate-initial language, predicative adjectives are in clause-initial position when in canonical word order. Many but not all adjectives and some participles require an inflectional suffix when used attributively (cf. Larsen 1988:134–6). Non-attributive, predicative adjectives (3) are not permitted to use the inflectional attributive suffix (ATT) (cf. (6)). The AdvP *sib'alaj* 'very much' in (4) cannot directly modify the predicate adjective *jeb'al*. In fact, no constituent is permitted between the absolutive AM and the predicate adjective. The DP *lee laj jaa* 'the small house' in (3) is the lexical subject of the adjectival predicate. Absolutive AMs are obligatorily to the left of the predicate

[6] Locative adverbs additionally require the non-verbal copula *k'oolik* 'existing, being.'

[7] Although I argue that the perfect tense-aspect and the *-tal* completive passives are also members of the zero copula group, they are not considered in this paper.

variable (4). The absolutive AM does not surface phonetically in (3) because the third person singular absolutive AM is null:

(3) saq-(*a) lee laj jaa
white-ATT DET small house
'The small house is white.'

(4) sib'alaj ee (*sib'alaj) jeb'al
very.much 3PLABS very.much pretty
'They are very pretty.'

Let us consider the second member of the the zero copula group, the nominal predicates. As their name suggests, nominal predicates are formed with nouns or gerunds – but not pronouns. Predicate nominals enable nominals to encode notions of identity (5), and classification (6):

(5) at w-achi'l at
2SABS 1SPOSS-friend 2SPRO
'You are my friend.'

(6) ee utz-*(alaj) tiko-n-el-aab'
3PLABS good-ATT farm-AP-NOML-PL
'They are very good farmers.'

Independent pronouns can also be used with nominal predicates, primarily for emphasis. The clause-final pronoun *at* in (5) is the lexical subject and triggers agreement with the absolutive AM *at*. The predicate nominal in (5) is possessed. The attributive adjective *utzalaj* in (6) directly modifies the predicate nominal.

Stative positional participial adjectives Let us consider the second NVP group, the group that requires the stative positional participle adjective *k'oolik*.

The positionals are a combination verbal and adjectival class that indicate the positions, shapes, or qualities of words. They are unique in the K'ichee'an languages in that they represent a class of lexical roots that have no underived forms, and are associated with no major word class (Dayley 1985, Larsen 1988). K'ichee' has two types of intransitive verbs: the simple (2) and the stative (Mondloch 1978). The stative intransitives, or the positionals, have an active and a stative root. The active root derives verbs, while the stative root derives stative adjectives, which is the stative root's primary derivational stem. The latter – the irregular stative positional participial adjective – is formed by suffixing *-vl* ∼ *-vn* to the monosyllabic CVC root. Only the stative root and its derivations are of concern to us here.

The positional participial adjectives are highly unusual in that they exhibit multiple verb-like properties. They are clause-initial and thus predicative in canonical word order. They use the intransitive verb's phrase-final (IPF) suffix *-ik*. They also derive imperatives, the perfect tense-aspect, and some even derive infinitives. For us, the most important stative positional participial adjective is *k'oolik* 'existing, being,' which, I contend, is both a participal and the non-verbal copula in K'ichee'.

NVPs that use the participial adjective *k'oolik* of group two encode three elements of stage-level predicates: existence (7), possession (8), and location (9). The existential predicate in (7) places a constraint on the subject that it must not be a DP, that is, not marked with the definite determiner. The subject must be either an

NP, or a NumP (an NP marked with indefinite *jun*), and must not be possessed. The only constraint on the possessive predicate in (8) is that its subject be possessed. The subjects of locational predicates are unrestricted in definiteness or possession:

(7)

ojeer	k'oo	jun	q'eq-a	sia	u-bii'	Miix	Miix	Miix
past	existing	NUM	black-ATT	cat	3SPOSS-name	M.		

'Once upon a time there was a black cat, its name was Meesh Meesh Meesh.'

(8)

k'oo	jun	niitz'	w-ochoch	pa	Chuwimeq'ana'
existing	NUM	small	1SPOSS-house	PREP	T.

'I have a small house in Totonicapán.' (lit. 'It existing, my small house in T.')

(9)

lee	nu-wuj	k'oo	p-u-wi'	lee	tz'alam	je le'
DET	1SPOSS-book	existing	PREP-3SPOSS-top	DET	table	over.there

'My books are on the table over there.'

3 C-structure

Let us consider the constituent structure of the NVP in this section. We begin with the core components, the absolutive AM and the predicate nominal, and then discuss negation, the interrogatives, and the left periphery.

Sentence (S) The AdvP *iwiir* 'yesterday' can be used either sentence-initially (10a) or sentence-finally (10b). The AdvP *iwiir* in (10a) cannot directly modify the predicate nominal *q'ab'arelab'*. The AdvP *iwiir* in (10b) cannot be used between the predicate nominal *q'ab'arelab'* and the pronominal subject *oj*:

(10) a.

iwiir	uj	(*iwiir)	q'ab'ar-el-ab'	oj
yesterday	1PLABS	yesterday	drunk-NOML-PL	1PLPRO

'Yesterday we were all drunk.'

b.

uj	q'ab'ar-el-ab'	(*iwiir)	oj	iwiir
1PLABS	drunk-NOML-PL	yesterday	1PLPRO	yesterday

'We were all drunk yesterday.'

It could be inferred from (10a) and (10b) that the absolutive AM, the predicate nominal, and the subject are all located in non-endocentric S. Note however that the attributive adjective in (6) directly modifies the predicate nominal. This suggests that the absolutive AM is probably not an integral part of the predicate constituent.

NVPs normally require absolutive AM inflection to form predicates. Consider, however, the two conjoined 'and' clauses in (11). The absolutive AM of the second conjunct has been gapped, yet it is still interpreted as a first person AM:

(11) in chaaku-n-el in chi'l ø tiko-n-el in
1SABS work-AP-NOML 1SPRO CONJ 1SABS farm-AP-NOML 1SPRO
'I am a worker and (I am a) farmer.'

The sentence-initial absolutive AM *in* 'I' thus takes scope over both predicates. This suggests the inflectional absolutive AM is most likely located in I^0, not S.

The data in (11) is accounted for by the constituent structure shown in Fig. 1.

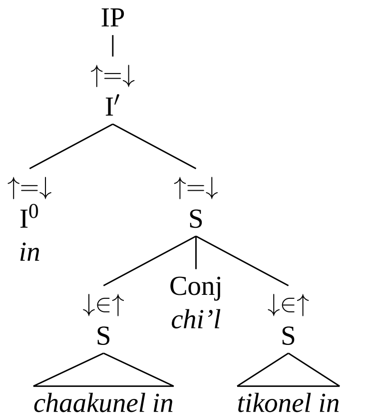

Figure 1 Coordinated nominal NVP

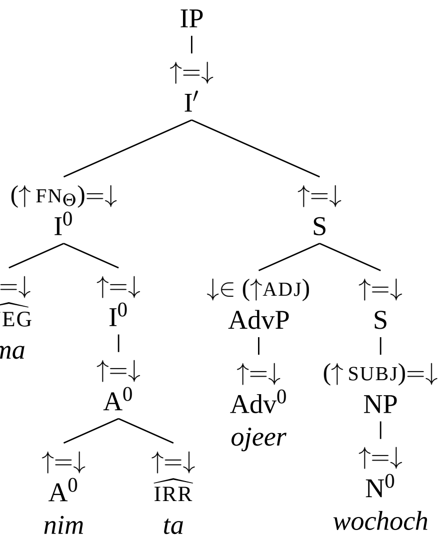

Figure 2 Standard negation

Negation Two types of negation occur in NVPs, standard negation and negative focus (NEGFOC). The negation of the adjective *nim* 'big' in (12) demonstrates standard or sentential negation. Note that the negated adjective *nim* is clearly predicative because the attributive suffix *–a* is not permitted. The AdvP *ojeer* 'in the past' in (12) can be used between the negated predicate adjective and its subject *wochoch*:[8]

(12) ma nim-(*a) taj ojeer w-ochoch
NEG big-ATT IRR past 1SPOSS-house
'My house was not large in the past.'

The subject, I argue, remains in its default location in S because the AdvP *ojeer* adjoins to S. Consequently the negated adjective *nim* must base-generate in I^0, not S. The behaviour of the negated predicate that base-generates in I^0 is the same as in the negation of verbs. I propose the c-structure in Fig. 2 for the data in (12).

The stative participial adjective *k'oolik* may itself undergo negation (13):

[8] The phrase-final suffix *-j* of irrealis (IRR) *taj* is only used when irrealis is phrase-final.

(13) ma k'o ta lee sia waraal
NEG exist IRR DET cat here
'The cat is not here.' (lit. 'It not existing the cat here.')

The subject of a locational *k'oolik* NVP can be negated (14), (15):

(14) man aree ta lee sia k'oo waraal
NEG 3SP IRR DET cat exist here
'It is not the cat that is here.'

(15) ma jun sia taj k'oo waraal
NEG NUM cat IRR exist here
'It is not a cat that is here.'

The subject of a possessive *k'oolik* NVP can be negated. The subject *uleej* in (16) is negated, and the subject's possessor *lee aa Xwaan* is extracted to sentence-initial position. The sentence-initial *lee aa Xwaan* preceeds and is also separated from the negated subject *uleej* by the AdvP *iwiir*. Data (14), (15), and (16) show that negative focus (NEGFOC) can occur in NVPs in addition to standard negation:

(16) lee aa Xwaan iwiir man u-leej taj k'oo-l-ik
DET CL J. today NEG 3SPOSS-tortilla IRR exist-POSL-IPF
'Juan today has no tortillas.' (lit. 'As for Juan, today no his tortilla existing.')

It is ungrammatical, however, to contrastively focus the subject's possessor:

(17) *aree lee aa Xwaan man u-leej taj k'oo-l-ik
3SPRO DET CL J. NEG 3SPOSS-tortilla IRR exist-POSL-IPF
('It is Juan that has no tortillas.' (lit. 'It is Juan no his tortilla it existing.'))

Unlike verbs and zero copula NVPs, the non-verbal copula *k'oolik* does not permit contrastive focus (CONFOC) to cooccur with negative focus (NEGFOC) (17). Zero copula NVPs place no cooccurence restrictions on contrastive and negative focus. I suggest that contrastive fcous and negative focus are located in the specifier of IP.

Interrogatives NVPs can be questioned by interrogative operators, such as *wh*-interrogatives and the *yes-no* interrogative *laa*.

The *wh*-interrogative *jas* 'what' in (18) questions the possessed predicate nominal *aachaak* 'your work.' To begin with, an AdvP can optionally be used sentence-initially. The AdvP *ojeer* 'in the past' in (18) can be used between the clause-initial DP *rii at* 'you' and the interrogative operator *jas* 'what,' and also in (19) between the interrogative operator *jas* and the predicate nominal *aachaak* 'your work':

(18) rii at jas ojeer aa-chaak?
DET 2PRO INT past 2SP-work
'As for you, what was your work?'

(19) rii at ojeer jas aa-chaak?
DET 2PRO past INT 2SPOSS-work
'As for you, what was your work?'

It can be inferred that the possessed predicate nominal is located in its default position in S, because the AdvP *ojeer* in (18) adjoins to S, and the AdvP in (19) adjoins to IP. Thus *wh*-interrogatives are most likely located in the specifier of IP.

Positive polarity (20) and negated predicate adjectives (21) can be questioned:

(20)	ee	jachin	q'enom?
	3PLABS	INT	rich
	'Who are rich?'		

(21)	ee	jachin	ma	q'enom	taj?
	3PLABS	INT	NEG	rich	IRR
	'Who are not rich?'				

Interrogatives always preceed their predicates (20). The subject of the negated predicate adjective in (22) is contrasted. The contrasted obligatorily preceeds the negated. Interrogative focus and contrastive focus are in complementary distribution:

(22)	aree	lee	winaq-ib'	man	ee	q'enom	taj
	3SPRO	DET	person-PL	NEG	3PLABS	rich	IRR
	'It is the people who are not rich.'						

Non-verbal predicates can also be questioned by the *yes-no* interrogative *laa*. The NVP *at tikoneel* 'You are a farmer' in (23) is questioned by the *yes-no* interrogative *laa*. The AdvP *chanim* 'now' in (23a) can be used between the clause-initial DP *rii at* and the *yes-no* interrogative *laa*. An AdvP can also be used between the *yes-no* interrogative *laa* and the absolutive AM *at* 'you' (23b):

(23)	a.	rii	at	chanim	laa	at	tiko-n-eel?
		DET	2SPRO	now	INT	2SABS	farm-AP-NOML
		'As for you, now are you a farmer?'					
	b.	rii	at	laa	chanim	at	tiko-n-eel?
		DET	2SPRO	INT	now	2SABS	farm-AP-NOML
		'As for you, are you now a farmer?'					

Because the absolutive AM is in I^0, it is proposed that the AdvP *chanim* adjoins to IP, and that the *yes-no* interrogative *laa* is a complementizer in the head of CP.[9]

The left periphery and external topics Let us now consider the left periphery. The AdvP *chanim* 'now' in (24) is situated to the left of the absolutive AM, which is in Infl (see Figs. 1, 2). So the AdvP *chanim* must adjoin to IP. Because the DP *lee tijonelab'* in (24) is leftwards of the AdvP, the DP is, I argue, an external topic:

(24)	lee	tijo-n-el-ab'	chanim	ee	k'oo	pa	w-ochoch
	DET	teach-AP-NOML-PL	now	3PLABS	existing	PREP	1SPOSS-house
	'As for the teachers, they are at my place right now.'						

[9] According to Aissen (1992:52, 73), Tz'utujiil's *yes-no* interrogative *la* is located in the head of CP, as is K'ichee's (Duncan 2010).

This proposal gains support in (25), (26). The sentence-initial DP *rii at* 'you' in (25) coindexes the absolutive AM. The sentence-initial DP *rii in* 'I' in (26) binds the possessor of the predicate nominal *w-achi'l* 'my friend':

(25) rii at at w-achi'l
DET 2SPRO 2SA 1SPOSS-friend
'As for you, you are my friend.'

(26) rii in at w-achi'l
DET 1SPRO 2SA 1SPOSS-friend
'As for me, you are my friend.'

It is claimed in Aissen (1999:178 figs.5–6) that the 'external possessor' (EPR) construction is an internal topic located in the specifier of CP.[10] I argue that the analysis above shows Aissen's proposal to be incorrect. Contra Aissen (1999), I suggest that topics in NVPs, including Aissen's EPR construction, are exclusively external topics, and that external topics adjoin to CP. What is noteworthy here is that internal topics are not licensed in K'ichee' NVPs.[11]

The constituent structure in Fig. 3 represents the data in (24).

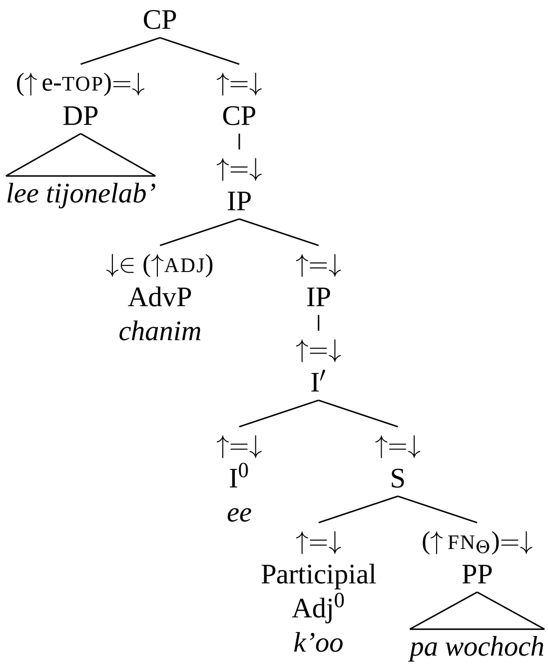

Figure 3 The left periphery and external topics (*lee tijonelab'*)

[10] 'Topic' in Aissen (1992) or 'logical subject' in Aissen (1999).

[11] Aissen's (1992:fn. 39 (iii)) prediction about the cooccurence of external and internal topics in Tz'utujiil is not supported in K'ichee' NVPs.

4 On nominal predicates

In this section, nominal predicates will be considered in greater detail. The morphosyntax of predicate nominals is more complex than that of predicate adjectives, or at least the predicate adjectives examined in this paper.

Cross-linguistic definiteness constraints that operate on the preverbal focus position will be reviewed in this section. It will then be shown how this issue impacts predicate nominals. The negation of nominals will then be discussed, as will the phrase-initial pronominal *are'* as a predicator rather than a 'clefting/focusing particle' as it is often described in the Mayanist literature.

Preverbal focus in Mayan languages Several researchers have noted that the preverbal / pre-predicate focus position imposes constraints on the use of nominals. Specifically, the use of definite nominals is not permitted unmediated in the preverbal focus position. Let us briefly review some relevant literature.

In Tzotzil Mayan, preverbal focus phrases, like *chobtik* 'corn' in (27)[12], may not begin with a definite determiner (Aissen 1992:49–50).

A focused transitive subject or object in Jakaltek Mayan is optionally preceeded by the clefting particle *ha'*. If the focused preverbal argument is a personal pronoun, like *naj* 'he' (28)[13], then the clefting particle *ha'* is obligatory (Aissen 1992:62–3):

(27) pero chobtik tztz'un un
but corn he.plants ENC
'But it was corn he was planting.'

(28) ha' naj x-maq-ni ix
CLEFT he ASP-hit-FOC she
'It's he that hit her.'

The preverbal focus position in Tz'utujiil Mayan is occupied either by an indefinite, a *wh*-interrogative, or a focus (Dayley 1985). Contrastive focus in K'ichee' may not include a definite nominal without using a focussing particle, like *are'* or *xow*, or equivalent, according to Can Pixabaj & England (2011:21, 23) (29)[14,15]:

(29) are ri achi x-ø-war kan-oq
EMPH DET man COM-3SABS-sleep remaining-SS
'It was the man who stayed sleeping (Can Pixabaj & England 2011:21).'

Can Pixabaj and England's (2011:18) domain of definiteness, which includes possessed nouns and proper names, is in principle uncontroversial. I argue, however, that their conventional definition of definiteness is not supported empirically for K'ichee'. For example, the data in (5) include an entirely acceptable possessed predicate nominal. Possessives like 'my' or 'their' are typically categorized in English

[12] Aissen's gloss: Aissen (1992:49) citing Laughlin (1977:334).

[13] Aissen's gloss: Aissen (1992:67) citing Craig (1977:11).

[14] Can Pixabaj and England's (2011) gloss.

[15] The constituent *xow*, its cognates *xuw(i)*, *xew(i)*, and *xaq* 'just, only' are focus adverbs. Consequently, they have no bearing on the specific issue at hand, which is the pronoun *are'*.

grammar as possessive determiners. But in K'ichee', possession is never indicated with determiners but normally with nominal prefixes (e.g. 3sPoss-).

Pronoun *are'* in non-focus contexts Here we consider data that highlights a different use of the pronoun *are'* but one that is without a distinction. In (31), the demonstrative *la'* 'that (one)' and *are'* are used declaratively as an NVP. Their word order cannot be reversed (32). The demonstrative *la'* cannot be an isolate (30). This is because *la'* is a non-projecting word that requires a host, the pronoun *are'*. I suggest that the demonstrative *la'* is the subject of the NVP *aree la'*:

(30) *la'
DEM
('That one')

(31) (*rii) aree la'
DET 3sP DEM
'That one (is it).'

(32) *la' are'
DEM 3sPro
('That one (is it).')

Consider the data in (33), (34). The pronoun *are'* is clause-initial, the nominal *nutz'i'* is a possessed noun, and the demonstrative *la'* head-adjoins either to the pronoun or the possessed nominal. There is no focusing or clefting in these data. The expletive argument *are'* merely provides a placeholder or host for the non-projecting word *la'* 'that' in (33). Nonetheless I argue that the placeholder is predicative, and present crucial evidence for this proposal later in 'Negation of predicate nominals.'

In (33), (34), *aree la'* represents the demonstrative NVP and *nutz'i'* is its subject. Both are daughters of S. The demonstrative *la'* head-adjoins to its host:

(33) aree la' nu-tz'i'
3sPro DEM 1sPoss-dog
'My dog is that one.'

(34) aree nu-tz'i' la'
3sPro 1sPoss-dog DEM
'My dog is that one.'

For comparative purposes, let us consider the adjectives *nim* 'big' (35) and *utz* 'good' (36). They are clearly predicative not attributive adjectives, and thus *in toto* represent adjectival NVPs. The demonstrative *la'* 'that (one)' is the subject of the NVPs. The demonstrative can also be used with the focus adverb *xewi* 'only' (37):

(35) nim-(*a) la'
big DEM
'That one is big.'

(36) utz-(*alaj) la'
good DEM
'That one is good.'

(37) xe(wi) la'
ADV DEM
'Only that, enough.'

In sum, several Mayan languages utilize an identical strategy to bypass the ungrammaticality of definite predicate nominals. That strategy involves the insertion of the third person pronoun *are'* into the clause as a predicate that can host subjects. The subject of the pronominal predicate is the nominal marked with the definite determiner. Let us pursue this analysis as it applies to K'ichee' NVPs.

Definite predicate nominals Possessed nouns in K'ichee' generally use a definite determiner, according to Larsen (1988:fn. 3, 145–146). A possessed noun that is marked as definite would not ordinarily be interpreted as an NVP.

Nevertheless, the (predicate) nominals *ri b'anow sii'* and *ri elaq'anik* in (38) are clearly definite:[16]

(38) a. ri nu-chaak, aree ri b'an-ow sii'
the 1SABS-work FOCUS the do-FOCUS firewood
'My work, it is firewood making (Larsen 1988:412).'

b. ri nu-maak, aree ri elaq'-a-n-ik
the 1SABS-sin FOCUS the steal-THEMATIC-AP-NOML
'My sin, it is stealing (Larsen 1988:412).'

To better understand the structure of Larsen's NVPs in (38), let us review the data in (38b) that I have tested in detail.

The third person pronoun *are'* almost always takes the definite determiner *rii* in clause-initial topic position (*rii are'* 'it') (see (23)). But *are'* is not permitted with *rii* in (39) following the topic *rii numaak*, or clause-initially in (40). The use of the definite determiner *rii* is ungrammatical in these examples because a predicate is not permitted to be marked with a determiner:

(39) rii nu-maak, ojeer (*rii) aree rii elaq'anik
DET 1SPOSS-sin in.the.past DET 3SPRO DET stealing
'As for my sin, in the past it was stealing.'

The AdvP *ojeer* 'in the past' in (39) can be used between *rii numaak* in clause-initial position and the pronoun *are'*. In addition, the AdvP *ojeer* in (40) can be used between the constituents *rii elaq'anik* and *rii numaak*. The DP *rii numaak* in (40) can also be used clause-finally in default subject position. Thus pronominal *are'* heads the focus structure because the (definite) DP *rii elaq'anik* cannot predicate:

(40) (*rii) *(aree) rii elaq'anik ojeer rii nu-maak
(DET) 3SPRO DET stealing past DET 1SPOSS-sin
'It was stealing that was my sin in the past. /My sin in the past was stealing.'

The c-structure in Fig. 4 represents the sentence in (40).[17]

In sum, the fundamental components of the NVP are the predicate and its subject. To state the obvious, the predicate of a NVP cannot be a verb. The NVP's subject is unrestricted: either bare, marked with indefinite *jun*, with the definite determiner, with demonstratives, etc. The nominal predicate, however, is constrained in its level of definiteness. It can be either bare or marked with indefinite *jun*. However the predicate nominal cannot be marked with a definite determiner, cannot

[16] Larsen's gloss. These are the only two examples of definite (predicate) nominals in Dayley (1985), Larsen (1988), or Mondloch (1978, 1981).

[17] Functional categories do not require heads (Bresnan 2001).

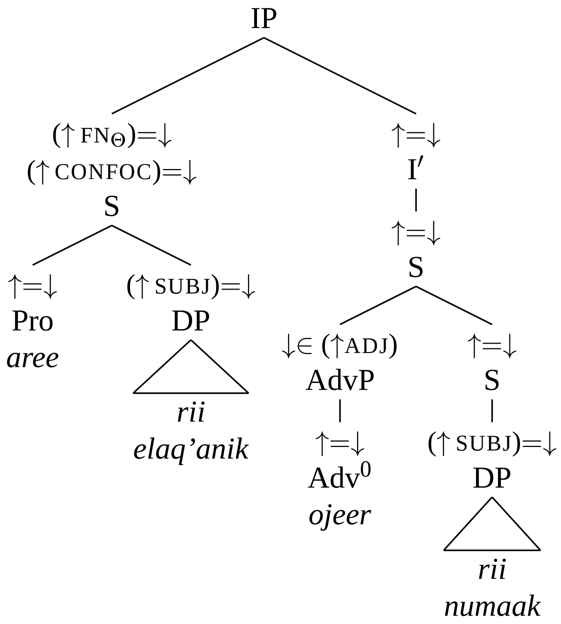

Figure 4 Definite (predicate) nominal in NVP focus phrase

be grammatically definite. The ungrammaticality can be resolved by inserting the third person independant pronoun *are’*, which functions as a dummy element. The pronoun *are’* is licensed to be a predicate that hosts a subject.

Certain data counter the proposal argued for here. In addition to the word categories already discussed, there are word categories, like interrogative adverbs (41) and cardinals (42), that host absolutive AMs:

(41) uj janipa’
1PLABS how.many
‘How many are we altogether?’

(42) rii oj uj jo’ob’
DET 1PLPRO 1PLABS five
‘As for us, we are five.’

However the behaviour of the proposed default predicate, the independent pronoun *are’*, differs from the above data in that independent pronouns in general appear not to be able to host absolutive AMs (43), (44):

(43) *uj ix
1PLABS 2PLPRO
(‘We are you all.’)

(44) *at are’
2SABS 3SPRO
(‘You are him.’)

It is entirely possible that it is not a syntactic but a semantic reason for the ungrammaticality of the data in (43), (44). The fact remains, however, that these data represent an unaccounted-for counter-argument to our proposal.

Bare, indefinite, and definite predicate nominals An NVP usually consists of a bare predicate nominal (45). Predicate nominals can also be marked with indefinite *jun* (46), although that is ambiguous because *jun* can also translate as a cardinal:

(45) in ajchaak
1SABS worker
' I am a worker.'

(46) in jun ajchaak
1SABS NUM worker
' I am a/one worker.'

A predicate nominal marked with a definite determiner as in (47), however, is not permitted. How, then, is a predicate nominal marked with the definite determiner expressed in K'ichee'?

(47) *in lee ajchaak
1SABS DET worker
('I am the worker.')

Negation of predicate nominals Although the grammar of definite predicate nominals discussed above might seem an outlier, it nonetheless can be reproduced with the negation of definite nouns. The negation of definite NVPs follows directly from my analysis of nominal predicates. The difference grammatically between nominals marked with a definite determiner and without a definite determiner can be captured by a generalization that distinguishes DPs from non-DPs.

The bare nominal *tz'i'* 'dog' in (48) can be negated using standard methods of negation. The same applies in (49) to *tz'i'* marked with indefinite *jun*:

(48) ma tz'i' taj
NEG dog IRR
'(It is) not a dog/not dogs.'

(49) ma jun tz'i' taj
NEG NUM dog IRR
'(It is) not a/one dog'

However a nominal marked with the definite determiner as in (50) cannot be negated in the same way as non-definite nominals are negated. To resolve this, the third person pronoun *are'* is inserted into the clause and undergoes negation itself (51). The nominal marked with the definite determiner is not negated:

(50) *man lee achii' taj
NEG DET man IRR
('He is not the man.')

(51) man aree ta lee achii'
NEG 3SPRO IRR DET man
'He is not the man.'

In sum, nominals marked with the definite determiner cannot be negated. If negation is the desired outcome, the clause requires the insertion of the pronoun *are'*. Bare nominals and nominals marked with indefinite *jun* do not require the pronoun *are'*.

The importance of the negation data is that it mirrors exactly, only in negative polarity, what occurs to predicate nominals marked with definite determiners. Further the negation data in its totality crucially demonstrate that the nominal marked with the definite determiner is not a predicate. Instead it is the inserted pronoun that is the predicate. This is why I have analysed the pronoun *are'* as a predicator.

Indefinite determiner *jun* reconsidered It has been shown above that the grammar responds to nominals marked with the definite determiner differently than to nominals not so marked. The question remains how to account for these different responses by the grammar. I suggest that these can be accounted for quite straightforwardly with a reevaluation of the status of the indefinite determiner *jun* 'a.'

Dayley (1985:159, 254) claims that in Tz'utujiil the indefinite determiner *jun* 'a' is just a short form of the indefinite pronoun and number *juun* 'one.' Pursuing Dayley's suggestion, I propose that the indefinite determiner *jun* 'a' is a morphophonemic alternation of the cardinal *juun* 'one.'[18] I suggest, following Dryer (2011:38), that the alternation is a function of stress, with indefinite *jun* unstressed and cardinal *juun* stressed.[19]

There are a number of empirical facts that support this proposal. Verbs in Tz'utujiil that are in phrase- or clause-final position or that are followed by nominals marked with the definite determiner require the verb's phrase-final suffix (Dayley 1985:82). Elsewhere the phrase-final suffix is never required on verbs. NVPs with a bare predicate nominal, or else, marked with indefinite *jun* are usually interpreted as indefinite. This suggests that indefinite *jun* is considered optional, unlike determiners, which are usually obligatory. Almost all topics in K'ichee' use the definite determiner, even possessed nominals, personal pronouns, and proper names, even though it is generally accepted that they are already definite, albeit inherently.

In addition, nominals in K'ichee'an allow definite and indefinite determiners to co-occur. The definite determiner *lee* in (52) can preceed indefinite *jun*, but not the reverse (53). Nor can the noun be marked or interpreted as a plural (54):

(52) lee jun ak'al
DET NUM child
'The child.'

(53) *jun lee ak'al
NUM DET child
('The child.')

(54) *lee jun ak'al-aab'
DET NUM child-PL
('The children.')

There has yet to be a convincing explanation for or even any agreement about the double-determiner construction and its meaning in the literature (cf. Dayley 1985:255, Larsen 1988:312–3). I suggest that the construction can be accounted for grammatically, even semantically, if the so-called indefinite determiner *jun* is reinterpreted as a cardinal. Determiners are used to fix a nominal's reference in a particular context. There is no reason why indefinite *jun* cannot fulfil the same function but not as a member of the determiner category. The indefinite determiner *jun* could then be reconfigured as a distinct projection called number phrase (NumP).

[18] Tibor Laczkó (p. c.) suggests reanalyzing indefinite determiners as numbers and then assume that they are NPs, thus differentiating them explicitly from DPs. I adopt this approach in this paper.

[19] Although vowel length is phonemic in Tz'utujiil and K'ichee', their vocalic morphophonemics are notoriously complex with sentential and phrasal stress playing an important role.

Numbers are formally nouns in K'ichee'an because they can be possessed to form ordinals (Dayley 1985:159, Larsen 1988:148 fn. 10), yet classifying a nominal as an adjective seems misguided. Adjectives are assumed to adjoin to the nominal phrase as adjective phrases (AP). Whatever the nomenclature the phrase would not be interpreted as a phrase marked with a determiner, that is, not as a DP. The DP's structure assumes the definite determiner as the DP's head. The demonstrative (demonstrative phrase, DemP) forms a higher projection of DP, which is its co-head. I assume that demonstratives are determiners in K'ichee'.

I propose the c-structure in Fig. 5 for the DP *lee jun saqa ch'iich'* 'the white car.' I propose in Fig. 6 a generic nominal c-structure.

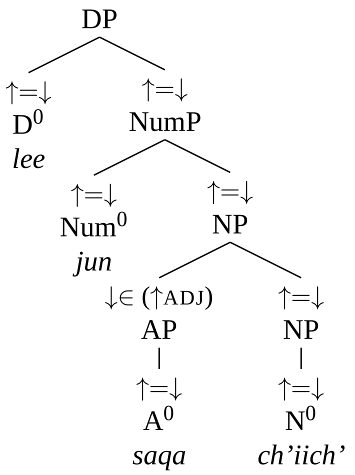

Figure 5 Determiner & number phrases

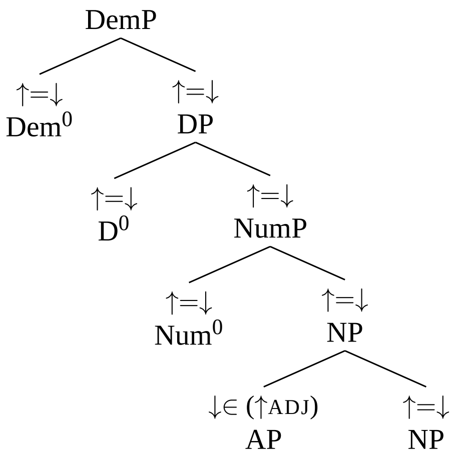

Figure 6 DemP, DP > NumP, AP, NP

Analysis In review, what is crucial for the obligatory epenthesis of the pronoun *are'* is that the definite determiner must be present. It is not the inherent definiteness of the predicate nominal itself that requires the use of the pronoun *are'* or equivalent. Rather it is the presence of the definite determiner that obligates the deployment of the pronoun *are'*. It is the very fact that the determiner node is filled that triggers the insertion of the pronoun *are'* as predicate.

I argue against the often reported interpretation of the pronoun *are'* as a 'focussing/clefting particle.' The constituent *are'* is the third person independent pronoun, which inflects only for number. The pronoun bears no causal relationship whatsoever to focusing or clefting. The grammatical functions of the pronoun are derived from its clausal, syntactic, or discourse configurational status, not from any inherent lexical qualities that it might possibly have. It is the inherent minimization or bleaching of properties that allow the third person singular pronominal to act as a form of impersonal or quasi-argument. Recall that the third person singular absolutive AM is null. The function of the phrase-initial pronoun *are'* in the data structures examined in this paper is, I suggest, predicative. This predicative property is the result of its specific location in the clause, licensed by phrase-structure rules.

The pronoun itself is simply a 'dummy' or an expletive element like the 'it' subjects in English weather verbs.[20] The pronoun's insertion into various clausal structures represents a grammatical strategy that the language resorts to whenever necessary, sometimes for stylistic reasons, or when all else has failed.

Consider that the pronoun *are'* can also be used in nominal predicates in the absence of a nominal marked with the definite determiner. But in these cases the insertion of the pronoun *are'* is not obligatory.

In the end, nominals marked with definite determiners are not permitted to be predicates. To resolve the ungrammatically, the grammar epenthesizes an expletive pronominal element so that the clause has a legitimate, licensed predicate that can be operated on, by negation for example. And the nominal marked with the definite determiner is selected for as the subject of the inserted (predicate) pronoun *are'*.

Lexical entries of predicates The lexical entries of the predicates discussed above are outlined in this section. Predicate adjectives are zero copula and are not able to be directly modified. In this way, they are archetypal heads that select for subjects (55). Adjectives can also be attributive and thus obligatorily prehead. In that case, many adjectives require the inflectional attributive suffix *-a* (56):

(55) *nim* A, $(\uparrow \textsc{pred}) = \text{`big}\langle\uparrow \textsc{subj}\rangle\text{'}$
$(\uparrow \textsc{num})$

(56) *-a* $\text{Aff}_{\textsc{att}}$ $(\uparrow \textsc{pred}) = \text{`big'}$
$(\uparrow \textsc{num})$

Not all adjectives require an attributive suffix when used attributively:[21]

(57) *niitz'* A, $\{\ (\uparrow \textsc{pred}) = \text{`small}\langle\uparrow \textsc{subj}\rangle\text{'}\ \mid\ (\uparrow \textsc{pred}) = \text{`small'}\ \}$

Let us consider the stative positional participial adjective *k'oolik*, which, as an adjective, can select for a subject (58). The participial adjective *k'oolik* can also function attributively, and in doing so requires the attributive suffix *-ik* (59):

(58) *k'oolik* A, $(\uparrow \textsc{pred}) = \text{`exist}\langle\uparrow \textsc{subj}\rangle\text{'}$
$\neg(\uparrow \textsc{num})$

(59) *-ik* $\text{Aff}_{\textsc{att}}$ $(\uparrow \textsc{pred}) = \text{`exist'}$
$\neg(\uparrow \textsc{num})$

Let us now consider lexical entries for nominals and nominal predicates. The LE for non-definite nominals includes bare and adjective modified nominals (NP) and nominals marked with indefinite *jun* (NumP) (60). The LE for nominals marked with the definite determiner excludes predication (61):[22]

[20] The expletive pronominal 'it' (*are'*) is predicative in K'ichee', not English.
[21] Most K'ichee' adjectives do not show number agreement, either attributively or predicatively.
[22] K'ichee' nouns do not mark for number, except for human and a few non-human animates.

(60) *ajchaak* N, $(\uparrow \text{PRED}) = \text{'writer}\langle\uparrow \text{SUBJ}\rangle\text{'}$
$\neg(\uparrow \text{DEF})$
$(\uparrow \text{NUM})$
$@(\text{CAT} \uparrow \neg\text{DP})$

(61) *ajchaak* N, $(\uparrow \text{PRED}) = \text{'writer'}$
$(\uparrow \text{DEF})$
$(\uparrow \text{NUM})$
$@(\text{CAT} \uparrow \text{DP})$

Phrase-structure rules Dalrymple et al. (2004) provide phrase-structure rules with phrase-structure annotations and virtual copula ε to account for copula and NVPs. The phrase-structure rule is ammended accordingly in Fig. 7 for K'ichee':

$$\text{S} \rightarrow \underset{(\uparrow \text{SUBJ})=\downarrow}{\text{DP}} \quad \underset{(\uparrow \text{FN}_\Theta)=\downarrow}{\neg\{\text{AP} \mid \text{AdvP}\}} \quad \underset{\uparrow=\downarrow}{\{\text{NumP} \mid \text{NP}\}} \quad \vee \quad \underset{\uparrow=\downarrow}{(\text{Part})\ \text{A}}$$

$$\vee \quad \begin{array}{l} \varepsilon \\ (\uparrow \text{PRED}) = \text{'ø-be}\langle\uparrow \text{SUBJ}\rangle\text{'} \ \{\text{FN}_\Theta\} \\ (\uparrow \text{ASP}) = \text{STATIVE} \\ (\uparrow \text{FN}_\Theta\ \text{PRED}) = \text{'}\textit{are}\text{'}\langle\uparrow \text{SUBJ}\rangle\text{'} \\ (\uparrow \text{FN}_\Theta\ \text{SUBJ}) = \text{DEF} \end{array}$$

Figure 7 Phrase-structure rules for K'ichee' NVPs

PREDLINK The copula's f-structure in Butt et al. (1999) subcategorizes for two grammatical functions, SUBJ and PREDLINK. Largely undefined, PREDLINK remains somewhat of a mystery. Nonetheless PREDLINK appears to be, in essence, a rebranded OBJect. The copula in Butt et al. (1999) thus represents, I argue, a bivalent transitive. Because K'ichee NVPs host absolutive AMs, K'ichee' NVPs are monovalent intransitives requiring a SUBJ-only argument list in the f-structure's semantic form. PREDLINK is thus not licensed in K'ichee' NVPs.

Function theta (FN_Θ) I propose instead an intermediate argument–adjunct category called Function Theta (FN_Θ). Function theta is not listed as a grammatical function in the semantic form of f-structure but is listed as a thematic role in a-structure. It represents a thematic role because it is obligatory, unlike a semantic role.[23] It thus represents a grammatical function that is thematically-selected for, but is not syntactically-selected for. Function theta thus identifies a previously unrecognized grammatical space that is revealed in a two-feature, four-way binary feature array. Because function theta is not included in the semantic form's specified argument list, it is not syntactically subcategorized for. Thus f-structure's completeness requirement is satisfied. Coherence is also satisfied because function theta is an adjunct, and thus does not show up in the semantic form's specified argument list. Function theta also satisfies the extended coherency condition (Bresnan and Mchombo 1987) because it is in an f-structure that contains PREDs. The properties of function theta thus follow from first principles.

[23] Function theta is completely distinct from Rákosi's (2006) optional Adjunct Theta (ADJ_Θ).

Because the binary argument–non-argument distinction (Bresnan 1982) is axiomatic in the strategic design of LFG, expanding the inventory of grammatical functions should not be undertaken lightly. Notwithstanding this, I maintain that the grammatical function function theta is well-founded and empirically motivated.[24]

The binary feature array consists of the four listed grammatical functions:

- arguments: [+syntactic, +thematic]
- non-arguments: [−syntactic, −thematic]
- expletive subjects & objects of raising verbs: [+syntactic, −thematic]
- FN_{Θ}: [−syntactic, +thematic]

The binary feature array is presented schematically in Fig. 8.

		SYNTACTIC	
		+	−
THEMATIC	−	RAISING GF	ADJUNCT
		Juan seems happy.	*Maria laughed loudly.*
		‘seem⟨XCOMP⟩SUBJ’	PRED ‘laugh⟨SUBJ⟩’
			ADJ {‘loudly’}
		$\lambda P.\text{seem}(P)$	$\lambda x.\text{laugh}(x)$
	+	SUBCATEGORIZED GF	FUNCTION THETA (FN_{Θ})
		Juan kissed Maria.	*My sin, it is stealing.*
		‘kissed⟨SUBJ, OBJ⟩’	PRED ‘ø-be⟨SUBJ⟩’
			FN_{Θ} ‘It is stealing.’
		$\lambda y.\lambda x.\text{kissed}(x,y)$	

Figure 8 Function theta (FN_{Θ}) in binary feature array

5 Conclusion

In this paper, the most important types of non-verbal predicates (NVP) of K’ichee’ Mayan have been described. The core types of NVPs are presented and constituent structures are proposed. The grammatical function function theta (FN_{Θ}) has been introduced to account for complements of monovalent intransitive NVPs.

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[24]The notation {FN_{Θ}} right-adjacent to the f-structure’s semantic form licenses function theta in that particular f-structure or phrase-structure rule.

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PARTIAL CONTROL AND ANAPHORIC CONTROL IN LFG

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Abstract

In this paper I discuss the phenomenon of partial control, which has been widely discussed in the derivational literature but almost completely ignored in LFG. I argue that it requires a treatment in terms of 'quasi-obligatory' anaphoric control, a type of control that is implicit in some earlier LFG work but has never been properly formalized. Quasi-obligatory anaphoric control does not involve syntactic specification of the controller but rather a semantic constraint that requires the controller to be a logocenter of the matrix predicate, combined with normal (pragmatic) resolution of anaphora.

1 Introduction

'Partial control' is a phenomenon that has attracted much attention in the derivational and recently also the semantic literature, cf. Landau (2000, 2004) and related work for syntactic and Grano (2012); Pearson (2013) for semantic analyses. The basic phenomenon, apparently first noticed by Lawler (1976), is that in some cases, there is only an indirect referential relationship between the controller and the controllee in a control construction. One of Lawler's original examples is (1).

(1) Mary wants to bomb Hanoi.

(1) has a natural reading where Mary wants *her country's air force* to bomb Hanoi, not herself. Lawler's example is unusual in that there is not even an inclusion relation between the controller and the controllee.[1] In the normal case of indirect referential relation between controller and controllee, the controllee denotes a plurality that includes the controller. Some predicates allow this construction and others do not. The difference appears for example when we embed a collective predicate, requiring a semantically plural subject, under a control verb with a semantically singular subject, as in (2).

(2) a. The chair$_i$ wanted to gather$_{i+}$ at six.
b. The chair$_i$ preferred to gather$_{i+}$ at six.
c. The chair$_i$ agreed to gather$_{i+}$ at six.

(3) a. *The chair tried to gather at six.
b. *The chair began to gather at six.
c. *The chair managed to gather at six.

The subscript $i+$ indicates that the subject of the infinitive is to be interpreted as a plurality containing the controller i. Following Landau we refer to this as partial control (PC). The verbs in (3) exhibit exhaustive control (EC).

† Thanks to Mary Dalrymple and John Lowe for comments on this paper.

[1] Or maybe there is. One informant reports that (1) is more naturally paraphrased as *Mary wants her country to bomb Hanoi.* This would give a regular inclusion relation but with a metonymic interpretation of the controllee position. See also footnote 3.

In the derivational literature, the PC/EC distinction has been brought to bear on the issue of whether control should be accounted for in terms of PRO (as argued by Landau in the above cited works) or movement (as in the movement theory of control (MTC), see Hornstein and Polinsky (2010); Boeckx et al. (2010)). In the LFG literature, with the exception of Asudeh (2005), PC has not been discussed. But insofar as the PRO/MTC distinction in derivational theories is isomorphic to the distinction between anaphoric and functional control in LFG, it would seem to bear on similar, important theoretical questions. In particular, PC suggests that the LFG theory of control as it stands is not sufficiently fine-grained: as we will see, the PC reading is looser than we would predict on an analysis as functional control or obligatory anaphoric control, but it is also stricter than an arbitrary anaphoric control analysis would lead us to expect.

2 The phenomenology of partial control

2.1 PC is obligatory control

The derivational literature has often focused on whether PC is obligatory or non-obligatory control. The notion of obligatory control in derivational grammar is not an entirely well-defined one, but it is clear that PC predicates pattern with prototypical obligatory control predicates such as *try* on a number of tests.

2.1.1 No arbitrary control

PC predicates do not allow the controller to be arbitrary/generic, as shown in (4).

(4) *John tried to be$_{arb}$ quiet. (Landau, 2000, p. 34)

(5) *John expected to be$_{arb}$ quiet together. (Pearson, 2013, p. 305)

This contrasts with e.g. subject gerunds, which *can* have arbitrary control:

(6) Amy$_i$ told Tom$_j$ that dancing$_{i/j/arb}$ with Dan might be fun.
(Culicover and Jackendoff, 2005, p. 422)

2.1.2 No long-distance antecedents

The controller must be in the clause directly governing the infinitive in both PC and EC cases.

(7) *Mary$_i$ knew that John tried [to perjure$_i$ herself$_i$].
adapted from Landau (2000, p. 34)

(8) *Mary$_i$ knew that John expected [to be$_{i+}$ found guilty as a group].
(Pearson, 2013, p. 306)

This is not the case with subject gerunds, as shown by the indexations i/j in (6).

2.1.3 Only sloppy readings of PRO in OC

It is a hallmark of obligatory control that we only get sloppy readings under ellipsis, i.e. (9) can only have a reading where Bill tried for Bill to leave early.

(9) John tried [to leave early], and Bill did too.

We find the same pattern in partial control, as shown in (10).

(10) Obama expected [to succeed as a party], and McCain did too. (Pearson, 2013, p. 306).

On the other hand, non-obligatory PRO constructions give rise to an ambiguity between strict and sloppy readings, as shown in (11).

(11) John thinks that getting his résumé in order is crucial and Bill does too. (Hornstein, 2003, p. 13)

(11) can mean that Bill thinks it is crucial that John gets his résumé in order, or that Bill thinks it is crucial that he himself gets his résumé in order.

2.1.4 Only *de se* readings of PRO in OC

In the semantics literature, much attention has been paid to the fact that PRO is infelicitous in 'mistaken-identity' scenarios, typically involving attitude reports where the attitude holder is unaware that the attitude involves herself. Typical examples, adapted from Pearson (2013, 318–319), are given in (12) (EC) and (13) (PC).

(12) John is an amnesiac. He is watching footage of an Olympic event in which he competed, although he has forgotten this fact, and does not even recognise himself on the screen. Bill asks him 'Who won the medal?' John points at himself on the screen and says 'He did'.

a. #John claimed to have won the medal.
b. John claimed that he had won the medal.

(13) The same scenario in a team sport like figure skating. John says 'I think that team is going to win the medal, look how well they work together.'

a. #John expects to win the medal by working well together.
b. John$_i$ expects that they$_{i+}$ will win the medal by working well together.

This means that PRO is a perspective-sensitive item, whose reference is dependent on whose point of view is taken, i.e. it is a logophor in the sense of Hagège (1974); Clements (1975); Sells (1987). However, PRO is only a logophor in obligatory control contexts. If in the scenario in (12), John points to himself and says 'He won. But it looks boring', it seems we can report this truthfully as in (14).

(14) John$_i$ thinks that getting$_i$ a medal looks boring.

adapted from Hornstein (2003, p. 13)

This is a *de re* reading, since John is not aware of his identity.

2.1.5 Conclusion

In conclusion, PC seems to form a natural class with EC according to the tests above. But notice that there are other properties sometimes taken to define obligatory control but which cross-cut the PC/EC division, such as the possibility of *for*-complements. In any case, it is not clear that obligatory control in derivational syntax corresponds one-to-one to a concept in LFG, so for us the properties illustrated in sections 2.1.1–2.1.4 are not criteria determining a specific analysis but properties of the PC construction that our analysis should account for.

2.2 Semantic versus syntactic plurality

It has been observed that the controllee in PC is only semantically plural, while it remains syntactically singular and fails to license a plural anaphor in (15-b).

(15) a. John told Mary$_i$ that he preferred to meet$_{i+}$ at 6 today.
b. *John told Mary that he$_i$ preferred to meet$_{i+}$ each other at 6 today.

The idea that plural anaphors require syntactic and not just semantic plurality is borne out by the behaviour of group nouns in American and British English, as reported in Pearson (2013). Group nouns are by definition semantically plural, but it is only in British English that they are syntactically plural in the sense of licensing plural agreement on the verb (16), or a plural anaphor (17).[2]

(16) The committee hope that you will accept the job. Pearson (2011, p. 161)

(17) The committee met each other in the hall. Pearson (2013, p. 309)

In American English, by contrast, group nouns are syntactically singular, so that only singular agreement is acceptable, and group nouns also cannot bind plural anaphors. In a similar way, the failure of the PC controllee in (15) to bind a plural anaphor can be explained if the plurality in (15) is semantic only.

This contrasts with the behaviour of split control, which is otherwise in many respects similar to partial control, cf. (18)–(19), adapted from Landau (2000, p. 53). The a. examples display partial control (indexed with $i+$) and the b. examples display split control (indexed with $i + j$).

(18) a. John told Mary that he$_i$ preferred to meet$_{i+}$ (*each other) at 6 today.
b. John$_i$ proposed to Mary$_j$ to meet$_{i+j}$ each other at 6.

[2]The data is actually more complex, cf. Hristov (2012), but we cannot go into details here.

(19) a. John$_i$ told Mary$_j$ that he$_i$ wondered whether to get$_{i(+)}$ (*themselves) a new car.
b. John$_i$ asked Mary$_j$ whether to get$_{i+j}$ themselves a new car.

The intuition here is that the assignment of a controller in (18-a) and (19-a) is limited to the governing clause, so only he_i is the controller. In (18-a), the embedded verb requires a plural antecedent, so the controllee position is coerced semantically to a plural reading. In the given context, this is most naturally interpreted as *John* + *Mary*, but this reinterpretation does not give *Mary* the status of a controller. In (18-b) and (19-b), by contrast, both *John* and *Mary* are (split) controllers, and the controllee is therefore syntactically plural and licenses a plural anaphor.

This does not mean that PC precludes split control. Since PC does not allow remote controllers, as we saw in section 2.1.2, split control is ruled out in (18-a) and (19-a). In (18-b) and (19-b), on the other hand, there are two possible *local* controllers. So the syntactic number facts follow from the locality constraint on controllers: only local antecedents are strictly speaking controllers and therefore antecedents for number agreement (in the way to be described in section 4.1); non-local antecedents merely act to faciliate the semantic reinterpretation of the controllee as a plurality including the controller.

2.3 The anaphoric nature of partial control

PC is a marked option which requires contextual support. It is much improved if the context offers a saliency plurality that contains the syntactic controller and is a suitable semantic subject for the embedded infinitive. For example, we saw in (18)–(19) that *John* + *Mary* is a suitable salient plurality. Similarly, in (2), the subject noun *chair* primes a group or committee that the chair is the head of.

The marked nature of partial control is corroborated by the questionnaire study reported (without much detail, unfortunately) in Pearson (2013), where speakers were asked to rate sentences for grammaticality on a scale from 1 (unacceptable) to 6 (perfect). The mean rating for partial control sentences was 3.56.

This suggests that PC is not a straightforward semnatic phenomenon but involves some pragmatic reinterpretation. It is in many respects similar to ‘bridging’ (Clark, 1975; Asher and Lascarides, 1998): when the discourse context does not provide a suitable antecedent for an anaphoric expression, the anaphor is resolved to an inferred expression instead, as in (20).

(20) The chair despaired. The committee was already late with its report.

We easily understand *the committee* as *the chair’s committee*, in a similar way to how we understand the controlled position in (2). Conversely, PC is distinctly odd if we try to force the interpretation of the controllee as a new discourse referent:

(21) John is lonely. #He wants to have lunch together.

It seems possible to interpret (21) as 'he wants to have lunch with me', but not as 'he wants to have lunch with someone', which introduces a new discourse referent.

It is well known that bridging is more constrained with pronouns than with definite descriptions, cf. the contrast in (22).

(22) We cannot use John's car.
  a. The tires are flat.
  b. #All four of them are flat. from Nouwen (2003, p. 73)

Nevertheless, it is clear that pronouns can in some cases take inferred antecedents when the contextual support is strong enough.

(23) John kept on staring at the newly-wed couple. *She* resembled a childhood sweetheart of his. from Nouwen (2003, p. 73)

(24) The priest was tortured for days. *They* wanted him to reveal where the insurgents were hiding out.

(25) The restaurant went bust when the liquor license *they* applied for was refused.

It seems possible, therefore, to capture the anaphoric nature of PC by assimilating control in these structures to pronominal anaphora with a locality constraint.

An anaphoric account sits well with the generally marked nature of PC, since as we just saw, bridging is a marked option for the anaphoric resolution of pronominal anaphora. Moreover, an account in terms of anaphoric resolution predicts that the semantics of both the governing and the embedded clause can influence the control behavior. This is borne out, for as observed by Borkin (1972, p. 384), PC is not an option in (26).

(26) Mary badly/desperately wants to bomb Hanoi.

Here it seems that the intensifier modifies the meaning of the matrix predicate in such a way as to rule out bridging relations that imply no personal participation in the event described by the control infinitive.[3]

However, while the acceptability of PC is not perfect, and highly contingent

[3]The issue is in fact complicated by examples such as (i), which seems fine on a PC reading.

(i) Nixon badly wants to bomb Hanoi.

However, similar readings are possible even with strictly EC predicates such as *try* in (ii), suggesting these examples involve metonymy.

(ii) Nixon tried to bomb Hanoi.

One informant finds PC acceptable in (26), and even better in (currently) more realistic scenarios such as *I badly want to leave the EU*. On the present account, there is no reason to expect categorical intersubjective judgments on such constraints.

Class	Examples
Factives	glad, sad, regret, like, dislike, hate, loath, surprised, shocked, sorry
Propositional	believe, think, suppose, imagine, say, claim, assert, affirm, declare, deny
Desideratives	want, prefer, yearn, arrange, hope, afraid, refuse, agree, plan, aspire, decide, mean, intend, resolve, strive, demand, promise choose, offer, eager, ready
Interrogatives	wonder, ask, find out, interrogate, inquire, contemplate, deliberate, guess, grasp, understand, know, unclear

Table 1: PC Verbs according to Landau

Class	Examples
Implicatives	dare, manage, make sure, bother, remember, get, see fit, condescend, avoid, forget, fail, refrain, decline, neglect, force, compel
Aspectual	begin, start, continue, finish, stop, resume
Modal	have, need, may, should, is able, must

Table 2: EC Verbs according to Landau

on semantics and contextual support, the contrast with EC verbs is clear, cf. (2)–(3). We cannot undertake an empirical investigation of the behaviour of different control verbs here, but Tables 1–2 show Landau's classification of predicates that take a control complement (either an infinitive or a gerund). Notice that *try* is lacking from the classification but clearly behaves like an EC verb. *Believe* is included, although its status as a control verb is controversial.

3 Against a functional control analysis

A functional control analysis equates the controller and the controllee at the level of f-structure. However, the defining feature of PC is that the two positions are *not* equal in the semantics. Consequently, a functional control analysis requires some footwork at the syntax-semantics interface. The problem is that it is hard to do this in a way that adequately captures the anaphoric nature of PC.

Asudeh (2005) provides the meaning constructors in (27) in his analysis of PC as functional control. For comparison, (28) provides his analysis of EC.

(27) $\lambda x.\lambda P.\exists y.x \sqsubseteq y \wedge \mathit{want}(x, P(y))$:
$(\uparrow \textsc{subj})_\sigma \multimap [(\uparrow \textsc{xcomp subj})_\sigma \multimap (\uparrow \textsc{xcomp})_\sigma] \multimap \uparrow_\sigma$

(28) $\lambda x.\lambda P.try(x, P(x))$:
$(\uparrow \textsc{subj})_\sigma \multimap [(\uparrow \textsc{xcomp subj})_\sigma \multimap (\uparrow \textsc{xcomp})_\sigma] \multimap \uparrow_\sigma$

The idea here is that PC verbs explicitly introduce a variable y denoting an improper superset of the controller x. y can be identical to x, or a plurality containing x. This is a very weak semantics, merely requiring there to exist some plurality including x to which the property P can be applied. No justice is done to the fact that the existence of this plurality must be supported by the discourse context.

Another problem is that in (27) the semantic representation of the controllee is introduced in the lexical entry of the control verb. Therefore, its scope must be fixed by that entry. This gives the wrong result in quantified contexts:

(29) Everybody wanted to have lunch together.

This has a strong preference for the collective rather than the distributive reading where for each x there is a plurality y such that x wants y to have lunch together. However, since the quantifier corresponding to the controllee subject is introduced in the lexical entry of *want*, there is no way *everybody* can scope under it. That is, we only derive the meaning in (30), which does not predict the strong preference for the collective reading of (29).

(30) $\forall x.\exists y.x \sqsubseteq y \wedge \mathit{want}(x, \mathit{have\_lunch\_together}(y))$

Another scope problem arises once we take into account that PC predicates like *want* are generally intensional verbs. To see this, we follow the analysis in Pearson (2013) which is very close in spirit to Asudeh's analysis (and would fit a functional control analysis in LFG), but also takes account of intensionality.

If we simplify Pearson's analysis by ignoring tense and the obligatory *de se* reading, which are of no immediate concern here, her analysis amounts to a traditional analysis of propositional attitude verbs as quantifiers over possible worlds. Let us write $\mathbf{boul}_x$ for the set of possible worlds compatible with with x's desires (in the actual world). We can then recast (27) as (31).

(31) $\lambda x.\lambda P.\forall w.w \in \mathbf{boul}_x \rightarrow \exists y.x \sqsubseteq y \wedge P(y)(w)$
'In all worlds compatible with x's (actual) preferences, there is a y such that x is a (possibly improper) part of y and $P(y)$ holds.'

Again, the problem is that the lexical entry of the control verb fixes the scope of the controllee. In (31), the scope of the controllee is inside the reported attitude, but this wrongly predicts that (21) is good. We could conceivably fix this by requiring the controllee to outscope the attitude, but this would give the wrong results in intensional contexts such as (32).

(32) John is looking for a group of elves. He wants to have lunch together.

On the most natural reading of (32), the second sentence elaborates on John's desires and so the controlled subject must scope under the attitude. This is the opposite of what we see in (21), showing that the relative scope of the attitude and the controlled subject cannot be fixed in the lexical entry of the control verb.

4 An anaphoric control analysis

In this section, we prepare the ground for an analysis of PC in terms of anaphoric control. In section 4.1 we discuss the fact that the controllee is syntactically singular, which Asudeh (2005) argued was incompatible with anaphoric control, and propose an analysis in terms of anaphor-antecedent agreement. In section 4.2 we consider the various flavours of anaphoric control that are available in the LFG literature. As it turns out, none of the formalized versions of anaphoric control are adequate for PC, but there are hints in the literature of an intuitive notion of 'quasi-obligatory' anaphoric control which, if properly developed, could account for PC.

4.1 The syntactic number feature

Under the functional control analysis, the controllee and the controller are identical and hence share all syntactic features. This is a welcome result since, as we have seen, the controllee position is syntactically singular even if it is semantically plural. In functional control, then, this would follow automatically from the sharing of features. In anaphoric control the mechanism is less obvious.

However, it is clear that anaphoric control generally involves agreement in number and gender with the controller in languages where number and gender are agreement features. This is shown in for Icelandic in (33).

(33) **Ólafi** finnst gott að PRO vera
Olaf.DAT.MASC.SG finds good to NOM.MASC.SG be
ríkur
rich.NOM.MASC.SG
'Olaf finds it nice to be rich.'

This must be anaphoric control (Andrews, 1982, 1990), since the CASE feature is not shared: but NUMBER and GENDER *are* shared.

In PC, the issue is slightly more complicated however, since one could expect that the inherent semantic features of the referent would override features from antecedent agreement. After all, pronouns with plural reference are usually morphosyntactic plurals too. However, it has been observed by Schlenker (2003, p. 79) that semantic features do not override agreement features in the case of PRO.

(34) John (a transsexual) hopes to become a woman and he hopes PRO to buy himself/*herself a car.

Here the first sentence sets up the context so that in all worlds compatible with John's hopes, John is a woman. The second sentence elaborates on John's hope worlds and so the referent of PRO must be female in those worlds if John's hopes are consistent. Nevertheless, PRO is syntactically masculine as shown by the reflexive.

There are other cases too which show that bound pronouns more generally (and not only PRO) can retain features from antecedent agreement in spite of the semantic features:

(35) We$_i$ all sometimes believe that we$_i$ are the only person in the world.

In sum, therefore, the agreement facts are non-conclusive. Although it is true that functional control predicts the singular number directly, there is evidence that the control target in anaphoric control (and in bound pronouns more generally) agrees with the controller even the agreement features contradict the semantic features.

4.2 On 'quasi-obligatory' anaphoric control

In the LFG literature since Bresnan (1982), there are mainly two variants of anaphoric control, arbitrary and obligatory anaphoric control. The contrast is described in the following way in Dalrymple (2001, p. 324):

> In an obligatory anaphoric control construction, coreference is required between an argument of the matrix clause and the controlled position in the subordinate clause. In contrast, in an arbitrary control construction, no coreference constraints are imposed by the control verb. Instead, the controlled argument in the subordinate clause finds its referent in a way very similar to an ordinary pronoun, and split antecedents and syntactically remote controllers are possible.

The pronoun-like nature of anaphoric control is also the basis for Falk's tests for control type (Falk, 2001, p. 142f.), which rely on the following three properties taken to be jointly characteristic of functional control:

syn-local The controller must be a core function in the immediately governing f-structure[4]

no-split Split control is not possible

identity Controller and controllee share all syntactic features

(Arbitrary) anaphoric control violates all three principes precisely because it patterns with typical semantic-pragmatic properties of pronouns: they need not have local antecedents and there is no restriction on the GF of their antecedents, they can take split antecedents, and they do not usually agree with their antecedents in features other than GENDER and NUMBER. This accords well with Bresnan's goal to achieve a (near-)unification of GB's pro and PRO via a rule of functional anaphora (36) (Bresnan, 1982, p. 380).

[4]Falk only says 'in the f-structure', but it is clear that he thinks control must be local.

(36) **Rule of functional anaphora**

For all lexical entries L, for all G $\in \Delta$, assign the optional pair of equations $\{((\uparrow \text{G PRED}) = \text{'PRO'}), (\uparrow \text{FIN}) =_c \alpha\}$ to L.

English fixes the parameters $\alpha = -$ and $\Delta = \{\text{SUBJ}\}$ and therefore only allows null anaphora for the subjects of nonfinite verbs (infinitives and gerunds), whereas languages with 'prodrop' allow null anaphora in finite contexts too, possibly in non-subject function.

However, as observed by Dalrymple, most of the pronoun-like features of PRO disappear in obligatory anaphoric control contexts. In particular, **syn-local** and **split**, while untypical of pronouns, do hold in obligatory anaphoric control: the controller must be a term (Dalrymple, 2001, p. 344) and split antecedence is not possible (Dalrymple, 2001, p. 339),

Although there are only two well-explored types of anaphoric control, there is consciousness in the LFG literature that with some verbs, the control patterns are looser than in obligatory anaphoric control, but stricter than in arbitrary anaphoric control. For example, Falk (2001, p. 143) observes that *agree* and *try* pattern differently with regards to tests for functional/anaphoric control. In particular *agree* allows control by an implicit (37) or explicit (38) agent.

(37) a. It was agreed to clone dinosaurs.
b. *It was tried to clone dinosaurs.

(38) a. It was agreed by the geneticists to clone dinosaurs.
b. *It was tried by the geneticists to clone dinosaurs.

Falk concludes that *agree* instantiates anaphoric control and *try* functional control. The possibility of control by (implicit) agents is used as a test for anaphoric control also in Lødrup (2011, p. 163) who notes the contrast in (39).

(39) a. It was decided to start.
b. *It was hesitated to start.

Decide and *agree* are treated as *obligatory* anaphoric control, implicitly in Falk (2001) and explicitly in Lødrup (2011). And indeed it is clear that these verbs are not as free in their control patterns as e.g. *gesture*, which allows a syntactically remote antecedent, cf. (40)–(42).

(40) *The geneticist$_i$ thought it was clear that the paleontologist$_j$ had decided to clone$_i$ dinosaurs.

(41) *The geneticist$_i$ thought it was clear that the paleontologist$_j$ had agreed to clone$_i$ dinosaurs.

(42) The geneticist$_i$ thought it was clear that the paleontologist$_j$ had gestured to follow$_i$ Ken.

adapted from Dalrymple (2001, p. 339)

This points to a locality constraint on the controller, but since these verbs do allow control by implicit agents, which are not represented at f-structure, the locality constraint cannot be syntactic. We therefore propose that instead of **syn-local**, the syntactic locality constraint associated with functional and obligatory control, these verbs have a *semantic* locality constraint, viz. they require that the controller is a (possibly unexpressed) participant in the matrix event.

On the other hand, Falk claims that *agree* allows split antecedence as in (43).

(43) The geneticist$_i$ said that the paleontologist$_j$ agreed to clone$_{i+j}$ dinosaurs.

But Falk was writing at a time when PC was not well known in the syntactic literature. It seems likely that the correct indexation in (43) is $i+$ (partial control) rather than $i + j$ (split antecedence), for the examples in (44)–(45) suggest that PRO in these cases, albeit semantically plural, is syntactically singular.

(44) The geneticist said that the paleontologist agreed to have lunch together.

(45) *The geneticist said that the paleontologist agreed to meet each other.

This means that there is no reason to view *the geneticist* as a non-local controller in (43): It merely serves to make salient a plurality, as in other cases of PC.

In sum, the observations of Falk and Lødrup motivate an intermediate class of 'quasi-obligatory' anaphoric control verbs: unlike arbitrary anaphoric control, these have a locality constraint, but unlike obligatory anaphoric control the constraint is semantic rather than syntactic in nature. Many of these verbs, including Falk's *agree* and Lødrup's *decide*, allow both implicit agent control and PC, so we will tentatively analyze them as a single class. It is unlikely, however, that the class is completely homogenous in its control behaviour. As we saw in section 2.3, semantics plays an important role in PC and hence we expect that the lexical semantics of both the governing and the embedded predicate to influence the control behavior. The challenge, then, is to develop a formal framework within which this can be studied. This is all the more important since LFG's control theory as it stands cannot easily accommodate the intuitions of Falk and Lødrup nor the PC phenomenon.[5]

5 Formalizing quasi-obligatory anaphoric control

We have stressed the anaphoric nature of PC. It is natural, then, to look to treatments of pronominal anaphora to develop an analysis of PC.

The traditional treatment of anaphora in LFG + Glue is to view them as functions on their antecedents (Asudeh, 2012, p. 83f.).

(46) $\lambda z.z \times z$: $(\uparrow_\sigma \text{ ANTECEDENT}) \multimap ((\uparrow_\sigma \text{ ANTECEDENT}) \otimes (\uparrow_\sigma))$

[5] A similar range of phenomena has been classified as 'nearly free control' by Jackendoff and Culicover (2003), although this concept is wider in also covering generic (but not arbitrary) control.

While this approach has been put to good use notably in the study of pronominal resumption (Asudeh, 2012), it cannot provide a general account of pronominal anaphora (nor, to be fair, is it clear that a unified account is desirable). An oft-mentioned problem is that it cannot work for cross-sentence anaphoric resolution. This has motivated attempts to use a dynamic semantics instead, either by coupling Glue to a dynamic meaning language (as set out in detail in Kokkonidis 2005) or by handling the dynamics in the Glue itself (Dalrymple, 2001) by treating pronouns as functions on their context (represented as Glue resources) rather than directly on their antecedent.

For the purposes of control, cross-sentential anaphora is not relevant. But there is another problem that we need to deal with: PC involves bridging, where the anaphor and the antecedent are related by relations other than identity. This is beyond the expressive power of linear logic, which is restricted to copying resources (using $\otimes$). To avoid this problem I will handle anaphora on the meaning side and use a dynamic meaning language.

5.1 Partial compositional discourse representation theory

The dynamic meaning language that I will be using is Partial compositional discourse representation theory (PCDRT, Haug 2013). PCDRT is a version of compositional DRT (CDRT, Muskens 1996) that aims at providing a clear separation of monotonic (semantic) and non-monotonic (pragmatic) content. To that end, it provides a model-theoretic semantics for unresolved anaphors (including accessibility constraints) but treats coreference resolution post-semantically in the pragmatics. (47) (from Kokkonidis 2005) is analyzed as in (48) (ignoring constraints from binding theory).

(47) An elephant saw a mouse. She frightened her.

(48)
$$\begin{array}{|l|}\hline x_1\ x_2\ \underline{x_3}\ \underline{x_4} \\ \hline \\ elephant(x_1) \\ mouse(x_2) \\ see(x_1, x_2) \\ \partial(female(x_3)) \\ \partial(female(x_4)) \\ frighten(x_3, x_4) \\ \\ \hline \end{array}$$

The DRS in (48) models the monotonic content of the discourse, i.e. the part of the meaning that cannot be denied in the subsequent discourse without making the discourse inconsistent. This is dealt with in the same way as in DRT (superficially at least – behind the scenes, the DRS in (48) in fact has no theoretical status but simply abbreviates a lambda term). Notice that the last sentence introduces *new* DRs x_3 and x_4, so the monotonic content does not make a claim about the reference of the anaphoric expressions.

To deal with anaphora we need to add some more machinery. In particular, the underlying logic is partial, discourse referents (DRs) are ordered (the relative ordering of variable indices is meaningful, so anaphors can only refer to DRs with lower indices[6]), anaphoric DRs are underlined and the descriptive content of anaphoric expressions is embedded inside the ∂ connective. Underlining is interpreted as a predicate ant which is true of a DR that corefers with its antecedent and follows it according to the DR order, and is undefined for all other DRs. ∂ (Beaver, 1992) is a unary truth-functional connective: $\partial\phi$ is true iff ϕ is true; otherwise it is undefined. A DRS is in effect interpreted as the weak Kleene conjunction of all its conditions, hence if one of the conditions is undefined, the entire DRS is.

A discourse with anaphoric DRs can only be evaluated for truth in the context of an anaphoric resolution, $\mathcal{R}$.[7] However, $\mathcal{R}$ itself is not part of the monotonic content, but arises through non-monotonic reasoning and can be destructively updated. For example the discourse in (47) could suggest an anaphoric resolution as in (49).

(49) $\mathcal{R}$= $\{3 \mapsto 1, 4 \mapsto 2\}$

But if the subsequent discourse suggests that it was the mouse that frightened the elephant, we can update $\mathcal{R}$ non-monotonically with $3 \mapsto 2$ and $4 \mapsto 1$.

5.2 Bridging in PCDRT

The short presentation in 5.1 follows Haug (2013) in assuming that anaphoric relationships always entail identity between the anaphor and the antecedent. But this is not always the case since anaphora allows bridging inferences as we saw in section 2.3. To capture this we need a more fined grained resolution function. We will take $\mathcal{R}$ to map anaphoric indices to pairs of antecedent indices and bridging relations, with the latter defaulting to identity. Now we can analyze (25) as in (50).[8]

(50) The$_1$ restaurant went bust when the$_2$ liquor license they$_3$ applied for was refused.
$\mathcal{R} = \{3 \mapsto \langle 1, \lambda x.\lambda y.owner(x, y)\rangle\}$

We change the semantics of the ant predicate (underlining of DRs) accordingly, so that it is true of a DR x iff $\forall y.\texttt{snd}(\mathcal{R}(x))(\texttt{fst}(\mathcal{R}(x)), y) \rightarrow y = x$.[9] So the resolution in (50) satisfies ant iff

[6]How exactly the ordering of DRs relates to linear order and/or c-command facts depends on the syntax-semantics interface and PCDRT is not committed to any particular view.

[7]In Haug (2013), $\mathcal{R}$ is a function from word indices to word indices, which is used to compute a function $\mathcal{A}$ from discourse referents to discourse referents within particular DRSs. In the simple examples we consider here we can take $\mathcal{R}$ to model anaphoric relations between discourse referents directly.

[8]The indices refer to DRs introduced by NPs and are put on the determiner since in the compositional semantics, it is the determiner that introduces the DR.

[9]Here we abuse the notation somewhat, since CDRT distinguishes between DRs and their 'inhabitants' (real world referents). $y = x$ should be taken to mean that the DRs x and y refer to the same

(51) $\forall y.owner(1, y) \rightarrow y = 3$

i.e. the DR 3 refers to the (contextually) unique referent such that the bridging relation holds between the antecedent and the anaphor, in this case the owner of the restaurant.

This is not intended as a theory of bridging, but as a formal framework in which such a theory could be stated. Indeed PCDRT is not a theory of anaphora resolution, although it has been explicitly designed to easily fit with such a theory. But that theory must be cast in a non-monotonic logic, for our assumptions about what anaphoric relations hold are liable to change as the discourse proceeds. This is no less true of PC than other anaphoric relationships. For example, the correct interpretation of (1) clearly requires there to be a bridging relationship between Mary and the group of people that she wants to bomb Hanoi, but our exact understanding of this relationship may change as the discourse proceeds.

5.3 An analysis of PC as bridging

Let us now see how a bridging analysis can be made to work compositionally for PC. We will use the example in (52).

(52) (The chair told the committee) he$_1$ preferred PRO$_2$ to gather at six.

For simplicity, we are only going to look at the meaning of *he preferred to gather*, ignoring tense. We assume the lexical meanings in (53).

(53)

he	$\lambda P.[\underline{x_1}|\ ]; P(\underline{x_1})$	$(h \multimap p) \multimap p$
prefer	$\lambda K.\lambda x.[\ |\mathit{prefer}(x, K)]$	$g \multimap h \multimap p$
pro	$\lambda P.[\underline{x_2}|\ ]; P(\underline{x_2})$	$(pro \multimap g) \multimap g$
gather	$\lambda X.[\ |\mathit{gather}(X)]$	$pro \multimap g$

These meanings can combine as in (54).

(54)

$$\dfrac{\dfrac{\dfrac{\begin{array}{c}\textbf{gather}:\\ pro \multimap g\end{array} \quad \begin{array}{c}\textbf{pro}:\\ (pro \multimap g) \multimap g\end{array}}{g} \quad \begin{array}{c}\textbf{prefer}:\\ g \multimap h \multimap p\end{array}}{h \multimap p} \quad \begin{array}{c}\textbf{he}:\\ (h \multimap p) \multimap p\end{array}}{p{:}[\underline{x_1}|\mathit{prefer}(\underline{x_1}, [\underline{x_2}|\mathit{gather}(x_2)])]}$$

This gives us a plausible meaning if we combine the semantic representation with a resolution $\mathcal{R}= \{2 \mapsto \langle 1, \lambda y.\lambda x.chair(x, y)\rangle\}$.

Moreover, the same approach can deal with control by implicit agents in passives, if we assume (as is standard) that the implicit agent is represented in the semantics. For example, *it was agreed* will be represented as in (55).

real world referents, not that the DRs themselves are identical.

(55) **it was agreed**: $\lambda K.[x|agree(x, K)]$

where K is a DRS representing the infinitive complement and x provides a suitable antecedent for PRO.

These representations achieve Bresnan's desired unification of PRO and other pronouns – witness the exactly parallel representations for PRO and *he*. But they also overgenerate, since there is nothing to stop discourse binding of PRO. To eliminate this problem, we must make sure that PRO finds its antecedent in the matrix clause, and not higher up (in the case of multiple embeddings), or even in the discourse. Since discourse referents are part of the object language in PCDRT (as in CDRT), we can achieve this if we enrich our system with two components.

First, let us represent the special status of PRO as a logophor (section 2.1.4) with a special predicate of discourse referents. Parallel to the underlining of anaphoric discourse referents ($\underline{x_1}$) we will use overlining of logophoric discourse referents ($\bar{x_1}$).

Second, we will assume that PC predicates, qua attitude verbs, are sensitive to logophoricity and therefore require logophors to bind to one of the logophoric centers that they introduce, i.e. one of their arguments. The notion of attitude verb that we have in mind is a broad one, covering not only attitude reports where there is only one logophoric center (the attitude holder, or experiencer of a verb like e.g. *believe*), but also transitive attitude verbs like *persuade* and *promise* where are two possible logocenters, the speaker and the addressee. If an individual x is a logocenter of an eventuality e, we will write this as $log(e, x)$ – this can be thought of as a 'cover relation' for the relevant logocentric thematic roles.

Formally, we ensure that logophors are bound to a logocenter by introducing a two place function `bind` mapping pairs of events e and DRS K to DRSs, as in (56). $U(K)$ denotes the universe of K, i.e. the discourse referents introduced in K. Recall that $\mathcal{R}(d)$ denotes the antecedent of d. It is important for PC that it is the *antecedent* of d that is a logocenter, not d itself, as we do not want to predict for scenarios like (13) that the entire team is the logocenter of John's expectations.

(56) $\texttt{bind}(e, K) \equiv K \wedge \forall \bar{d}.\bar{d} \in U(K) \rightarrow log(e, \mathcal{R}(\bar{d}))$

Basically, $\texttt{bind}(e, K)$ returns the DRS K augmented with the condition that the antecedents of any logophors in the universe of K should be logocenters of e. (Note that this blocks binding into embedded DRSs in K.) We can now revise the meanings of **prefer** and **PRO** as in (57). I assume a Davidsonian event representation, i.e. the verb is a predicate of its 'standard arguments' plus an event argument, rather than a neo-Davidsonian representation where the verb only takes an event argument and the other arguments are introduced via thematic relations. Nothing hinges on this however.

(57)	**prefer**	$\lambda K.\lambda x.[\,|prefer(e, x, \texttt{bind}(e, K))]$	$g \multimap h \multimap p$
	PRO	$\lambda P.[\bar{x_2}|\,]; P(\bar{x_2})$	$(pro \multimap g) \multimap g$

Notice that although **PRO** is marked as logophoric discourse referent, its logophoricity is only ‘activated’ as it were by the meaning of the attitude verb **prefer**. This maintains Bresnan’s unification of PRO and other pronouns: unless PRO is trapped inside a logophoric context it behaves like any other pronoun.

5.4 The properties of PC revisited

Let us now revisit the properties of PC that we saw in section 2. We took the anaphoric nature of PC that we saw in section 2.3 as the starting point of our analysis, so we do capture that. And the syntactic singularhood of PRO in PC constructions (section 2.2) is dealt with in section 4.1. But what about the other properties discussed in section 2.1?

That there is no arbitrary control in PC (2.1.1) clearly follows from our account, since the controller must be a logocenter in the matrix event. For the same reason, there can be no long-distance antecedents (2.1.2).

The absence of strict readings (2.1.3) also follows, although much depends on the details of the particular theory of ellipsis assumed. I can only offer a cursory treatment here. Consider (10), repeated here as (58).

(58) Obama expected [to succeed as a party], and McCain did too.

We assume the representation in (59) for the first conjunct.

(59)
$$\begin{array}{|l|}\hline e_1\ x_1 \\ \hline Obama(x_1) \\ expect(e_1, x_1, \mathtt{bind}(e_1, \begin{array}{|l|}\hline \bar{x_2} \\ \hline succeed\_as\_a\_party(\bar{x_2}) \\ \hline \end{array})) \\ \hline \end{array}$$

A sloppy reading of the second conjunct will look as in (60), where the redeclaration of x_2 in the embedded DRS introduces a *new* discourse referent x_2.

(60)
$$\begin{array}{|l|}\hline e_2\ x_3 \\ \hline McCain(x_3) \\ expect(e_2, x_3, \mathtt{bind}(e_2, \begin{array}{|l|}\hline x_2 \\ \hline succeed\_as\_a\_party(\bar{x_2}) \\ \hline \end{array})) \\ \hline \end{array}$$

But several theories of ellipsis resolution, including Dalrymple et al. (1991), will also generate a similar representation *without* redeclaration of x_2, i.e. a strict reading. Dalrymple et al. (1991, p.445) block this by treating PRO as a 'primary occurrence' on a par with its controller, but this is essentially just a restatement of the facts. In the current approach, by contrast, we see that (59) and (60) are not jointly satisfiable if x_2 is not redeclared in (60), for `bind` would require x_2 to be resolved to a logocenter in both e_1 and e_2, i.e. simultaneously to both McCain and Obama. Hence the strict reading is ruled out on semantic grounds.

As for the obligatory *de se* reading, the theory presented here offers only the beginnings of an analysis. To have a complete account, we need to spell out the log predicate (overlining of DRs) in such a way as to force *de se* readings, rather than just designate logophoric discourse referents. This remains to be done.

6 Conclusion

We have seen that the standard LFG theory of control cannot properly deal with partial control. Both functional control and obligatory anaphoric control are too strict, and arbitrary anaphoric control is too loose. But we observed that there is an intuitive notion of 'quasi-obligatory' anaphoric control in the LFG literature, which would generalize well to PC. This gives us a four-way typology of control as in (61).[10]

(61)	f-control	obligatory a-control	quasi-obligatory a-control	arbitrary a-control
locality	syntactic	syntactic	semantic	discourse
identity	+	-	-	-

We provided a formalization of quasi-obligatory anaphoric control in terms of dynamic semantics. Our notion of quasi-obligatory anaphoric control is a quite general one, covering verbs that allow partial control, control shift, split (but local) antecedence and/or implicit agent control, but disallow arbitrary and long distance control. However, since the process is semantic-pragmatic rather than purely syntactic (as in functional and obligatory anaphoric control) we do not necessarily expect the class to behave in a unified manner but to be influenced by semantic factors. I leave to future research how these processes work.

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[10]The **no-split** property discussed in section 4.2 can be derived from the way the controller in functional and obligatory anaphoric control is syntactically assigned.

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MOVING RIGHT ALONG: MOTION VERB SEQUENCES IN URDU

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Abstract

In this paper I survey the phenomenon of motion verb sequences (MVSs) in Urdu/Hindi, a combination of two motion verbs denoting a complex motion event. First noted by Hook (1974), the construction exhibits interesting syntactic and semantic properties and behaves unlike other complex verbal expressions found in the language. The paper shows that MVSs should be treated as a special type of complex predicates, *complex predicates of motion*, complementing the various types of complex predicates already established in Urdu/Hindi (e.g., Mohanan (1994), Butt (1995)). This paper provides a first formal analysis of the construction and accounts for the types of combinations, word orders and argument structures that are possible in the language.

1 Introduction

Urdu/Hindi is known to exhibit various types of complex verbal constructions, including N+V, ADJ+V and V+V complex predicates (CPs) (e.g., Mohanan (1994); Butt (1995)). A lesser known construction, but one that occurs fairly frequently is that of motion verb sequences (MVSs), where two motion verbs combine in a verbal phrase to express motion and direction in one complex event. (1) exemplifies the construction with the two motion verbs *kud-na* 'to jump' and *nıkal-na* 'to emerge' which results in the interpretation of 'jumping out'.

(1)	cor	mɑkan=se	bahɑr	**kud**	**nıkl-a**
	thief.M.Sg.Nom	house.M.Sg=Source	outside	**jump**	**emerge-Perf.M.Sg**
	'The thief jumped out of the house.'				(Hook 1974, p. 69)

Hook (1974) discusses the construction in the context of complex predication, but is puzzled by several of its properties: In contrast to other complex predicates in Urdu/Hindi, the lexical semantic load seems to be equally distributed on both verbs and syntactic properties which are common among simple verbs but not complex predicates in the language are possible in these constructions, for instance causativization and the ability to swap the verbs. Moreover, the wealth of combinatorial possibilities between different motion verbs is surprising.

This paper investigates the phenomenon of motion verb sequences in Urdu/Hindi and shows that they should be treated as a new type of complex predicate, the *complex predicate of motion*. I propose an analysis that accounts for the types of combinations, word orders and argument structures that are possible in Urdu and I sketch a formal analysis of the construction. The paper proceeds as follows: section 2 provides a brief overview of complex predicates in Urdu, followed by a presentation of the motion verb data and their syntactic properties. The section is complemented by a quantitative investigation of the phenomenon, which provides

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hints as to its pervasiveness in the language. In section 3, the paper continues with a discussion of the syntactic status of MVSs, situating the construction with respect to similar constructions and their analyses in other languages. Based on these insights, section 4 provides an analysis of MVSs in Lexical Functional Grammar, followed by a general discussion and conclusion of the paper in section 5.

2 The phenomenon

2.1 In general: Verb sequences in Urdu

Complex predicates (CPs) are a special type of V+V sequence in Urdu, where a verb in the root form denoting the main action is modified by a so-called light verb, which merges with the argument structure of the main verb (Butt, 1995). CPs are a very common and in fact preferred way of expressing events in Urdu and they complement the rather small set of around 700 simple verbs. The light verbs, which also serve as main verbs in the language, contribute a bleached version of their full verb meaning. Table 2.1 presents an overview of light verbs, mainly those which also serve as full motion verbs.

	Light verbs	**Contribution**
Aspectual CPs	*paṛ-na* 'to fall'	Inception (no conscious control)
	uṭ^h-na 'to rise'	Inception
	ja-na 'to go'	Telicity
Permissive CP	*de-na* 'to give'	Adds a causer to the event

Table 1: Common light verbs in Urdu/Hindi

The light verbs in (2) and (3) support the event denoted by the verb in the root form: in (2), the main verb *gɪr-na* 'to fall' is aspectually modified by *paṛ-na* 'to fall', which contributes a sense of sudden inception without conscious control. In (3), the light verb *de-na* 'to give' adds an external argument to the event of *ja-na* 'to go' and constitutes the so-called permissive construction.

(2) am **gɪr paɑ̣ṛ-a**
mango.M.Sg.Nom **fall fall-Perf.M.Sg**
'The mango fell (suddenly).'

(3) ɑnjʊm=ne sɑddɑf=ko **ja-ne dɪ-ya**
Anjum.F.Sg=Erg Saddaf.F.Sg=Acc **go-Inf.Obl give-Perf.M.Sg**
'Anjum let Saddaf go.'

Butt (1995) shows that both CPs are monoclausal, but aspectual and permissive CPs differ in so far as in (2), the argument structure of the light verb *paṛ-na* 'to fall' merges with the argument structure of the main verb *gɪr-na* 'to fall', whereas in (3), the light verb *de-na* 'to give' merges its argument structure with *ja-na* 'to go', but moreover adds the permission-giving entity *anjʊm* 'Anjum'.

2.2 Motion verb sequences

Superficially, motion verb sequences in Urdu/Hindi are parallel to aspectual CPs in that at most two (motion) verbs are put in sequence, where the first motion verb is in the root form, complemented by a second, finite motion verb. The constructions in (4) to (7) exemplify the phenomenon.

(4) sanḍ gayõ=ki ṛevɑṛ **bɑṛ^h doṛ-a**
ox.M.Sg.Nom cow.F.Pl.Obl=Gen.F herd.M.Sg **advance run-Perf.M.Sg**
'The ox charged into a herd of cows.'

(5) sanḍ hɑmare mɑkan=mẽ **g^{h}ʊs cɑl-a**
ox.M.Sg.Nom Pron.1.Pl.Obl.Gen house.M.Sg=Loc **enter move-Perf.M.Sg**
'An ox got into our house.'

(6) ʊs=ki ank^{h}õ=mẽ ansu **a b^{h}ɑr-e**
Pron.3.Sg=Gen.F tear.F.Pl=Loc tear.M **come advance-Perf.M.Pl**
'Tears welled up in her eyes.'

(7) g^{h}oṛa **doṛ b^{h}ag-a**
horse.M.Sg.Nom **run run-Perf.M.Sg**
'The horse ran away.'

In all examples, the combination of two motion verbs yields a complex motion event, for instance combining *bɑṛ^h-na* 'to advance' and *doṛ-na* 'to run' as in (4) yields the bounded-path interpretation 'running to'. The combinatorial possibilities are not restricted to directional motion verbs combining with manner of motion verbs as in (4) and (5), but constructions with both verbs denoting direction (*a-na* 'to come' and *b^{h}ɑr-na* 'to advance' in (6)) or manner (*doṛ-na* 'to run' and *b^{h}ag-na* 'to run' in (7)) are also possible. Moreover, different valencies do not prevent motion verbs from combining, as shown in (5) with the transitive verb *g^{h}ʊs-na* 'to enter' and the intransitive *cɑl-na* 'to walk' which combine to mean 'walking/getting into'.

Oddity #1 An interesting property of MVSs is that some combinations facilitate the swapping of motion verbs. This means that the root verb becomes the finite verb and vice versa, while retaining the overall interpretation of the sentence. In (8), the verbs *cɑl-na* 'to walk' and *ʊṛ-na* 'to fly' render the interpretation of 'flying up', regardless of the particular order they occur in. The same behavior is found for *nɪkɑl-na* 'to emerge' and *b^{h}ag-na* 'to run' in (9).

(8) hɑva=ke ek j^{h}onke=ke sat^h
wind.M.Sg=Gen.Obl one gust.M.Obl=Gen with

pɑtɑng **uṛ cɑl-i / cɑl uṛ-i**
kite.F.Sg.Nom **fly move-Perf.F.Sg / move fly-Perf.F.Sg**
'The kite flew up with a gust of wind.' (Hook 1974, p. 57)

(9) ek kala sap bɑl=se
one black.M.Sg snake.M.Sg.Nom snake-pit.M.Sg=Instr

b^{h}ag nɪkl-a / nɪkɑl b^{h}ag-a
run emerge-Perf.M.Sg / emerge run-Perf.M.Sg
'A black snake shot out of the snake pit.'

In both examples, the order of the motion verbs in the sequence is flexible and the MVSs denote the same event, despite the different syntactic configuration that the motion verbs are found in. This property is not found for aspectual and permissive CPs in Urdu/Hindi, probably due to the fact that the light verb is so light that it cannot provide the main propositional content of the clause. The contribution of the finite verb in MVSs is therefore "heavier" than in Urdu/Hindi CPs, an observation further confirmed by the following examples.

Oddity #2 Some constructions allow for the causativization of (at least one of) their motion verbs. The examples from (10) to (12) show the causativized versions of the constructions in (7), (8) and (9), respectively. While in (10), the finite verb *doṛ-a-na* 'to run-Caus' is in the causative[1], (11) shows that in other cases, the verb in the root form, *ʊṛ-a-na* 'to fly-Caus', causativizes. In (12), both verbs, *b^{h}ag-a-na* 'to run-Caus' and *nɪkal-na* 'to emerge.Caus' are in the causative.

V$_1$.base + V$_2$-Caus

(10) malɪk=ne g^{h}ore=ko **b^{h}ag doṛ-a-ya**
owner.M.Sg=Erg horse.M.Sg.Obl=Acc **run run-Caus-Perf.M.Sg**
'The owner made the horse run away.'

V$_1$-Caus + V$_2$.base

(11) hɑva pɑtang=ko **ʊṛ-a cɑl-i**
gust.F.Sg.Nom kite.M.Sg=Acc **fly-Caus move-Perf.M.Sg**
'The gust made the kite fly up.'

V$_1$-Caus + V$_2$-Caus

(12) malɪk=ne sap=ko bɑl=se
owner.M.Sg=Erg snake.M.Sg=Acc snake-pit.M.Sg.Obl=Instr

b^{h}ɑg-a nɪkal-a
run-Caus emerge.Caus-Perf.M.Sg
'The owner made the snake shoot out of the snake pit.'

[1] In fact, *b^{h}ag doṛ-a-na* (and its inverse *doṛ b^{h}ag-a-na*) 'to run away' are the sole instances of Urdu/Hindi MVSs where causativization only applies to the finite verb. This might be due to the existence of the nominal compound *b^{h}ag doṛ* 'a lot of running around', which might be used as a "simple" verbal predicate in this construction, taking the causative suffix *-a-*.

In all cases, an external argument, the causer, is added to the overall event structure. If, as in (12), both verbs are in the causative form, the external argument is shared between the two verbs. Verbs that do not causativize as simple verbs also do not allow for causativization in MVSs. In turn, verbs that can causativize as simple verbs do not necessarily allow for causativization in MVSs, where certain constraints seem to hold between the two verbs. Again, the nature of the finite verb is different from aspectual and permissive light verbs in Urdu/Hindi, as those cannot causativize.

Challenge Despite the seeming flexibility in MVSs, some combinations are clearly ungrammatical, as shown in (13) with *ring-na* 'to crawl' and *g^{h}ʊs-na* 'to enter'. Native speaker intuition says that in those cases, the lexical semantic entailment of *ring-na* 'to crawl' as a slow movement is not compatible with the determination and force contributed by *g^{h}ʊs-na* 'to enter'.

(13) * bɑccɑ kɑmre=mẽ **ring g^{h}ʊs-a**
child.M.Sg.Nom room.M.Sg.Obl=Loc **crawl enter-Perf.M.Sg**
'The child crawled into the room.'

What complicates the matter is that some MVSs exhibit a varying degree of speaker acceptance, as is the case for example (14), which is grammatical for the Urdu informants, but unacceptable for Hindi speakers.

(14) √/* bɑccɑh kɑmre=se **ring nɪkl-a**
child.M.Sg.Nom room.M.Sg.Obl=Instr **crawl emerge-Perf.M.Sg**
'The child crawled out of the room.'

Based on the data in Hook (1974) and my own fieldwork data for Urdu/Hindi, motion verb sequences in the language exhibit a number of interesting properties that have so far not been attested for other verbal complexes in the language. In order to obtain a better grasp of the phenomenon, the following quantitative investigation based on different corpora sheds some light on the construction in present-day usage.

2.3 A quantitative investigation of MVSs

The preceeding section shows that there are considerable idiosyncrasies in MVSs and the aim of the quantitative investigation is to provide insights into the pervasiveness of the phenomenon as well as the combinatorial patterns. Moreover, investigating large amounts of data might show tendencies for some motion verbs to appear in specific slots in the sequence.

The investigation makes use of three different Urdu corpora, namely a corpus crawled from the BBC Urdu website (BBC), the CLE corpus (Urooj et al., 2012) (CLE) and the Urdu section of the Hindi-Urdu Treebank (Bhatt et al., 2009)

(HUTB). In total, the corpora have around 16.1 million tokens. Due to the adjacency of the motion verbs and the fact that only two verbs can combine, an automatic bigram analysis suffices to extract all MVS instances. These were then aggregated over the whole corpus and the number of times the motion verbs appear as simple verbs was recorded. This serves as an approximation as to how common the verb is overall and how preferred it is in combination with other motion verbs. Table 2 gives an overview of the results, with the number of simple motion verbs found in the corpus, the number of MVSs and the number of unique MVSs.[2]

	BBC	CLE	HUTB
# of tokens	8,018,600	7,984,827	96,388
# of simple motion verbs	13,035	11,709	181
# of MVS	146	677	6
# of unique MVSs	33	81	3
% of MVSs	1.1%	5.8%	3.3%

Table 2: Statistics on motion verbs in the three corpora

The investigation shows that the percentage of MVSs compared to the overall usage of motion verbs is comparatively low and ranges from 1.1% in the BBC corpus to 5.8% in the CLE corpus. This might be due to the fact that MVSs preferably occur in literary text and the only corpus which accounts for this text genre is the CLE corpus, which in turn has the highest percentage of MVSs.

Moreover, the number of unique MVSs in comparison to the overall number of MVSs shows that some combinations are clearly preferred and in fact used across corpora, for instance *b^{h}ag nɪkal-na* ‘to run out of (lit. to run emerge)’, *baṛ^h caṛ^h-na* ‘to climb up (lit. to advance climb)’ and *ʊtar caṛ^h-na* ‘to climb down (lit. to descend climb)’. In addition, the verbs *b^{h}ag-na* ‘to flee/run’, *doṛ-na* ‘to run’ and *cal-na* ‘to move/walk’ are often used as the finite verb in MVSs, with a range of different root verbs. The most flexible motion verb is *nɪkal-na* ‘to emerge’ which can be used both as a root and a finite verb in a range of combinations. The investigation also shows that direct causative MVSs are less frequent than their base counterparts, whereas MVSs with indirect causatives do not exist.

2.4 Intermediate summary

What the empirical basis shows is that MVSs in Urdu/Hindi are complicated insofar as they exhibit a variety of patterns on different levels: the combinatorial possibilities regarding their lexical semantics as well as their valency, the ability to swap and the way causativization can apply. The properties imply that the construction is unlike other verbal complexes in the language, most notably those of aspectual and permissive complex predicates, which seem similar from their surface structure.

[2] MVSs with *ja-na* ‘to go’ as V_2 are not counted, as those combinations can be aspectual CPs denoting completion, following Butt (1995).

3 The status of the finite verb in MVSs

3.1 Mono- versus biclausality

An important question is whether the finite verb in MVSs functions as a light verb similar to aspectual and permissive light verbs or whether MVSs are modifying constructions, where the root verb modifies the finite verb. A prerequisite for complex predicatehood is monoclausality. Concerning monoclausality in Urdu/Hindi CPs, Butt (1995) proposes a number of tests, for instance the behavior of the CPs in anaphora and control constructions. However, the MVSs considered here are mostly intransitive and therefore Butt's tests for monoclausality cannot be applied reliably across constructions. Instead, I test the grammatically of MVSs in passive constructions and their behavior with respect to negative polarity items.

Passivization Passivization in Urdu/Hindi is done via the passive auxiliary *ja-na* 'to go' which attaches to the verbal phrase. As shown in chapter 3 on passive alternations in Urdu/Hindi, if the passive auxiliary *ja-na* 'to go' combines with intransitive verbs, the interpretation of the passive construction is one of ability: the subject is able to perform an action (Butt and King, 2001). As an example, see (15): (15a) shows the active construction with the verb *g^hʊs-na* 'to enter' where the subject of the clause is nominative. In the ability passive alternant in (15), the subject receives the instrumental marker =*se* and is interpreted as having the ability to enter.

(15) a. lɑṛki kɑmre=mẽ g^hʊs-i
girl.F.Sg.Nom room.M.Sg.Obl=Loc enter-Perf.F.Sg
'The girl entered the room.'

b. lɑṛke=se kɑmre=mẽ g^hʊs-i gɑ-yi
girl.F.Sg.Obl=Instr room.M.Sg.Obl=Loc enter-Perf.F.Sg go-Perf.F.Sg
'The girl was able to enter the room.'

The example in (16a) shows a construction with the MVS *g^hʊs cal-na* 'to enter walking', where the finite verb *cal-na* 'to walk' licenses the subject *sanḍ* 'ox' of the event. The verb in the root form, *g^hʊs-na* 'to enter' contributes the locational oblique *mɑkan* 'house', which is not licensed by *cɑl-na* 'to walk'. If the root verb *g^hʊs-na* 'to enter' was embedded under the finite verb *cɑl-na* 'to walk', passivization should not be possible. However, the grammaticality of the passive alternant in (16b) shows that both motion verbs are in fact in the same clause: the nominative subject in (16a) becomes the instrumental-marked subject *sanḍ=se* 'by the ox' in (16b), when the passive auxiliary *ja-na* 'to go' is attached to the verbal phrase. MVSs thus behave parallel to simple verbs.

(16) a. sanḍ mɑkan=mẽ **g^hʊs cɑl-a**
ox.M.Sg.Nom house.M.Sg=Loc **enter move-Perf.M.Sg**
'An ox got into the house.'

b. saṇḍ=se mɑkan=mẽ **g^{h}ʊs cɑl-a** gɑ-ya
ox.M.Sg=Instr house.M.Sg=Loc **enter move-Perf.M.Sg** go-Perf.M.Sg
'The ox was able to get into the house.'

This pattern holds for all Urdu/Hindi MVSs and it provides initial evidence with respect to the monoclausality of MVSs, a fact that will be further confirmed by the behavior of MVSs with negative polarity items.

Negative polarity items Using evidence from negative polarity items (NPIs) put forth by Bhatt (2005), Butt (to appear) shows that permissive complex predicates in Urdu/Hindi behave like other monoclausal constructions in the language, in that the NPI reading is obtained because the negation particle and the polarity item are in the same clause. Using the NPI test reliably distinguishes monoclausal constructions like permissive CPs from biclausal constructions like the instructive.

The construction in (17) shows that according to Bhatt (2005), motion verb sequences in Urdu/Hindi are indeed monoclausal: The polarity item *ek b^{h}i* 'only one' is attached to *bal=se* 'from the snake pit', an argument which is licensed by the finite verb in the clause, *nɪkal-na* 'to emerge', which is transitive. If the verb in the root form, *b^{h}ag* 'run' were in an embedded clause, the negation particle *nahĩ* 'not' could not be placed in front of it and yield the NPI reading of the whole clause.

(17) [sap] ek b^{h}i [bɑl=se]
snake.M.Sg.Nom one Emph snake-pit.M.Sg=Instr

nɑhĩ **b^{h}ag nɪkl-a**
not **run emerge-Perf.M.Sg**
'The snake did not shoot out of even one snake pit.'

Similarly, this holds for intransitive motion verb sequences, as shown in (18).

(18) ek b^{h}i pɑtɑng <u>nɑhĩ</u> **uṛ cɑl-i**
one Emph kite.F.Sg <u>not</u> **fly move-Perf.F.Sg**
'Not even one kite flew up with a gust of wind.'

The evidence from both passivization and NPIs shows that MVSs in Urdu/Hindi are clearly monoclausal constructions and therefore parallel the behavior of aspectual and permissive complex predicates found in the language. This leads to the question as to how these constructions should be treated syntactically, in particular whether they belong to the class of serial verbs or complex predicates. This is elucidated in the following.

3.2 MVSs: serial verbs or complex predicates?

Using the concept of sequential motion verbs in order to express complex motion is a common phenomenon across languages, in particular in many West African, Papua New Guinean and Australian languages. A cross-linguistic overview of the pattern is shown in the following examples, with (19) for Korean (Zubizarreta and Oh, 2007), (20) for Edo (Baker and Stewart, 1999; Ogie, 2003), (21) for Thai (Wechsler, 2003) and (22) for Dagaare, a West-African language spoken in North-Western Ghana.[3] The exact concept that is conveyed by the construction can only be approximated by the English translation.

(19) John-i kongwen-ey **kel-e** **ka-ss-ta**
John-Nom park-Loc **walk-L** **go-Past-Decl**
'John walked to the park.' Korean (Zubizarreta and Oh, 2007, (7))

(20) Òzó **rhùlé-rè** **làá** òwá
Ozo **run-Past** **enter** house
'Ozo ran into the house.' Edo (Ogie, 2003, (19))

(21) Piti **den** **khâw** rooŋrian
Piti **walk** **enter** school
'Piti entered the school walking.' Thai (Wechsler, 2003, (2))

(22) ó **varef** **kpéf** **waf** **lef** la a die poó
Pron.3.Sg **jump.Perf** **enter.Perf** **come.Perf** **fall.Perf** Part Def room inside
'S/he jumped (and) fell into the room.' Dagaare

With respect to their syntactic treatment, the constructions in (19) to (22) are mostly analyzed as serial verbs, a syntactic class which has not yet been attested for Urdu. Instead, two kinds of complex predicates (aspectual and permissive CPs) have been established for Urdu/Hindi (Butt, 1995). Serial verbs and complex predicates share three crucial properties: First, the construction is characterized by a succession of verbs in a single clause with one subject. Secondly, the verbs behave as a single unit with respect to tense. Lastly, the verbs in the sequence share arguments. All three criteria match the properties of Urdu/Hindi MVSs.

Despite the fact that Urdu MVSs share a number of properties with serial verbs, they also exhibit major differences: In particular the verbs in the sequence do not contribute delimited subevents of the overall event, but the subevent of the root verb in Urdu MVSs merges with the subevent denoted by the finite verb. Moreover, Urdu MVSs do not meet the criterium of causativization in serial verbs set forth by Aikhenvald (2006), in that not only the first verb causativizes, but in fact either of the two verbs in the sequence can appear in the causative or even both. In addition, it has not been attested that Urdu MVSs share their objects, the only exception being the case of causativization, where the addition of the external argument renders the former subject the new object, which is shared by both verbs. I am fully aware that this discussion of MVSs in the light of serial verbhood only approximates of

[3]The example was provided by an anonymous reviewer.

what the literature provides as criteria for different languages. Nevertheless, all properties taken together, I claim that MVSs are not prototypical serial verbs.

In contrast to the serial verb, the concept of the complex predicate in Urdu has a set of well-defined criteria and therefore facilitates a comparison with phenomena like MVSs. Table 3 shows the comparison of MVS properties with the set of criteria proposed by Butt (1995), Butt and Geuder (2001) and Butt (2010), which set complex predicates apart from serial verbs.

Criteria	MVSs
Light verbs do not have a systematic semantic contribution.	√
CPs have a complex argument structure.	√
Light verbs contribute a bleached version of their lexical semantics.	√
Only a reduced set of verbs function as light verbs.	√

Table 3: Comparison of CP properties with MVSs

The properties of Urdu MVSs mostly correspond to those exhibited by aspectual and permissive complex predicates in Urdu. Using the example in (23), I briefly exemplify the criteria that are characteristic for complex predicates and are also found for Urdu/Hindi MVS.

(23) sap bɑl=se nɪkɑl b^hag-a
snake.M.Sg.Nom snake-pit.M.Sg=Instr emerge run-Perf.M.Sg
'The snake shot out of the snake pit.'

Most importantly, the way arguments are merged and contributed by the motion verbs in the MVS is complex. In (23), the main verb *nɪkal-na* 'to emerge' licenses a SUBJ and an OBL, whereas the finite verb *b^hag-na* 'to run' is intransitive and only licenses a SUBJ. Overall, the MVS is transitive. The complexity is increased in cases where one verb in the MVS causativizes and adds an external argument which is not licensed by the other verb. A detailed discussion on the way arguments are merged follows in section 4.

Moreover, example (23) shows that the lexical semantic contribution of the finite motion verb is a bleached version of its full-verb counterpart. The snake in (23) cannot actually perform a running motion in the way that the verb is used for a human agent, but what is conveyed by using *b^hag-na* 'to run' as the light verb is the notion of speed. The same holds for other light verbs of motion, e.g. the near-synonym of *b^hag-na* 'to run', *doṛ-na* 'to run', which contributes the same notion of speed in its light verb usage. In total, the data in Hook (1974) and the three corpora show that around ten light verbs of motion participate in the construction. A classification based on their lexical semantic and syntactic entailments follows in Section 4.

Despite the similarities, in order to anchor motion verb sequences in the set of complex predicates, the notion of the light verb in Urdu/Hindi has to be extended in a number of aspects: First, aspectual and permissive light verbs do not allow for causativization, an alternation that is generally possible for Urdu/Hindi MVSs. Moreover, it is not possible to swap the verbs of aspectual and permissive CPs, a property that holds for a restricted number of MVSs. Lastly, the number of "light" verbs in MVSs is larger than the set of verbs found in the complex predicates established for Urdu (one permissive light verb, *de-na* 'to give', and around 15 aspectual light verbs (Hook, 1974)). However, the quantitative investigation in section 2.3 shows that there are clear tendencies for some verbs to appear more frequently and in combination with a range of different main verbs.

In sum, the above investigation has shown that Urdu MVSs are closer to complex predicates than they are to serial verbs. Nevertheless, MVSs are not prototypical Urdu CPs as established by Butt (1995), and the characterization of complex predicates in the language has to be slightly extended in order to accommodate these motion constructions, in particular with respect to the characteristics of the light verbs available in the language. However, in principle, MVSs work according to the criteria for complex predicatehood set forth by Butt (1995) and I suggest that MVSs should be analyzed as *complex predicates of motion*. The following section provides a formal account of the construction and sheds more light on the lexical semantic concepts underlying the light verbs of motion.

4 An LFG account

The following analysis of complex predicates of motion in Lexical Functional Grammar (LFG) (Bresnan and Kaplan, 1982; Dalrymple, 2001) accommodates the different kinds of MVSs. The motion verb in the root form as well as the light verb of motion contribute syntactic and lexical-semantic properties of the event.

4.1 Argument sharing

The data show that indeed two groups of light motion verbs exist in Urdu/Hindi: those that contribute arguments that are unified with the arguments of the main verb and those that merge arguments as well as add extra arguments to the event, while both light verbs additionally contribute lexical semantic content. In terms of Butt (1998), the first type of light verb triggers *event fusion* in that "the highest arguments of each a-structure are unified with one another" (p. 145). This mechanism accounts for aspectual complex in Urdu/Hindi predicates and is transferrable to CPs of motion, illustrated with the example in (24). The main motion verb *ʊṛ-na* 'to fly' licenses a theme argument, while the light verb *cal-na* 'to walk' unifies its theme argument with it and moreover contributes information on the continuity of the motion event. Using lexical mapping theory as in Bresnan and Kanerva (1989), the theme *patang* 'kite' then maps onto the subject of the construction.

(24) hɑva=ke ek j^{h}onke=ke sat^h pɑtɑng **ʊṛ cɑl-i**
wind.M.Sg=Gen one gust.M.Obl=Gen with kite.F.Sg **fly walk-Perf.F.Sg**

'The kite flew away with a gust of wind.'

Constructions with the second type of light verb are instances of *argument fusion*, by which the highest embedded argument is identified with the lowest matrix argument. This approach accounts for the allow-to-do permissive CP in Urdu/Hindi (Butt, to appear), where the permissive light verb *de-na* 'to give' licenses a permission-giving entity and embeds the event denoted by the main verb under it. In motion CPs, however, the light verb adds a locational oblique and is embedded under the main verb, as exemplified in (25). Here, the light motion verb *nɪkal-na* 'to emerge' contributes the theme subject *sap* 'snake' which merges with the theme of the main motion verb *b^{h}ag-na* 'to run', but also contributes the oblique location *nale=se* 'from the pipe' which is not licensed by the main verb.

(25) [ek sap] [bɑl=se] **b^{h}ag nɪkl-a**
one snake.M.Sg.Nom snake-pit.M.Sg=Instr **run emerge-Perf.M.Sg**

'A snake shot out of the snake pit.'

In order to differentiate between the two kinds of light verbs of motion, I use the term *event-fusional light verbs of motion* for those light verbs which unify arguments and *argument-fusional light verbs of motion* for those light verbs which add locational arguments to the clause. This implies that the two kinds of light verbs trigger different representations at f-structure, same as Butt (1995) assumes for aspectual and permissive complex predicates.

4.2 Lexical semantics

In addition to the argument structure sharing properties presented in the previous section, the LFG analysis also has to account for the lexical semantic entailments of the motion verb combinations. The assumption I make is that light motion verbs, independent of their argument sharing properties, contribute lexical semantic information to the event. In particular, I claim that the lexical semantic contribution of a light verb falls into one of two categories: PATH or CONFIGuration. This division is inspired by the conceptualization of motion events based on Talmy (1985), where *motion, path, figure, ground, manner* and *cause* are key notions of expressing motion events. In particular, the ways of combining manner and path of motion differ across languages (see Narasimhan (2003) for Urdu/Hindi, although she does not take into account complex predicates of motion), which is confirmed by psycholinguistic experiments on the conceptualization of motion events (Slobin (2004) and references therein). Therefore, I argue for an explicit encoding of these two notions on the level of f-structure.

For PATH, I build on Jackendoff's (1990) assumption that the notion of path is one of the "semantic parts of speech" and is specified by a set of attributes. For complex predicates of motion, I claim that the specific shape of the PATH is in fact instantiated by the light motion verbs in Urdu/Hindi, complementing the range of spatial postpositions. Table 4 shows the PATH attributes proposed by Jackendoff (1990) and the corresponding light verbs in Urdu.

Jackendoff's PATH attributes	Light verbs of motion in Urdu
to	*g^{h}ʊs-na* 'to enter'
toward	*baṛ^h-na* 'to advance'
away-from/from	*nɪkal-na* 'to emerge'

Table 4: Light verbs of path in Urdu

Following the key notions of Talmy (1985) and Slobin (2004), motion events are also characterized by the configuration (or manner) with which they are carried out. As for PATH, I assume that this concept is conveyed by a number of light motion verbs which, based on the entailments of their full verb meaning, modify the manner with which the motion is carried out. So far, the literature does not provide a set of semantic attributes which are abstract enough to describe the contribution of the Urdu/Hindi motion light verbs, therefore I base the attributes on the results of the quantitative investigation in section 2.3 and the lexical semantic contribution of the respective light verbs. From this, a set of configurational attributes can be derived. Table 5 summarizes a number of light verbs which encode the configuration or manner in Urdu/Hindi motion CPs.

CONFIG attributes	Light verbs of motion in Urdu
continuity	*cal-na* 'to walk'
speed	*b^{h}ag-na* 'to run' *doṛ-na* 'to run' *uṛ-na* 'to fly'

Table 5: Light verbs of motion configuration in Urdu

Nevertheless, the data show that these light verbs cannot be added arbitrarily to motion events, in particular the two near synonyms *b^{h}ag-na* 'to run' and *doṛ-na* 'to run' cannot be used interchangeably. The lexical constraints that need to be fulfilled in order for the light verbs to be compatible still need to be worked out.

4.3 Constituent structure

The verbal phrase of complex predicates of motion is grouped under one constituent (VCmotion), where the main motion verb (Vmain) precedes the light motion verb (Vlight-motion). The c-structure for (25) is shown in Figure 1.

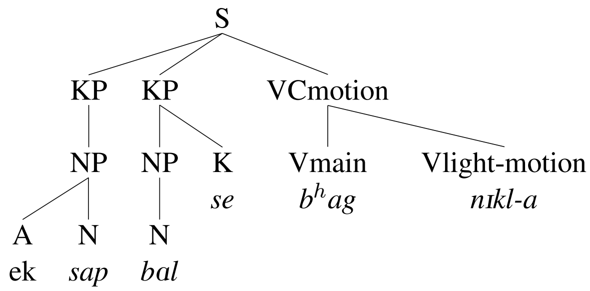

Figure 1: C-structure analysis of motion CPs

This analysis parallels the treatment of other complex predicates in Urdu, in particular their computational analysis in the Urdu ParGram grammar (Butt et al., 1999; Butt and King, 2007; Bögel et al., 2009).

4.4 Functional structure

The contribution of motion verbs in complex predicates of motion with respect to argument sharing and lexical semantic contribution is stored in the lexicon. For this, I adopt the basic idea in Butt (2010), who argues for one underlying underspecified entry which can play out as a light or full verb. The lexical-semantic features of PATH and CONFIG are kept under a [LEX-SEM MOTION] feature, as the [LEX-SEM] f-structure is already used for other lexical semantic information such as agentivity, which is syntactically represented by the ergative case marker in Urdu/Hindi. In the following, I present the analyses for the two kinds of light verbs.

Case #1: The finite motion verb is an event-fusional light verb of motion. The event-fusional light verbs of motion such as *cal-na* 'to move/walk' and the near-synonyms *doṛ-na* and *b^h ag-na* 'to run' contribute lexical semantic information and unify their arguments with those of the main verb. The construction in (26) exemplifies the f-structure treatment of a CP with *b^h ag-na* 'to run': Its lexical semantics is bleached or "light" in the sense that it looses its actual running interpretation, but it contributes a sense of speed to the main motion event.

(26) sap bɑl=se **nɪkɑl** **b^h ag-a**
snake.M.Sg.Nom snake-pit.M.Sg.Obl=Instr **emerge** **flee-Perf.M.Sg**
'The snake shot out of the snake pit.'

The functional structure in Figure 2 shows that similar to aspectual CPs in Urdu/Hindi, the verb in the root form, *nɪkal* 'emerge' is the main verb of the sentence and licenses a SUBJ and an OBL. The light verb *b^h ag-na* 'to run' does not have its own predicate value, but contributes its lexical semantic information under [LEX-SEM MOTION CONFIG].

$$\begin{bmatrix} \textsc{pred} & \text{‘nıkɑl} < \textsc{subj}, \textsc{obl} > \text{’} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{‘sap’} \end{bmatrix} \\ \textsc{obl} & \begin{bmatrix} \textsc{pred} & \text{‘nala’} \end{bmatrix} \\ \textsc{lex-sem} & \begin{bmatrix} \textsc{motion} & \begin{bmatrix} \textsc{config} & \text{speed} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Figure 2: F-structure for (26)

This analysis of the light verb makes the correct predictions for the behavior of the construction in the causative in that in CPs with event-fusional light verbs, only the main verb in the root form can be causativized. This is exemplified in (27) for the causative alternant of the construction in (26): The external causer *malık* ‘owner’ is added to the event, licensed by the causative form of the main verb *nıkal* ‘emerge.Caus’.

(27) a. malık=ne sap bɑl=se
owner.M.Sg=Erg snake.M.Sg.Nom snake-pit.M.Sg.Obl=Instr
nıkal **b^{h}ag-a**
emerge.Caus flee-Perf.M.Sg
‘The owner made the snake shot out of the snake pit.’

Figure 3 shows that the analysis of the causative CP construction is parallel to the construction with simple verbs proposed by Butt (1998) and Butt and King (2006), in that the main verb *nıkal* ‘emerge’ is embedded under a causative predicate A-CAUSE, which licenses the subject of the sentence, *malık* ‘owner’. The subject in the inchoative variant in (26), *sap* ‘snake’, turns into the object in the causative variant. The event-fusional light verb *b^{h}ag-na* ‘to run’ again contributes LEX-SEM information.

$$\begin{bmatrix} \textsc{pred} & \text{‘}\textsc{a-cause} < \textsc{subj}, \text{nıkɑl} < \textsc{obj}, \textsc{obl} > > \text{’} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{‘malık’} \end{bmatrix} \\ \textsc{obj} & \begin{bmatrix} \textsc{pred} & \text{‘sap’} \end{bmatrix} \\ \textsc{obl} & \begin{bmatrix} \textsc{pred} & \text{‘nala’} \end{bmatrix} \\ \textsc{lex-sem} & \begin{bmatrix} \textsc{motion} & \begin{bmatrix} \textsc{config} & \text{speed} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Figure 3: F-structure for (26)

In the following, I present the analysis for argument-fusional light verbs of motion, which in addition to their lexical semantics contribute extra arguments to the motion event.

Case #2: The finite motion verb is an event-fusional light verb A more complex case arises when the light verb in a motion CP adds arguments which are not licensed by the main verb. As an example, consider the construction in (28). The verb *nɪkal-na* ‘to emerge’ is a very common light verb in motion CPs and contributes lexical semantic information close to its full verb meaning in that it emphasizes the path out of a source location, but it also licenses a source oblique, here *mɑkan* ‘house’, which is not licensed by the main verb of the sentence, *kud-na* ‘to jump’.

(28) cor mɑkan=se bahɑr **kud nɪkl-a**
thief.M.Sg.Nom house.M.Sg=Instr outside **jump emerge-Perf.M.Sg**
‘The thief jumped out of the house.’

One solution would be to use the finite light verb as the main predicate of the sentence and treat the verb in the root form as a modifier of that verb, however this goes against the syntactic evidence for monoclausality presented in section 3. The solution I propose makes use of the restriction operator introduced by Butt et al. (2003) for complex predicate formation, in that the subject of the light verb is restricted out in order to allow the subject of the main verb take its place. This means that the root verb, here *kud-na* ‘to jump’, is treated as the main predicate of the construction, which also licenses an event filled by *nɪkal-na* ‘to emerge’, which in turn licenses an oblique source location. As a whole, the two predicates license two grammatical functions, SUBJ and OBL. The lexical semantic information on PATH additionally contributed by *nɪkal-na* ‘to emerge’ is encoded under [LEX-SEM MOTION]. Figure 4 illustrates the analysis.

$$\left[\begin{array}{ll}
\text{PRED} & \text{‘kud} < \text{SUBJ}, \text{nɪkɑl} < \text{OBL} > >\text{’} \\
\text{SUBJ} & \left[\begin{array}{ll}\text{PRED} & \text{‘cor’}\end{array}\right] \\
\text{OBL} & \left[\begin{array}{ll}\text{PRED} & \text{‘mɑkan’} \\ \text{SEM-PROP} & \left[\begin{array}{ll}\text{LOCATION} & \text{from}\end{array}\right] \\ \text{CASE} & \text{instr}\end{array}\right] \\
\text{LEX-SEM} & \left[\begin{array}{ll}\text{MOTION} & \left[\begin{array}{ll}\text{PATH} & \text{away-from}\end{array}\right]\end{array}\right]
\end{array}\right]$$

Figure 4: F-structure for (28)

An interesting case arises with the causative alternant of argument-fusional CP constructions: In these CPs, both predicates are required to be marked with the causative, otherwise the construction is ungrammatical. This is illustrated by example (29), the causative variant of (28), where the verbs *kud-a-na* ‘to jump-Caus’ as well as *nɪkal-na* ‘to emerge.Caus’ are in the causative. The requirement that the finite verb has to be in the causative confirms the “less light” status of these finite verbs in that they actively contribute to the subcategorization frame of the construction.

(29)	malık=ne	cor	makan=se	bahar
	owner.M.Sg=Erg	thief.M.Sg.Nom	house.M.Sg=Instr	outside

kud-a	**nıkal-a**
jump-Caus	**emerge.Caus-Perf.M.Sg**

‘The owner made the thief jump out of the house.’

The analysis I propose here is shown in Figure 5: The causative subevent introduced by both motion verbs is recorded as the single outermost predicate A-CAUSE, which embeds the two motion verbs and their subcategorization frames. This analysis abstracts away from the fact that both verbs have a causative subcategorization frame on their own, but accounts for the fact that the motion verbs contribute the same causer to the event.

$$\begin{bmatrix} \text{PRED} & \text{‘A-CAUSE} < \text{SUBJ, kud} < \text{OBJ, nıkal} < \text{OBL} > > >\text{’} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{‘malık’} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{‘cor’} \end{bmatrix} \\ \text{OBL} & \begin{bmatrix} \text{PRED} & \text{‘makan’} \\ \text{SEM-PROP} & \begin{bmatrix} \text{LOCATION} & \text{from} \end{bmatrix} \\ \text{CASE} & \text{instr} \end{bmatrix} \\ \text{LEX-SEM} & \begin{bmatrix} \text{MOTION} & \begin{bmatrix} \text{PATH} & \text{away-from} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Figure 5: F-structure for (29)

In sum, the f-structure analyses show that light motion verbs are not uniform in the way they merge with main motion verbs in complex predicates of motion, in particular with respect to predicate-argument structure. As a consequence of the analysis, swapped motion verb constructions do not have the same f-structure, although their interpretation is the same.

5 Discussion and conclusion

The survey of motion verb sequences in Urdu/Hindi has shown that they should be treated as a new type of complex predicate in the language, the *complex predicates of motion*. This implies a new set of light verbs, namely *light verbs of motion*, which are shown to behave differently than aspectual and permissive light verbs established by Butt (1995). On the one hand, their influence on the overall event structure is more prominent than what is known from other complex predicates in the language, in particular due to causativization and the ability to swap light verb and main verb. On the other hand, the constraints that are contributed by each motion verb and the exact mechanisms that prevent or license motion verb combinations are less transparent, not least because of dialectal differences.

However, light verbs of motion share important conceptual properties with other light verbs in the language, in particular, they merge their arguments and contribute lexical semantic information, a "bleached" version of their full verb meaning. However, the group of light verbs of motion is not uniform due to the fact that they share their arguments in different ways: The *event-fusional light verbs of motion* share their arguments and contribute lexical semantic features, whereas the *argument-fusional light verbs of motion* contribute additional arguments, which are not licensed by the main verb. This variation yields two different analyses on the level of f-structure: For the event-fusional CPs, the main verb is the sole predicate of the sentence, whereas in the argument-fusional case, the main verb merges its arguments with those of the embedded light verb. The causative alternants of motion CPs are parallel to simple verb causatives in that the causer is licensed by an A-CAUSE predicate, which embeds the argument structure of the motion CP.

The LFG analysis also records the lexical semantic contribution of the light motion verbs and groups it according to the two notions PATH and CONFIGuration, two key notions of expressing motion events. The attributes of PATH are cross-linguistically well-established and have been formalized in Jackendoff (1990). The contribution of the CONFIG attributes, on the other hand, is harder to grasp and highly language-dependent, as the description of manner of motion is more difficult to formalize. In the case of Urdu/Hindi complex predicates of motion, the contribution of the light verbs regarding CONFIG is inferred based on the evidence coming from the quantitative investigation of the phenomenon and the way different motion verbs consistently modify motion events language-internally.

An interesting area for further research is to investigate the exact workings that determine the grammaticality and ungrammaticality of certain combinations. The restrictions do not seem to hold on a syntactic, but rather on a lexical semantic level that goes beyond the encoding of PATH and CONFIG. This relates to the question as to what aspects of meaning apart from path and configuration are exactly contributed by the verbs in the sequence. Resolving these issues will also pave the way for a more formal account of the argument structure which deals both with argument sharing as well as lexical semantic composition.

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CAUSATIVES AS COMPLEX PREDICATES WITHOUT THE RESTRICTION OPERATOR

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Abstract

The paper explores an extension of the LFG framework at the level of semantics. The problem of so-called syntactically formed complex predicates is discussed and a solution is proposed that combines the elegance of the treatment of morphology and syntax within LFG with modern approaches to semantics.

1 Introduction

While LFG provides a well-studied framework for morphosyntactic analysis, semantics is less elaborated and several mutually incompatible approaches have been proposed within this formalism (we survey some of them briefly in Subsection 5.1). The aim of this paper is to sketch a formal approach to semantics and its integration with the apparatus of LFG.

The impulse for the reported research was a close examination of so-called syntactically formed complex predicates, especially causatives in Romance languages. Mohanan (1997) defines complex predicates as a "[...] construction [...] in which two semantically predicative elements jointly determine the structure of a single syntactic clause." While complex predicates appear already in the work of Aissen and Perlmutter (1983), in the context of LFG they were investigated, for example, by Alsina (1996, 1997) and Butt (1997).[1] The latter approach was the point of departure for our investigation. Aside from Catalan causatives, we will also illustrate the interplay between syntax and (lexical) semantics with examples from Aymara, a polysynthetic language. We restrict ourselves to verb-verb compounds.

We use Kaplan's (1995) mathematical notation[2] throughout the paper.

2 Complementation vs. Composition

Within LFG, Alsinas's (1996; 1997) concept of complex predicates has been applied to a number of phenomena and languages including, for example, Turkish causatives (Çetinoğlu et al., 2008). These approaches are comparable insofar as they use the so-called restriction operator (RO) introduced by Kaplan and Wedekind (1993). The reason for the use of the RO is the fact that standard LFG does not allow for modification of the PRED attribute in f-structures. The RO solves this problem by allowing the exclusion of attributes from an f-structure. We propose two solutions to this problem that circumvent the RO. One is the so-called equational unification, a generalization of the unificational mechanism used

[1] See also (Alsina et al., 1997) for a general overview.

[2] More specifically, A denotes the set of atomic symbols, N denotes the set of nodes, F denotes the set of feature structures, S denotes the set of semantic forms. An f-structure is a function that takes atomic symbols to $A \cup F \cup S$. Functional correspondence is expressed by the function $\phi : N \to F$ that takes nodes in a c-structure to f-structures.

in "standard" LFG, and the other is the so-called event semantics. The latter approach represents a rather radical extension of LFG that goes far beyond the treatment of complex predicates.

Consider the following Catalan example. The PRED value of the main f-structure we use in the examples to explicate how E-unification works is given in (2).

(1) *El vaig fer riure.*
him go.1SG do.INF laugh.INF
"I made him laugh."

(2) $\text{cause}\langle(\uparrow \text{SUBJ}), \text{riure}\langle(\uparrow \text{OBJ})\rangle\rangle$

Unlike in languages with morphologically formed causatives, such as Turkish or Aymara, Catalan causatives are formed syntactically, i.e. the complex PRED value is not created in the lexicon. We will show in the next section that the creation of complex predicates can be formalized as unification. First, however, let us illustrate Alsina's formal treatment of complex predicates.

The operation that "merges" two semantic forms is called "composition" by Alsina as opposed to "complementation" (which is the term he uses for structural unification). His "composition" operation, which uses the RO, is defined thus (Alsina, 1997, p. 236):

Definition 1 *The operator $=_H$ is defined as follows:*

$$\begin{aligned}\uparrow =_H \downarrow \stackrel{df}{\equiv}\ & (\uparrow \backslash PRED) = (\downarrow \backslash PRED)\\ & (\uparrow PRED) =\\ & = F((\downarrow PRED), (\rightarrow_H PRED))\end{aligned}$$

where the symbol $\rightarrow_H$ refers to a sister node with the head equation and

1. $F(x, \varnothing) = x$,
2. $F(P^1\langle a\rangle, \dots P^*\langle b\rangle \dots) = \dots P^1\langle c\rangle \dots$ *where P^* is an unspecified predicator and c is the unification of a and b,*
3. *elsewhere, the result is vacuous.*

We illustrate in the next section how two semantic forms, like (3), are composed to form a complex form in a single f-structure.

3 *E*-Unification in Term Algebras

The process of the composition of f-structures is based on unification. In standard LFG, PRED values are treated as atoms in the syntactic component, making it impossible to alter them. However, it is possible to use equational unification, a concept used in logical programming for deduction and reasoning, to circumvent the RO and use only standard functional descriptions.

For Catalan causatives, we assume the following PRED values of the verbs in (1):

(3) *fer* $\text{cause}\langle(\uparrow \text{SUBJ}), f\langle(\uparrow \text{OBJ})\rangle\rangle$
riure $\text{laugh}\langle(\uparrow \text{SUBJ})\rangle$

The symbol f represents a higher-order variable that can be instantiated with a function symbol. To form a complex causative predicate in the syntax, we define an equational theory ($\doteq_E$) induced by the following term identity (equational theories E_i constitute a separate part of the grammar, aside from the lexicon and context-free rules with functional annotations):

(4) $E = \{\text{cause}\langle(\uparrow \text{SUBJ}), f\langle(\uparrow \text{OBJ})\rangle\rangle \approx f\langle(\uparrow \text{SUBJ})\rangle\}$

If we unify the f-structures of *fer* and *riure* modulo $\doteq_E$, we get the complex PRED value given in (2).[3]

3.1 Formal Definition of *E*-Unification

Let $\mathcal{T}(\mathcal{F}, \mathcal{V})$ be a term algebra with a signature (set of function symbols) $\mathcal{F}$ and a set of variables $\mathcal{V}$. Let E be a set of equations over $\mathcal{T}(\mathcal{F}, \mathcal{V})$ (called identities or axioms). We define equational theory $\doteq_E$ as the least congruence relation on $\mathcal{T}(\mathcal{F}, \mathcal{V})$ closed under substitution and containing E. More formally, $\doteq_E$ is the least binary relation on $\mathcal{T}(\mathcal{F}, \mathcal{V})$ with the following properties:

1. $E \subseteq \doteq_E$
2. $s \doteq_E s$ for all s
3. if $s \doteq_E t$ then $t \doteq_E s$ for all s, t
4. if $s \doteq_E t$ and $t \doteq_E r$ then $s \doteq_E r$ for all s, t, r
5. if $s_1 \doteq_E t_1, \ldots, s_n \doteq_E t_n$ then $f(s_1, \ldots, s_n) \doteq_E f(t_1, \ldots, t_n)$ for all s, t, n, f
6. if $s \doteq_E t$ then $s\sigma \doteq_E t\sigma$ for all s, t, σ

An E-unification problem over $\mathcal{F}$ is a finite set of equations $\Gamma = \{s_1 \doteq_E t_1, \ldots, s_n \doteq_E t_n\}$ where $s_i, t_i \in \mathcal{T}(\mathcal{F}, \mathcal{V})$. An E-unifier of Γ is a substitution σ such that $s_1\sigma \doteq_E t_1\sigma, \ldots, s_n\sigma \doteq_E t_n\sigma$. $\mathcal{U}_E(\Gamma)$ is the set of E-unifiers of Γ and Γ is E-unifiable iff $\mathcal{U}_E(\Gamma) \neq \emptyset$. Unlike syntactic unification, a most general unifier may not exist. Typically, one can compute a minimal complete set of E-unifiers (i.e., a set of unifiers that are not comparable to each other with respect to the relation of being more general modulo E).

[3] Since E-unification as defined in the next subsection operates on first-order terms, we reify all terms in order for the function variable to be an argument. For example, $f(x)$ becomes $pred(f, x)$.

3.2 Discussion

It follows from the definition given above that equational unification is a simple generalization of syntactic unification. In (1), for example, we unify the PRED values of *fer* and *riure* modulo E as defined in (4) using the substitution

$$\sigma = \{f \mapsto \text{riure}\}$$

We have seen how the f-structures of *fer* and *riure* can be combined to an f-structure with a complex PRED value using only unification, i.e. using $\uparrow=\downarrow$ for both nodes. By defining an equational theory $\doteq_E$ over a set of identities E ((4) is a simple example for causatives of intransitive verbs) E can be understood as a linguistically motivated transparent description of syntactically formed PRED altering constructions. E is, of course, language-specific while the unification mechanism is universal.

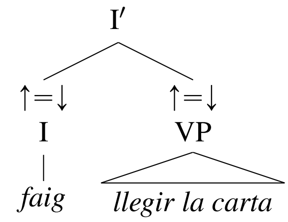
We conclude this section with an example for a transitive verb (in "standard" LFG, the unification of the PRED values in (6) would lead to a clash, thus '=' is to be understood as E-unification):[4]

(5)

Li	*faig*	*llegir*	*la*	*carta.*
him	do.1SG	read.INF	the	letter

"I make him read the letter."

(6)



The PRED value of the f-structure of the sentence and the corresponding E-theory are as follows:

(7) $\text{cause}\langle(\uparrow \text{SUBJ}), \text{llegir}\langle(\uparrow \text{OBJ}_\theta)(\uparrow \text{OBJ})\rangle\rangle$

(8) $E = \{\text{cause}\langle(\uparrow \text{SUBJ}), f\langle(\uparrow \text{OBJ}_\theta)(\uparrow \text{OBJ})\rangle\rangle \approx f\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\}$

4 *E*-Unification of Feature Structures

The solution proposed in the previous section, while formally sound and correct, entails a serious problem: it uses higher-order logic since the variable f in the

[4]It is clear that verbs with different valency frames need to be treated by different equations. To make the declarations more transparent to traditional linguists, one could use equation templates to express more equations with merely one expression (much like $S \to \mathcal{C}^+$ is a rule template which represents an infinite set of context-free rules).

equations in (4) and (8) stands for a function symbol. Thus, we adapt the method to a "reified" semantic representation and investigate E-unification of features structures. We assume an intuitive interpretation of feature structures as directed acyclic graphs with edges labelled by atomic symbols (elements from A) and nodes labelled by elements from $F \cup A \cup S$. A formal treatment based on attribute-value logic will be described in the next subsection.

For clarity, we repeat here (1) as (9).

(9) *El* *vaig* *fer* *riure*
him go.1SG do.INF laugh.INF
"I made him laugh."

The corresponding lexico-semantic value of the complex predicate, expressed as a feature structure, is given in (10).[5] The feature structure is a straightforward (recursive) conversion of a term where FN is its functor and ARGn its arguments.

$$(10)\quad \begin{bmatrix} \text{FN} & \text{`cause'} \\ \text{ARG1} & \textsc{subj} \\ \text{ARG2} & \begin{bmatrix} \text{FN} & \text{`riure'} \\ \text{ARG1} & \textsc{obj} \end{bmatrix} \end{bmatrix}$$

Note that there is no way to obtain (10) from the feature structures of the two verbs in (9) as formed in the lexicon (given in (11)[6]) by means of structural unification.

$$(11)\quad \begin{bmatrix} \text{FN} & \text{`cause'} \\ \text{ARG1} & \textsc{subj} \\ \text{ARG2} & \begin{bmatrix} \text{FN} & f \\ \text{ARG1} & \textsc{obj} \end{bmatrix} \end{bmatrix} \quad \begin{bmatrix} \text{FN} & \text{`riure'} \\ \text{ARG1} & \textsc{subj} \end{bmatrix}$$

The operation that merges the two values ("composition") can be implemented by means of E-unification of feature structures based on the following E-theory[7] (the curve denotes, according to a common LFG notation, value sharing).

$$(12)\quad E = \left\{ \begin{bmatrix} \text{FN} & \text{`cause'} \\ \text{ARG1} & \textsc{subj} \\ \text{ARG2} & \begin{bmatrix} \text{FN} & \\ \text{ARG1} & \textsc{obj} \end{bmatrix} \end{bmatrix} \approx \begin{bmatrix} \text{FN} & \\ \text{ARG1} & \textsc{subj} \end{bmatrix} \right\}$$

As with term algebras, E states that, for example, *He laughs* and *I made him laugh* are equal modulo the feature of causation.

[5]We use attribute symbols from (Kaplan and Maxwell, 1996).

[6]These PRED values are encoded as terms in the corresponding morpholexical entries of the verbs in the lexicon.

[7]Here again, '=' in the corresponding rule annotation denotes E-unification.

4.1 Formal Representation of Feature Structures

This subsection explicates how the extended unification method, described in the previous subsection, is implemented in our system. Feature structures can be represented as formulae of a fragment of first order logic with equality. We use the attribute-value logic (henceforth AVL) proposed by Wedekind (1991) which is briefly sketched here in the context of E-unification.

In AVL, we have a set of constants $\mathcal{C}$ and a set of unary function symbols $\mathcal{F}_1$ ($\mathcal{C} \cap \mathcal{F}_1 = \emptyset$). The class of terms $\mathcal{T}$ contains all constants and if τ is a term and f a function symbol, $f\tau$ is also a term. The atomic formulae of AVL have the form $\tau_1 = \tau_2$ where $\tau_1, \tau_2 \in \mathcal{T}$ or $\perp$.[8] The formulae are formed recursively by means of the logical connectives $\neg$ and $\vee$.

Equivalence classes of certain AVL formulae can be seen as a commutative idempotent monoid. The atoms of the monoid are atomic formulae of the form $\sigma a = b$ where $\sigma \in \mathcal{F}_1^+$ and a and b are constants. The unit element is $\top$ and the complementation operation is $\wedge$. Subsumption is defined as $\varphi \sqsubseteq \psi \equiv \psi \rightarrow \varphi$. It is easy to see that a thus defined monoid is commutative and idempotent (further it is atomistic and distributive). The operator I that states whether a feature structure is well-formed can be defined on the set of formulae as follows:

$$I(\varphi) = \begin{cases} \mathbf{1} & \text{if } \varphi \text{ is satisfiable} \\ \mathbf{0} & \text{otherwise} \end{cases}$$

Thus $I(\varphi \wedge \psi) = \mathbf{1}$ if the feature structures expressed by φ and ψ are unifiable. Since AVL is decidable, I is computable for all formulae.

Now we turn to E-theories. The equational axioms (the elements of E) have the form

$$\sigma_1 x \wedge \cdots \wedge \sigma_n x \approx \tau_1 x \wedge \cdots \wedge \tau_m x$$

where $\sigma_i, \tau_i \in \mathcal{F}_1^+$ and $x \in \mathcal{C}$ (i.e., x is a constant). Sometimes it may be useful to allow x to be a term, i.e., ηy where $\eta \in \mathcal{F}_1^*$ and $y \in \mathcal{C}$ (which gives us the possibility of replacing a substructure in a feature structure).

4.2 Computationally Tractable *E*-Unification via Rewriting

In this subsection we briefly describe an efficient implementation of E-unification as implemented in our experiments. Readers not interested in implementation details may skip to Section 5. While there is a universal E-unification procedure that is sound and complete (Baader and Snyder, 2001; Gallier and Snyder, 1989), it is in general very inefficient and yields redundant results. In this subsection, we briefly discuss techniques that allow for an efficient E-unification algorithm for a subclass of E-theories. The terminology in what follows as well as some theorems are taken from (Baader and Nipkow, 1998) (for this reason we omit the proofs).

[8] We use the symbol $=$ instead of $\approx$ for equality in AVL as the latter symbol is already in use for equational axioms.

Definition 2 *A rewriting system R is terminating if there is no infinite chain*

$$a_1 \to_R a_2 \to_R \dots$$

Definition 3 *b is a normal form of a if $a \overset{*}{\to}_R b$ and there is no c such that $b \to_R c$. A rewriting system R is called normalizing if every a has a normal form.*

Definition 4 *A rewriting system R is called locally confluent if for every a, b, c such that $a \to_R b, a \to_R c$ there exists a d and $b \overset{*}{\to}_R d, c \overset{*}{\to}_R d$.*

Definition 5 *A rewriting system R is called confluent if for every a, b, c such that $a \overset{*}{\to}_R b, a \overset{*}{\to}_R c$ there exists a d and $b \overset{*}{\to}_R d, c \overset{*}{\to}_R d$.*

Lemma 1 (Newman's lemma) *A terminating rewriting system is confluent iff it is locally confluent.*

E-equivalence on F can be interpreted as a confluent rewriting system if an ordering $<$ defined on F can be found such that $a < b \to a \cdot c < b \cdot c$ for all $a, b, c \in F$ (i.e. $<$ is monotone) and the Knuth-Bendix completion procedure (Knuth and Bendix, 1970) succeeds. In such a case, we obtain a rewriting system R and $\doteq_R$ (defined by $a \doteq_R b \equiv a \overset{*}{\leftrightarrow}_R b$) is equivalent to $\doteq_E$.

Note that if there is an oriented rewriting system $\to_R$ equivalent to $\doteq_E$ that is not confluent, we can check E-equivalence of a and b by computing all normal forms $a \overset{*}{\to}_R \hat{a}$ and $b \overset{*}{\to}_R \hat{b}$ and checking whether $\hat{a} = \hat{b}$.

5 Towards More Flexible Semantic Forms

In the previous section, we have seen how values of the PRED attribute (elements of S) can be represented using (a fragment of first-order) logic. Now we put semantic forms in context of the well-studied so-called "Davidsonian" semantics. Davidson (1967) analyzes sentences using events that stand for actions treated as individuals in a first-order language. We use Hobbs' (1985; 2003) notation[9] (such as primed predicates that denote "eventualities") in the examples.

After surveying two most elaborated approaches to semantics within LFG, we show how simple and complex predicates are represented and how semantic representations can be incrementally created in LFG via codescription.[10]

[9]A reviewer has raised the question whether the so-called "donkey sentences" can be build up in this formalism. The answer is "yes" and the issue is discussed in detail by Hobbs (1983).

[10]While we used LFG in the experiments, the method is flexible enough to be used in any rule-based grammar formalism based on context-free or categorial grammars such as (Uszkoreit, 1986) or (Kay, 1979, 1984).

5.1 Related Work

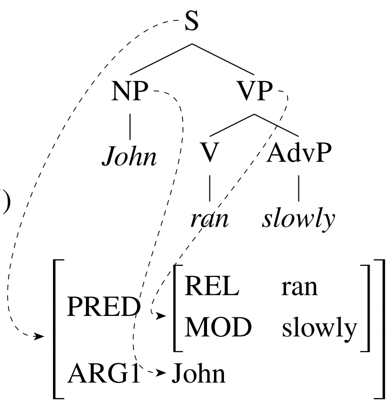
Virtually all approaches to formal semantics assume the Principle of Compositionality, formally formulated by Partee (1995) as follows: "The meaning of a whole is a function of the meanings of the parts and of the way they are syntactically combined." This means that semantic representation can be incrementally built up when constituents are put together during parsing. Since c(onstituent)-structure expresses sentence topology rather than grammatical relations, the rules that combine the meanings of subphrases frequently refer to the underlying syntactic structure, that is, f(unctional)-structure in LFG. Indeed, Halvorsen and Kaplan (1995) in their account of semantics within LFG define the s(emantic)-structure as a projection of the c-structure (through the correspondence function σ) but they refer to grammatical functions (GFs) by means of the compound function $\sigma\phi^{-1}$ (ϕ is the correspondence function from c-structures to f-structures), as in the following example:

(13) John ran slowly.

The corresponding lexical entry for the verb is

(14)
$$\begin{array}{l} (\sigma\mathcal{M} * \mathrm{REL}) = \mathrm{ran} \\ (\sigma\mathcal{M} * \mathrm{ARG1}) = \sigma\phi^{-1}(\uparrow \mathrm{SUBJ}) \\ (\sigma\mathcal{M} * \mathrm{ARG2}) = \sigma\phi^{-1}(\uparrow \mathrm{OBJ}) \end{array}$$

and the resulting correspondence between the c-structure and the s-structure is

(15)


Note that Halvorsen and Kaplan (1995) represent s-structures as feature structures (since they use functional annotations to construct them). Example (15) can be more conventionally expressed as $slowly(ran)(John)$.

Recent approaches to semantics in LFG are based on the so-called "glue semantics" (Dalrymple et al., 1993, 1995; Dalrymple, 2001). Consider the sentence

(16) Bill obviously kissed Hillary

Its semantic form is, according to Dalrymple et al. (1993),

$$obviously(kiss(Bill, Hillary))$$

Glue semantics uses linear logic; lexical entries are assigned "meaning constructors" that consist of a logical expression and instructions for how the meaning is put together. For *to kiss*, for example, we have

(17) $\forall X, Y.(f\ \text{SUBJ})_\sigma \rightsquigarrow X \otimes (f\ \text{OBJ})_\sigma \rightsquigarrow Y \multimap f_\sigma \rightsquigarrow kiss(X, Y)$

In words, (17) means that if the meaning of $(f\ \text{SUBJ})_\sigma$ is X and the meaning of $(f\ \text{OBJ})_\sigma$ is Y, then the meaning of f_σ is $kiss(X, Y)$. For brevity, meaning constructors are sometimes written as $[\![\mathbf{word}]\!]$. For (16), then, we get

(18) $$[\![\mathbf{Bill}]\!] \otimes [\![\mathbf{obviously}]\!] \otimes [\![\mathbf{kissed}]\!] \otimes [\![\mathbf{Hillary}]\!] \\ \vdash f_\sigma \rightsquigarrow obviously(kiss(Bill, Hillary))$$

The idea behind glue semantics is that the lexicon and the rules for syntactic assembly provide meaning constructors that are interpreted as soon as all expressions on the left-hand side of the linear implication ($\multimap$) are available.[11]

Note that both Halvorsen and Kaplan (1995) and glue semantics use higher-order logic. Furthermore, both approaches are "functionist" In the next section we go on to outline an account of semantics that, while using codescription, relies on pure first-order logic (FOL) for representation and on conjunction of existentially quantified positive literals as the means of meaning assembly, as advocated by Hobbs (1985) and on Minimalist grounds by Pietroski (2005).

5.2 Davidsonian Logical Representation

The sentence *John loves Mary* can be logically expressed (disregarding tense for the sake of simplicity) using a binary predicate for the verb and constants for its arguments:

(19) $love(John, Mary)$

Davidson (1967) has introduced "events" into the description of logical forms of sentences to be able to refer to "actions" by means of FOL (i.e. events are treated as individuals). We use the notation and terminology of Hobbs (1985; 2003) who introduced the "nominalization operator" and the term "eventuality" to refer to "possible events". The predicate $love$ in (19) can be "nominalized" and defined as follows:

(20) $love(x, y) \equiv \exists e.love'(e, x, y) \wedge Rexists(e)$

The newly introduced variable e is the eventuality of John's loving Mary and Hobbs' predicate $Rexists$ states that the eventuality is realized (this predicate is

[11]More recent work on glue semantics uses a slightly different notation. (17) would be written as

$$\lambda X.\lambda Y.kiss(X, Y) : (\uparrow \text{SUBJ})_\sigma \multimap [(\uparrow \text{OBJ})_\sigma \multimap \uparrow_\sigma]$$

discussed at length in (Hobbs, 1985, 2003), we will not need it in the remainder of the paper).

In the rest of the paper, we refer to "Davidsonian" formulae (with actions denoted by primed predicates) as *conjunctive logical forms* (CLF).[12]

5.3 Conjunctive Logical Forms and Parsing

As Bresnan (2001) puts it, "the formal model of LFG is *not* a syntactic theory [...] Rather, it is an architecture for syntactic theory". In light of this fact, we show in this section how CLFs can be integrated with the context-free backbone of LFG regardless of the concrete theory used (such as X′ theory).

Recall that in the formal architecture of LFG, N is the set of nodes and F is the set of f-structures. By Φ we denote the set of formulae (CLFs) and V denotes the set of variables that may occur in CLFs. In standard LFG, the mapping $M : N \to N$ takes nodes to their mother node and $\phi : N \to F$ takes nodes to f-structures. We introduce $\xi : N \to \Phi$ that takes nodes to formulae and $\tau : N \to V$ that takes nodes to variables.

For terminal nodes, ξ and τ are defined in the lexicon. The conversion of standard LFG semantic forms (PRED values) to CLFs is almost straightforward. A few examples are given in the following table:

(22)

(ϕ M $*$ PRED)	ξ M$*$	τ M$*$
'John'	$x = John$	x
'dog'	$dog(x)$	x
'see⟨(↑SUBJ),(↑OBJ)⟩'	$see'(e, \tau\phi^{-1}(\phi\,\mathrm{M} * \mathrm{SUBJ}),$ $\tau\phi^{-1}(\phi\,\mathrm{M} * \mathrm{OBJ}))$	e

The variables in the lexicon (i.e., x and e in (22)) are instantiated independently for every morpholexical entry. The derivation is considered invalid if the corresponding values of ϕ^{-1} are not defined.

Since the variables used in morpholexical entries are distinct, they are instantiated as unique in the same way as PRED values in standard LFG. An illustration (in prenex normal form) is given in (23).

(23) *John sees a dog.*

$$\exists e, x_1, x_2 . see'(e, x_1, x_2) \wedge x_1 = John \wedge dog(x_2)$$

[12]An alternative representation has been suggested by Parsons (1990). He, too, uses events but proposes unary predicates for actions and special predicates for their arguments. In this spirit, we use the following notation:

(21) $love'(e, x, y) \equiv love''(e) \wedge actor(e, x) \wedge patient(e, y)$

The formula of a nonterminal node is composed from the formulae of its daughter nodes. In LFG, the context-free rules are enriched with functional (morphosyntactic) annotations. Likewise, we enrich them with logical annotations. Since Hobbs' (1985; 2003) "ontologically promiscuous" formulae are conjunctions of positive literals, we combine the formulae of the daughter nodes using the logical connective $\wedge$.

In (24), n_i are the daughter nodes of n and $\varepsilon(n_i)$ are the corresponding logical annotations in rules (such as $actor(\vartriangle, \triangledown)$ for a NP node). Note that $\{n_1, \ldots, n_k\} = M^{-1}(n)$.

(24)
$$\begin{array}{ccccc} & & n & & \\ \varepsilon(n_1) & \varepsilon(n_2) & \ldots & \varepsilon(n_{k-1}) & \varepsilon(n_k) \\ n_1 & n_2 & & n_{k-1} & n_k \end{array}$$

Since n is a nonterminal node, $M^{-1}(n) \neq \varnothing$. We define $\xi(n)$ for nonterminal nodes by

(25) $$\xi(n) = \exists\tau(n). \bigwedge_{m \in M^{-1}(n)} \xi(m) \wedge \varepsilon(m)$$

$\tau(n)$ is a newly introduced variable. For ease of exposition, we give all formulae in an equivalent prenex normal form, i.e. $\mathsf{Q}_1 x_1 \ldots \mathsf{Q}_n x_n.\varphi$ where Q_i are quantifiers and φ contains no quantifiers.

In the logical annotations, we use two metavariables defined as follows in the context of $\varepsilon(n_i)$:

(26) $$\triangledown = \tau(n_i), \vartriangle = \tau(M(n_i))$$

Thus $\vartriangle$ and $\triangledown$ are to logical annotations what $\uparrow$ and $\downarrow$ are to functional annotations in standard LFG.[13]

[13]If we wanted the Neo-Davidsonian semantic representation, we would enrich context-free rules with logical annotations instead of using the ϕ function in the lexicon. For example:

(27)
$$\begin{array}{cccc} \mathrm{S} & \rightarrow & \mathrm{NP} & \mathrm{VP} \\ & & (\uparrow \mathrm{SUBJ}) = \downarrow & \uparrow = \downarrow \\ & & actor(\vartriangle, \triangledown) & \vartriangle = \triangledown \\ \mathrm{VP} & \rightarrow & \mathrm{V} & \mathrm{NP} \\ & & \uparrow = \downarrow & (\uparrow \mathrm{OBJ}) = \downarrow \\ & & \vartriangle = \triangledown & patient(\vartriangle, \triangledown) \end{array}$$

Rather than θ-roles, we use what is called "protoroles" (Dowty, 1991), "tectogrammatical roles" (Sgall et al., 1986) or "roles on the action tier" (Jackendoff, 1990) in the literature on semantic analysis of natural languages. Thus $actor(e, x)$ means that x has the role "actor" in the eventuality e.

5.4 Complex Eventualities

In this subsection we apply the formal machinery explicated in the previous subsection to complex eventualities[14] (of which complex predicates are a special case). Consider the sentence *John made Mary cry* with a syntactically formed causative. The sentence is represented by one f-structure (i.e. the f-structures of *made* and *cry* are unified and the corresponding nodes are coheads) with a complex semantic form (with two predicators as can be seen in (29)):

(28) cause$\langle$($\uparrow$SUBJ),cry$\langle$($\uparrow$OBJ)$\rangle\rangle$

The CLF of the sentence *John made Mary cry* is given in (29).

(29) $\exists e_1, e_2.cause'(e_1, John, e_2) \wedge cry'(e_2, Mary)$

To create a CLF given in (29), the rule that combines the causative verb (in English *make*) with the main verb is enriched with a logical annotation (that is used instead of the default formula (25)). The morpholexical entries of the verbs and the corresponding rule are given in (30) (φ is the logical form associated with the c-structure node of the main verb; the slash symbolizes substitution):[15]

	ξ M$*$	τ M$*$
make	$cause''(e) \wedge actor(e, \tau\phi^{-1}(\phi\text{M} * \text{SUBJ}))$	e
cry	$cry''(e) \wedge actor(e, \tau\phi^{-1}(\phi\text{M} * \text{SUBJ}))$	e

(30)
$$\begin{array}{llll} \text{VP} & \rightarrow & \text{VP} & \text{V} \\ & & \uparrow=\downarrow & \uparrow=\downarrow \\ \xi: & & & \psi \\ \varepsilon: & & \triangle = \triangledown & patient(\triangle, \triangledown) \end{array}$$

where $\psi = \varphi[actor(\triangledown, \tau\phi^{-1}(\phi\text{M} * \text{SUBJ}))/actor(\triangledown, \tau\phi^{-1}(\phi\text{M} * \text{OBJ}))]$. The morpholexical entries in conjunction with the rule in (30) generate the semantic form in (29).

5.4.1 Complex Eventualities in a Polysynthetic Language

The logical annotation that adjusts the alignment between semantic forms and grammatical functions may get more complicated in polysynthetic languages, such as Aymara (Hardman et al., 2001; Briggs, 1976; Adelaar, 2007; Cerrón-Palomino and Carvajal, 2009; Yapita and Van der Noordaa, 2008). Like many languages with polysynthesis, Aymara has polypersonal agreement, but object marking is forbidden from occurring on nominalized verb forms. The corresponding suffix is attached to the inflected verb instead, as in (31).[16] (In Aymara, clauses are individ-

[14] Complex eventualities can be roughly conceived of as a flat representation of Jackendoff's (1990) conceptual structures.

[15] While Parson's (1990) notation is equivalent to Davidson's (1967) from the standpoint of representation and reasoning, in case of complex eventualities the former is clearly easier to manipulate within LFG, thus we use it in the examples that follow.

[16] This feature is discussed in depth in (Homola and Coler, 2013) whence we take the examples.

uated by morphological marking (Hardman et al., 2001); affirmative clauses, for example, contain exactly one *-w(a)* suffix, i.e., (31) is a syntactic unit that constitutes a single clause.)

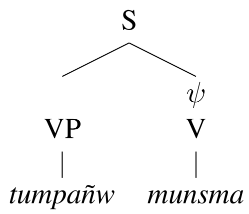
(31) *Tumpa-ñ-w* *mun-sma*
visit-INF-FOC want-SMPL$_{1\to 2}$
"I want to visit you."

The suffix *-sma* (which is a combined subject/object marker) has the annotation

(32)
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{(PRED} & \text{‘pro’)} \\ \text{PERSON} & 1 \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{(PRED} & \text{‘pro’)} \\ \text{PERSON} & 2 \end{bmatrix} \end{bmatrix}$$

$$actor(\triangle, \tau\phi^{-1}(\phi\text{M} * \text{SUBJ})) \wedge patient(\triangle, \tau\phi^{-1}(\phi\text{M} * \text{OBJ}))$$

The c-structure with the logical rule annotation is

(33)


where $\psi = \varphi[patient(\rhd, \tau\phi^{-1}(\phi\text{M} * \text{OBJ}))/patient(\nabla, \tau\phi^{-1}(\phi\text{M} * \text{OBJ})]$ and $\rhd$ refers to the term associated with the sister node (this notation is analogous to Alsina's (1997) $\to_H$). Described informally, the object marked on the finite verb is semantically transferred to the main (infinite) verb.

A very similar example follows:[17]

(34) *Tump-iri-w* *jut-sma*
visit-AG-FOC come-SMPL$_{1\to 2}$
"I came to visit you."

The difference is that the verb *to come* is intransitive, thus is cannot have a (syntactic) object at all. This puzzling example needs a detailed examination at the syntactic level. At the level of semantics, however, the compositional representation above is adequate.

[17]Note that the sentence contains exactly one *-w(a)* suffix, thus it is a single clause.

5.5 An Example

For illustration, we give here an analysis of a sentence taken (in a slightly modified form) from (Alsina, 1997) in the notation of CLFs.

(35) *L'* *elefant* *fa* *riure* *la* *hiena*
the elephant-MASC make-PRES,3SG laugh-INF the-FEM hyena
"The elephant makes the hyena laugh."

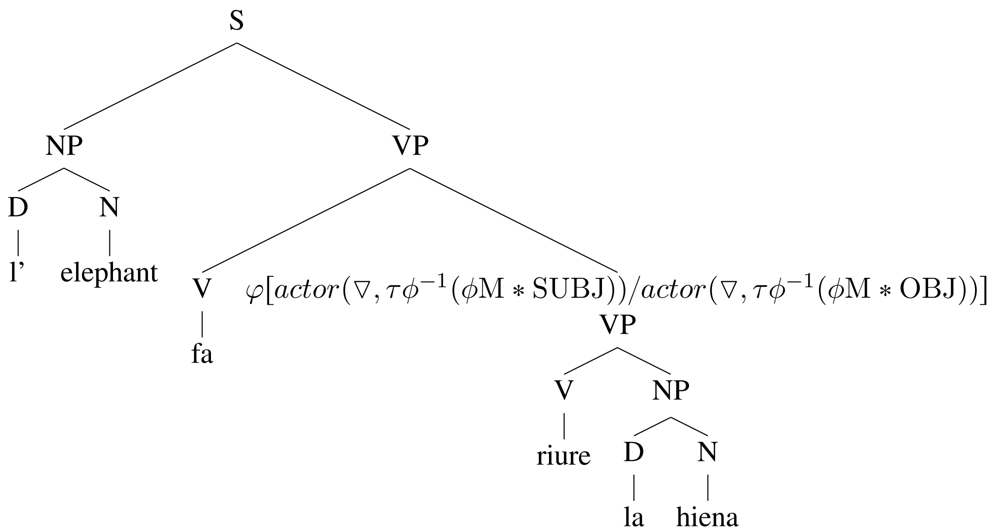
The morpholexical entries are:

(36)

$(\phi$ M $*$ PRED$)$	ξ M$*$	τ M$*$
'elefant'	$elephant(x)$	x
'hiena'	$hyena(y)$	y
fer	$cause''(e_1) \wedge actor(e_1, \tau\phi^{-1}(\phi\text{M} * \text{SUBJ}))$ $\wedge patient(e_1, \rhd)$	e_1
riure	$laugh''(e_2) \wedge actor(e_2, \tau\phi^{-1}(\phi\text{M} * \text{SUBJ}))$	e_2

The analysis yields the following c-structure

(37)



The CLF is as follows:

$$\exists x, y, e_1, e_2.elephant(x) \wedge cause''(e_1) \wedge actor(e_1, x) \wedge patient(e_1, e_2)$$
$$\wedge laugh''(e_2) \wedge actor(e_2, y) \wedge hyena(y)$$

Note that in conjunction with a commonsense theory, such as that of Hobbs (2005), we can directly conclude that

$$\exists y, e_2.laugh''(e_2) \wedge actor(e_2, y) \wedge hyena(y)$$

That is, *The elephant makes the hyena laugh* implies *The hyena laughs*.

6 Conclusions and Further Research

We have discussed the representation and syntactic formation of complex predicates, such as causatives, in the formal framework of LFG. The more conservative solution we have suggested is the use of E-unification that operates on semantic forms represented as expressions in term algebras, and as formulae in Wedekind's (1991) attribute-value logic.

As a more radical solution, we showed how a new, more flexible semantic representation (conjunctive logical forms) based on the (Neo-)Davidsonian approach to semantics can supplant the PRED attribute. Although we focused primarily on complex predicates, the latter account has far reaching consequences as it provides a full-fledged semantic framework that can be used to capture entire sentences and even discourse in a well-studied logical formalism.

A few ideas for further research include the following:

- Explore in detail E-unification and identify other areas where it could prove useful.
- Investigate the use of conjunctive logical forms in other types of compound sentences within LFG.
- Compare different predicate logical approaches to semantics, such as Hobbs' (1985; 2003) "ontological promiscuity", and identify the best one for the purposes of LFG.

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Abstract

This paper contributes to the debate over the number of features needed in order to offer an adequate analysis of agreement. Traditional grammar and some recent proposals, notably by Alsina and Arsenijević (2012a, b, c), operate with two types – what is conventionally referred to as syntactic versus semantic agreement. Adopting Wechsler and Zlatić's (2000: 800, 2003, 2012) model, which envisages a division into three types of agreement (two syntactic ones, in addition to a separate, purely semantic feature), this paper argues that we need such a tripartition, because without it we cannot account for the facts in languages like Serbian/Croatian, English and Bulgarian.

1 Introduction[1]

Traditional grammar has for a long time distinguished between so called syntactic (formal or grammatical) agreement/concord, (1), and semantic (or notional) agreement/concord, (2).[2]

(1) Even stage-shy, anti-industry **Nirvana <u>is</u>** on board. (COCA).
(2) **Nirvana <u>are</u>** believed to be working on cover versions of several seminal punk tracks. (BNC)

Some formal approaches, among them constraint-based ones, have called for at least three types of agreement (Wechsler and Zlatić 2000: 800, 2003, 2012), as have researches with a more typological background (Corbett 1983a: 81, 1986: 1015). Recently there has been renewed interest in agreement features in the setting of constraint-based theories like LFG and HPSG, with some doubts expressed as to how many sets of features are really needed to account for agreement phenomena. Alsina and Arsenijević (2012a,

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[2]Traditional sources often use the terms *concord* and *agreement* interchangeably. In this paper, following the established LFG and HPSG practice, *agreement* is used as a cover term, whereas *concord* is reserved to designate a type of agreement feature.

b, c), for instance, argue that it is extravagant to work with Wechsler and Zlatić's (2000, 2003, 2012) proposal involving three sets, namely concord, index and semantics. In Wechsler and Zlatić's model, concord and index both belong to syntax, the former more closely related to morphological declension and the latter more closely reflecting semantics, with semantic features forming a separate category. The motivation behind this apparent proliferation comes from Serbian/Croatian nouns like *deca* 'children' and *braća* 'brothers', which are said to agree with feminine singular attributive targets (concord agreement), neuter plural verbs and pronouns (index agreement) and, potentially, masculine plural pronouns (semantic/pragmatic agreement), as in example (3), where we illustrate concord agreement within the subject NP and index agreement in the predicate.

(3)	Ta	dobr-a	deca	su	doš-l-a.
	that.F.SG	good-F.SG	children	AUX.3PL	come-PPRT-N.PL[3]
	'Those good children came.'			(SC; Wechsler and Zlatić 2003: 51)	

Alsina and Arsenijević (2012a, b) believe that, rather than having three faces, agreement has only two – traditionally referred to as syntactic versus semantic agreement (or grammatical versus notional agreement/concord). The first accusation they level at Wechsler and Zlatić's trichotomy is that it gives rise to rampant redundancy and complexity, predicting that there would be numerous classes of nouns based on all the possible combinations of features, though in reality, only a handful of those classes have any members in them. In addition, it is deemed suspicious that most nouns, even in Serbian/Croatian, should have the same values for all their feature sets.

This paper aims to justify the need for at least three agreement feature sets. In the first place, redundancy is often misguided as criticism, especially in the light of agreement, which could be viewed as a superfluous linguistic luxury itself. Secondly, many of the putative classes involving nouns with no members in them can be independently ruled out by Corbett's (1983 and elsewhere) agreement hierarchies, which, roughly speaking, anticipate increasingly semantics-based agreement the further away from the controller the target is located. The system can be further streamlined by postulating default principles of feature inheritance. In addition, as Wechsler and Zlatić (2012: 384) point out, Alsina and Arsenijević's alternative proposal creates as much complexity as the original one which it is meant to replace.

Thirdly, this paper sets out to demonstrate that Alsina and Arsenijević's treatment rests on some rather problematic assumptions regarding the Serbian/Croatian data, which go against Corbett's (1983 and elsewhere) otherwise typologically and empirically sound generalisations of how agreement works. Therefore Alsina and Arsenijević do not provide a

[3] This analysis is not uncontroversial. It will be revisited below.

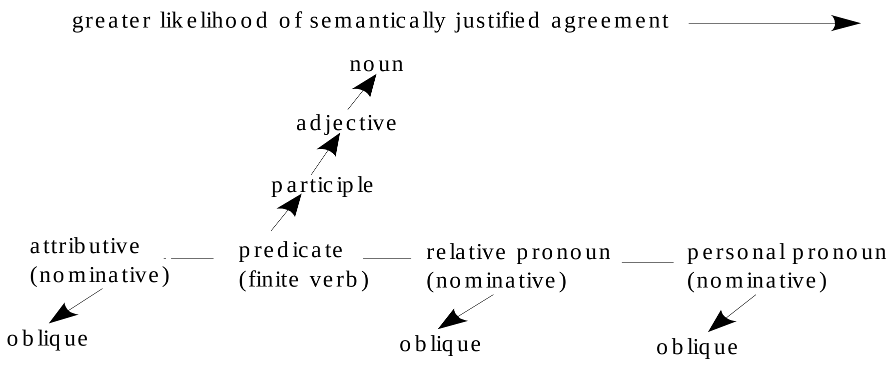
viable solution that can be squared with the evidence. The second half of the paper outlines attempts to demonstrate that the three sets of features are actually necessary even for morphologically and/or declensionally impoverished languages such as present-day English and Bulgarian.

2 Redundancy

According to Alsina and Arsenijević (2012a: 371), postulating three sets of features would lead to a wasteful proliferation of noun classes, most of them with no members at all. Given that a language such as Serbian/Croatian has two numbers (singular vs. plural) and three genders (masculine, feminine and neuter), leaving aside the category of case, a simple neuter singular noun would have to have neuter singular concord, neuter singular index and neuter (i.e. inanimate) singular semantics. Compared to saying that this is just a neuter singular noun, this three-tier description may look clumsy and excessive, but the apparent clumsiness is easily overcome with feature inheritance, envisaged by Wechsler and Zlatić (2000: 800, 2003: 49) themselves. In other words, the default scenario is that all the features of a noun are the same, with no mismatches. Such an intuitive idea makes light the possible burden on the memory of storing the information separately for each feature type and domain.

Now, there could be mismatches, as we have seen above, which would have to put more of a strain on processing capacities, since different values are needed for the different feature types. There are declensionally neuter nouns which have masculine or feminine semantics, as they refer to human beings, e.g. German *Mädchen* and Bulgarian *момиче/momiče* ‘girl’, both grammatically neuter but with female referents. However, we would hardly expect to find a noun that refers to a man or a woman and possesses masculine or feminine concord and neuter index. This would be one of the empty categories Alsina and Arsenijević feel uneasy about. Since Wechsler and Zlatić’s feature sets are to a large extent (not always, though) tied to agreement domains, it is obvious that semantic agreement will have the closest link to semantic justification, followed by index and then concord, for

(4) *Corbett’s (1983: 88) Combined Target Hierarchies:*



which the link to meaning is loosest, as per their definition. This is also anticipated by Corbett's Combined Agreement Hierarchies, reproduced in (4), stating that the likelihood of semantic justification increases monotonically, without any corresponding decrease, the further to the right one moves.[4] A lot of potential empty classes are thereby ruled out. Concrete figures or statistics are hardly needed for anyone to be able to imagine how this would bring down the number of potential classes.

Even if this were not so, however, and all the redundancy and proliferation remained, neither would be a fair criticism. If anything, language is a system which fosters extreme redundancy, agreement being a case in point, as is the repetition of time information indicated with an adverb like *yesterday*, as well as via the tense of the verb for instance. Similarly, there are so many combinations of phonemes or morphemes in any given language which are allowed, but are simply not made use of. This rarely keeps linguists up at night.

3 The analysis of the Serbian/Croatian data

More troublesome are some of the assumptions on which the analysis of Alsina and Arsenijević (2012a, b) rests. Relevant Serbian/Croatian evidence is presented in (5) below. The central point to note about the marking in (5) is that in Serbian/Croatian, as in other Indo-European languages, the suffix *-a* is ambiguous between feminine singular and neuter plural.

(5) Sreo	sam	braću$_i$.	On-a$_i$	su	došl-a.
met.M.SG	AUX.1SG	brothers	they-F.SG/N.PL	AUX.3PL	came-F.SG/N.PL

'I met the brothers. They came.'

(SC; Alsina and Arsenijević 2012a: 371)

On the analysis involving only two agreement feature sets, *braća* is thought to be syntactically feminine singular and semantically masculine plural (Alsina and Arsenijević 2012a: 370, 373), so the morphologically ambiguous pronoun *ona* in (5), as well as the participle of the lexical verb, would have to be feminine singular, as opposed to neuter plural, the latter being Wechsler and Zlatić's (2003: 56ff.) and Corbett's (1983: 78ff.) interpretation. Crucially, the pronoun *ona* and the participle in (5) cannot be feminine singular in the environment of a plural finite verb, in line with Corbett's (1983: 88) robust Predicate Hierarchy in (4) above (see Wechsler and Zlatić 2012: 383). Following Corbett's empirically tested generalisations, both targets should be seen as neuter plural here, and nothing else, unless one wants to make the unjustified claim that Serbian/Croatian has pronouns and participles with mismatched F.SG and N.PL features, which would be nothing more than an *ad hoc* stipulation (see Alsina and Arsenijević 2012a:

[4] Cf. Alsina and Arsenijević (2012c) for a discussion of their model in comparison with Corbett's predictions.

373, fn. 9, 375, fn. 14, who seem to be making this implicit assumption involving mismatched pronouns throughout their paper). Corbett's Predicate Hierarchy obtains for any given clause and predicts that you cannot start with more semantically justified agreement, i.e. the plural finite verb, and then switch to more grammatical agreement on the participle (cf. Dalrymple and Hristov 2010: 193-195, Hristov 2012: chap. 2).[5]

In effect, the only viable proposal which can be reconciled with the Serbian/Croatian data involves three agreement features for nouns like *deca* or *braća*:

- feminine singular concord, as suggested by unambiguously feminine singular targets in the attributive domain or in relative clauses – (6) (cf. Corbett 1983, Dalrymple and Hristov 2010, Hristov 2012: chap. 2, and the references cited there);
- neuter plural index, following the arguments adduced above;
- masculine plural semantics, as evidenced by the availability of unambiguously masculine plural anaphoric pronouns (see Wechsler and Zlatić 2003: 51).

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[5]The following example seems to contravene Corbett's principles, as it has an unambiguously plural finite verb and an unambiguously singular predicative adjective:

(i)	Pričamo	o	deci.		
	talk.1PL	about	children		
Ona	se	danas	smatraju	gladnom/*gladnim.	
they.N.PL/F.SG	REFL	today	consider.PL	hungry.INST.F.SG/*INST.PL	

'We're talking about children. They are considered hungry today.'

(SC; Alsina and Arsenijević 2012a: 375)

Wechsler and Zlatić (2012: 383) admit that they have no convincing solution, but Alsina and Arsenijević's theory does not fare much better, as the assumptions which they make in order to solve this particular problem unleash a host of other problems that run counter to the very foundations of Serbian/Croatian grammar, including the *ad hoc* postulation of mismatched pronouns (see Alsina and Arsenijević 2012a: 383, Wechsler and Zlatić 2012). This remains a puzzle.

The present author feels it must have to do with the fact that the sentence in (i) is a passive-reflexive structure related to an active of the type '[Someone] considers these children hungry [children]', where 'hungry' is in attributive position and is expected to agree in concord. There might be a trace of this state of affairs in the passive too, as 'children' is recoverable in 'They are considered hungry children today' – cf. '*They came/have come the children'.

As pointed out by an anonymous reviewer, Wechsler and Zlatić (2003) propose that secondary predicate adjectives resemble attributive adjectives in showing concord agreement, which may in turn be related to the typical (though not obligatory) adjacency between the noun and the adjective phrase, whether attributive or predicative. On the other hand, primary predicates resemble finite verbs and auxiliaries in showing index agreement, perhaps because they can be more distant from the agreement trigger.

(6)	deca	koj-u	vidite
	children	who(m)-ACC.F.SG	you.see
	'the children whom you can see'		(SC; Corbett 1983: 79)

With all its subtleties, the Serbian/Croatian material vindicates the tripartite division of agreement, but such a case can be made even on the basis of a language as morphologically impoverished and as 'unexotic' as English (see Hristov 2012: chap. 5), to which we turn in the next sections. Bulgarian, again much more declensionally modest than its western relative Serbian/Croatian, also seems to rely on three types of agreement.

4 Concord, index and semantic agreement in English

4.1 Agreement with collective nouns

The case for three types of agreement in English is built on three premises. Firstly, **NP-internal English targets** seem to exhibit concord (i.e. more morphologically sensitive) agreement (cf. Kim 2004), as in *this/*these family*. Putative counter-examples like *another few weeks/this 12 pounds*, etc. are only admitted in the presence of a word such as *few* or *twelve* which has no overt plural morphology. In *a little milk*, the indefinite article must surely combine with *little*, not with *milk*, which does not admit such determiners (cf. Quirk et al. 1985: 262-263).[6] Concord agreement in the NP-internal domain is also supported by coordination data: *this boy and girl* is well-formed, but **these boy and girl* is not because neither noun is morphologically plural (see King and Dalrymple 2004). In the context of coordination in English, concord is a distributive feature – the coordination itself has no concord of its own and a target such as *this* checks the concord of each individual member, which has to be singular in order to satisfy the requirements of the demonstrative pronoun (King and Dalrymple 2004).[7]

By contrast, index is said to be a resolving feature – the coordination itself projects an index which can be computed on the basis of the index features of each conjunct. **Subject-verb agreement** in English appeals to index (Wechsler and Zlatić 2003, King and Dalrymple 2004, Kim and Sells 2008: 112-117; cf. Pollard and Sag 1988: 245, 1994: 70ff.). Otherwise, it would be hard to explain why a singular verb is incompatible with a subject like *this boy and girl* (again, as per King and Dalrymple 2004). Potential counter-examples are due to a plausible singular interpretation, i.e. index:

[6]For a discussion of phrases like *a pleasant three days in Philadelphia*, see Keenan (2013), who offers a summary of salient properties and a derivational account which appeals to underlying structure.

[7]Actually, only the conjunct closest to the demonstrative target might have to be singular, as suggested by G. Corbett (p.c.). In this case, concord would have to participate in closest-conjunct agreement (see Dalrymple and Hristov 2010).

none of them is/are, *my friend and colleague is/are*, *Eggs is my favourite breakfast*, *12 pounds is a lot to pay for that*, etc. (see Hristov 2012: chap. 5).

In view of these observations, **collective nouns** such as *government*, *family* or *committee* must have singular concord in both British English and North American English, since they only admit singular NP-internal dependents (**these government/family*). Subject-verb agreement suggests that British speakers are happy either with a singular or with a plural index, whereas Americans usually admit only singular verbs. It is well known that speakers of different varieties of English express different preferences about number agreement with collective nouns (cf. Johansson 1979: 203-205, Quirk et al. 1985: 316, 758-759, Bauer 1988, and Corbett 2000: 189 for discussion of various regional Englishes and/or empirical data).[8] On the other hand, both varieties readily accept singular, as well as plural, personal pronouns. The most economical account that takes into consideration the feature values in the different domains and varieties would have to assign the value combinations to at least three separate features, as summarised in the table below (see Hristov 2012: chap. 5).

Table 1: *Agreement with collective nouns in English*

	NP-internal agreement: CONCORD	Subject-verb agreement: INDEX	Pronominal agreement: SEMANTICS
BrE	**SG**	*SG/PL*	<u>SG/PL</u>
NAmE	**SG**	*SG*	<u>SG/PL</u>

The alternative proposal, whereby we recognise only two types of agreement – syntactic (SG) vs. semantic (PL), would leave it as a total mystery why no speakers seem to tolerate either syntactic (SG) or semantic (PL) verb agreement when the subject is a conjoined phrase of the type of *this boy and girl*. Likewise, grammatical agreement is exclusively obeyed in the environment of *more than*, in spite of potential conflicts with meaning (Quirk et al. 1985: 758).

[8]It should be acknowledged that both singular and plural subject-verb agreement occur in both BrE and NAmE, so the distinction is one of frequency, as opposed to one of kind (see Quirk et al. 1985: 316; Huddleston and Pullum et al. 2002: 502). A search for the string *the committee have*, for instance, returns 10 relevant hits from the British National Corpus (100 million words), and only 1 relevant hit from the Corpus of Contemporary American English (450 million words). For *the committee are*, we get 6 hits in the BNC and 2 in COCA. For *his family are*, there are 12 hits in each. Another issue is whether it is advisable to abstract away from the grammars of two *separate* varieties (Mitko Sabev, p.c.). Even if the present paper's idealisation is not upheld, and collective nouns only merit a split into two types of agreement, it will be demonstrated below that set-taking predicates such as *increase in numbers* require a distinct third type.

(7) a. More than a thousand inhabitants have signed the petition.
b. More than one member has protested against the proposal.
(Quirk et al. 1985: 758)

So it is preferable to assume that a collective noun must have mismatched index, as opposed to allowing index or concord agreement with the verb. In conclusion, both case studies so far appear to confirm the ‘three-faced’ nature of agreement. There are some more frills to the situation in English, which need to be addressed before further support is adduced from Bulgarian.

4.2 Some apparent problems

In spite of what was stated above, there might be evidence that index can exceptionally be active NP-internally, as in (8), (9) and (10) (Hristov 2012: chap. 5).

(8) That/*those french fries is/*are getting impatient. (Eggert 2002: 216)
(9) At Tsavo we filmed several rhino as they came down to the river.
(Allan 1986: 131)
(10) These cucumber are doing well; it’s a good year for them.
(Allan 1986: 132)

However, *french fries* in (8) is better treated as a zero-derived noun with singular concord and index. There exist other words where *-s* is not an exponent of the plural like *linguistic**s**, physic**s**, (**a**) mean**s** (of transport), **a** lazybone**s*** etc. (cf. Molhova 1992: 20, 98-99); (9) and (10) can likewise be regarded as zero-inflected plurals, because such agreement is not allowed with any noun (see Allan 1986: 131ff.).[9]

Another potential exception might be the (pre-)determiner *all*, which according to Pollard and Sag (1994: 83, 87-88) co-varies in index with the head noun, on the basis of the following judgements:

(11) a. all men/all faculty/*all man
b. Every faculty is/*are homogenous.
c. Every faculty meets/*meet on a monthly basis.
d. All faculty *meets/meet on a monthly basis.
(Pollard and Sag 1994: 83-84)

Controllers such as *staff, clergy, laity, peasantry, nobility, aristocracy* would pattern with *faculty* in (11) a. and d. above, but *government, committee* and *family* do not behave in the same way (Pollard and Sag 1994: 83; cf. Huddleston and Pullum et al. 2002: 375, Kim 2004: 1120). Very perceptively, Kim (2004: 1120) speculates that the items compatible with *all*

[9]It should be noted that this use of *french fries* is more reminiscent of a hapax legomenon than of a properly lexicalised item (John Payne, p.c.).

might have acquired both singular and plural concord (= his AGR), but the plural concord has to be made unavailable for other targets: *Those faculty are*… (cf. Hristov 2012: chap. 5).

On closer inspection, it will likewise be established that both the singular concord of *twenty* and the plural concord of *pounds* are available for other attributive elements to agree with – cf. *this/these twenty pounds* (Hristov 2012: chap. 5). It remains for future research to probe how this interacts with animacy (cf. *those/*that twenty students*) and the nature of the target (cf. *another twenty students*). In the environment of inanimate controllers, both the contribution of the numeral and that of the head noun are visible to targets, whereas animate nouns like *students* probably suppress the values of the numeral, making their own concord and index the only features a target can gain access to. This, however, does not affect determiners like *another* (Hristov 2012: chap. 5).

This section has demonstrated that, despite some apparent exceptions, for which there are plausible alternative stories, English can safely be taken to operate with concord within the noun phrase.

4.3 Set-taking predicates

More support for our model comes from the well-formedness contrasts in (12) and (13) (Hristov 2012: chap. 5).

(12) The hedgehog is/*are increasing in numbers. (Perlmutter 1972: 245)
(13) *The hedgehog that I saw in the woods yesterday is increasing in numbers. (Perlmutter 1972: 245)

The obvious solution that immediately springs to mind would be that *hedgehog* does not supply a plural index, so the plural verb is ruled out in (12). Nevertheless, as Perlmutter notes, predicates such as *increase in numbers* and *become extinct* take sets, not individuals, as illustrated in (13). The correct explanation therefore seems to be that what we observe in (12) is a mismatch between index and semantics (Hristov 2012: chap. 5). When *the hedgehog* is shorthand for the species, as in (12), it keeps its singular concord and index, although its semantics is now plural. As verbs in English operate with index, only a singular finite element will pass muster in (12). The meaning of the rest of the predicate, *increasing in numbers*, additionally forces a plural interpretation (but not index!) on the subject, which it indeed has in its species sense. Such a plural reading cannot be reconciled with the referent of (13), which is why this example crashes. It crashes for semantic and pragmatic reasons, though, and not because of any morpho-syntactic considerations. What is more, plurality alone does not suffice – the semantic restriction very precisely targets a species, since we cannot talk of a government or a family increasing in numbers. (#?*The government/family is increasing in numbers.*).

Even if we discarded the cross-dialectal considerations concerning collective nouns like *family* and we conceded that they only merited a two-way split into concord (NP-internal) and index (subject-verb *and* pronominal) agreement, 'species' nouns like *hedgehog* would still require a split of another kind – between index (subject-verb) and semantic (on the predicate as a whole) agreement.

4.4 Animacy effects[10]

As pointed out repeatedly in the preceding text, we keep encountering an interwoven mesh of morphology, syntax and semantics, where semantics is one of the components, but not the only one. It has been argued that animacy is a major factor favouring plural agreement with collective nouns (cf. Dahl and Fraurud 1996: 56 and the references cited there). Such influence is felt in examples like (14) below.

(14) a. The Fleet is in harbour. (i.e. a number of ships)
b. The fleet are in town. (i.e. a number of sailors) (Nixon 1972: 121)

However, those are not just clear-cut cases of picking up whatever the semantics of the controller is. Certainly, it is not merely a matter of semantic versus grammatical; instead, the empirical facts call for a model that relies on dedicated properties, like concord and index, which have to be attached to particular lexical items. In spite of being closer to meaning, index does not fully coincide with semantics because it ultimately belongs to syntax (cf. Nixon 1972). As Corbett (2000: 188) notes, 'if we adopted a notional definition, just requiring the (singular) noun to denote a collection of individuals, then nouns like *forest* or *wood* (group of trees) would be included. Here, however, there is no possibility of agreement options'. Sets of human beings (e.g. *committee*) can take plural agreement even when they lack the inflectional exponence, whereas plural "notional" agreement is disallowed with inanimates (**the forest are...*);[11] finally, the plural is permissible, though unusual in English, with non-human animates *(?the herd are restive*). See Pollard and Sag 1994: 70-71 and Allan 1986: 124-136 for discussion of "corporate" nouns, as well as Juul 1975: 85-114 for more examples; Levin 2001: 11-14 reflects on the conceptualisation of human, animate and inanimate collectives; formal semantic approaches are presented

[10]The rest of this section is based on Hristov (2012: chap. 5).
[11]It should be acknowledged that *forest* is not semantically plural for any agreement purposes, despite its reference:
(i) The forest caught fire. *They started burning. (Mary Dalrymple, p.c.)
There may also be exceptions to the animacy restrictions, as in (ii) (cf. Allan 1986: 127).
(ii) The snow-fed vegetation are subjected to the most intense heat of the summer.
(Hoeksema 1983: 73)

in Barker 1992 and the titles cited there.

4.5 Evidence from the behaviour of verbal predicates and relative pronouns

As suggested above, the singular and plural options on verbal targets that go together with collective nouns should not be perceived as grammatical and semantic agreement respectively; it seems preferable to treat both of them as semantically-driven grammaticalised agreement (i.e. index agreement), based on different interpretations of the noun (either as a unit or as a plurality of individuals) (cf. Levin 2001: 27-28). There are studies reporting that the singular is given almost exclusive priority with verbs like *consist of*, *contain*, or *be composed of*. If the relevant noun denotes a single organisation (e.g. *committee*), building (e.g. *university*) or another similar entity, i.e. if it has a singular index, which is the interpretation presupposed by such targets, then the singular form of the predicate takes over and the plural becomes unacceptable (Quirk et al. 1985: 758, Allan 1986: 127ff., Pollard and Sag 1994: 71, Levin 2001: 29, Huddleston and Pullum et al. 2002: 502). This is confirmed by the following material:

(15) a. A commission of eminent people from other countries, such as Canada and Norway, is likely to be set up to oversee that process. (Levin 2001: 96)
b. *A new committee have been constituted. (Pollard and Sag 1994: 71)

Verbs like *set up* or *constitute* are only compatible with collectives that are viewed holistically and therefore a plural predicate would be inappropriate in this context, as in (15)b. In (16), the singular verb can only refer to the number of the people who make up the audience, while the plural verb can only hint at the size of the attendees themselves (Quirk et al. 1985: 758, Levin 2001: 149). In (17) and analogous cases, a singular verb is deemed unacceptable by some speakers for semantic reasons too (Levin 2001: 164, Allan 1986: 127ff.), although Google gives a lot of hits for the singular.

(16) The audience was/were enormous. (Levin 2001: 149)
(17) The McKnight family were at each other's throats. (Levin 2001: 164)
(18) The family has been notified but they haven't responded. (Levin 2001: 33)

Judging by examples like (18), which exhibit shifts in agreement, it might not be advisable to claim that the variation depends on different grammaticalised semantic conceptualisations (cf. Levin 2001: 33). And yet, this is not necessarily so, because one could first regard a group as a body or unit, and then as a multitude of various individuals, when one is better acquainted with it.[12] Crucially, those are ordinary instances of switching the point of view (cf. Levin 2001: 33). In addition, the rival analysis, whereby these are not seen as shifts in semantic conceptualisation, but as alternations between grammatical and semantic agreement, does not fare any better in explaining the phenomena.

Another reason to advocate simultaneously coexisting singular and plural indices for nouns like *committee*, coupled with subject-verb agreement invariably with the index feature, is that '*which* is generally found where singular agreement would normally occur and *who* where plural agreement would be expected' (Levin 2001: 55; cf. Quirk and Greenbaum 1973: 379, Quirk et al. 1985: 759, Corbett 2000: 190, as well as Johansson 1979: 204-205 and Bauer 1988 for experimental evidence). The choice of relativiser parallels the way the antecedent is thought of – either as an entity/organisation (corresponding to *which*), or as a plurality of individuals (corresponding to *who*). This argument is substantiated with ample statistical evidence gleaned from corpora of British, American and Australian English (Levin 2001: 55-60). More support can be sought in the usage of personal pronouns.

Most importantly, this overview of English collectives and how they fit in the larger picture has furnished us with ample proof of the multi-faceted nature of English agreement, rudimentary though its inflectional inventory may be. Similar inferences emerge from investigating Bulgarian.

5 Concord, index and semantic agreement in Bulgarian[13]

One might ask if the concord-index distinction exists in Bulgarian at all, and if one cannot do without it. We believe that the fourfold elaboration into declension, concord, index and semantics from Wechsler and Zlatić's monograph needs to be upheld, so that we can account for cases like *момиче/momiče* 'girl', which is grammatically neuter but denotes females, just like German *Mädchen*. Hence, the clause-internal domain will normally be dominated by the neuter, but further away in the discourse a switch can be made to the feminine (e.g. on a pronoun in the next sentence). The split here is probably not between index and concord, however, but between index and

[12]The author does not endorse the opinion that we should always get the singular first and then the plural (e.g. on different verbs), never the other way around (Hristov 2012: chap. 4, section 5), 'but one would not normally switch from a plural verb to a singular pronoun in close proximity' (Huddleston and Pullum et al. 2002: 495):

(i) *The committee$_i$ haven't yet made up its$_i$ mind.

(Huddleston and Pullum et al. 2002: 495)

A mechanism of enforcing identity between the verb and the rest of the predicate might come in handy here, but not with *The committee hasn't yet made up their mind(s)*. This will naturally fall out from Corbett's Hierarchies if it is assumed that the plural target has greater semantic justification than the singular one, which is not far-fetched in view of the meaning of 'making up one's mind'.

[13]This section is based on Hristov (2012: chap. 3).

semantics. Attributive elements affiliated with ‘girl’, as well as relative pronouns and predicative participles, have to be neuter. Only a personal pronoun in a different clause is allowed to appeal to semantics and hence appear in the feminine.

By contrast, the misalignments in words like *баща/bašta* ‘father’ and *дядо/djado* ‘grandfather’ are either between morphology and concord, or alternatively, between concord and index, thereby lending support to the three-faced nature of agreement. Formally, *баща/bašta* ‘father’, *съдия/sădija* ‘judge’, and *слуга/sluga* ‘servant’, look like feminine nouns because they end in *–a*. They also take the feminine singular definite article *–та/-ta*. Similarly, *дядо/djado* ‘grandfather’ and *чичо/čičo* ‘uncle’ have the morphological make-up of neuter nouns and consequently host the definite article typical of that gender. However, all attributive and predicative targets, as well as relative and personal pronouns that co-occur with such controllers have to be masculine.

(19) *The Bulgarian definite article:*

a) **MASCULINE**	b) **FEMININE**	c) **NEUTER**
-ът/-ăt (-ят/-jat), -а/-a (-я/-ja)	*-та/-ta*	*-то/-to*

The Bulgarian definite article behaves like an enclitic or phrasal affix which appears on the first nominal element of the NP (with which it forms a single word, as they “move” together and no other units may be inserted between them). If *баща/bašta* is the first or only nominal element, it will get the feminine definite article: *баща-**та**/bašta-**ta*** ‘father-the’ (see (19) above). If there is a pre-posed adjective, the adjective will act as a landing site and the article will be masculine: *добри-**ят** баща/dobri-**jat** bašta* ‘good-the father’ (see (19)).[14]

Bulgarian can be demonstrated to admit index agreement NP-internally, since resolution is possible with conjoined controllers (see Hristov 2012: chap. 3):

(20)	*тези*	*брат*	*и*	*сестр-а*
	tezi	brat	i	sestr-a
	this.PL	brother(M)[SG]	and	sister(F)-SG

‘this brother and sister’ (lit. ‘these brother and sister’)

(Bulgarian; Hristov 2012: 107)

[14]For more on the Bulgarian definite article, see Scatton (1993: 202), Bojadžiev, Kucarov and Penčev (1999: 469-474, 516), Tilkov et al. (1983: 36-37, 115ff., 167-170, 186, 195) and Pašov (1999). Consult Ortmann and Popescu (2000), who insist that the definite article in Romanian and Bulgarian is a suffix and come up with specifications within the domain of morphology which are in the spirit of our own.

If we preserve index agreement within the NP, nouns like those for 'father', 'judge' or 'uncle' can be said to manifest concord-index mismatches. The definite article will pick up the concord features of the head when it attaches directly to it, but will otherwise operate with index. This entails postulating concord agreement within the morphological/word boundaries of the head noun, but index agreement elsewhere within the noun phrase (as in (21) below).[15]

Some scholars might argue that the choice of article does not depend on grammatical gender, but on phonological shape. For example, if a noun ends in a consonant, it gets the *-ът(-ят)/-ăt(-jat)* allomorph; if it ends in /a/, it gets the *-та/-ta* allomorph, and so on and so forth. It just so happens that the vast majority of nouns that end in /a/ are feminine, with only a handful of exceptions, like 'father', 'judge' and 'servant'. Such "exceptions" combine with *-та/-ta*, not because they are morphologically feminine, but because of the word-final /a/ vowel. Although the adoption of phonological principles seems appealing and might successfully sum up the way articles work in the plural,[16] there is evidence against employing a sound-based mechanism, at least in the singular.

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[15]An anonymous reviewer suggests that it is possible to treat this type of mismatch as a mismatch between declension/morphology and concord, rather than concord-index, as argued in Wechsler and Zlatić (2003: 33) for similar nouns in Serbian/Croatian, like *sudija* 'judge' or *gazda* 'landlord'. The reason to go for concord and index here is the availability of resolved index agreement within the NP (see (20) above), but the main argument concerning the existence of at least three distinct agreement features remains unaltered irrespective of where the split is located.

[16]In the plural, selection is based on phonological generalisations. The allomorph is *-та/-ta* if the plural noun ends in /a/, or *-те/-te* if the plural noun has a final /i/ or /e/ (see Tilkov et al. 1983: 123, Scatton 1993: 202). Neuter plural nouns usually end in /a/ and go with *-та/-ta*, whereas non-neuter plural nouns often end in /i/ or /e/ and are consequently marked as definite with *-те/-te*, so the article can be argued to agree in gender (neuter vs. non-neuter) in the plural as well (cf. Tilkov et al. 1983: 103ff., esp. 105, and Scatton 1993: 199-203 on building plurals in Bulgarian). Exceptions like the neuter plural form *колене/kolene* 'knees', an old dual which has a word-final /e/ and takes *-те/-te*, or the masculine plural *пътища/pătišta* 'roads', which ends in /a/ and takes *-та/-ta*, can be said to change their gender in the plural. However, this explanation might be too excessive and theory-driven.

This issue aside, plural adjectives, numerals and pronouns are consistently made definite with *-те/-te*, following the plural agreement marker *-и-/-i-*. *Много/mnogo* 'much/many' selects *-то/-to*, but it ends in /o/, like a neuter singular noun or adjective, and is compatible with plural or singular mass nouns of any gender.

(i) *много-то* *студент-и*
mnogo-to student-i
many-DEF.N.SG student(M)-PL
'the many students'

In view of examples like (i), it is more accurate to state that the article agrees with its host, which, if adjectival, in turn agrees with the head noun.

While most masculine nouns do end in a consonant and are accordingly assigned the *-ът(-ят)/-ăt(-jat)* variant, as in *млекар-ят/mlekar-jat* 'milkman(M)-the', *прозорец-ът/prozorec-ăt* 'window(M)-the', there is a sizeable group of morpho-syntactically feminine nouns which also end in a consonant (instead of the usual feminine singular suffix *-a*). Such nouns, however, require the feminine *-та/-ta* article, despite their final consonant, as in *доблест-та/doblest-ta* 'valour(F)-the', *младост-та/mladost-ta* 'youth(F)-the'. Lexemes with the same final phoneme can belong to different genders, and are thus compatible with different articles: *мирис-ът/miris-**<u>ăt</u>*** 'smell(M)-the' and *орис-та/oris-**<u>ta</u>*** 'fate(F)-the'.[17] What is more, there are consonantal stems which vary in gender, e.g. *прах/prax* 'dust' (Burov et al. 1995: 569). They are sometimes treated as masculine and sometimes as feminine, receiving the appropriate definite affix in line with their grammatical gender, oblivious of the fact that the phonological shape of the stem remains constant. It is hardly surprising that the article should mirror the gender of the noun, since the former's paradigm is a grammaticalisation of an Old Bulgarian/Old Church Slavonic post-posed demonstrative pronoun (cf. the history of German and English; for the OB/OCS demonstrative, see Duridanov et al. 1991: 236-237, 554-555).

The most concise analysis therefore involves concord (or possibly morphological) agreement between the noun and the article attached to it,[18] in addition to index agreement for all other NP-internal targets.[19] In this way, articles will pick out concord when suffixed directly to the head noun, and index if they appear on another nominal element, as shown in (21). Straightforward examples for a masculine, feminine and neuter noun are given in (22). Mismatches are illustrated in (23).

[17]The same idea extends to syncretic numerals like *първи/părvi* 'first'. In isolation, this form is ambiguous between masculine singular and all-gender plural. If it is masculine singular, it takes the masculine singular article *-я(т)/-ja(t)*. As expected, it takes the plural article *-те/-te* when plural.

[18]As opposed to appealing to a combination of gender and phonological make-up, which has been the traditional approach (see Bojadžiev, Kucarov and Penčev 1999: 469-474, 516).

[19]There is evidence to suggest that concord can exceptionally be available for agreement between an adjective and a noun, as in the following relatively archaic example. The word *vojvoda* 'chieftan' has the same feminine-like morphological make-up as *bašta* 'father' and now normally takes masculine adjectives. Fluctuation is observed in the likes of *пияница/pijanica* 'a drunk', which admits masculine or feminine adjectives even when it refers to a male.

(i)	*Страхил-е,*	*страшн-а*	*войвод-о...*
	Straxil-e	strašn-a	vojvod-o
	Strahil(M)-VOC.SG	fearsome-F.SG	chieftan(F/M)-VOC.SG
	'Oh, Strahil, you fearsome chieftain…'		(Mladenov 1979: 320)

(21) *Co-occurrence constraints on Bulgarian articles in the singular:*

a) **MASCULINE**	b) **FEMININE**	c) **NEUTER**
-ът/-ăt (-ят/-jat), -а/-a (-я/-ja)	*-та/-ta*	*-то/-to*
(↑CONCORD GEND)=M (↑CONCORD NUM)=SG *(within N)*	(↑CONCORD GEND)=F (↑CONCORD NUM)=SG *(within N)*	(↑CONCORD GEND)=N (↑CONCORD NUM)=SG *(within N)*
OR:	**OR:**	**OR:**
(↑INDEX GEND)=M (↑INDEX NUM)=SG *(within NP)*	(↑INDEX GEND)=F (↑INDEX NUM)=SG *(within NP)*	(↑INDEX GEND)=N (↑INDEX NUM)=SG *(within NP)*

(22)a	*стол-ът* stol-ăt chair(M)[SG]-DEF.M.SG ‘the chair’	*дървени-ят* dărveni-jat wooden[M.SG]-DEF.M.SG ‘the wooden chair’	*стол* stol chair(M)[SG]
(22)b	*мас-а-та* mas-a-ta table(F)-SG-DEF.F.SG ‘the table’	*дървен-а-та* dărven-a-ta wooden-F.SG-DEF.F.SG ‘the wooden table’	*мас-а* mas-a table(F)-SG
(22)c.	*дърв-о-то* dărv-o-to tree(N)-SG-DEF.N.SG ‘the tree’	*висок-о-то* visok-o-to tall-N.SG-DEF.N.SG ‘the tall tree’	*дърв-о* dărv-o tree(N)-SG
(23)a	*бащ-а-та* bašt-**a**-**ta** father(F/M)-SG-DEF.F.SG ‘the father’	*добри-ят* dobri-jat good[M.SG]-DEF.M.SG ‘the good father’	*бащ-а* bašt-a father(F/M)-SG

(23)b	*дяд-о-то*	*добри-ят*	*дяд-о*
	djad-**o**-**to**	dobri-jat	djad-o
	grandad(N/M)-SG-DEF.N.SG	good[M.SG]-DEF.M.SG	grandad(N/M) -SG
	'the grandfather'	'the good grandfather'	

In conclusion, Bulgarian nouns like those for 'father', 'judge' and 'uncle' rely on concord within the boundaries of the head noun and on index elsewhere, including verbal and pronominal agreement. The words for 'boy' and 'girl', on the other hand, take neuter articles and adjectives, and agree with neuter predicates, only allowing feminine or masculine anaphors, which suggests a split between index and semantics. When plotted together, these two types of noun validate the existence of three types of agreement features in Bulgarian.

6 Conclusion

This paper set out to demonstrate the usefulness of operating with at least three types of agreement. It was shown that accusations of extravagance were unfounded, and at the same time a two-tier proposal could not provide an adequate description of the empirical facts in Serbian/Croatian, English and Bulgarian. It is worth reiterating that both English and Bulgarian are relatively morphologically and/or declensionally impoverished languages and yet require this type of agreement system.

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ON THE ‘SPIRIT OF LFG’ IN CURRENT COMPUTATIONAL LINGUISTICS

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Abstract

In this position paper, I take a look at some of the key "design principles" of LFG and draw some parallels to developments in research on Natural Language Processing (NLP) and computational linguistics over the past few years. A number of recent trends and findings in NLP research seem to have precedents in earlier LFG work in ways that have not received much attention so far.

1 Introduction

In this position paper, I draw some parallels between some of the key "design principles" of LFG and recent developments in research on Natural Language Processing (NLP) and computational linguistics. Since the current computational work in which some original LFG design principles resurface is embedded in quite a different methodological context, one might argue that the parallels that can be drawn are at a level that is too abstract to make any point that is of scientific interest. I believe however that it is worthwhile taking a closer look and seeing whether the common aspects behind the original LFG ideas and the current computational research questions can be given a meaningful interpretation across frameworks. The hope is that an increased awareness both in the LFG community and in the NLP community may lead to some new cross-fertilisation in the near future.

The paper is structured as follows: section 2 will very briefly review a development in the relation between theoretical and computational work in LFG over the past 10 years or so; in section 3, I will then point out some recent developments in data-driven computational linguistics, which are seemingly unrelated to LFG, but as I will claim display many features of the 'spirit of LFG'. To be able to situate the various approaches in the same architectural coordinate system, I will introduce in section 4 a high-level scheme for classifying different ways of modeling the relation between linguistic forms and their interpretation as a function of the given context of utterance, which in turn serves as the basis for describing different types of modular interface architectures in section 5. Against this backdrop, I illustrate the claim advanced in section 3 for a particular study (specifically Seeker and Kuhn (2013b), of which I will outline the conceptually relevant points). In section 7, I point out the ways in which I think it is the 'spirit of LFG' that is particularly relevant for the point I am making and I conclude.

[†]The considerations in this contribution and the work from within my group that I refer to have been carried out in SFB 732 "Incremental Specification in Context", funded by the German Research Foundation (DFG), in particular in projects D2 and D8. I am indebted to my group for discussions and for contributing the computational and experimental work – in particular to Wolfgang Seeker who has influenced these considerations a lot – and to the collaborators from the SFB for ongoing exchanges about the representational and architectural conception of specification in context.

2 LFG and NLP: The past and the status quo

Traditionally, the LFG community has been known to be a rare showcase for a continued and successful exchange between theoretical and computational linguistics. This has probably numerous reasons, but one is clearly that the representations used in the LFG formalism are an ideal common ground for exchanging thoughts about linguistic analyses of data from languages across the typological spectrum. The reflex of heavily theory-internal assumptions is carefully avoided in the representations; and for each relevant dimension of linguistic description, a formal structure is chosen for representation that displays the observed properties (trees for c-structure, set-based feature structures for f-structure etc.). These structurally straightforward representations allow both the theorists and the computationalists to anchor their respective systematic accounts – using a constraint-based and lexicalist approach. In what Johnson (2011, 3) calls the "golden age for collaboration and cross-fertilisation between linguistic theory and computational linguistics" – the 1980s – the connection was very obvious, but in the LFG community, the collaboration continued to be successful when the "empiricist" camp in NLP gathered momentum in the 1990s and statistical techniques were beginning to dominate research in computational linguistics (see Church (2011)). LFG has not only been the theoretical framework for one of the most successful attempts of engineering linguistically grounded broad-coverage grammars across languages (in the well-known ParGram project, Butt et al. (2002)), but it also provided the representational framework for important work on treebank-based grammar acquisition (Cahill et al., 2008a), discriminative ranking models for parse disambiguation (Riezler et al., 2002), and statistical constituency-based pruning (Cahill et al., 2008b).

There is successful ongoing research work in the mentioned traditions; at the same time however, it has to be acknowledged that many computational analysis tasks (e.g., machine translation, semantic role labeling, coreference resolution) for which there was no doubt in the late 1980s that they would require carefully engineered knowledge sources, are quite successfully approached with cascades composed of statistical modules, each solving a structurally relatively simple input-output mapping. This is not to say that the importance of linguistic insights is not acknowledged in the field of NLP – the last few years have brought about many occasions in which the relation between linguistics and language technology has been discussed (the 2011 *Linguistic Issues in Language Technology* on "Interaction of Linguistics and Computational Linguistics" is just one example; here King (2011) represents the LFG view); the occasionally hostile atmosphere between the camps from the 1990s has by and large disappeared. However it somehow seems that the common denominator across fields ended up less sophisticated than many would have hoped: linguistic insight is clearly needed for high-quality gold-standard corpus annotation; but most other ingredients for effective computational models seem to be taken from general-purpose machine learning that operates on this training data, avoiding any tailoring to peculiarities of the data representations. Methodologically, if language-specific hard constraints on the search space are used in some experiment, these are considered to be simplifying working assumptions that should ultimately be abandoned in favor of purely data-driven acquisition of all constraints. This is diametrically opposed to linguistic methodology in the generative tradition, which attempts to identify non-trivial generalizations or implications that hold across languages and thus help pre-structuring the search space for the language learner.[1]

3 Recent developments

It is at this point that I would like to go into some recent developments: As the results for some of the standard NLP problems that can be addressed with supervised methods (such as treebank-trained constituent parsing or dependency parsing for English) are reaching a plateau, a new set of refined research questions comes up:[2]

(i) The standard NLP approach to multi-level analysis (e.g., part-of-speech tagging, morphological analysis, syntactic constituent and/or dependency parsing, semantic role labeling, coreference resolution) is to assume a pipeline of separate input-output modules, each solving a single intermediate step the output of which is then fed into the next step. This is conceptually perspicuous, it avoids additional algorithmic complexity, and allows for module-specific supervised training. However it comes at the cost of error propagation. This has recently prompted considerable attention on "joint modeling", i.e., effective ways of solving combined problems that span more than one step in the classical pipeline (for tractability, the joint modeling is often approximated using some flexible combination of modules). Examples of task combinations are morphological segmentation and parsing (Goldberg and Tsarfaty, 2008), part-of-speech tagging and parsing (Bohnet and Nivre, 2012), morphological disambiguation and parsing (Seeker and Kuhn, 2013a), syntactic and semantic parsing (Li et al., 2010), and, in the reverse direction, referring expression generation and surface realization (Zarrieß and Kuhn, 2013).

(ii) If some approximation of a joint model is assumed, how can the "candidate set" of intermediate results be best represented? One may for instance assume some (underspecified or packed) representation of the exhaustive list of candidates, or a k-best list according to some preliminary scoring, possibly combining candidates from different alternative modules. Björkelund et al. (2013) for instance use output from various parsers to populate a candidate set for ranking, achieving state of the art results for parsing across various "morphologically rich languages". Depending on the data structure, one may even be in a position to combine partial analyses by a technique sometimes called "blending" (Sagae and Lavie, 2006; Hall et al., 2007).

[1]Note however that since both frameworks are motivated by learning/learnability considerations, they *could* be related to each other at a substantial level – the differences can be argued to be mainly in prioritizing the step-by-step lifting of one's idealizing working assumptions.

[2]The citations given in this listing are not intended to be exhaustive. Given that this is an individual position paper, there is a bias towards examples of work from my group and our department. This implies by no means that I think there is no other, more important work.

(iii) Related to the previous points, a question arises for applications involving only a level of analysis that is relatively far "downstream" in the pipeline: if the typical pipeline could build on alternative intermediate representations, which do not affect the outcome directly – how can one decide on the type that should be chosen? For example, should constituent or dependency parses, or both, be used for the task of coreference resolution (Björkelund and Kuhn, 2012); how should morphological segmentation be addressed in "morphologically rich" languages (Goldberg and Tsarfaty, 2008)? Taking this question to the limit, one may ask what intermediate (linguistic?) representation to assume in end-to-end tasks like machine translation. Quernheim and Knight (2012), for instance, propose a probabilistic model for Machine Translation that uses a semantic feature structure as an intermediate representation, which is in the spirit of earlier LFG work on translation using f-structures (Kaplan et al., 1989; Riezler and Maxwell, 2006).

(iv) Can latent representations of intermediate levels be induced – e.g., for inducing semantic properties in a grounded learning scenario like in Richardson and Kuhn (2012) or for adjusting parsing models across languages, Titov and Henderson (2010)? If so, is the induced latent representation superior to an established intermediate representation, which can be trained directly, evaluated and tuned (to the extent that annotated resources are available)?

(v) Are there systematic linguistic constraints that can be exploited for improving a data-driven component, exploiting structural building blocks of linguistic expressions and detailed knowledge about the synchronization across (underspecified) interface representations? And can the relevant constraints be formulated in a way that they carry over across typologically different languages?

For the questions under (v) I will provide a relatively detailed illustration from the study in Seeker and Kuhn (2013b) in section 6 below.

Note that none of the approaches mentioned are modeled in terms of an LFG grammar or sub-grammar. I would like to claim however that the methodology and the set of research questions is very much in the 'spirit of LFG': as mentioned, part of the long-term interdisciplinary success of LFG lies in the combination of (or: Parallel Correspondence across) relatively straightforward representational levels for which there are good empirical tests. So, typical high-level LFG research questions could be paraphrased as 'what are the primitives that should be assumed at the level of f-structure/a-structure – what effect do the possible choices have on the neighbouring levels of representation?'

Up until about five years ago, the data-driven paradigm in NLP was not questioning the input and output representations assumed in supervised approaches to particular analysis problems – the available datasets were taken for granted, and the challenge was to devise maximally general machine learning techniques. As the network of subtasks feeding one another (depending on the assumed architecture) has been growing as outlined above, questions about appropriate interface representations do however gain crucial importance. So, when it comes to deciding on a global model architecture spanning across subtasks, the field of NLP very much resembles the problem space that LFG theorists have been addressing all along.

And indeed, most of the major interface representations under discussion in current NLP work can be argued to bear close resemblance to the LFG representations, as is sketched in Figure 1:

LFG	Data-driven NLP
c-structure categories	part-of-speech tags
morphological f-structure features	morphological analysis
c-structure trees	constituent syntax
f-structure embeddings (minus functional control)	dependency structure
a-structure (incl. functional control)	semantic role labeling
anaphoric control	coreference resolution

Figure 1: Rough correpondences across levels of representation

In addition, we can note that some of the more controversial parts of the NLP architecture, like the interplay of morphological segmentation and syntactic parsing, correspond to controversial parts of the LFG architecture (the morphology-syntax interface).

The major difference is that in classical LFG, the concrete modeling task for relating the various levels is solved in terms of the formulation of symbolic formal constraints describing the possible correspondence relations (and this task is addressed by the linguist or grammar writer), whereas in current "multi-level correspondence" NLP, the concrete pairwise (or larger) relation across levels is determined by machine learning methods operating on training data, possibly with latent intermediate representations. But as the character of the interface representations ceases to be fixed a priori in NLP work, the high-level search for the best possible set of interface representations gains importance: is there a combination of interface representations that allows for effective modeling of arbitrary languages? This does not seem to be all that different from linguistic research in the generative tradition.

4 The broader picture for interface representations in linguistic modeling

In this and the following sections, I take a few steps back to develop a high-level picture of the role of representations (and in particular interface representations assumed for interacting "modules") that is broad enough for capturing linguistic work on the theory of grammar on the one hand and data-driven computational work in Natural Language Processing on the other hand.

This line of reasoning is closely connected to the Stuttgart collaborative research center SFB 732 *Incremental Specification in Context*, in which linguists and computational linguists from distinct research paradigms have been successfully cooporating. This SFB has been set up to depart from one of the most characteristic properties of natural language(s) and the human language faculty: the high degree of ambiguity in linguistic expressions and the mostly effortless ability of speakers and hearers to deal with it when the expressions are contextually embedded.

Any model of language interpretation in the face of ambiguity will follow the general scheme in the top half of Figure 2; models of choice in language generation follow the same scheme in the reverse direction, as seen in the bottom half.

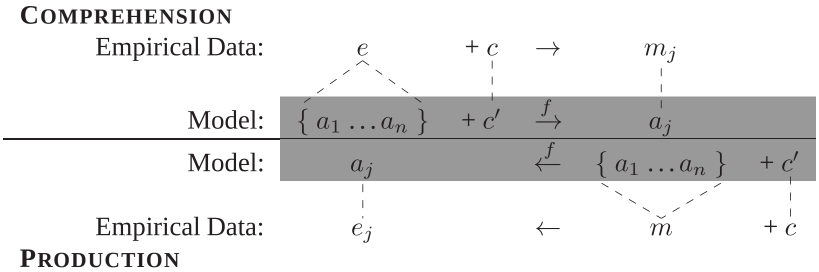

Figure 2: The general modeling scheme for specification in context

The observable empirical process in comprehension is a hearer's ability, given some linguistic expression e that she is confronted with in a particular context c, to decide which is the appropriate interpretation m_j among a large set of interpretations which e could have in different contexts. Any theoretical or computational model characterizes the input expression e in the empirical data by a set of alternative analyses of this input and assumes some appropriate representation c' of the empirically observed context c. At the core of the model is some function f which picks out one analysis a_j among the alternatives, given context c'. The form of representation of the competing analyses, and in particular of the target analysis a_j is chosen in such a way that a_j contains a representation of the hearer's interpretation m_j (e.g., $a_1 \ldots a_n$ may be different syntactic trees for an observed string, and one of the trees reflects the structure that hearers find natural in the given utterance context). In the same way, the reverse process models a speaker's choice among possible expressions for realizing some underlying thought or message in a given utterance context.

The representations and functions assumed for a particular model process are chosen in a way that they satisfy certain meta-theoretical principles and allow for the prediction of some corpus of empirical language data. We will go into details of the modeling choices below, but note at this point that a wide-spread objective is to follow some principle of economy. For a process of specification in context, economical modeling can often be fleshed out as follows: Rather than assuming an explicit listing of the entire set of choices $\{a_1 \ldots a_n\}$ prior to contextual disambiguation, the representation language is designed to provide a compact representation for this set – this is the widespread notion of *underspecification* in linguistic modeling, especially in its symbolic guise. Design decisions in probabilistic modeling are typically influenced by additional constraints, such as the attempt to exploit the information available in a given data sample/corpus in the best possible way for deriving generalizations, without overfitting the model parameters to the training data.

In summary, the relationship between the two levels of representation is generally determined by meta-principles and a combination of considerations, which can have various forms depending on the theoretical framework.

Adopting a plain and simple common schematic core structure for all approaches to ambiguity in language is very useful for identifying the commonalities (and distinctions) between alternative approaches in the study of language – across disciplines, theoretical paradigms, and language families and languages. While the entities, representations and functions/processes under consideration may differ, the common scheme of specification in context makes it possible to pinpoint systematic similarities and differences – for instance the potential/justification for using underspecification in different modeling tasks.

5 The internal interface architecture of models of specification in context

The schematic process in Figure 2 captures the ordinary language notion of *ambiguity*: many natural language expressions can have various different interpretations or *readings*, but language users normally have the competence to pick a single one (or, more generally, reduce the set of choices) in a given context of usage.

In order to be able to model this process systematically, the relevant properties of expressions have to be accessible in some representation, and since various properties are known to interact in the process of context-sensitive specification, or disambiguation, the simple scheme requires some further explication. To capture different properties in the general case, each of the representations a_i from the set $\{a_1 \ldots a_n\}$ of candidate analyses for some expression e can be thought of as a bundle $\langle \ell_i^1, \ell_i^2, \ldots \ell_i^k \rangle$ of properties – maybe at k different levels of linguistic representation, or layers, so ℓ_1^3 may be the constituent syntax representation for reading 1 of an utterance e, ℓ_2^3 the representation of a different reading of e, and ℓ_2^5 the corresponding representation at some more abstract linguistic level.

Since the cognitive process of picking a particular reading in context is extremely complex (and for instance involves extra-linguistic knowledge), it is common to focus attention on a subprocess with defined linguistic interface representations, typically relating two (or more) established levels of linguistic descriptions, such as syntactic constituent structure and grammatical functions, etc. The subprocess can then, quite conveniently, be seen as a small-scale version of the full process; and it suggests itself to construe the full process as a cyclic chain of formally similar subprocesses, as indicated in Figure 3.

The underlying assumption is that at each layer i, a specification process f^i reduces a set of possible alternatives $\{\ell_1^i \ldots \ell_{n_i}^i\}$ for this layer to a particular choice $\ell_{j_i}^i$, which then again defines the choice of options for the next layer $i+1$, and so on. Note that if we view the cascade as a series of contextually driven specification

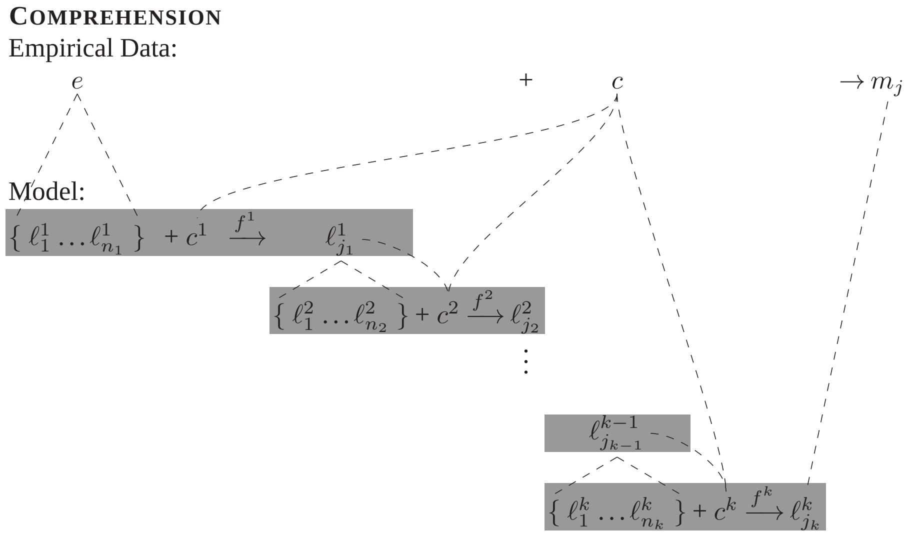

Figure 3: The cyclic (pipeline) model of specification in context

steps, the relevant context for each step is not just determined by the empirically observed (presumably largely extra-linguistic) context c, but each layer contributes highly relevant bits of information for the specification context at the next layer. For instance, layer 2 may be the level at which inflectional feature values such as number (on verbs with subject agreement and on nominal elements) are determined, and layer 3 may be the level at which the syntactic structure for this input string is determined. Then, due to agreement constraints, the feature values determined in layer 2 will affect the specification in layer 3.

Classical feature underspecification at intermediate levels of representation is typically motivated by the observation that certain choices stay open across layers at which the relevant feature type would normally be resolved. Clearly, the modeling decision for interface representations is intimately tied to the assumed sequence of cyclic specification decisions, i.e., the architectural design. Modeling alternatives can be decided on the grounds of economical considerations.

The cyclic specification sequence goes along with strong assumptions: growth of specificity has to follow the same sequence across layers for all analysis problems; in a classical pipeline architecture, specification decisions cannot normally be undone later. Often, the contextual clues at a particular layer give strong indications for a certain specification, but the decision can be overridden later. This effect cannot be modeled appropriately in a plain pipeline. While earlier work in Generative Linguistics (e.g., the GB model) was based on a clear concept of subsequent levels of information, more recent models (Minimalism and Distributed Morphology) have abandoned the idea of a step-by-step sequence of specification. Largely, problems of ambiguity are resolved at the interfaces with the articulatory and the perceptual system, respectively.

Despite the conceptual limitations tied to the strong implications for the sequence of specification decisions, pipeline models typically form the baseline systems in data-driven approaches in Natural Language Processing. Here, a layer corresponds to some analysis tool trained on annotated corpus data following the classical levels of linguistic representation. When applied on new input data, the tools make no strict choice of specification, but assign probability scores to the various options. In the typical pipeline setup, the highest-scoring prediction is passed on to the next layer, which may of course occasionally bring a subsequent layer in the situation where it can no longer make correct predictions – even though it may locally have strong evidence available.

As has become obvious, the pipeline architecture is not fully adequate to model situations where two independent linguistic subsystems interact in constraining the space of possibilities of further specification. An alternative abstract architecture is the joint model sketched in Figure 4, which does not pre-specify any particular sequence of subsequent specification, but posits a simultaneous decision, in principle allowing for arbitrary global interaction across layers.

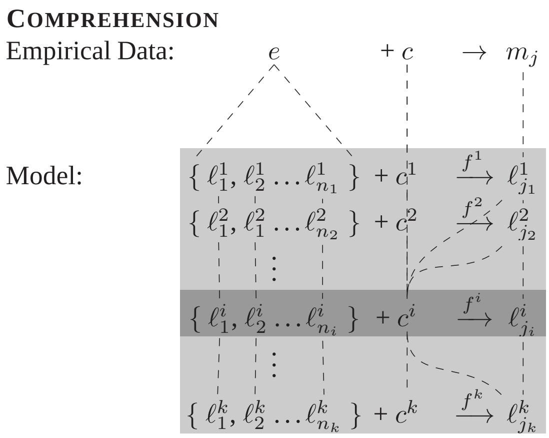

Figure 4: The joint model of specification in context

In the joint model, any subprocess of layer-specific specification can (at least abstractly) be informed by the output of any other subprocess; i.e., effectively the specification decisions mutually contribute context information for each other.

Of course, any concrete model following this idealized setup has to break up the circularity in its design. Moreover, complex model architectures can combine ideas from the pipeline and from the joint model, yielding a vast space of possible system architectures. This essentially characterizes the architectural status quo for several of the recent research questions in NLP, addressed in section 3.

Let me now come back to the question of representational interfaces. We note that despite considerable methodological differences, the various approaches tend to “meet at” common interface representations – mostly the classical levels of linguistic descriptions, such as segmental and prosodic phonological representations, representations of core aspects of morphological and syntactic structure, and meaning representations of key notions of semantic interpretation.

This representational interfacing has been a key element for many of the successful examples of collaborations between linguistics and Natural Language Processing, providing hubs both for model combination across layers and for cross-paradigm comparison (or combination) of models addressing the same layer with alternative approaches. However, as research has proceeded to address advanced implications of modeling decisions, the fields are at a point where one can and should start lifting some of the simplifying assumptions – such as the assumption that the interface representations can be carried over without adjustment from one research paradigm/modeling approach to another. While it is convenient to use an existing treebank annotation for training a submodule, it is unlikely that the assumptions that informed the original annotation guidelines do actually hold in all respects for the context in which the trained submodule is currently supposed to be used.

The set of recently developing research questions (section 3) is a sign that a process of re-thinking the simplifying architectural and representational assumptions is happening. By looking at such activities with the coordinate system from classical linguistic modeling in mind, there is a (maybe somewhat unexpected) chance to take advantage of lessons learned from theoretical work in linguistics – or, as I am pointing out in this paper, the 'spirit of LFG'.

To provide a more concrete illustration of how one should imagine this linguistically informed view on recent data-driven modeling, I will briefly review some high-level conclusions from the study by Seeker and Kuhn (2013b), which shows very clearly that it can be crucial to question the justification of particular representational decisions even in well-established standard NLP scenarios.

6 Questioning standard representations – an illustration

Data-driven parsing of text from the newspaper domain is one of the most established standard tasks in modern NLP. People have spent two decades on improving the processing pipeline to achieve the best possible results for syntactic analysis (and in particular contextual disambiguation) in a domain for which sizable amounts of hand-labeled training data, so-called treebanks, are available. The supervised scenario makes it possible for machine learning to exploit clues from various levels of representation for the disambiguation decision, possibly including non-linguistic statistical tendencies from the real-world domain – such as the fact that it is more likely for managers to employ people than for athletes.

Most recent advances in this task have thus been due to techniques that allow machine learning methods to capture more and more complex and potentially subtle constellations of contextual clues for the disambiguation decision. For instance, in statistical dependency parsing, the complexity of exploitable machine learning features has been subsequently increased to include combinations of two or three dependency arcs (some relevant contributions were Carreras (2007); Koo and Collins (2010); Bohnet and Kuhn (2012)). Training a reranker among the most promising candidate analyses from an initial parser has been very successful in constituent parsing (the best known work here is Charniak and Johnson (2005), but the technique is widely used, and computational work in the LFG framework was among the first studies to this end (Riezler et al., 2000, 2002)).

Although it is acknowledged that the choice of appropriate linguistic representations is also important, most researchers assumed that after many years of tuning, no further improvements could be made by adjusting the representational assumptions behind the standard task (which depends on the initial decisions made in the original treebanking effort).

For the syntactic parsing task, the ultimate structural disambiguation decision depends on a constellation of morphosyntactic features (among other things): what are the inflectional person/number features of a verb, what is the case and number of a noun, etc.? The German sentence provided in figure 5 below for example is in OSV order, and it is not just selectional preferences of the verb that indicate this order; the inflectional marking of the initial determiner, in combination with the noun, makes it a clear accusative, and in addition, there is plural subject agreement on the verb.

Since the morphological features cannot be read off deterministically from the surface form (the two nouns in the example, by themselves, are ambiguous between nominative and accusative), data-driven parsing is typically split up into several subtasks: part-of-speech tagging, morphological tagging and structural dependency parsing. Although in morphological disambiguation, strict grammatical rule knowledge plays a more decisive role than in syntactic disambiguation (where it is obvious that data-driven techniques are needed to help with certain decisions), it has been established that training the inflectional disambiguator on the full sentences is important for achieving competitive results. One may intuitively imagine that the system can pick up corpus-specific statistical tendencies in the linearization of certain forms, so the morphological disambiguator effectively anticipates certain syntactic decisions.

Ideally, the syntactic parser should be able to override decision from an earlier morphological step, but the search space of all possible combinations of inflectional options for the words in a sentence is huge (at least for languages with a relatively rich inflectional morphology that displays syncretism). Even with a fairly large manually annotated treebank, a parser that is learning to make structural decisions and inflectional decisions jointly, without any side constraints, has too few indications from the corpus data to pick up some important patterns. Thus, it is more effective to break up the task in a pipeline of two subsequent decisions. The occasional errors in the earlier inflectional decisions are outweighed by the majority of cases where there are enough helpful clues available in the surface string; the second step, syntactic disambiguation can thus use the available training data very effectively for making decisions within the inflectionally constrained search space. Even the idea of allowing the syntactic parser to fall back on the second or third most likely morphological analysis of a word will typically lead to an overall decrease in parsing performance (on the standard in-domain test data).

As the considerations and experiments in Seeker and Kuhn (2013b) show, there is however one point in the established standard setup for data-driven parsing that *can* be improved substantially, and this is where questioning the representations assumed at the interfaces between subprocedures is highly effective.

As just discussed, training a morphological disambiguator in the full sentence context is empirically superior to a purely symbolic approach that will feed the syntactic parser with all possible morphosyntactic options for each word. Conveniently, a syntactic treebank can be used as gold-standard data for this task too: the treebank annotators used their grammatical knowledge and understanding of the real-world context to determine exactly the right inflectional feature values for each word in the string. For instance, each word in the German NP *das kleine Auto* ("the small car"), when used in a treebank context like *the small car is parked in a side street* will receive an unambiguous marking for case, number and gender, although each form is ambiguous in several ways, and even the full NP – out of context – is ambiguous between nominative and accusative. Of course, the morphological disambiguator trained on such fully disambiguated data will not be perfect – it will occasionally make incorrect predictions for a syncretic inflectional form – but it can nicely exploit the tendencies mentioned above.

There seem to be just two alternatives: either feeding a subsequent syntactic parser with the word-by-word predictions of the statistically trained morphological disambiguator, or leaving all but the strictly symbolic decisions to the syntactic parser. This however ignores what in modern linguistics has been captured by the notion of underspecification, and cyclically increasing specification as more information becomes available: in the space of available analyses for the full sentence string, the adjective *kleine* as part of the NP *das kleine Auto* cannot be plural – although the word form certainly can. It is the local phrasal context that partially disambiguates the word forms. However, recognizing the three-word sequence as an NP still leaves the case feature for each of the three words open: they could be nominative or accusative (but all of them have to be the same).

The standard architectural scenario for input-output training of (token-based) machine-learning classifiers does not provide a basis for capturing this middle ground state of information half-way between the full set interpretation options for an ambiguous (syncretic) word form and the one contextually singled out interpretation. Note that it is not just a question of assigning different weight to potential interpretation options: a machine-learning classifier can quite well provide a probability distribution over the potential morphosyntactic feature values in the given string context. But this still does not capture the interdependencies across words (mediated through the syntactic structuring decision): if *kleine* ends up accusative, *Auto* will not end up nominative, unless there is some other syntactic structure in which they do not form an NP.

Of course it is not at all trivial to set up an architecture that is able to capture these very interdependencies, while at the same time still taking advantage of the statistical tendencies when predicting the distribution over possible inflectional values/syntactic structures. But it is possible, using the meta-level framework of Integer Linear Programming (ILP) for navigating the search space of interrelated options, as Seeker and Kuhn (2013b) show. The present position paper is not the place to go into the technical details of how this works. The crucial point is that the frameworks allow a linguistically informed modeller to express interrelations across the choices for the various word-level and sentence-level decisions. The knowledge that NPs are a structural domain with important implications for the distribution of inflectional features within the sentence string is thus a priori knowledge that the machine learning system does not have to pick up from the available training data. Moreover, the way in which syncretic forms hold for several cells in the morphological paradigms for various inflectional classes can be stated explicitly as a quasi-underspecification of combinations of inflectional features. And finally, certain aspects of verb subcategorization can be enforced when assembling the predictions for a verb's arguments – mainly what corresponds to LFG's functional uniqueness principle: there cannot be two arguments that are *subject*.[3]

	Diesen	Unterschied	sehen	die	Versuchspersonen
	this	*distinction*	*sehen*	*the*	*experimental.subjects*
1.	ACC	NOM/ACC/DAT		NOM/ACC	NOM/ACC
2.	- - - - - NP - - - - -			- - - - - NP - - - - -	
3.	→	~~NOM~~/ACC/~~DAT~~		NOM/ACC	NOM/ACC
4.			→	NOM/~~ACC~~	NOM/~~ACC~~
5.	OBJECT			SUBJECT	

Figure 5: Illustration of the intuitive flow of information for disambiguation

The intuitive flow of information is sketched for a locally ambiguous (but globally unambiguous) German example in Figure 5, ignoring morphosyntactic features other than case. Both nouns in the sentence are case ambigous by themselves. Since the dependency parser considers possible readings with the transitive main verb, it is clear that there must be two NPs. The NP *diesen Unterschied* is disambiguated by the demonstrative determiner. Because of functional uniqueness, this excludes the accusative/object reading for *die Versuchspersonen*, although it is locally ambiguous.

Figure 6 sketches more far-reaching interactions involving different inflectional paradigms for German adjectives and certain nouns, depending on the choice of determiner, plus the interaction with subject agreement on the finite verb. Note that the final noun has the same form in all instances (*Befragte*), but this is a syncretic form that could be nominative/accusative of feminine singular or plural.

In the transition from the second to the third variant of the example, changing only the word *viele* ("many") to *die* (the definite article) turns an ambiguous sentence into an unambiguous one, because the article forces the de-adjectival noun

[3]Any more far-reaching subcategorization constraints tend to be empirically problematic, because of a fair degree of variation in real corpus data.

Stuttgarts	größte**n**	Verein	erwähnte**n**	viele	Befragte
Stuttgart's	*largest*	*club*	*mentioned (3pl)*	*many*	*interviewees*
- - - - - - - OBJECT - - - - - -				- - - SUBJECT - - -	
Stuttgarts	größte	Verein**e**	erwähnte**n**	viele	Befragte
Stuttgart's	*largest*	*clubs*	*mentioned (3pl)*	*many*	*interviewees*
- - - - - - - - ? - - - - - - -				- - - - ? - - - -	
Stuttgarts	größte	Verein**e**	erwähnte**n**	die	Befragte
Stuttgart's	*largest*	*clubs*	*mentioned (3pl)*	*the*	*interviewee*
- - - - - - - SUBJECT - - - - - -				- - - OBJECT - - -	
Stuttgarts	größte	Verein**e**	erwähnte	die	Befragte
Stuttgart's	*largest*	*clubs*	*mentioned (3sg)*	*the*	*interviewee*
- - - - - - - OBJECT - - - - - -				- - - SUBJECT - - -	

Figure 6: Illustration of subtle interactions between inflectional paradigms, NP-internal agreement and subject/verb agreement

Befragte to be a feminine singular rather than a plural. To complicate things some more, it is not the article in *die Befragte* alone that enforces this reading. With a singular subject agreement on the verb, as in the forth variant, the subject/object interpretation in the complete sentence is flipped, since all word forms in the NPs are syncretic for nominative/accusative. This illustration should give some intuitive indication that a syntactic parser that does not have to rely on some locally informed morphological prediction may have a real empirical advantage.

	Czech			German			Hungarian		
	NO-C	C	PRED-M	NO-C	C	PRED-M	NO-C	C	PRED-M
subject	85.41	**87.23***	85.46	90.02	**92.91***	90.59	85.05	**87.67***	86.53
predicative	87.13	**90.09***	87.11	72.86	**80.70***	74.33	74.16	**78.88***	74.79
obj (nom)	47.48	**53.19***	38.74	–	–	–	–	–	–
obj (gen)	70.15	**72.54**	70.27	31.41	**42.98**	34.26	–	–	–
obj (dat)	79.99	**80.42**	79.54	65.21	**77.78***	71.05	75.33	**77.92***	73.49
obj (acc)	84.27	**86.79***	84.12	83.74	**87.96***	84.86	91.96	**93.21***	92.53
obj (instr)	67.36	**68.76**	65.02	–	–	–	–	–	–
all arg funcs	84.33	**86.37**	84.21	86.27	**90.11**	87.24	86.87	**89.04**	87.78
all other	81.37	**81.37**	81.05	89.79	89.88	**89.98**	82.73	82.86	**83.43**

Table 1: Table from Seeker and Kuhn (2013b): Parsing results for the unconstrained (NO-C) and the constrained (C) ILP models, and the Bohnet parser with predicted morphology output (PRED-M) in terms of labeled attachment f-score.

Table 1 shows a summary of the results that Seeker and Kuhn (2013b) report for the different variants in the combination of data-driven syntactic and morphological models.[4] The datasets considered were standard treebanks for Czech, Ger-

[4] $*$ marks statistically significant differences when comparing the performance on a grammatical function for the C model to the PRED-M model.

man and Hungarian (three languages with relevant case marking in NPs). The ILP-constrained search (system output C) of the combination of predictions from the morphological disambiguator and a dependency parser leads to a significant improvement for the (case-marked) argument functions when compared with a parser that does not use the linguistically informed constraints (system output NO-C). The constrained combination is also superior to the state-of-the-art Bohnet parser (Bohnet, 2010), provided with morphological predictions as input to syntactic parser (system output PRED-M): Note the increase of more than two percentage points for the argument functions ("all arg funcs") in Czech and German over the morphological prediction based parsers (84.21 → 86.37 and 87.24 → 90.11).[5] For the other functions, which are independent of case marking, no decrease of performance is incurred. These overall results are quite remarkable, given that the baseline systems are very competitive parsers.

To conclude this section, we have seen an example of advanced NLP research that takes advantage of principled linguistic knowledge about the interaction across interface representations in the setup of a modeling architecture. Running the best available machine learning techniques on gold standard input/output pairs alone does not suffice. For best results, it is crucial to know about the role of intermediate interfaces and the status of the corresponding representations.

7 Conclusion: Is it the 'spirit of LFG' rather than the spirit of linguistic thinking more generally?

The interactions are subtle and the technical solution is quite involved – but I think the discussion of Seeker and Kuhn (2013b) in the previous section makes it clear that even in advanced statistical NLP modeling, targeted, linguistically informed constraining of the search space can have a very noticable effect. Reaching the same effect in an exclusively data-driven way would be extremely hard, even when powerful general-purpose machine learning techniques are applied for picking up the constraints from training data: there is always just a limited amount of high-quality training data, and if an unconstrained model has to *learn* that case/number/gender feature agreement occurs inside of NPs, and person/number agreement holds between subjects and inflected verbs (but no agreement occurs in other configurations), the "signal" in the same data cannot be used to induce other important generalizations.[6] In particular, the wide-spread syncretism in the morphosyntactic feature paradigms tends to blur many of the data points, so pre-structuring the space in terms of underspecified abstract representations makes the

[5] The advantage from the constraints is least pronounced for Hungarian, which has very few cases of sycretism in its inflectional paradigms.

[6] One might speculate that some of these configurational hard constraints reflect an aspect of Universal Grammar, but I do not want to go into this here. Note that the standard treebank-trained parser experiments may fail to reflect some bootstrapping scenario which human language learners are exposed to and which *does* allow for a more data-driven induction of the relevant constraints.

available data much more informative.

The critical reader will probably think, alright, this shows the importance of linguistic awareness about important interface representations even for heavily data-driven NLP – but is there really any specific point related to the 'spirit of LFG' that can be made? Or in other words, there *are* similarities for various LFG levels of representation and important interface representations in recent NLP work, as sketched in Figure 1 on page 6 – but these may reflect some rather unsurprising convergence which any empirical account has to undergo sooner or later, simply to capture the systematic patterns in the data!? After all, the affected levels also resemble traditional levels from descriptive grammar. So it would seem that similar parallels as listed in Figure 1 could be drawn for any other grammatical paradigm, especially constraint-based ones (such as HPSG or CCG) that share the conceptual view of simultaneous interaction across interface representations.

To a certain degree, this reservation is of course justified: if we look just at the representations at the established "hub" levels of grammatical analysis, and we ignore differences in the theoretical assumptions and mechanisms that different approaches assume to relate them to one another, we must expect structural similarities across all approaches at a relatively high level of abstraction (maybe with the exception of heavily derivational approaches).

However, I would nevertheless like to make a stronger point, and I think it is justified to argue that LFG *is* closer than other established grammatical frameworks to the emerging picture in NLP research sketched in section 3 and discussed in more detail in sections 5 and 6. I think there is an explanation for this circumstance at the level of sociology of science. Throughout its development, the LFG framework has been shaped in an interdisciplinary dialogue, involving theoretical linguists, descriptive linguists and computational linguists (as discussed in section 2). This circumstance can have an effect on the characteristics of the canonical interface representations that are being established: if one particular modeling goal dominates the design process, principles advocating formal uniformity and theoretical simplicity (which are of course important in any systematic approach) will have a stronger effect than in a multi-disciplinary setup. In the latter case, new uniformity assumptions about some level of representations will immediately prompt a debate if they are not compatible with the various points of view that the representation is relevant for. So, empirically grounded applicability of the interfaces ranks higher than aesthetic/theoretical considerations of cross-level uniformity (and as a side-effect, a multidisciplinary framework may be somewhat more conservative and keep up established assumptions). At points in time when it turns out that relevant interactions across levels are more complex than previously assumed (like in the examples discussion in section 3), this has the advantage that new accounts do not have to work around simplifications that are orthogonal to the issue under consideration.[7]

[7]To give an example, LFG has generally used relatively "flat" collections of features in the f-structure, whereas HPSG has established sophisticated, hierarchically organized feature structures bundling groups of features. Using inheritance hierarchies over sorted feature structures, the HPSG

Even if this explanation is not correct, it is a fact that LFG has consciously adapted an extensible projection architecture of heterogeneous representation structures. This allows users of the framework to consider alternative paths in the connection between representational layers. By assumption, all layers are in parallel correspondence, so there cannot be any non-monotonic effects that would strictly exclude more indirect cross-level effects (e.g., c-structure information becoming relevant for some decision that is normally made exclusively at f-structure). Yet, it is considered to be the scientific goal to identify the systematic, "direct" effects that are behind the empirical generalizations derived from the data.

And it is this architecture of parallel correspondence across formally heterogeneous representation structures represents that I would characterize as the 'spirit of LFG' in the present context. More than most other frameworks, LFG has avoided superimposing theory-internally motivated meta principles on the modeling approach and has thus kept an open eye on how empirically observable effects can help to make a design decision in one way or another. As a consequence, a considerable number of LFG contributions have looked at a network of levels of representations (the LFG projections) in an explorative way, trying to find arguments that help decide what are the most fundamental correspondence relations across levels, and what are the derived relations. As a matter of fact, with the availability of inverse projection functions and functional composition of projections, there are essentially no effects that cannot be modeled at least indirectly. Examples of relevant considerations are the questions under what circumstances the inverse of the ϕ projection (from c-structure to f-structure) is needed (e.g., Halvorsen and Kaplan (1988/1995); Bresnan (1995) and more recently Asudeh (2009)), or whether some local level of morphological structure is projected from c-structure or from f-structure (Butt et al., 1996; Frank and Zaenen, 2002). In computational work in the LFG framework, there have also been discussions of alternative approaches to the same underlying problem, e.g., disambiguation using symbolic constraint ranking (Frank et al., 2001) vs. data-driven training of discriminative models (Riezler et al., 2002); for disambiguation, it is a combination of the respective strengths of approaches that is effectively being applied in the large-scale ParGram grammars.

LFG's way of *not* treating any particular architectural assumption as a strict given opens up the research paradigm to the possibility of what one might call conditional interface effects, i.e., seemingly incompatible cross-level effects that could not be explained by a single pipeline sequence of modules.[8] As I also ar-

formalism can thus model theories about cross-feature interactions in an aesthetically appealing way, and more uniformly than LFG. It turns out however that it is extremely difficult, if not impossible, to establish a single hierarchical structuring of the feature geometry that is consensus among different points of view, as is reflected in long debates. In LFG, the *representations* of linguistic expressions were tentatively chosen in a way that does not reflect sophisticated theoretical assumptions (these are rather reflected in the constraints or *descriptions* of the objects, e.g., the mechanism of functional uncertainty).

[8] I would say that other constraint-based frameworks have made stronger commitments in terms of turning one particular assumption into a guiding representational principle – enforcing that other assumptions will be subordinate to it. (Of course, such statements are always somewhat subjective.)

gued in Kuhn (2007), it is a strength of constraint-based approaches to the theory of grammar that different systematic effects involving the same interface representation may quite well be based on different interface-to-interface correspondence, without enforcing the prediction that one of them is more fundamental than the other. Another way of stating this observation is that LFG never assumed a strict pipeline architecture, according to the classification from section 5 – which is of course what can be expected from a non-derivational approach, at a technical level, but the observation is also true at a more abstract conceptual level.

The benefit of being able to use "conditional interfaces effects" in the modeling extends quite naturally from classical symbolic modeling of the interface-to-interface relations, using some logic language to input-output modeling as it is done in current machine learning work.[9] Hence, the observations made throughout this paper about more and more cross-level relations (seemingly) deviating from the step-by-step processing pipeline are not at all surprising from the LFG point of view of the architecture of grammar and interfaces.

So, in conclusion, as far as I can see, LFG's architecture of parallel correspondence seems to be closer to the current NLP situation than most other linguistic frameworks. This implies that there may be lessons to be learned from the LFG experience, and if the ultimate goal is to develop a satisfactory overall framework that makes sense both to linguists and to NLP researches working in the current paradigm, LFG's parallel correspondence architecture may be a good starting point. Such a framework would also provide the basis for assessing the implications of important developments in NLP work from a linguistic point of view, and thus revive the cross-fertilization between linguistics and computational linguistics.

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For example, HPSG has decided to generalize the idea of systematic head-driven/intrinsic determination of the phrase-structure configuration – X bar theory and its exensions – in such a way that it stopped to provide any other way of specifying phrase-structure rules. CCG has given systematic principles in the lexicon (for which there is good empirical evidence) precedence over the entire grammatical theory. LFG is more pluralistic in this respect, it provides various points of entry for capturing some generalization.

[9]The same holds for a different target direction in which likewise the 'spirit of LFG' allows for a natural extension (which I did not consider in the present context as I focused attention on computational linguistics/NLP with a relatively technical motivation): this is the recent work on Probabilistic Grammar by Joan Bresnan and colleagues.

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HUNGARIAN PARTICLE VERBS REVISITED: REPRESENTATIONAL, DERIVATIONAL AND IMPLEMENTATIONAL ISSUES FROM AN LFG PERSPECTIVE

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Abstract

In this paper, I will make a systematic and critical comparison between two salient approaches to Hungarian particle verb constructions (PVCs): (i) a fully and uniformly lexicalist treatment proposed by Ackerman (2003) and Ackerman et al. (2011); (ii) a mixed analysis developed by Forst et al. (2010) and Laczkó & Rákosi (2011), whose essence is that non-compositional PVCs receive a special lexical treatment, while compositional PVCs are handled by means of a particular syntactic predicate composition. After discussing various processes involving PVCs, e.g. preverb-reduplication and various types of derivation, I will conclude that the uniform lexical treatment is more appealing LFG-theoretically and it is also more plausible. At the same time, I will claim that the analysis I have developed has several advantages over the (rather programmatic) approach advocated by Ackerman (2003) and Ackerman et al. (2011).

1 Introduction

Particle verb constructions ('PVCs', for short) manifest a varied set of well-attested and widely investigated cross-linguistic phenomena. For an excellent example of variation across languages and theoretical frameworks, see Dehé et al. (2002). PVC phenomena can also be posited in the broader context of complex predicates, see Alsina et al. (1997), for instance.

As is well-known, Hungarian PVCs pose substantial challenges both for theoretical analysis and for computational implementation, because they exhibit a mixture of lexical and syntactic properties: their formation typically affects argument structure, they can be input to productive derivational processes, they can be either compositional or non-compositional, but their pieces (the particle and the verb) are separable in the syntax. These PVCs have been analyzed from a variety of perspectives over the years. For a discussion, examples and references, see Ackerman (2003), Laczkó & Rákosi (2011) and Rákosi & Laczkó (2011).

In this paper, I will make a systematic and critical comparison between two salient approaches: (i) a fully and uniformly lexicalist treatment of all types of Hungarian PVCs proposed by Ackerman (2003) and Ackerman et al. (2011); (ii) a mixed analysis developed by Forst et al. (2010) and Laczkó & Rákosi (2011, 2013), whose essence is that non-compositional PVCs receive a special lexical treatment, while compositional PVCs are handled by means of a particular syntactic predicate composition. After discussing various processes involving PVCs e.g. preverb-reduplication and various types of derivation, I will conclude that the uniform lexical treatment is more appealing LFG-theoretically and it is also more plausible. At the same time, I will claim that the analysis I have developed has several advantages over the (rather programmatic) approach advocated by Ackerman (2003) and Ackerman et al. (2011).

The structure of the paper is as follows. In section 2, I highlight the traits of two different approaches to PVCs: (i) realization-based lexicalism, see Ackerman (2003) and Ackerman et al. (2011); (ii) an LFG-XLE analysis proposed by Laczkó & Rákosi (2011), inspired by Forst et al. (2010). In section 3, I modify and augment this approach by also presenting an account of several derivational processes PVCs undergo. In section 4, I make some concluding remarks.

2 On some previous approaches

Ackerman et al. (2011) give an overview of several salient approaches to predicates with respect to derivational and inflectional processes as well as their synthetic vs. analytic mode of expression. They point out that classical LFG very strongly subscribed to the Strong Lexicalist Hypothesis (SLH), in which all derivational processes (e.g. those affecting a predicate's argument structure, the assignment of grammatical functions, etc.) and all inflectional processes are assumed to be strictly lexical in nature. In addition, this model advocated the classical lexicalist view which holds that each lexical item is a synthetic morphological object functioning as a single syntactic atom. However, when the behaviour of various sorts of complex predicates, including PVCs, was taken into consideration, it turned out that this classical LFG view could no longer be maintained in its entirety. Naturally, the basic problem was that the relevant types of complex predicates are composed of two syntactic atoms. There have been two major types of solutions proposed. *(i)* We should allow well-defined types of complex predicate formation in the syntax. *(ii)* We should allow analytic morphological objects (consisting of more than one syntactic atom) in the lexical forms of predicates as a marked option in addition to the default synthetic mode of realization.

In this section, first I highlight the most crucial general aspects of the realization-based lexicalism approach, opting for solution (i), to PVCs on the basis of Ackerman (2003) and Ackerman et al. (2011) in subsection 2.1, and then I offer an overview of a syntactic predicate formation approach to certain types of PVCs, in the spirit of solution (ii), on the basis of Forst et al. (2010) and Laczkó & Rákosi (2011), by also comparing certain ingredients of the two approaches in subsection 2.2.

2.1 On Ackerman (2003) and Ackerman et al. (2011)

These papers adopt the notion of Ackerman & Webelhuth's (1998) *Morphological Expression* (for a discussion, see Ackerman 2003: 15).

(1) a. *Synthetic realization principle*
Where the realization *w* of <L,δ> is a synthetic member of category X, *w* may be inserted as the head of XP.

b. *Periphrastic realization principle*
Where the realization w_1w_2 of <L,δ> is periphrastic and w_1 and w_2 belong to the respective categories X and Y, w_1 and w_2 may be inserted as the heads of the respective nodes X(P) and Y(P).
[δ = either morphosyntactic or derivational properties]

Crucially, in this approach both inflectional processes and derivational processes are treated in a paradigmatic-realizational fashion. Furthermore, this system allows both the synthetic (= concatenational) and the analytic (= juxtapositional) realization of predicates with certain featural compositions. In the analysis of PVCs, for instance, the preverb and the verb can be realized as either one (morphologically complex) syntactic atom (Concat) or two distinct syntactic atoms (Juxtap).

Basically, both Ackerman (2003) and Ackerman et al. (2011) are programmatic, and they concentrate on what general arguments PVCs provide for their strictly lexicalist, realization-based, paradigmatic approach. Neither develops an analysis of Hungarian PVCs. I hasten to add that I do not question the possibility of developing a fully-fledged and coherent account in the frame of this approach. But it is only when this has been carried out that meaningful comparison can be made between such an account and an alternative, detailed analysis like that in Laczkó & Rákosi (2011), see the next subsection.

2.2 On Forst et al. (2010) and Laczkó & Rákosi (2011)

Forst et al. (2010) discuss the problems posed by PVCs in German, English and Hungarian for both theory and implementation. Their theoretical framework is LFG, and their implementational platform is the Xerox Linguistic Environment (XLE). They argue that the compositional and (sufficiently) productive types of PVCs should be sharply and consistently distinguished from the non-compositional and/or non-productive types. They claim that this distinction should be so dramatic that the compositional types should be handled in the syntax in terms of syntactic complex predicate formation (by employing XLE's restriction operator), while the non-compositional types should receive a special lexical representational treatment coupled with XLE's concatenation template. This paper is highly programmatic, and it only offers an overview of possible general PVC types in the three languages and a sketch of the way in which they could be treated. In addition, it leaves the investigation of the effect that derivational processes involving PVCs may have on this approach for future research.

In Laczkó & Rákosi (2011) we explore the tenability and implementational applicability of the approach proposed by Forst et al.

(2010).[1] In this vein, we give a detailed analysis of both the compositional and the non-compositional uses of two Hungarian spatial PVC types and report its successful implementation. Consider the following examples.

(2) *A rák* *ki* *mász-ott* *a* *folyó-ból*.
the crab.NOM out crawl-PAST.3SG the river-out.of
'The crab crawled out of the river.'

(3) *Az elnök* *ki* *fej-ez-te* *együttérzés-é-t.*
the president. NOM out head-Vsuf-PAST.3SG sympathy-his-ACC
'The president expressed his sympathy.'

The sentence in (2) is an example of the compositional use of the preverb *ki* 'out', while (3) illustrates an utterly non-compositional use (because the simplex verb form *fejezte* does not exist on its own). We assume that preverbs are non-projecting words in the sense of Toivonen (2001), and their syntactic category is PRT (short for particle).[2] For the analysis of (2) we need the following lexical forms for the preverb and the verb (only the relevant details are indicated in these XLE style implementational representations).

(4) a. *mászik* V (↑ PRED)= 'crawl < (↑ SUBJ) (↑ OBL) >'.

b. *ki* PRT (↑ PRED) = 'out < %ARG1 (↑ OBL) >'.

The verb *mászik* 'crawl' has its regular lexical entry. It is a two-place predicate with a subject and a (goal) oblique argument. The preverb *ki* 'out' in its compositional use is also a two-place predicate: it takes a verb as its first argument and a (source) oblique second argument. In c-structure, the preverb, analyzed as the main predicate, has the customary functional head annotation, while the verb has a set of annotations containing the restriction operator encoded by the \ symbol.[3] The interplay of these annotations results in syntactic complex predicate formation, represented in f-structure. The PRED feature in the f-structure of (2) has the following value:

[1] Reviewer 1 makes two remarks in this connection. On the one hand, they miss, from the current paper, the discussion of further PVC types analyzed in either Laczkó & Rákosi (2011) or Rákosi & Laczkó (2011). On the other hand, they query the justifiability of the syntactic predicate composition analysis of the type exemplified in (2) above. My response is this. (i) Space limitations have prevented me from discussing further PVC types (the reader is referred to those two previous papers). (ii) In Laczkó & Rákosi (2011) we argue in a detailed fashion for the syntactic treatment of two types of compositional PVCs (again, space limitations do not make it possible to repeat those arguments here). Moreover, one of the main conclusions of the present paper is that the syntactic treatment is implausible anyhow in the light of certain derivational processes.

[2] In using this PRT category, we also follow the practice of the English and German implementational grammars.

[3] For further details, see Laczkó & Rákosi (2011).

(5) ‘ki < ‘mászik < [rák], NULL >, [folyó] >.

The preverb (*ki* ‘out’) is the main predicate, and it has a “nested” argument structure. Its first argument is the verb (*mászik* ‘crawl’) with its own embedded two-place argument structure. The verb’s first argument is the subject (*rák* ‘crab’), and its second (oblique) argument receives the zero grammatical function (NULL). The preverb’s second argument is a source oblique (*folyó* ‘river’).

In analyzing non-compositional spatial PVCs in Laczkó & Rákosi (2011) we also adopt Forst et al.’s (2010) XLE approach. For instance, in the analysis of (3) we employ the following lexical forms for the (independenty non-existing) verb and the preverb.

(6) *fejez* V (↑PRED) = ‘%FN < (↑ SUBJ) (↑ OBJ) >’
(↑ CHECK _PRT-VERB) = +
(↑ PRT-FORM) =c ki
@(CONCAT (↑ PRT-FORM) # stem %FN).

(7) *ki* PRT (↑ PRT-FORM) = ki
(↑ CHECK _PRT-VERB) =c +.

In the XLE notation, the %FN symbol expresses the value of the PRED feature without its argument structure, see the first line. Within angle brackets in the same line, the argument structure of this non-compositional PVC is given: it is a two-place predicate taking a subject and an object argument. The second line contains one of the two members of a CHECK feature pair. This member is defining and the other is constraining. This is an extremely useful XLE device. Its function is to regulate the obligatory co-occurrence of two elements in a particular configuration. The essence of this _PRT-VERB type CHECK feature is that it requires that the two elements involved must co-occur in a PVC configuration. The third line constrains that form of the particle in this particular instance has to be *ki* (out). The fourth line calls XLE’s concatenation (CONCAT) template. The function of this template is to formally combine (concatenate) the two elements, the preverb form and the verbal stem, in a string connected by the hash mark. This string serves as %FN, the value of the PRED feature without the argument structure.[4] So in our analysis of (3), the PRED feature has the following value

[4] Note that this XLE concatenation process is radically different from that assumed by Ackerman et al. (2011). In their system concatenation means the creation of a synthetic form, a morphologically complex word. By contrast, the XLE device only brings about a string in the value of the PRED feature of a complex predicate in f-structure, and the elements corresponding to the two pieces of the string (flanking the hash mark) are still two free morphemes, that is, two independent syntactic atoms in c-structure.

representation in f-structure (where *elnök* = president, *együttérzés* = sympathy).

(8) 'ki#fejez < [elnök], [együttérzés] >'

As regards the lexical form of the preverb in (7), notice that in this use it has no PRED feature, it only has a form feature (whose value is *ki*), see the first line in its lexical form. The second line is the other (constraining) side of the CHECK _PRT-VERB coin.[5] In c-structure, the preverb and the verb are functional co-heads.

This approach employs an apparatus which is capable of maintaining the "one lexical item – one morphological word – one syntactic atom" correspondence in such a way that it can still capture the marked behaviour of (non-compositional) PVCs. For this purpose, it applies a system of devices: efficient cross-referencing between distinct lexical items via appropriate constraining equations and CHECK-features. The analysis has been successfully tested implementationally, which can be taken to be a rather strong indication of its feasibility.

It is highly significant from the perspective of the present paper that Laczkó & Rákosi (2011), just like Forst et al. (2010), do not examine whether derivational process pose any challenges for their analysis.

In Laczkó & Rákosi (2013) we give a detailed theory-internal and cross-theoretical assessment of our PVC analysis in Laczkó & Rákosi (2011). Two points are directly relevant for the topic of this paper. (i) We only very briefly touch upon derivational issues and make the following rather programmatic statement: "… if a particular morpheme, in our par excellence case, the nominalizing suffix, requires a single morphological word input then the lexical redundancy rules of LFG can provide this by forming one morphological word from the lexical entries of the two distinct elements of the complex predicate (along similar lines to productive compounding processes)" (2013: 167). (ii) In two paragraphs (2013: 167-168) we mention that although we still strongly support the syntactic complex predicate formation approach to compositional PVCs (and thereby the violation of the Strong Lexicalist Hypothesis), we think that technically there is a way to extend our lexical treatment of non-compositional PVCs to that of compositional ones, and we present two sample lexical forms. In subsection 3.3, I address these issues in a detailed manner.

[5] Given that XLE does not tolerate multiple entries for the same lemma in its lexicons, in our HunGram grammar we have a single lexical form for the preverb *ki* (out) and the two representations in (4b) and (7) are expressed disjunctively in a single entry, but this has no theoretical repurcussions.

3 Revisiting Hungarian spatial PVCs

This section has the following parts. In subsection 3.1, I add a general aspect to our analysis: the treatment of various constituents in the [Spec,VP] position. In subsection 3.2, I present an alternative lexical analysis of compositional PVCs in our LFG-XLE framework. Next, I discuss on what basis we can choose between the lexical and the syntactic account of this PVC type (3.3). Then I concentrate on two extremely productive derivational processes both compositional and non-compositional PVCs readily undergo: nominalization (3.4) and preverb reduplication (3.5).

3.1 On treating constituents in [Spec,VP]

In the current version of our HunGram XLE grammar we postulate a VP constituent in Hungarian sentence structure. Our treatment of the [Spec,VP] position is oversimplified, and it fails to capture some basic facts. We employ an XP vs. PRT (that is, preverb) complementary distribution in such a way that the XP is always a focussed constituent. The problem with this approach is that the designated arguments of certain predicates can, or rather must, occupy this position in neutral, i.e. non-focussed and non-interrogative, sentences. Most often they are "reduced arguments" (e.g. bare nouns), but they can also be full XPs. In widely used descriptive terms, they and preverbs are collectively called "verbal modifiers" (VMs).[6]

In Laczkó (2013) I propose a fuller and more comprehensive LFG-XLE treatment of this position. In (9) below, I give a version of it which has been simplified for expository purposes in the context of the current paper.

(9) { (↑ GF)= ↓
  { (↑ FOCUS)= ↓
  | (↓ CHECK _VM-INTER)=c +
  | (↓ CHECK _VM)=c + }
 | ↑=↓
  (↓ CHECK _VM)=c + }

In this approach, the main distinction is between constituents associated with grammatical functions and constituens associated with the functional head annotation, see the major dual disjunction in (9). In the first main disjunct, focussed constituents, "question constituents" of "WH interrogative sentences" and various types of designated arguments of certain predicates occupying the [Spec,VP] position in non-focussed and non-interrogative sentences are in complementary distribution. In the second main disjunct, the functional head annotation is reserved for preverbs in the spirit of our analysis of PVCs in Laczkó & Rákosi (2011, 2013), supplemented with the

[6] For an excellent overview of the most important VM types, see Komlósy (1985).

_VM CHECK feature, constraining the preverb to appear in the [Spec,VP] position in non-focussed and non-interrogative sentences (cf. the same check-featural constraint on designated arguments in the third disjunct of the first main disjunct).

3.2 A possible lexical treatment of compositional PVCs

The lexical analysis of even compositional PVCs would undeniably have the advantage that classical LFG's subscription to the Strong Lexicalist Hypothesis could be maintained in the domain of complex predicates represented by Hungarian PVCs. In this subsection, I show a possible way in which such an approach can be developed in an LFG-XLE framework. In the next subsection I explore what arguments processes involving PVCs provide for or against the lexical vs. syntactic treatment of compositional PVCs.

Let us take a second look at our previous examples in (2) and (3), repeated here as (10) and (11), respectively, for convenience. The former is compositional and the latter is non-compositional.

(10)	*A rák*	*ki*	*mász-ott*	*a*	*folyó-ból*.
	the crab.NOM	out	crawl-PAST.3SG	the	river-out.of
	'The crab crawled out of the river.'				

(11)	*Az elnök*	*ki*	*fej-ez-te*	*együttérzés-é-t*.
	the president. NOM	out	head-Vsuf-PAST.3SG	sympathy-his-ACC
	'The president expressed his sympathy.'			

Given that in Laczkó & Rákosi (2011) we analyze non-compositional PVCs lexically and compositional PVCs syntactically, if one seeks to develep an account of the latter along lexical lines then it is almost inevitable that the analyses of the two types will share important aspects. Below I show that this is really the case to a remarkable extent.

First of all, note that the true counterpart of complex predicate formation in the syntax via restriction would be complex predicate formation via restriction in the lexicon. This process would involve sublexical structures within a morphologically complex word. However, this option is not available exactly because of the syntactic separability of the verb and the preverb. This fact very strongly moves us towards some crucial ingredients of the analyis of non-compositional PVCs.

I propose the following lexical form for the preverb.

(12) *ki* PRT
(↑PRT-FORM)= ki
(↑CHECK _PRT-VERB) =c +
{ (↑ FOCUS)
| (↑CHECK _VM) =c + }
((↑ DIR) = out).

It is a “shared” lexical form for both the non-compositional and the compositional uses. Its crucial property is that even in the compositional use it has no PRED feature, it only has a FORM feature, just like in the non-compositional use, see (7) in section 2.2. Compare this with the argument-taking predicate representation in (4b) on the syntactic account in section 2.2. The other (by now) uniform trait of the preverb in both uses is that it is constrained to a PVC configuration, see the _PRT-VERB CHECK feature in the second line, and compare this with the representations in (7) and (4b). I have added the disjunction between the focus annotation and the _VM CHECK feature in the third and fourth lines on the basis of section 3.1. It is the optional (↑ DIR) = out equation that differentiates between the compositional and non-compositional uses of the preverb. The idea is that in the compositional use, it encodes this spatial-directional feature,[7] it explicitly contributes this feature to the entire PVC, and in the non-compositional use it does not.

I assume the following lexical forms for the two relevant simplex verbs.

(13) *fejez* V
(↑PRED) = ‘%FN < (↑ SUBJ) (↑ OBJ) >’
(↑ CHECK _PRT-VERB) = +
(↑ PRT-FORM) =c ki
~(↑ DIR)
@(CONCAT (↑ PRT-FORM) # stem %FN).

(14) *mászik* V
(↑PRED) = ‘out < ‘crawl < (↑SUBJ) NULL >’ (↑OBL) >’
(↑CHECK _PRT-VERB) = +
(↑PRT-FORM)=c ki
(↑ DIR) =c out.

Not surprisingly, the lexical form of the simplex verb in the non-compositional use of the PVC on this uniform account has not changed much, compare (6) and (13). The only difference is that in (13) I have added a negative existential constraint: the preverb does not encode a directional feature.

For obvious reasons, the lexical form of the simplex verb in the compositional use of the PVC on this uniform account has changed rather dramatically, compare (4) and (14). The representation in (14) follows the non-compositional strategy to a great extent. To begin with, it encodes the

[7] Note that on this lexical account the preverb itself cannot have a PRED feature, because in the syntax there is no restriction operation: both the preverb and the verb have the functional head annotation, i.e. they are functional co-heads. In this respect, they are treated in the same way as non-compositional PVCs, and only one of them can have a PRED feature (which is a general LFG constraint on functional co-heads).

PRED feature of the entire PVC. Now it is constrained to a PVC configuration, and it prescribes that in this meaning the form of the preverb has to be *ki* (out). As opposed to the simplex verb in the non-compositional use, here it requires the presence of the directionality feature (to be contributed by the preverb). The other difference is that here there is no concatenation template. Instead, I assume a PRED feature representation whose details are identical to the result of restriction on the former syntactic predicate composition analysis, see the second line in (14) and compare it with (4b) and the PRED value in (5) in section 2.2. For this account to work, we need a special lexical redundancy rule responsible for creating (14) from the ordinary lexical form of this motion predicate, shown in (4a) in section 2.2. This approach, mimicking the result of the syntactic restriction operation, has a marked aspect. The main predicate 'out' has no lexical form that could serve as input to this derivational process. In a loose sense, a particular type of conversion takes place which introduces a "superordiate" predicate whose "dummy" morphological exponence is a morpheme with special properties: it has no PRED feature on its own, its actual contribution is just a directionality feature, and it is a syntactic atom.[8]

Inevitably, there emerges a potential problem for this approach: preverbs in their compositional use can be foci or contrastive topics, see (15).

(15)	*Ki*	*a*	*rák*	*mász-ott*	*a*	*folyó-ból.*
	out	the	crab.NOM	crawl-PAST.3SG	the	river-out.of

cca. 'As regards out(crawling) it was the crab the crawled out of the river.'

My response is this. First of all, note that the preverbs of absolutely non-compositional PVCs can also occur independently, on their own in short answers, for instance (although they are definitely semantically empty, with no PRED feature). Consider:

(16)	A: *Ki*	*fejez-ted*	*a*	*vélemény-ed-et?*	B: *Ki.*
	out	head.Vsuf-PAST.2SG	the	opinion-your-ACC	out

'Did you express your opinion?'

Naturally, a constituent's use as a contrastive topic (or focus) does require some meaningful content. In this new approach, although the preverb does not function formally as the main predicate of the sentence, in its compositional use it does have some semantic contribution: it encodes directionality, hence its focus/contrastive topic potential. This is the significance of, and rationale behind, my employing the directionality feature in the lexical form of the preverb.

[8] A reminder is in order here: this marked aspect of the analysis is the consequence of the behaviour of PVCs: the syntactic separability of the two pieces. That is why the restriction operation as we know it cannot work in the lexicon.

In the next subsection, I address the following question. On what basis can the choice between the lexical and the syntactic predicate composition account be made?

3.3 On the choice between the syntactic and the lexical accounts

At a general level, the pros and cons are as follows. The syntactic account gives up classical LFG's adherence to the Strong Lexicalist Hypothesis, which is a disadvantage. At the same time, it can elegantly capture the special behaviour of these PVCs: it employs a coherent device for complex predicate formation in the syntax. Moreover, it has an extremely favourable implementational merit. These productive PVCs can be parsed "on the fly": no lexical aspect is needed. This reduces the burden on the lexical component of a large scale XLE grammar to a great extent.[9] By contrast, the lexical account respects the Strong Lexicalist Hypothesis. It basically follows the treatment of non-compositional PVCs and supplements it with a special lexical redundancy rule for the generation of a "transparent" PRED feature value. Its implementational disadvantage is that it requires the generation and storage of each PVC in the lexical component, which can be a serious hindrance for a robust XLE grammar.

At this point let me take further facts and criteria into consideration. Fundamentally, I will concentrate on the relevance of various types of productive derivational processes PVCs (whether compositional or non-compositional) can undergo.[10] Below I discuss three processes: causativization, iterativization and event nominalization.

PVCs, like ordinary verbal predicates, readily undergo causativization. Consider the following examples. (17) exemplifies an intransitive compositional PVC and its causative counterpart, while (18) shows a transitive non-compositional PVC and its causative version. The empirically and intuitively correct generalization is that both the non-compositional and the compositional PVCs are in the scope of the causative morpheme.

(17) a. *A fiú* *ki* *mász-ott* *a* *folyó-ból.*
the boy.NOM out crawl-PAST.3SG the river-out.of
'The boy crawled out of the river.'

b. *Ki* *mász-at-tam* *a fiú-t* *a* *folyó-ból.*
out crawl-CAUS-PAST.1SG the boy-ACC the river-out.of
'I made the boy crawl out of the river.'

[9] For a detailed discussion of this issue, see Forst et al. (2010).
[10] As I mentioned in subsection 2.2, this is an issue Forst et al. (2010) and Laczkó & Rákosi (2011) do not address and leave for future research.

(18) a. *Az elnök* *ki* *fej-ez-te*
the president. NOM out head-Vsuf-PAST.3SG

az *együttérzés-é-t.*
the sympathy-his-ACC

'The president expressed his sympathy.'

b. *Ki* *fej-ez-tet-tem* *az* *elnök-kel*
out head-Vsuf-CAUS-PAST.1SG the president-with

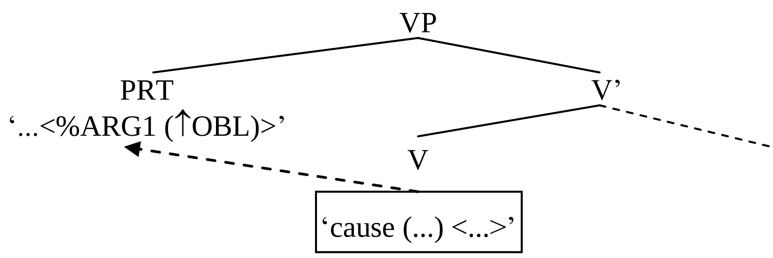
az *együttérzés-é-t.*
the sympathy-his-ACC

'I made the president express his sympathy.'

In theory, in the case of non-compositional PVCs this can be properly captured in the CONCAT type lexical analysis proposed by Forst et al. (2010) and Laczkó & Rákosi (2011), and also adopted here. We can causativize the lexical form of the simplex verb (containing the entire value of the PRED feature of the PVC) just like the lexical form of any ordinary verb,[11] and at the same time the derived form will inherit the CONCAT apparatus from the input verb (the CONCAT template itself and the PRT-FORM constraint).

If compositional PVCs are also treated lexically, in fundamentally the same manner as non-compositional ones as shown in the previous subsection, then their causativization can also be handled along the same lines, so the empirically and intuitively justified uniformity can be achieved. However, on the "syntactic complex predicate formation via restriction" account this seems to be impossible for the following reason. In Hungarian, the causative morpheme is strictly bound: it is a derivational suffix. From this it follows that in this approach the simplex verb has to be causativized in the lexicon, and this form with its PRED will combine with the preverb in the syntax. Thus, the causative simplex verb will be the first argument (that is, it will be in the scope) of the preverb, rather counterintuitively. Consider the abstract representation of this scenario.

(19)



[11] For instance, this device can be a metarule macro or the lexical type of restriction. This is an issue to be explored carefully from an XLE perspective which I cannot deal with here.

I think this is a serious problem for the syntactic analysis, and it is made even more serious by the fact that there are several absolutely productive derivational processes which can follow one another in a series. There is one such example in (20).

(20)	*a*	*fiú*	*ki*	*mász-at-gat-ás-a*	*a*	*folyó-ból.*
	the	boy.NOM	out	crawl-CAUS-ITER-DEV-his	the	river-out.of

cca. 'repeatedly making the boy crawl out of the river'

The problem is that the PVC is best interpreted as being in the scope of the causative suffix (CAUS), this combination should be in the scope of the iterative suffix (ITER), and this new combination should be in the scope of the deverbal nominalizing suffix (DEV). However, in the syntactic approach it is the simplex predicate and its hierarchically growing suffixed counterparts that ultimately undergo complex predicate formation via restriction with the preverb. This fact makes the syntactic approach rather implausible.[12]

3.4 On the nominalization of PVCs

One of Ackerman's (2003) central arguments for treating Hungarian PVCs lexically is that they can serve as input to event nominalization. His fundamental generalization is as follows. "Phrasal predicates generally become synthetic morphological entities when they undergo category changing derivation" (2003: 9). Consider, for instance, the nominalized counterpart of (17), one of our previous examples.

(21)	a	*fiú*	*ki*	*mász-ás-a*	*a*	*folyó-ból*
	the	boy.NOM	out	crawl-DEV.his	the	river-out.of

'the boy's crawling out of the river'

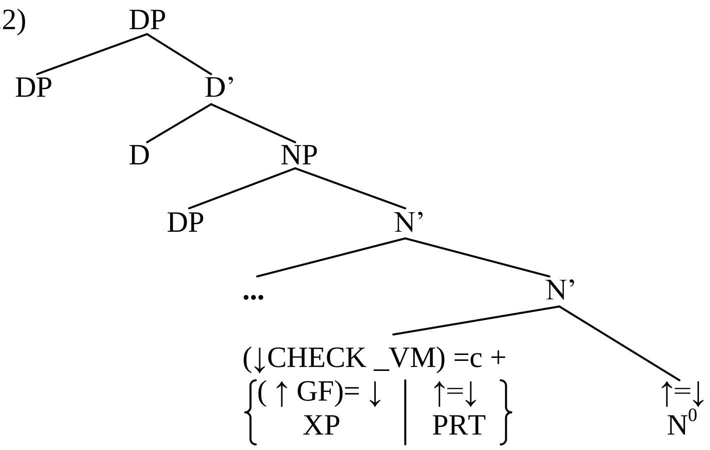
Before discussing the treatment of the nominalization of PVCs, let me point out that in this paper my approach is along the same general lexical lines as Ackerman's. On the one hand, I adopt Forst et al.'s (2010) and Laczkó & Rákosi's (2011) lexical treatment of non-compositional PVCs, and, on the other hand, I argue for a similar lexical account of compositional PVCs (contra Forst et al. 2010 and Laczkó & Rákosi 2011).[13]

[12] Note that one way out would be to allow ordinary suffixal derivation (e.g. causativization and nominalization) also to take place in the syntax of Hungarian. This, however, would even more seriously undermine classical LFG's view of morphology in a different respect: it would allow bound morphemes to live independent syntactic lives in a GB/MP fashion. (The nominalizing morpheme cannot be treated as either a clitic or a phrasal suffix, because – among other things – it is affected by the rules of vowel harmony, which is only characteristic of world-level bound morphemes.)

[13] As I mentioned in subsection 2.1, it is not possible to compare our approaches in a detailed fashion, because Ackerman's is rather programmatic.

In my analyis of the nominalization of PVCs, my most crucial assumption is that these derived forms are not synthetic morphological entities (contra Ackerman's claim). On the basis of Laczkó (2000), I postulate that Hungarian DPs have the following (skeletal) structure.

(22)



The key idea here is that I assume a special position below the lower N' which I take to correspond to the [Spec,VP] position in the verbal domain. Furthermore, I postulate that this position is available to the overwhelming majority of the VMs in the verbal domain,[14] e.g. to preverbs with the functional head annotation and a range of designated arguments with their respective grammatical functions. My main motivation for this structure is that among these designated arguments there are also clearly maximal projections.

Let us first take a look at one of Ackerman's own examples (2003: 28).[15]

(23)	a.	*szabályszerű-vé*	*válik*	b.	*szabályszerű-vé*	*vál-ás*
		regular-TRANS	become		regular-TRANS	become-DEV
		'become regular'			'becoming regular'	

Ackerman's claim is that in this case, too, nominalization results in the "incorporation" of the VM element, that is, the nominalized version becomes a synthetic morphological entity (just like in the case of the nominalization of PVCs). Notice, however, that the adjective *szabályszerű* 'regular' can be modified and this results in an AP, for instance: *meglepően szabályszerű* 'surprisingly regular'. This weakens the tenability of the lexical incorporation analysis considerably, because it does not seem to be plausible to "lexicalize" a (possibly infinite) number of accidental adverb + adjective combinations

[14] For a preliminary, incomplete and undeveloped version of this idea, in comparison with Szabolcsi's (1994) GB solution, see Laczkó (2000).

[15] I have modified the glosses so that they conform to the glossing pattern followed in this paper. TRANS glosses the translative case suffix.

like this. Furthermore, the verbal predicate in (23a) can also take a full referential DP in translative case as its complement, see the examples in (24).

(24) a. *Pál* *Éva* *barát-já-vá* *vált.*
Paul.NOM Eve.NOM friend-her-TRANS became
'Paul became Eve's friend.'

b. *Pál-nak* *az* *Éva* *barát-já-vá*
Paul-DAT the Eve.NOM friend-her-TRANS

vál-ás-a
become-DEV-his

'Paul's becoming Eve's friend'

I think it would be even more implausible to assume that the referential possessive DP (*Éva barátja* 'Eve's friend') incorporates into a synthetic morphological entity as a result of nominalization.

This phenomenon manifests a very old problem for approaches to VM constituents which aim at a uniform analysis of all these elements (given their complementarity and their fundamentally similar syntactic positional behaviour in neutral, focussed and negative clauses). I have just shown that a uniformly lexical/morphological treatment is not feasible. The other logical possibility is to treat all these VMs and their verbal or nominalized companions as distinct syntactic atoms consistently. My approach does exactly this.

Now let us take a look at the details of my analysis of examples like (21). Of the two VM options in (22), it is the PRT version that is invoked. The preverb has the same lexical form as before in (12), repeated here as (25) for convenience.

(25) *ki* PRT
(↑PRT-FORM)= ki
(↑CHECK _PRT-VERB) =c +
{ (↑ FOCUS)
| (↑CHECK _VM) =c + }
((↑ DIR) = out).

From the lexical form of the simplex verb shown in (14) a lexical redundancy rule creates its event nominal counterpart by changing its syntactic category and replacing the (SUBJ) grammatical function of the first argument of the verb with the (POSS) function.

(26) *mászás* N
(↑PRED) = 'out < 'crawl < (↑POSS) NULL >' (↑OBL) >'
(↑CHECK _PRT-VERB) = +
(↑PRT-FORM)=c ki
(↑ DIR) =c out.

Note two fundamental differences related to the VM position in DPs as opposed to VPs. (i) This position cannot have the (↑ FOCUS) annotation in DPs. (ii) As a rule, a preverb (PRT) can only occupy this position in DPs: it cannot follow the noun head, nor can it target any other pre-head position.

3.5 Preverb reduplication

This is an absolutely productive process even in the case of non-compositional PVCs. Consider two of our previous examples, (2) and (3), this time with reduplicated preverbs. The PVC is compositional in (27) and non-compositional in (28).

(27) *A rák* *ki-ki* *mász-ott* *a* *folyó-ból.*
the crab.NOM out-out crawl-PAST.3SG the river-out.of
'The crab crawled out of the river from time to time.'

(28) *Az elnök* *ki-ki* *fej-ez-te*
the president. NOM out-out head-Vsuf-PAST.3SG

együttérzés-é-t.
sympathy-his-ACC

'The president expressed his sympathy from time to time.'

In Ackerman's (2003) terminology, preverb reduplication introduces the following aspectual feature: intermittently repeated action (IRA), see the translations of (27) and (28). Relying on Kiefer (1995/1996), he makes the following generalizations. Preverb reduplication brings about a synthetic morphological object. Their main test is negation, the observation being that the reduplicated preverb cannot occur postverbally when the verb is preceded by the negative particle, which is the way of negating ordinary PVCs.

My comment on Kiefer's and Ackerman's generalization to the effect that reduplicated preverbs make up a synthetic morphological unit is that it is false. The reason for this is that if this combination was really a complex morphological entity and a single syntactic atom then it should be inserted under a V^0 node and it should be negatable as an ordinary verb. This can only be stipulated in the context of their generalization. My claim is that the (empirically) correct generalization is that a reduplicated preverb is constrained to occupying the [Spec,VP] position. This single constraint captures the (negative) negation facts, which makes it more tenable than the "Kiefer-Ackerman" approach. I think it is a further (and related) problem that the reduplicated preverb can get "very far" from its base verb in the syntax. Consider the following example.

(29) *A rák* *ki-ki* *akar* *mász-ni* *a* *folyó-ból.*
the crab.NOM out-out wants crawl-INF the river-out.of
'The crab wants to crawl out of the river from time to time.'

Notice that in this sentence the reduplicated preverb occurs in the Spec position of a VP headed by a verb different from its own simplex verb within the PVC.

If the PV-PV–V complex is an ordinary synthetic V^0, as is assumed by Kiefer and Ackerman, then, in addition to the impossibility of the negative particle's preceding this V, it is also puzzling why no focussed constituent can precede it, either, in the regular [Spec,VP] position. Consider (30).[16]

(30) **Csak*	*a*	*rák*	*ki-ki*	*mászott*	*a*	*folyóból.*
only	the	crab	out-out	crawled	the	river.from

'It was only the crab that crawled out of the river from time to time.'

This fact also follows from my alternative analyis: no focussing is possible because the designated position is occupied by the reduplicated preverb.

All this having been said, the following legitimate question arises. Why are reduplicated preverbs constrained to the [Spec,VP] position?[17] My tentative answer is that they are capable of enforcing their aspectual content in that position, but this issue requires further investigation.[18]

My analysis of PVCs with reduplicated preverbs is as follows. The lexical form of the simplex verb has to be modified minimally: in addition to the simple form of the preverb, it also has to admit the reduplicated version disjunctively: see (31) below and compare it with (14).

(31) *mászik* V
(↑PRED) = 'out < 'crawl < (↑SUBJ) NULL >' (↑OBL) >'
(↑CHECK _PRT-VERB) = +
(↑PRT-FORM)=c { ki | ki-ki }
(↑ DIR) =c out.

A lexical redundancy rule creates a lexical form for the reduplicated version of the preverb, and it brings about two changes with respect to the lexical form of the input preverb (in addition to the obvious FORM feature change). On the one hand, it eliminates the two-member disjunction by removing the (↑ FOCUS) disjunct,[19] and, on the other hand, it introduces a special aspectual feature which, following Ackerman (2003), I informally represent as IRA ("intermittently repeated action"). Compare the lexical form of the

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[16] This example is a reliable test because Hungarian *csak* 'only' constituents obligatorily occupy the [Spec,VP] focus position.

[17] It is also to be noted that at least for some speakers the postverbal occurrence of a reduplicated preverb is also acceptable (György Rákosi, p. c., July 14, 2013); thus, in their grammar reduplicated PVCs provide even more spectacular evidence for their non-synthetic nature.

[18] It is noteworthy in this context that É. Kiss (1992), in her GB framework, assumes that certain (phonetically null) aspectual operators occupy the [Spec,VP] position.

[19] In this way we can constrain the reduplicated preverb to a VM position.

simple preverb in (25), repeated here as (32a) for convenience, with that of the reduplicated counterpart in (32b).

(32)	a. *ki* PRT	b. *ki-ki*, PRT
	(↑PRT-FORM)= ki	(↑ PRT-FORM) = ki-ki
	(↑CHECK _PRT-VERB) =c +	(↑ ASPECT) = IRA
	{ (↑ FOCUS)	(↑CHECK _PRT-VERB) =c +
	| (↑CHECK _VM) =c + }	(↑CHECK _VM) = +
	((↑ DIR) = out).	((↑ DIR) = out).

Ackerman (2003) rejects Kiefer's (1995/1996) claim that reduplicated PVC cannot undergo category changing derivation. Ackerman is right. Consider the nominalized counterpart of (27).

(33)	*a rák*	*ki-ki*	*mász-ás-a*	*a*	*folyó-ból*
	the crab.NOM	out-out	crawl-DEV.its	the	river-out.of
	'the crab's crawling out of the river from time to time'				

My treatment of this nominalization is very simple. The lexical form of the reduplicated preverb is the same: (32b), and the relevant lexical redundancy rule nominalizes the modified lexical form of the simple verb given in (31).[20]

4 Conclusion

In this paper I have revisited crucial LFG theoretical and XLE implementational issues related to the treatment of spatial PVCs in Hungarian. I compared, in a detailed fashion, the lexical-realizational approach advocated by Ackerman (2003) and Ackerman et al. (2011), among others, with an LFG-XLE approach developed by Forst et al. (2010), Laczkó & Rákosi (2011) and Rákosi & Laczkó (2011). As regards the latter two papers, on the one hand, I added some important aspects to their analysis, and, on the other hand, I proposed a significant modification. I argued that compositional PVCs should also be treated lexically in a manner similar to the treatment of non-compositional PVCs, and I presented a possible way of carrying this out. I pointed out that one of the advantages of this uniform lexical treatment is that classical LFG's view of the distribution of labour between the lexical and the syntactic components of grammar can be maintained.[21] I also showed how various morphological processes (often

[20] The reduplication of inflecting preverbs poses an additional challenge for an analysis along these lines. I have a solution, but space limitations prevent me from showing it here.
[21] In this connection, Reviewer 1 writes: "the paper […] tries to adhere to the Strong Lexicalist Hypothesis despite the fact that it has been shown (not necessarily for Hungarian PVCs of type (A), but for other phenomena in other languages) that this hypothesis does not hold 100% while happily sacrificing the productivity of compositional PVCs." My answer is this. I myself think that a linguistic phenomenon

consecutively) involving PVCs can be handled (e.g. causativization, preverb reduplication and nominalization). And a final remark: it is a favourable aspect of our LFG-XLE approach that its apparatus makes it possible to adhere to the classical notions of a morphological word and a syntactic atom to a great extent.

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may call for a syntactic analysis in violation of the SLH (in Laczkó & Rákosi 2011, we argued for such a solution). However, in the present paper, on the basis of further investigation, my claim is that additional crucial facts more strongly support a lexical treatment. Moreover, I do not "sacrifice" productivity: I simply capture it in the lexical component of grammar. So in this case the SLH is not the motivation or aim driving my (re)analysis; instead, it is just a welcome consequence, making this account one degree less marked, given the general assumptions of LFG.

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(DE)SELECTING ARGUMENTS FOR TRANSITIVE AND PREDICATED NOMINALS

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Abstract

Transitive nominals, that is nouns or adjectives that syntactically govern object arguments, are a problematic phenomenon under many influential categorizations of word classes. I show that in some languages, syntactic context can restrict the transitivity of transitive nominal categories; specifically, there is a clear association between predication and nominal transitivity, such that nominals can only be transitive when predicated. I develop a formal model of this restriction, based on the assumption that it should be specified syntactically, rather than lexically; I also consider the selectional properties of copular clauses more generally.

1 Transitive Nominals

Transitive nominals, by which I mean nouns or adjectives that subcategorize for object arguments, are a problematic concept for several influential categorizations of word classes (as noted, in relation to adjectives, by Vincent and Börjars 2010: 459). For example, Bresnan and Kanerva (1989: 25), defining the feature [+objective], explicitly deny that objects appear with nouns or adjectives. Similarly, for Bresnan and Moshi (1990: 166–167) this is part of the very definition of an object: "objects are hypothesized to have the primitive property of complementing transitive predicators such as verbs and adpositions, and not complementing intransitive predicators such as basic nouns and adjectives." Bresnan (2001: 100, 120) assumes the following feature distinctions for the major lexical categories (cf. also Bresnan 1976: 19):

(1)

	+predicative	–predicative
+transitive	V	P
–transitive	A	N

In this model, +transitive categories "may take an object or direct complement function." Adjectives and nouns, then, are denied the ability to take objects. These features are essentially the same as those of Chomsky (1970); the categorization of Jackendoff (1977: 31–33) likewise defines adjectives and nouns as inherently non-transitive (having the feature [–OBJ]).

Despite the seemingly widespread formal definition of adjectives and nouns as inherently non-transitive, transitive adjectives have been recognized to exist in some languages. Platzack (1982a) noted and formalized the existence of transitive adjectives in Mordern Swedish. Other works that discuss the possibility of transitive nominals, but that seem uneasy with the idea, include Maling (1983: English),

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van Riemsdijk (1983: German), and van Kemenade (1987: Old English). Vincent and Börjars (2010) find evidence for transitive adjectives in Swedish, Danish, Norwegian and Dutch, but treat them as marked relics in Modern Germanic, rather than a synchronically systematic phenomenon. Beside this relatively widespread evidence for transitive adjectives, transitive *nouns* appear to be cross-linguistically considerably rarer. Some do exist, however, and will be discussed below.

Note that we are not here considering non-finite verb forms like participles and infinitives that may be morphologically nominal and yet transitive. The transitivity of such categories is fundamentally dependent on their verbal status, and is in no way typologically remarkable. From an LFG perspective non-finite verb forms can be treated as inflectional forms of verbs, sharing the same PRED value and subcategorization frame as finite verbal forms inflected to the same stem, in contrast to verbally derived nominals, whose PRED values are not paradigmatically identified with a verbal PRED (Lowe 2012).

Note also that we are not here considering derived event nominals that display nominal phrasal syntax but that are often analysed in LFG as selecting for subject and object arguments at f-structure, although these appear in c-structure as possessive or prepositional modifier phrases (e.g. Laczkó 2000). The assumption that derived event nominals like *destruction*, *observation* etc. select for syntactic subject and object arguments involves a conflation of semantic and syntactic argumenthood. The fact that in the noun phrase *Napoleon's invasion of Russia*, *Napoleon* is the semantic agent of the invasion and *Russia* is the semantic patient does not mean that at f-structure *Napoleon* need necessarily be a SUBJ and *Russia* an OBJ. In a parallel architecture, no such direct isomorphism between syntax and semantics is required. Rather, it is simpler to assume that at f-structure *'s* possessives are consistently POSSs, and optional postmodificatory PPs are consistently ADJs, but in some contexts mapped to semantic arguments rather than semantic adjuncts.[1]

For the purposes of this paper, I restrict the notion of nominal transitivity to refer only to syntactic subcategorization for an object (OBJ) argument. Subcategorization for other grammatical functions by nouns and adjectives is typologically less rare and will not be treated in detail here, but the formalism advanced is capable of accounting for nominals that subcategorize for any combination of non-subject arguments.[2]

[1]As discussed by Asudeh (2005) there may be distinct differences between syntactic and semantic argument structures, e.g. arguments may be present in the semantics that are entirely absent from the syntax.

[2]Despite the apparent rarity and problematic status of transitive nominals as discussed in this section, there is of course no formal problem in licensing subcategorization frames, including subcategorization for objects, for nouns and adjectives in LFG; cf. e.g. Butt et al. (1999: 105). Recent works discussing adjectives that select for non-subject arguments include e.g. Mittendorf and Sadler (2008), Al Sharifi and Sadler (2009) and Raza and Ahmed (2011). It is the syntactic alternation discussed in the following section, and not nominal "transitivity" per se, that I seek to account for in this paper.

2 Data

I focus here primarily on data from Old Avestan (OAv.), which is discussed in detail in Lowe (2014), but also briefly discuss phenomena in other languages which demonstrate that the OAv. data is typologically well paralleled. OAv. is the oldest attested Iranian language, surviving in a relatively small body of literature consisting of religious poems attributed to Zarathustra, the founder of Zoroastrianism, and a liturgical prose text of roughly contemporary date.[3] In many respects the texts are obscure and linguistically difficult, but I show in Lowe (2014) that clear patterns emerge in the distribution and syntax of transitive nominals that are not only remarkably unambiguous in OAv. terms, but that are also supported by typological parallels in other languages.

I define nominal transitivity in OAv. as government by a noun or adjective of an accusative case dependent that does not show the semantics (expression of goal/extent) expected of an accusative adjunct in the language.[4] Only certain morphological categories of nominal can display transitivity in this sense. Most, but not all, of these show marginally verbal morphological features. These features are not sufficient to justify analysing the forms involved as part of the non-finite verb system, i.e. they cannot be categorized as participles vel sim.; rather, their morphology suggests a derivational relationship with the verbal system: they are lexical nouns and adjectives, but derived from (or at least from stems related to) verbal stems.

The ability of these forms to govern object arguments clearly derives from their morphological relationship with verbal stems, but this ability is in certain respects distinct from the seemingly parallel transitivity of non-finite verbal forms built to the same stems. Non-finite verb forms proper can be transitive in whatever syntactic context they appear, as long as the verbal stem to which they are formed is itself transitive. But the transitive nominal categories under discussion show a clear distribution of transitive vs. non-transitive uses: only when functioning as the main predicate in a nominal or copular clause do these ‘potentially transitive’ categories appear with objects; when not so predicated such nominals are intransitive. The two categories differ in other ways too: participles in OAv., for example, are rare as the main predicate in a nominal or copular clause, while this is common with all the transitive adjective categories. In this paper, I use the term “predicated” to refer to nouns or adjectives that function as the main predicate in a nominal or copular clause, as the superlatives in exx. (2) and (3) respectively.

The distribution of transitive vs. non-transitive uses of certain nominal categories is most clear with the ‘verbal’ subclass of superlative adjectives (Tucker 2009).[5] For example the superlative *mairišta-*, related to the verbal root $\sqrt{mar}$

[3]Estimates of its date range from about 1500 to 700 B.C.

[4]Due to the problematic nature of the language as it is attested, there are unfortunately no unambiguous syntactic tests that can be used alongside this criterion.

[5]These are superlative adjectives built to roots that also form primary finite verbal systems, in contrast to another set of superlative adjectives, formed in precisely the same way but to adjectival

‘remember’, clearly governs an accusative, and is also predicated (2). Similarly *vaēdišta-*, derived from the verb $\sqrt{\textit{vid}}$ ‘know’ (3); in this clause there is an explicit copula.[6]

(2)

mazdā̊	sax^{v}ārə	*mairištō*
Mazda.N.SG	outrage.A.SG	best_recalling.N.SG

‘Mazda *best remembers* outrage.’ (Y. 29.4a)

(3)

yaēšą̇m	tū	ahurā	irixtəm	mazdā
which.G.PL	you.N.SG	Lord.V	assets.A.SG	Wise.V
vaēdištō	ahī			
best_knowing.N.SG	be.2SG			

‘for which (crimes) you, Wise Lord, *know best* the net assets.’ (Y. 32.7)

All the predicated ‘verbal’-type superlatives in OAv. that are derived from transitive roots are unambiguously transitive. However, the one example of a ‘verbal’-type superlative formed to a transitive root that is not predicated is also, crucially, not transitive. The form *zrazdišta-* is unambiguously a ‘verbal’-type superlative, and given the meaning of the root the form would otherwise be expected to be transitive (4). In fact the morphologically and functionally equivalent *zrazdātəma-*, attested in a later (Younger Avestan) text, is transitive and, notably, predicated (5).

(4)

yauuaṯ	āžūš	*zrazdištō*	būnōi	haxtiiā̊
yoke.FUT	penis.A	most_faithful_to.N	base.L.SG	thigh.G.SG

‘*The most faithful one* will yoke (his) penis at the bottom of the (female) thighs.’ (Y. 53.7b)

(5)

yaθra	narō. . .	aṣ̌əm	*zrazdātəma*
where	man.N.PL	truth.A	most_faithful_to.N.PL

‘. . . where the men are *most faithful to* truth.’ (Yt. 13.25)

‘Verbal’-type superlatives therefore display transitivity under two conditions: firstly, derivation from a transitive verbal root, and secondly predication in a nominal or copular clause (exx. 2, 3, 5 vs. 4). This pattern of transitive predicated vs. intransitive non-predicated appears clearly also with root nouns in *-mi-*. The noun *dą̇mi-* ‘creator’ is transitive twice, and in both passages is clearly predicated (6); none of the four non-predicated instances are transitive, any dependent appearing in the expected objective genitive (7).

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roots (like *vah-* ‘good’); these latter never display transitivity. There are no transitive comparative adjectives in OAv., but this is likely an accidental gap in the data, as such forms are found in the later Younger Avestan language.

[6] Translations of OAv. passages are largely taken from Humbach (1991). Non-self-evident abbreviations used in the glosses: A accusative, G genitive, I instrumental, L locative, N nominative, V vocative.

(6) huuō xraθβā *dąmiš* aṣ̌əm
that.N.SG intellect.I.SG creator.N.SG truth.A.SG
'That one is *the creator* (of) truth through his intellect.' (Y. 31.7b)

(7) huuō *dāmōiš* drūjō hunuš
that.N.SG creator.G.SG lie.G.SG son.N.SG
'That one is a son *of the creator* of the lie.' (Y. 51.10)

The reduplicated *i*-stem noun *caxri-* 'maker' governs a double accusative in the sense 'make X (into) Y'; again the form is predicated (8). The only other example of this morphological category in OAv., *mąnarōiš*, genitive of an original **mamri-*, is not predicated, and not transitive (9); the form is morphologically problematic, but at the very least does not contradict the observed pattern.

(8) yōi. . . aspə̄ṇcīt̰ sādrācīt̰ *caxraiiō*
who.N.PL misfortune.A.PL=any distress.A.PL=any maker.N.PL
ušəurū
pleasure.A.PL
' Who. . . *turn* any misfortune and distress *into* pleasure.' (Y. 34.7ab)

(9) kadā mazdā *mąnarōiš* narō vīsəṇtē
when Mazda.V reciter.G.SG men.N.PL take_position.3PL
'When, O Wise One, will (some) honourable persons take up their positions side by side *with the reciter*.' (Y. 48.10a)

Some other nominal categories in OAv. are consistently transitive and predicated, but there are no corresponding non-predicated, non-transitive instances that would prove the vital role of predication in licensing transitivity; nevertheless we can assume that the same pattern may well have extended to all potentially transitive nominals in the language.

A relation between nominal transitivity and predication is found in several other old Indo-European languages. In Ṛgvedic Sanskrit, closely related to OAv., the only instances of nominals selecting for infinitival complements (admittedly XCOMPs, not OBJs) all involve those nominals being predicated (Keydana 2013: 310–312).[7] More specifically in relation to object government, the only transitive nominal in Gothic is always predicated; likewise the only transitive nominal in Old High German is transitive only when predicated (10), and intransitive otherwise (11).[8]

[7] Otherwise, although there appears to be a strong preference in Ṛgvedic Sanskrit for potentially 'transitive' nominals to take object arguments only when predicated, there are many couterexamples, in contrast to Avestan, such that the analysis proposed in this paper for Avestan cannot fully carry over into an analysis of nominal transitivity in Sanskrit.

[8] Although synchronically transitive, the diachrony of this construction is more complicated; cf. Lowe (2013). It also differs from the Avestan construction in that an explicit nominative subject is never found; in all other respects it is parallel, however.

(10)

tés	íst	míh	*uuúnder*
this.G	is	me.A	wonder.N

Lit. ‘(There) is wonder (to) me of this’. (*Boeth.*)

(11)

uuir	gisahumes	*uuuntar*	hiutu
we.N	see.PF	wonders.A	today

‘We saw wonders today.’ (*Tat.*)

A close association between nominal transitivity and predication is found also in Early Latin (mainly in Plautus, c. 254–184 B.C.). In Classical Latin (c. 75 B.C. on), no nominal can take an accusative object, but in the early language a few such forms are found, and again the same pattern seen in OAv. is found here: all of the forms concerned are predicated.[9]

A further instance of predicated, transitive nominals is that of predicated relational nouns in the Central Guerrero dialect of the Uto-Aztecan language Nahuatl, discussed by Amith and Smith-Stark (1994). In Central Guerrero Nahuatl (CGN) *predicate* nouns referring to “culturally recognized interpersonal relationships” (largely kinship terms) can take verbal argument markers, whereby the referent of the noun is marked as an object, and the possessor as subject, but only where the referent/object is 1^{st} or 2^{nd} person.

(12) *ti-ne:č-na:n*
2sgS-1sgO-mother
‘I am your mother.’

(13) *ti-miȼ-iȼk^{w}in*
1sgS-2SgO-dog
‘You are my dog.’

Amith and Smith-Stark (1994) show that these constructions derive from an inherited Uto-Aztecan construction in which the noun was originally inflected and used essentially as a verb (which accounts for the association between transitivity and predication here); the verbal construction survives to an extent in related languages like Huichol, Cora, and Hopi. In CGN, however, all verbal properties have been lost, leaving, as the only vestiges of the verbal origin of the construction, both the transitivity of the nouns concerned and the fact that they must be predicated. This verbal origin is different from the Indo-European forms discussed here, the morphological origins of which were entirely nominal, and any verbal associations of which were entirely secondary. Transitive nominals, then, can result from distinct diachronic developments affecting categorially divergent words.

The languages discussed above attest a direct association between predication and nominal transitivity. It is this phenomenon that I will attempt to account for formally in §4. However, it is also worth noting that in some other languages we find similar but distinct phenomena, which cannot be explained in the same way, but that do at least support the concept of an association between degree of predication and nominal transitivity.[10] In Modern Swedish, several adjectives take

[9] The forms are listed by Bennett (1914: 252–253). Only one of the nominals attested as predicated and transitive in early Latin is also attested in a non-predicated context in the same period, where it is intransitive (*observatio* ‘observation’, Plautus *Mil.* 2.6.5).

[10] A similar connection between nominal transitivity and a particular syntactic context, though not specifically predication, is seen e.g. in Japanese, where certain nominals can license arguments only when used in a complex predicate construction with the light verb *suru* (Grimshaw and Mester 1988).

NP object complements: e.g. *hängiven* ‘devoted to’, *lik* ‘like’, *tillgiven* ‘attached to’, *underlägsen* ‘inferior to’, *värd* ‘worthy of’. Platzack (1982b) notes that these adjectives can also be transitive when attributive. Even so, there is still a syntactic difference between predicated and attributive constructions: attributive transitive adjectives must have the object directly preceding the adjective, while the objects of predicated transitive adjectives can either precede or follow. In Modern Swedish too, then, transitivity is more restricted (though not excluded) with non-predicated adjectives.

Again, there is a similar but distinct pattern in the distribution of complements and adjuncts with adjectives in English: they can appear only when the adjective concerned is either predicated or predicative, but not when it is attributive (predicated *he is happy about the result*, predicative *the man, happy about the result,* . . . , but attributive **the happy about the result man*). Syntactically, this is an entirely different phenomenon from that discussed above, but descriptively it is nevertheless similar.[11]

In descriptive terms, such patterns are easily comprehensible: predicated nominals (both nouns and adjectives) are in some way more ‘verbal’ than non-predicated nominals, in that they carry the main predication of the clause, a role prototypically associated with finite verbs. In terms of a cline between verbal and nominal, predicated nominals are somewhat further from purely nominal, and somewhat closer to purely verbal. In a similar vein, Hopper and Thompson (1980: 280ff.) discuss the relation between backgrounding and lower transitivity, which implies a corresponding relation between foregrounding (e.g. predication) and higher transitivity.

In §4 I develop a formal model of the relation between transitivity of nominals and predication. I begin, however, with a seemingly parallel question concerning nominal predication in LFG.

3 Nominal Predication in LFG

Several possibilities exist for the f-structural formalization of copular and verbless clauses in LFG. I follow such authors as Dalrymple et al. (2004), Falk (2004), Nordlinger and Sadler (2007) and Laczkó (2012) in assuming that the different f-structure possibilities may be valid for different languages, and even for different constructions within the same language, depending on the syntactic properties of the construction concerned.[12]

There are three widely used analyses for predicated nominals: one ‘single-tier’ analysis, in which the predicated nominal itself is the functional head of the clause (15), and two ‘double-tier’ analyses, in which a (perhaps null) copular verb is the functional head and the predicated nominal an argument of it (16, 17).[13]

[11] For a syntactic explanation, see Sadler and Arnold (1994).

[12] Contrasting with the uniform PREDLINK approach of Butt et al. (1999), Attia (2008), Sulger (2009), Dione (2012). Cf. also Rosén (1996) on copular clauses.

[13] Laczkó (2012) argues that the XCOMP analysis is not necessary but can be subsumed under the

(14) Henry is good.

(15) $$\begin{bmatrix} \textsc{pred} & \text{‘good}\langle\textsc{subj}\rangle\text{’} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{‘Henry’} \end{bmatrix} \end{bmatrix}$$

(16) $$\begin{bmatrix} \textsc{pred} & \text{‘be}\langle\textsc{xcomp}\rangle\textsc{subj}\text{’} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{‘Henry’} \end{bmatrix} \\ \textsc{xcomp} & \begin{bmatrix} \textsc{pred} & \text{‘good}\langle\textsc{subj}\rangle\text{’} \\ \textsc{subj} & [\ \ ] \end{bmatrix} \end{bmatrix}$$

(17) $$\begin{bmatrix} \textsc{pred} & \text{‘be}\langle\textsc{subj},\textsc{predlink}\rangle\text{’} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{‘Henry’} \end{bmatrix} \\ \textsc{predlink} & \begin{bmatrix} \textsc{pred} & \text{‘good’} \end{bmatrix} \end{bmatrix}$$

In terms of analysing the association between predication and nominal transitivity, it does not matter greatly which representation we choose. For simplicity, I assume the single-tier analysis in the following, but the rules presented below could easily be rewritten to apply under either of the double-tier analyses. In this section, however, I address an issue of the single-tier analysis and of the open complement double-tier analysis that appears at least superficially similar to the issue of nominal transitivity.

These analyses of copular clauses assume that predicated nominals (and, indeed, prepositions, etc.) in such constructions select for a subject argument; in non-predicated contexts such selection for arguments is either unnecessary or problematic. Dalrymple et al. (2004) claim that nominals could be open complements in predicative positions but closed in non-predicative contexts; this would be particularly likely for nouns, since it is hard to imagine that all nouns in a language would select for subjects in all contexts (whereas this is not inconceivable for adjectives). The same assumption is made by Falk (2004).

However, neither Dalrymple et al. nor Falk make clear how this alternation would be modelled. Bresnan (2001) assumes lexical rules that effectively create duplicate lexical items, one of which subcategorizes for a subject. This solution is similar to lexicalist treatments of other argument structure alternations, such as the passive, but in this case there is no difference in morphological/phonological form, nor lexical irregularities in the alternation, that might provide any support for treating this as a lexical alternation.[14] Such a solution is certainly possible, since LFG predicts a certain amount of redundancy in the lexicon, but the potential

single-tier analysis, and also argues for a second type of closed two-tier analysis, involving an OBL. These proposals do not affect the arguments made in this section.

[14]Interestingly, in Zapotec a large class of adjectives show different morphological forms in attributive and predicative uses (Broadwell 2007). This provides clear evidence for lexically distinct forms of the adjective for use in different syntactic contexts in this language, contrasting with the complete absence of evidence for such a lexical distinction in English and the other languages considered here.

duplication of every noun, adjective, preposition etc., in the lexicon would involve massive redundancy, and moreover would not capture the fact that this alternation is determined purely syntactically, and not lexically. The alternative to multiple lexical entries is some sort of function in the *syntax* that licenses argument selection for predicated nominals.

I exemplify my formalization with reference to adjectival predication and (14) above, and begin by dealing with the semantic requirements. I assume that the lexical entry of an adjective contains only the meaning constructor denoting the intrinsic meaning of the adjective, as in (18). As discussed by Dalrymple (2001: 264ff.), two distinct meaning constructors are required to account for adjectival attribution, one denoting the intrinsic meaning of the adjective (as appears in 18), the other determining the semantic combination of a modifier with its noun.[15] Dalrymple implies that the second meaning constructor, given (in adapted form) in (19), may be a part of the lexical entry of an adjective along with that denoting the intrinsic meaning.[16]

(18)

good: A
($\uparrow$PRED) = 'good'
$\lambda x.good(x) : (\uparrow_\sigma \text{ V}) \multimap \uparrow_\sigma$

(19) ATTRIB-ADJ: $\lambda Q.\lambda P.\lambda x.Q(x) \wedge P(x) : ((\downarrow_\sigma \text{ V}) \multimap \downarrow_\sigma) \multimap (((\text{ADJ} \in\downarrow)_\sigma \text{V}) \multimap ((\text{ADJ} \in\downarrow)_\sigma \text{R}) \multimap ((\text{ADJ} \in\downarrow)_\sigma \text{V}) \multimap ((\text{ADJ} \in\downarrow)_\sigma \text{R}))$

The meaning constructor in (19) combines with the intrinsic meaning of an adjective to produce an adjectival meaning that can then combine with a noun. However, this meaning constructor is designed to apply only to attributive adjectives, that is to adjectives that function as adjuncts, in f-structure, of the noun that they semantically modify. A predicated adjective in a copular clause requires a different meaning constructor to produce a coherent semantic structure.

The attributive adjective meaning constructor, then, applies only in certain syntactic contexts. Rather than have this meaning constructor appear (even optionally) within the lexical entry of an adjective, we can attach it to the c-structure node under which an attributive adjective will appear.[17] We can assume a PS rule such as (20) for attributive adjectival phrases, in which the template ATTRIB-ADJ calls the meaning constructor in (19). This rule licenses an optional AP adjunct within a noun phrase that functions as an ADJ at f-structure. The meaning constructor introduced by the phrase structure enables the adjective to semantically modify the noun.

[15]Two meaning constructors are required not only, as argued here, to permit basic adjectival meanings to appear in different contexts, but also, as discussed by Dalrymple (2001), to permit adjectival meanings to be modified by adverbial meanings.

[16]I abbreviate the semantic attributes VAR and RESTR as V and R respectively. I also abstract away from the temporal/aspectual side of the semantics, including the event variable assumed for stage-level adjectives by Haug (2009).

[17]On the attachment of semantic material to phrase structure positions cf. Dalrymple (2001: 240).

(20)
$$\text{N}' \quad \rightarrow \quad \ldots \quad \begin{pmatrix} \text{AP} \\ \downarrow\in (\uparrow\text{ADJ}) \\ @\text{ATTRIB-ADJ} \end{pmatrix} \quad \ldots$$

The functional and semantic annotations in this rule are relevant only, however, when an adjective is used attributively. In order to obtain a coherent semantic structure for a sentence like (14), we must introduce a meaning constructor that enforces subcategorization for a subject. The meaning constructor required appears in the following PS rule.

(21)
$$\text{V}' \quad \rightarrow \quad \ldots \quad \begin{pmatrix} \text{AP} \\ \uparrow=\downarrow \\ \lambda P.P : ((\downarrow_\sigma \text{ V}) \multimap \downarrow_\sigma) \multimap ((\uparrow\text{SUBJ})_\sigma \multimap \uparrow_\sigma) \end{pmatrix} \quad \ldots$$

The PS-rule in ex. (21) applies to APs filling the functional head of the clause ($\uparrow=\downarrow$, where $\uparrow$ finds the f-structure associated with the V$'$, and by implication the VP, I$'$ and IP). The meaning constructor introduced on the AP node in the above PS-rule will combine with the meaning constructor specified in the lexical entry for *good*; the semantic proof is given in (22).

(22)
$$\dfrac{\dfrac{\begin{matrix}\lambda x.good(x) : \\ (g_\sigma \text{ V}) \multimap g_\sigma\end{matrix} \qquad \begin{matrix}\lambda P.P : \\ ((g_\sigma \text{ V}) \multimap g_\sigma) \multimap \\ ((g \text{ SUBJ})_\sigma \multimap g_\sigma)\end{matrix}}{\begin{matrix}\lambda x.good(x) : \\ (g \text{ SUBJ})_\sigma \multimap g_\sigma\end{matrix}} \qquad Henry : h_\sigma}{good(Henry) : g_\sigma}$$

By the rule in (21), however, this derivation will be associated with the f-structure in (23) which, by traditional assumptions, is incoherent: it violates Completeness and Coherence since a SUBJ appears even though it is not subcategorized for by the PRED.

(23)
$$g : \begin{bmatrix} \text{PRED} & \text{'good'} \\ \text{SUBJ} & h : \begin{bmatrix} \text{PRED} & \text{'Henry'} \end{bmatrix} \end{bmatrix}$$

There are two possible solutions. Authors such as Kuhn (2001), Andrews (2008) and Asudeh and Giorgolo (2012) have noted that the resource-sensitivity of glue, and the widespread codescriptional approach to semantics in LFG, render the f-structure conditions of Completeness and Coherence superfluous, since they are enforced in s-structure as *semantic* conditions on well-formedness. Asudeh and Giorgolo (2012: 69) propose that f-structure PRED features do not encode subcategorization for semantic arguments, enabling them to encode both transitive and intransitive uses of verbs like English *eat* in a single lexical entry, which is not possible under traditional assumptions about subcategorization at f-structure. Following this approach, then, the f-structure in (23) would be valid: selection for a SUBJ, and only a SUBJ, is enforced in the semantics and need not also be enforced in f-structure.[18]

The alternative is to utilize analyses for complex predicates and predicate composition in order to effectively 'add' selection for a subject argument to the lexical PRED. Previous work on this topic, e.g. Butt (1995), Alsina (1996), Butt et al. (1997), Arka et al. (2009), assumes that a single f-structure PRED can be composed of information supplied by two distinct lexical items or morphemes. It is relatively trivial to extend this to the construction of PRED values also by information supplied by the c-structure, in precisely the same way that e.g. semantic information can be introduced in the c-structure (cf. 20). We can simply augment the PS-rule proposed above (21) with a rule that adds subcategorization for SUBJ to the PRED introduced by a predicated adjective, using the restriction operator to distinguish the lexical PRED from the composed PRED value (24).[19] The semantic proof will be identical to that in (22), but the associated f-structure will be as in (15) rather than (23), i.e. by traditional assumptions it will be well-formed.

(24)
$$V' \quad \rightarrow \quad \dots \quad \begin{pmatrix} \text{AP} \\ \uparrow/\text{PRED}{=}\downarrow/\text{PRED} \\ (\uparrow\text{PRED}) = \text{`}(\downarrow\text{PRED})\langle\text{SUBJ}\rangle\text{'} \\ \lambda P.P : ((\downarrow_\sigma\ \text{V}) \multimap \downarrow_\sigma) \multimap ((\uparrow\text{SUBJ})_\sigma \multimap \uparrow_\sigma) \end{pmatrix} \quad \dots$$

The analysis presented here can easily be adapted to treat predication of nouns, prepositional phrases, etc. So, the only difference between predicated adjectives and predicated nouns is that the meaning constructor introduced by the PS rule must differ slightly in the latter case, due to the contrasting semantic properties of nouns; i.e. in place of the last line of (24), we would need rather:

(25) $\lambda P.P : ((\downarrow_\sigma\ \text{V}) \multimap (\downarrow_\sigma\ \text{R})) \multimap ((\uparrow\text{SUBJ})_\sigma \multimap \uparrow_\sigma)$

Note that by this analysis the subject argument of a predicated noun or adjective has no thematic role. This is appropriate for the subject argument, since (i) it is introduced directly into the f-structure, thereby bypassing argument structure, and (ii) there is no thematic role applicable for the subjects of most predicated nouns and adjectives (thematic roles apply to the arguments of eventualities, not the 'possessors' of attributes). So there is no thematic role associable with the property of being good, or of being a student, etc. This would be problematic if the subject

[18]There would be no difference here, for our purposes, between a codescriptional approach to semantics and the 'description-by-analysis' approach of Andrews (2007, 2008).

[19]It will make no difference at the semantic level whether a copula is obligatory, as in English, or optional, as in Old Avestan.

of a noun or adjective were selected for in the lexicon just like a verbal argument.[20] Furthermore, this explains why subjects of nominals (and prepositions, etc.) cannot participate in the same argument structure alternations (e.g. voice alternations) as verbal subjects, since they are not present in argument structure.

In this way, then, the alternation between predicated nominals selecting for subjects and non-predicated nominals not selecting for subjects can be easily captured. Such a process is necessary if copular and verbless clauses are to be modelled with one of the open nominal analyses; it would not be required for closed complement analyses. Note that I am not specifically advocating the single-tier or XCOMP analysis here for any particular language, merely showing how the necessary selectional properties can be specified in the syntax.[21]

4 Back to Transitive Nominals

We can now return to the phenomenon seen above, that in various languages certain nouns or adjectives can be transitive, but only when predicated. In this case there is more support for treating the alternation as lexical. This may be the simplest solution for the Old Germanic and CGN forms discussed above, which are either isolated or very small closed classes of forms in their respective languages. The alternation is, however, entirely syntactic, just as with the selection for subjects discussed in the previous section; the Old Avestan forms in particular are members of productive morphological classes, such that in principle their number was unrestricted. For this reason, although it would be possible merely to propose two separate lexical entries, one for the non-transitive, one for the transitive variant, it seems preferable if the alternation can be captured in a way that reflects the syntactic context of the alternation.

In the context of nominal transitivity and predication, the 'semantics only' approach to Completeness and Coherence entails a significantly different analysis from the integrated f-structure/s-structure approach. The former approach simplifies the analysis by relaxing the rules of f-structure composition, but thereby

[20]In this way, subjects in copular clauses are very different from subjects in 'ordinary' verbal clauses, which will always bear a thematic role in relation to the main verbal element. For this reason, the process of subject addition proposed here is entirely different from, and cannot be extended to cover, the proposal found in transformational grammar that subjects are *always* introduced in the syntax (Marantz 1984, Kratzer 1996). Such an extension would in any case be unwarranted in the present framework, since there is no alternation between subject-having and subjectless forms of finite verbs, as there is with nouns, adjectives, etc.

[21]It should be noted that alternative analyses of subject selection may be possible. Homola and Coler (2013) argue against the use of the restriction operator, although it is unclear whether their suggested alternative would be capable of *removing* arguments, as discussed in §4. An alternative would be to permit default PRED values to simply be overwritten where necessary, as suggested by Asudeh et al. (2013). Yet a further possibility might be to take seriously the presence of the s-string between the lexicon and c-structure, and somehow derive f-structure PRED values from s-string F(OR)M features (cf. Mycock and Lowe 2013) rather than specifying them directly in the lexicon, facilitating their manipulation according to syntactic context.

removes the possibility of using f-structure to constrain semantic composition. There are two possibilities for treating nominal transitivity and its connection to predication under a 'semantics only' approach. One would be an optional meaning constructor in the lexical entry introducing, or existentially quantifying, the object argument, parallel to Asudeh and Giorgolo's (2012) treatment of the optional argument of verbs like English *eat*. However, it would be difficult to constrain the application of such a meaning constructor only to contexts in which the nominal was predicated, or the converse, such that we could not directly model the dependence of nominal transitivity on syntactic context.

The second option would be to introduce a meaning constructor in the c-structure, as we saw above, so that it would apply only in the correct syntactic context. But a meaning constructor introduced in the syntax could not be used to add arguments, because different nominals select for different numbers and combinations of non-subject arguments with different thematic roles, such that no generalized addition could be specified. The only alternative would be to existentially quantify lexically selected non-subject arguments in non-predicated contexts. But here too, there is no way to determine in advance precisely what sort of argument is to be suppressed, or indeed how many arguments are to be suppressed. We would therefore have to frame an appropriately vague rule, and permit it to apply as many times as necessary. A meaning constructor like the following might achieve the desired result, but the use of the ! operator is distinctly unsatisfactory in a resource-sensitive semantics (Asudeh and Crouch 2002, Asudeh 2012: 101), and would have to be carefully constrained to prevent overapplication.

(26) $!\exists x : ((\downarrow \textsc{gf})_\sigma \multimap ((\downarrow_\sigma \textsc{v}) \multimap \downarrow_\sigma \textsc{r})) \multimap ((\downarrow_\sigma \textsc{v}) \multimap \downarrow_\sigma \textsc{r})$

This semantic problem can be avoided by retaining Completeness and Coherence as f-structure conditions, and manipulating the PRED value in the syntax, as we saw above. As stated, potentially transitive nominals select for non-subject arguments in the lexicon; under a single-tier/XCOMP analysis of predication the subject argument will be introduced when necessary by the syntactic rules discussed above. Ex. (27) shows the lexical entry for OAv. *dąmi-* 'creator', which appeared in (6–7).

(27)

dąmi-: N
(↑PRED) = 'creator-⟨OBJ⟩'
$\lambda x.\lambda e.create(e) \wedge agent(e,x) : (\uparrow_\sigma \textsc{ev}) \multimap ((\uparrow_\sigma \textsc{v}) \multimap \uparrow_\sigma \textsc{r})$
(@THEME-OBJ)

The noun *dąmi-* selects for an OBJ argument in the lexicon. However, the semantic specification in the lexical entry makes only optional reference to the theme argument associated with that OBJ, by permitting, but not enforcing, calling of the THEME-OBJ template in (28). The non-optional meaning constructor in the lexical entry does not refer to a theme argument; the theme argument may or may not be introduced into the semantics by calling the template. I assume the PS-rule in (29), where Nom $\equiv$ { N | A }.

(28) THEME-OBJ: $\lambda y.\lambda e.\lambda P.P(e) \wedge theme(e,y) : ((\uparrow_\sigma \text{V}) \multimap \uparrow_\sigma \text{R}) \multimap ((\uparrow \text{OBJ})_\sigma \multimap ((\uparrow_\sigma \text{V}) \multimap \uparrow_\sigma \text{R}))$

(29)
$$\text{NomP} \quad \rightarrow \quad \ldots \quad \begin{pmatrix} \text{Nom}' \\ \text{GF } (\in) \uparrow \\ \uparrow/\text{PRED}{=}\downarrow/\text{PRED} \\ (\uparrow\text{PRED}) = \text{`}(\downarrow\text{PRED\_FN})\text{'} \end{pmatrix} \quad \ldots$$

By (29), when an NP or AP is used in a context other than predication, a predicate composition rule is introduced, just as with predicated nominals, but here the composition produces a PRED that selects for no arguments, regardless of whether the noun or adjective itself selects for arguments in its lexical entry. This will apply vacuously to the vast majority of nouns and adjectives, which do not select for arguments.

If, then, a 'transitive' nominal such as *dąmi-* is used in a non-predicated context, its argument is effectively removed from the syntax by the above rule. A coherent semantics will then result only by the non-application of the optional meaning constructor in the lexical entry. If, on the other hand, such a nominal is used in a context of predication, the above rule cannot apply and its argument will not be removed. A coherent semantic structure will then result only by the application of the optional meaning constructor, introducing the syntactically selected argument(s) into the semantics. In this way, f-structure formation constrains semantic structure, such that a coherent derivation always results.

Exx. (30) and (31) show the f-structure and semantic proof respectively for (6), ignoring the instrumental adjunct. Exx. (32) and (33) show the f-structure and semantic proof for (7).[22]

(30)
$$c:\begin{bmatrix} \text{PRED} & \text{`creator}\langle\text{SUBJ,OBJ}\rangle\text{'} \\ \text{SUBJ} & t:\begin{bmatrix}\text{PRED} & \text{`that one'}\end{bmatrix} \\ \text{OBJ} & r:\begin{bmatrix}\text{PRED} & \text{`truth'}\end{bmatrix} \end{bmatrix}$$

[22]In (31) and (33), as above, I abstract away from the semantics of tense-aspect, hence the unquantified EV argument, but cf. Haug (2008), Bary and Haug (2011), and Lowe (2012) on the semantics of tense-aspect. The first meaning constructor in (33) is an approximation of the meaning of genitive case.

(31)

$$
\dfrac{
\dfrac{
truth : r_\sigma
\qquad
\dfrac{
\dfrac{
\begin{array}{l}
\lambda x.\lambda e.create(e) \\
\wedge agent(e,x) : \\
(c_\sigma\ \mathrm{EV}) \multimap \\
((c_\sigma\ \mathrm{V}) \multimap (c_\sigma\ \mathrm{R}))
\end{array}
\qquad
\begin{array}{l}
\lambda y.\lambda e.\lambda P.P(e) \\
\wedge theme(e,y) : \\
((c_\sigma\ \mathrm{V}) \multimap c_\sigma\ \mathrm{R}) \multimap \\
((c\ \mathrm{OBJ})_\sigma \multimap \\
((c_\sigma\ \mathrm{V}) \multimap c_\sigma\ \mathrm{R}))
\end{array}
}{
\begin{array}{l}
\lambda x.\lambda y.\lambda e.create(e) \\
\wedge agent(e,x) \wedge theme(e,y) : \\
(c_\sigma\ \mathrm{EV}) \multimap ((c\ \mathrm{OBJ})_\sigma \\
\multimap ((c_\sigma\ \mathrm{V}) \multimap c_\sigma\ \mathrm{R}))
\end{array}
}
\qquad
\begin{array}{l}
\lambda P.P : \\
((c_\sigma\ \mathrm{V}) \multimap (c_\sigma\ \mathrm{R})) \\
\multimap (c\ \mathrm{SUBJ})_\sigma \multimap c_\sigma
\end{array}
}{
\begin{array}{l}
\lambda x.\lambda y.\lambda e.create(e) \\
\wedge agent(e,x) \wedge theme(e,y) : \\
(c_\sigma\ \mathrm{EV}) \multimap ((c\ \mathrm{OBJ})_\sigma \\
\multimap (c\ \mathrm{SUBJ})_\sigma \multimap c_\sigma)
\end{array}
}
}{
\begin{array}{l}
\lambda x.\lambda e.create(e) \wedge \\
agent(e,x) \wedge theme(e,truth) : \\
(c_\sigma\ \mathrm{EV}) \multimap (c\ \mathrm{SUBJ})_\sigma \multimap c_\sigma
\end{array}
}
\qquad
that : t_\sigma
}{
\begin{array}{l}
\lambda e.create(e) \wedge agent(e,that) \wedge \\
theme(e,truth) : (c_\sigma\ \mathrm{EV}) \multimap c_\sigma
\end{array}
}
$$

(32)

$$
s : \left[\begin{array}{ll}
\mathrm{PRED} & \text{‘son}\langle \mathrm{SUBJ} \rangle\text{’} \\
\mathrm{SUBJ} & t : \left[\begin{array}{ll} \mathrm{PRED} & \text{‘that one’} \end{array}\right] \\
\mathrm{ADJ} & \left\{ c : \left[\begin{array}{ll}
\mathrm{PRED} & \text{‘creator’} \\
\mathrm{CASE} & \text{genitive} \\
\mathrm{ADJ} & \left\{ l : \left[\begin{array}{ll} \mathrm{PRED} & \text{‘lie’} \\ \mathrm{CASE} & \text{genitive} \end{array}\right] \right\}
\end{array}\right] \right\}
\end{array}\right]
$$

5 Conclusion

Despite traditional definitions of adjectives and nouns as inherently intransitive, there is clear evidence for nominals in various languages selecting object arguments. In Old Avestan, Old Germanic and CGN, there is a direct association between nominal predication and nominal transitivity: only predicated nominals can govern object arguments in the syntax. This appears similar to the requirement that nouns and adjectives select for a subject argument when predicated but not otherwise, under the single-tier or XCOMP analyses of copular clauses. It is not only possible, as I hope to have shown, but also desirable to account for the variable argument selection of nouns and adjectives in both these contexts without having to assume lexical duplication, that is, to manipulate the selectional properties of nouns and adjectives in the syntax, appropriately reflecting the fact that this variation is syntactically, not lexically, determined.

(33) Glue proof for (7):

$$\lambda P.\lambda Q.\iota x.\lambda y.P(x) \wedge Q(y) \wedge R_c(x,y) : \\ ((l_\sigma\ \text{V}) \multimap (l_\sigma\ \text{R})) \multimap \\ ((((\text{ADJ} \in l)_\sigma \text{V}) \multimap ((\text{ADJ} \in l)_\sigma \text{R})) \multimap \\ (((\text{ADJ} \in l)_\sigma \text{V}) \multimap ((\text{ADJ} \in l)_\sigma \text{R})))$$

$$\lambda x.lie(x) : ((l_\sigma\ \text{V}) \multimap (l_\sigma\ \text{R}))$$

$$\lambda P.\lambda y.\iota x.lie(x) \wedge P(y) \wedge R_c(x,y) : \\ ((((\text{ADJ} \in l)_\sigma \text{V}) \multimap ((\text{ADJ} \in l)_\sigma \text{R})) \multimap \\ (((\text{ADJ} \in l)_\sigma \text{V}) \multimap ((\text{ADJ} \in l)_\sigma \text{R})))$$

$$\lambda x.\lambda e.create(e) \wedge \\ agent(e,x) : (c_\sigma\ \text{EV}) \multimap \\ ((c_\sigma\ \text{V}) \multimap (c_\sigma\ \text{R}))$$

$$\lambda P.\lambda Q.\iota x.\lambda y.P(x) \wedge Q(y) \wedge R_c(x,y) : \\ ((c_\sigma\ \text{V}) \multimap (c_\sigma\ \text{R})) \multimap \\ ((((\text{ADJ} \in c)_\sigma \text{V}) \multimap ((\text{ADJ} \in c)_\sigma \text{R})) \multimap \\ (((\text{ADJ} \in c)_\sigma \text{V}) \multimap ((\text{ADJ} \in c)_\sigma \text{R})))$$

$$\lambda y.\lambda e.\iota x.lie(x) \wedge create(e) \\ \wedge agent(e,y) \wedge R_c(x,e) : \\ (c_\sigma\ \text{EV}) \multimap ((c_\sigma\ \text{V}) \multimap (c_\sigma\ \text{R}))$$

$$\lambda P.\lambda z.\lambda e.\iota x.\iota y.lie(x) \wedge create(e) \wedge \\ agent(e,y) \wedge R_c(x,e) \wedge R_c(y,z) : \\ (c_\sigma\ \text{EV}) \multimap ((((\text{ADJ} \in c)_\sigma \text{V}) \multimap ((\text{ADJ} \in c)_\sigma \text{R})) \\ \multimap (((\text{ADJ} \in c)_\sigma \text{V}) \multimap ((\text{ADJ} \in c)_\sigma \text{R})))$$

$$\lambda x.son(x) : \\ ((s_\sigma\ \text{V}) \multimap (s_\sigma\ \text{R}))$$

$$\lambda P.P : \\ ((s_\sigma\ \text{V}) \multimap (s_\sigma\ \text{R})) \multimap (s\ \text{SUBJ})_\sigma \multimap s_\sigma$$

$$\lambda z.\lambda e.\iota x.\iota y.lie(x) \wedge create(e) \wedge agent(e,y) \\ \wedge R_c(x,e) \wedge son(z) \wedge R_c(y,z) : \\ (c_\sigma\ \text{EV}) \multimap ((s_\sigma\ \text{V}) \multimap (s_\sigma\ \text{R}))$$

$$\lambda z.\lambda e.\iota x.\iota y.lie(x) \wedge create(e) \wedge agent(e,y) \\ \wedge R_c(x,e) \wedge son(z) \wedge R_c(y,z) : \\ (c_\sigma\ \text{EV}) \multimap ((s\ \text{SUBJ})_\sigma \multimap s_\sigma)$$

$$that : t_\sigma$$

$$\lambda e.\iota x.\iota y.lie(x) \wedge create(e) \wedge agent(e,y) \\ \wedge R_c(x,e) \wedge son(that) \wedge R_c(y,that) : \\ (c_\sigma\ \text{EV}) \multimap s_\sigma$$

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DISCOURSE FUNCTIONS OF QUESTION WORDS

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Abstract

Butt (2012) presents an analysis of echo questions in Urdu/Hindi which makes crucial reference to the information structure status of the 'wh' question word involved. Such a question word occupies the post-verbal position reserved for Background Information in Urdu/Hindi, which is characterized as [−NEW, −PROM(INENT)] according to the information feature system proposed by Butt & King (1996). This contrasts with the information feature values most often associated with a question word, namely those identified with Focus: [+NEW, +PROM]. One consequence of Butt's (2012) analysis is that it opens up an intriguing possibility: if a question word can belong to either the information structure category Focus or the information structure category Background Information, can it also belong to the other two major categories in Butt & King's (1996) system, i.e. Topic and Completive Information? And if so, how is this to be captured? I argue that question words can indeed belong to these two information structure categories. I propose to capture the relevant generalizations by having question words fully populate the information feature space, a proposal which relies on introducing an interface feature **Q** that is potentially relevant at multiple levels of the grammar, in line with Dalrymple & Mycock's (2011) approach to interface phenomena within the LFG framework, subsequently revised in Mycock & Lowe (2013). An initial review of a small sample of cross-linguistic data reveals support for a proposed distinction between [+PROM] and [−PROM] question words. By integrating question words fully into Butt & King's (1996) analysis of discourse functions and adding **Q** to the inventory of semantic/pragmatic information to be included in interface structures, this work further increases our understanding of interface phenomena and their analysis within the LFG framework.

1 Introduction[1]

In order to account for facts about word order in Urdu and Turkish, specifically the relations between particular syntactic positions and the information structure status of the constituents which may occupy them, Butt & King (1996) define four discourse functions based on binary values for two features, [±NEW] and [±PROM(INENT)], as shown in Figure 1. Butt & King's (1996) approach is based on Choi's (1996) analysis of information

[1] I would like to thank Miriam Butt, Özlem Çetinoğlu, Mary Dalrymple, John Lowe, and those attending the 11th South of England LFG Meeting and LFG13 in Debrecen for helpful comments and discussion, as well as the editors and reviewers. I gratefully acknowledge financial support from the Faculty of Linguistics, Philology and Phonetics at the University of Oxford and Ministerio de Ciencia e Innovación Grant FFI2011-23046 (P.I. Alex Alsina), which enabled me to attend LFG13.

structure in LFG, which itself is an extension of Vallduví's (1992) trinomial partition of a sentence on the basis of its information structure.

	[+NEW]	[–NEW]
[+PROM]	FOCUS	TOPIC
[–PROM]	COMPLETIVE INFORMATION	BACKGROUND INFORMATION

Figure 1. Information features and discourse functions (Butt & King 1996)

I take the information feature [±NEW] used in Butt & King's (1996) system to refer to relational rather than referential givenness–newness because, as Lambrecht (1994: 489) points out, "the conveying of [new] information is in principle independent of the previous mention or non-mention of the designata of the different constituents in a sentence". For instance, given an appropriate context a sentence consisting solely of anaphoric expressions such as *She did it* serves to establish relations between the various elements of the proposition, thus conveying new information and changing the addressee's representation of the world. This relational definition of the information feature [±NEW] is key to accounting for the discourse functions which question words may have. As for [±PROM], Butt & King (1996) define this feature in terms of whether the information is "of primary importance to the information structure of the discourse at hand" or not. Butt & King (1996) show that the four discourse functions defined in terms of these two binary-valued information features are associated with specific c-structure positions in Urdu and Turkish.

While Butt & King's influential work on discourse functions has been referred to in studies of constituent ('wh') questions within the LFG framework, previous analyses have not explored the possibility that question words can fully populate the information feature space defined by Butt & King (1996). Mycock (2006) proposed that all non-echo question words inherently have Focus status, thus [+NEW, +PROM] in Butt & King's system; cf. Horvath's (1986: 118) Focus Constraint. Gazdik (2011) meanwhile analyzed question words as having the feature value [+PROM]. Both approaches are inconsistent with Butt's (2012) analysis of Urdu/Hindi echo questions as having Background Information status, i.e. information feature values [−NEW, −PROM].

In this paper, I seek to explore the possibility that question words can have the same information feature values, and hence the same discourse functions, as non-interrogatives. In order to account for discourse functions of question words, I propose to introduce the feature **Q**, which is an interface feature similar to those first proposed in Dalrymple & Mycock (2011) and extended to discourse functions such as Focus in Mycock & Lowe (2013). Question words will fully populate the information feature space as a result of the incorporation of the feature **Q**.

In §2, I present a summary of the claims presented in Butt (2012) relating to the discourse functions of question words in Urdu/Hindi as signalled by the syntactic positions that they may occupy. I outline my proposal concerning the introduction of the feature **Q** (§3), before defining each of the discourse functions included in the expanded information feature space and exemplifying them using English data (§4). The results of a preliminary survey of the syntax of constituent questions cross-linguistically are presented and discussed in §5, and a possible correlation between relative prominence and how prominence is encoded is considered. Finally, in §6, I provide the conclusion and outline some wider issues which remain to be addressed.

2 Constituent questions in Urdu/Hindi (Butt 2012)

Butt (2012), drawing on previous work including Manetta (2012), presents data from Urdu/Hindi, which show that question words occupy different positions depending on the type of question asked. Butt (2012) links these differences to the distinct discourse functions of the question word.

The default word order in Urdu/Hindi is SOV, but certain syntactic positions in this language are associated with specific discourse functions and therefore it is best understood as being to some extent a discourse-configurational language; see Butt & King (1996) for details. Key to Butt's (2012) analysis of question formation in Urdu/Hindi are the immediately preverbal Focus position and the immediately post-verbal, clause-final position associated with Background Information. In a regular Urdu/Hindi question like (1), the question phrase by default occupies the immediately pre-verbal Focus position.

(1) sita=ne d^hyan=se **[kɪs=ko]$_{\textbf{Focus}}$** dek^h-a
Sita.F=ERG carefully who.OBL=ACC see-PERF.M.SG
t^h-a?
be.PAST-M.SG
'Whom had Sita looked at carefully?' (Butt 2012)

In an echo question, by contrast, the question phrase occupies the position reserved for Background Information immediately following the verbal complex.

(2) sita=ne d^{h}yan=se dek^{h}-a t^{h}-a
Sita.F=ERG carefully see-PERF.M.SG be.PAST-M.SG
[kɪs=ko]$_{\textbf{Background Information}}$?
who.OBL=ACC
'Sita had looked carefully at who?' (Butt 2012)

Butt (2012) states that this is not surprising, but rather reflects how information structure interacts with question semantics to give different pragmatic interpretations: a constituent question containing a post-verbal question word "cannot be interpreted as a typical information-seeking question, but receives an echo question interpretation", implying that this is as a result of the question word's status as Background Information. This is particularly clearly illustrated by examples from Urdu/Hindi given the transparent relationship between syntactic position and the relevant discourse function (Background Information) in this language.

3 The feature Q

The relevant generalizations as reported in Butt (2012) concerning question words in a typical information-seeking question and an echo question in Urdu/Hindi could be incorporated into the information feature space given in Figure 1 by simply permitting the possibility that question words can have Focus or Background Information status just as non-interrogatives can. However, this cannot be the whole story because it is not the case that interrogatives and non-interrogatives will have identical properties when they apparently have the same information structure status as proposed above. For instance, in English a question word with the discourse function Focus occupies SpecCP (appears 'ex situ'), as illustrated by A's utterance in (3), but there is no such restriction on non-interrogative Focus, as the location of the 'answer constituent' *flowers*, which has the discourse function Focus in B's response in (3), demonstrates.

(3) A: What did Lily buy at the market?
B: She bought flowers.

I therefore propose to augment Butt & King's (1996) system by introducing a feature **Q**. **Q** will be part of any question word's lexical entry and will be included in the 'interface structures' associated with the relevant string units, as first proposed in Dalrymple & Mycock (2011), and revised and extended in Mycock & Lowe (2013). With the incorporation of **Q**, the feature space becomes more complex, as shown in Figure 2. I argue that this is justified and, indeed, necessary if we are to account for the discourse functions of question words whose properties are not identical to their non-interrogative counterparts.

	[+NEW]	[–NEW]
[+PROM]	FOCUS	TOPIC
	Q: QUESTIONING FOCUS	**Q**: SORTING KEY
[–PROM]	COMPLETIVE INFORMATION	BACKGROUND INFORMATION
	Q: NON-SORTING KEY	**Q**: ECHO QUESTION

Figure 2. Expanded version of Butt & King's (1996) information feature space including the interface feature **Q**

Q's status as an interface feature is justified because it represents information that may be relevant at multiple levels of the grammar, for instance for the purposes of clause typing or for determining which intonational pattern can appropriately be used with a clause. Note that **Q** is not a feature which is introduced only by particular lexical items. It could also be associated with a specific intonational contour, as in *She BOUGHT flowers?* where capitals indicate that the verb bears the sentence's main stress and the result is questioning of the event type. This would be another way to introduce **Q** as a feature in the interface structures associated with string units.[2] For an LFG analysis of declarative questions, see Dalrymple & Mycock (2011); for an LFG approach to the prosodic encoding of interface features, see Mycock & Lowe (2013).

4 Discourse functions of question words

In this section I define and exemplify using English data the discourse functions Questioning Focus (§4.1), Echo Question (§4.2), Sorting Key (§4.3) and Non-Sorting Key (§4.4), and formulate a hypothesis relating to the syntactic encoding of relative prominence, before going on to consider cross-linguistic data and its implications in relation to the information feature [±PROM] in §5. Differences in the information structure of questions containing single versus multiple question words lead me to deal with them separately. Constituent questions containing a single question word are

[2] Falk (2012) proposes a function Q, but under his analysis Q is an i-structure attribute. He defines Q as "the function of question words" and proposes that a question word bears both Q, which he suggests is classified as [+PROM], and another discourse function. The justification for treating Q as a discourse function/i-structure attribute comparable to Topic or Focus, however, remains unclear.

covered in §4.1; constituent questions containing multiple question words are discussed in §4.3 and §4.4.

4.1 (New Information) Focus and Questioning Focus

With respect to question–answer pairs, the information structure category Focus, as exemplified in (4), has received the most attention in the literature. This kind of exchange involves a constituent question whose form and function are regularly treated as being prototypical: the sentence is a request for the addressee to supply information to fill a gap in the questioner's knowledge; the information gap is denoted by a clause-initial question word, either on its own or in a phrase.

(4) [+NEW, +PROM]
A: <u>What</u> did Lily buy at the market?
Q: QUESTIONING FOCUS
B: She bought <u>flowers</u> at the market.
NEW INFORMATION FOCUS

The classification of the underlined constituents in (4) as examples of Focus is widely accepted and their [+NEW, +PROM] feature specification is straightforward given the definitions of the two information features presented in §1. In both cases, the information is of primary importance, i.e. [+PROM]: in A's sentence the question word indicates the gap in the speaker's knowledge that s/he seeks to be filled, while in his/her response B provides the information that has been requested. Both the question word *what* and the answer constituent *flowers* in (4) are [+NEW] in the relational sense because the information they express changes the respective addressee's representation of the world (in the case of the question word, it expresses a gap in the speaker's knowledge) and establishes new pragmatic relations.

As discussed in §3, in English the difference between interrogative and non-interrogative foci is reflected in their syntax: *what* appears clause initially in the 'ex situ' SpecCP position in (4), while the neutral position of its non-interrogative counterpart (*flowers*) is 'in situ'.[3] Syntactic differences between the two types of foci are found in other languages too. For example, in a neutral constituent question in Hungarian, multiple question words/phrases (interrogative foci) appear together immediately before the verb, whereas only a single non-interrogative Focus constituent may appear in immediately preverbal position. I follow Dik (1997), who groups these two

[3] I adopt the terms 'in situ' and 'ex situ' for the sake of convenience. Within a non-derivational framework like LFG, there is of course no assumption that movement is involved.

types of Focus together as a major sub-type of Focus, viz. Information Gap Focus, but also distinguishes between the two using the terms Questioning Focus and New Information Focus respectively for the types of interrogative and non-interrogative Focus illustrated in (4).[4]

4.2 Background Information and Echo Question

I follow Butt (2012) in analysing a question word in an echo question as having the same information feature specification as Background Information, i.e. [−NEW, −PROM]. Expressions that have this information structure status do not change the addressee's representation of the world nor establish new pragmatic relations; they do not encode information of primary importance. For example, in A's initial utterance in (5), flowers were mentioned as having been bought by Lily, thus establishing the relation between the flowers – referred to in B's sentence as *them* – and the other elements of the proposition. Under the relational definition of newness therefore, *them* in (5) is classified as [−NEW]. In this particular context, *them* (referring to the flowers) does not represent information of primary importance, i.e. [−PROM]; cf. *her mother* (Focus) and *she*, i.e. Lily, (Topic; see §4.3). This means that *them* in (5) is classified according to Butt & King's (1996) system as Background Information.

(5) [−NEW, −PROM]
A: Who did Lily buy flowers for?
B: She bought <u>them</u> for her mother.
BACKGROUND INFORMATION

Butt (2012) proposes that a question word in an echo question similarly has the information feature classification [−NEW, −PROM], i.e. the opposite of Questioning Focus (§4.1). With respect to [±NEW], in an echo question such as (6) it is not the relational status of the questioned element that is at issue because this is, after all, expressed in the preceding utterance.[5]

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[4] Dik's (1997) other main sub-type of Focus is Contrast. I will have nothing to say about contrast in this article. While Choi's (1996, 1999) original characterization incorporates contrast, it is not part of Butt & King's (1996) version of the information feature space.

[5] I confine myself in this paper to discussion of echo questions that request repetition of information already provided, as illustrated by (6). Such questions are also referred in the literature to as a type of reprise question, e.g. by Ginzburg & Sag (2000) following Bolinger (1978). I do not discuss another type of question with which such echo questions are often grouped, namely one used to express shock or disbelief that includes a prosodically prominent in-situ question word in English. Such questions, while similar in terms of their secondary nature and the in-situ position of a question word, are functionally distinct – they do not express a true gap

(6) [−NEW, −PROM]
A: Lily bought flowers yesterday.
B: She bought WHAT yesterday?
Q: ECHO QUESTION
A: Flowers.

Utterance of an echo question does not establish new pragmatic relations; it is simply a request for repetition of information that the addressee did not catch the first time – s/he is asking for reiteration of an unheard linguistic expression. This supports Butt's [−NEW] classification, which reflects the 'secondary' nature of an echo question. An echo question refers back to an immediately preceding utterance and cannot be uttered 'out of the blue', in contrast to a constituent question containing a question word whose discourse function is Questioning Focus, as in (4), which can.

While an echo question signals a gap in speaker knowledge, the question word is not classified as information of primary importance according to Butt (2012), so it is [−PROM]. It seems reasonable to posit that this is also related to the secondary nature of this type of question. Furthermore, a classification of [−NEW, +PROM] would not be appropriate: the echo question word is not a Topic, nor does it determine what will be the Topic(s) in the addressee's response; cf. the Sorting Key question word in a multiple constituent question discussed in §4.3.

Finally, it is interesting to compare the syntax of the echo question in (6) with its non-echo counterpart in (4). The question word *what* appears in clause-initial position (SpecCP) when it has the discourse function Questioning Focus, but it appears in the same position as a non-interrogative equivalent when it has the discourse function Echo Question. In terms of the syntactic position in English of these question words with distinct discourse functions therefore, we see a contrast between a question word classified as [−PROM] (in situ) and a question word classified as [+PROM] (ex situ). This suggests a correlation between relative prominence, i.e. the value of the information feature [±PROM], and long-distance dependencies, an issue which will be considered further in §5.

4.3 Topic and Sorting Key

A Topic shares one information feature specification with Background Information and one with Focus, being classified as [−NEW, +PROM]. For example, the Topic *she* in (7) does not represent new information: the relation between Lily and the rest of the proposition was established in A's

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in the speaker's knowledge. I leave the issue of the relationship between such questions, the echo questions I discuss here, and other types of constituent question for future work.

sentence. As a Topic though, *she* is prominent in informational structural terms. A Topic is crucial in determining the basic division of information into Topic and Comment in a categorical utterance, a distinction which may be encoded in syntactic structure (see, e.g., Sasse 1987).

(7) [−NEW, +PROM]
A: What did Lily do?
B: <u>She</u> bought flowers at the market.
TOPIC

The more Topic-like status of one question phrase in a multiple constituent question such as the one in (8) has long been observed, see e.g. Bolinger (1978), Erteschik-Shir (1986) and Kuno & Takami (1993). Bolinger (1978) maintains that the leftmost question word in a multiple constituent question can be seen as belonging to the Topic part of the Topic–Comment organization of the sentence. He claims that the clause-initial position of a question word "topicalizes it as a first assumption" (Bolinger 1978: 133). This question word is effectively adopted as a Topic and any other question words are predicated about it. I follow Bolinger (1978) in assuming that the discourse functions of question words in multiple constituent questions are not identical. On this basis, I assume that the information structure of non-echo single and multiple constituent questions differ in certain fundamental respects, meaning that an analysis of the feature specification of all non-echo question words as [+NEW, +PROM] obscures crucial distinctions relating to discourse functions.

Kuno & Takami (1993: 112) refer to the Topic-like question word in a multiple constituent question as the Sorting Key. It is this question word which communicates how the questioner expects information to be organized in the addressee's response, and therefore is crucial in determining the (in)felicity of an answer, as the relative felicity of (9b) and (9b') in response to (9a) shows. I use Kuno & Takami's (1993) term Sorting Key to refer to the discourse function of such a question word. A Sorting Key shares the feature specification [+PROM] with Questioning Focus, the discourse function of the only question word in the type of neutral constituent question discussed in §4.1.

(8) [−NEW, +PROM]
A: <u>Who</u> bought what?
Q: SORTING KEY
B: Lily bought flowers, Charlie bought cakes and Fiona bought balloons.

(9) a. Which of these climatic conditions occurs in which countries?

b. Typhoons occur in Japan, Korea and China; hurricanes occur in …

b'. #In Japan, typhoons and early summer rain spells occur; in Thailand, they have monsoons and tornadoes; …

(Kuno 1982: 144)

I refer to the Sorting Key as the more Topic-like question word advisedly. I do not seek, as others may have done, to propose that this question word *is* a Topic; there is good evidence that this is not the case. For example, in Hungarian question words do not appear in the Topic field (Puskás 2000). In this way a Sorting Key is not the same as its non-interrogative counterpart, with which it shares the feature specification [−NEW, +PROM]. Such differences provide further justification for distinguishing Sorting Key from Topic, and thus for introducing the interface feature **Q** as a way of capturing the relevant distinction.

Sorting Key as a discourse function distinct from Topic also has a bearing on the more general issue of the value of information features and the discourse functions which they have been used to define. Butt & King (1996), in common with Choi (1996, 1999), propose binary values for the information features [±NEW] and [±PROM]. However, the differences between Topic and Sorting Key, which I hypothesise are due to the Sorting Key being the most Topic-like of all the question words in a multiple constituent question without actually being a Topic, indicate that binary conceptions of information features alone are too simplistic when it comes to accounting for the discourse functions of constituents within a sentence. This is because the information structure status of any constituent depends on the information structure status of other elements in the same sentence. Rather than binary values then, the relevant information features may be best understood in terms of a spectrum. Dalrymple & Nikolaeva (2011: 66) in their work on differential object marking make the same point regarding the feature [±PROM] in relation to primary and secondary Topics. A more refined analysis of discourse functions in general awaits an approach to information features which will enable relative levels of prominence, newness, etc. to be modelled.

4.4 Completive Information and Non-Sorting Key

The fourth and final discourse function defined in Butt & King (1996) is Completive Information, which is classified as [+NEW, −PROM]. To give an example, in (10) *flowers* were not mentioned in the preceding question so the information that Lily has just bought these items at the market is new to the addressee A, but that information is not of primary importance in this context; it simply represents unsolicited additional information which gives A a fuller picture of the event under discussion.

(10) [+NEW, −PROM]
A: Where has Lily been shopping?
B: She's just bought <u>flowers</u> at the market.
COMPLETIVE INFORMATION

I propose that the interrogative constituent with the information feature specification [+NEW, −PROM] is any question word in a multiple constituent question which does not have Sorting Key status, for instance *what* in (11). I use the term Non-Sorting Key to refer to the discourse function of such question words. This term and its definition reflect the dependent relationship, in terms of information structure status, which Bolinger (1978) and Kuno & Takami (1993), inter alia, assume exists between question words in a multiple constituent question.[6] Note that Completive Information, by its very nature, displays a directly comparable lack of independence in terms of information structure status.

(11) [+NEW, −PROM]
A: Who bought <u>what</u>?
Q: NON-SORTING KEY
B: Lily bought flowers, Charlie bought cakes and Fiona bought balloons.

A Non-Sorting Key is [+NEW], a feature shared with Questioning Focus, because it establishes new pragmatic relations, thus changing the addressee's representation of the world. It is [−PROM] because it represents information that is *relatively* less important than other information – most notably the Sorting Key – in the given context.

Once more, the issue of relative values for an information feature like [±PROM] has arisen. It is interesting in this respect to consider multiple constituent question formation possibilities in a language with word order that is freer than that of English, at least in terms of the relations which exist between grammatical functions and syntactic positions. As the examples in (12) show, when there is more than one question phrase in a Hungarian constituent question, different orderings of the immediately preverbal question phrases are possible.

[6] The nature of the relationship between Sorting Key and Non-Sorting Key question words is also reflected to some extent in their diametrically opposed feature specifications, each of which shares one feature with that of Questioning Focus (see §4.1), i.e. the Sorting Key is [+PROM] while a Non-Sorting Key is [+NEW].

(12)	a.	Ki	ki-t	ki-nek	mutat-ott	be?
		who.NOM	who-ACC	who-DAT	introduce-PAST.3SG	VM
	b.	Ki-t	ki-nek	ki	mutat-ott	be?
		who-ACC	who-DAT	who.NOM	introduce-PAST.3SG	VM
	c.	Ki-nek	ki-t	ki	mutat-ott	be?
		who-DAT	who-ACC	who.NOM	introduce-PAST.3SG	VM
		'Who introduced who to who?				

I contend that these different ordering possibilities in Hungarian will be best understood in relative terms with respect to the question words' information structure status. As with the notion of the Sorting Key discussed in §4.3, an approach to discourse functions which incorporates relative levels of prominence, newness, etc. is required before a full analysis of such phenomena can be provided. This goes beyond the scope of the work presented in this paper, but I wish to highlight this as a matter of significant importance for future research; see also §5.2.

Finally, an important comparison remains to be made in relation to the English data presented in §4.3 and §4.4. This involves the Sorting Key and Non-Sorting Key question words, which differ in terms of their value for the information feature [±PROM]. Note that a [+PROM] Sorting Key question word appears clause initially in English. With the possible exception of a question phrase which has the grammatical function subject (whose syntactic position has been the topic of debate in the literature and which I set aside here), the Sorting Key question phrase occupies SpecCP and thus appears ex situ. By contrast, a [−PROM] Non-Sorting Key question word appears in situ in English. The same correlation was observed with respect to Questioning Focus versus Echo Question in §4.2.

4.5 Hypothesis: syntactic encoding of relative prominence

When the syntax of question words with the discourse functions Questioning Focus and Echo Question (§4.2) and Sorting Key and Non-Sorting Key (§4.4) are compared, we see a correlation between relative prominence, i.e. the values for [±PROM], and syntactic marking or 'highlighting' of this prominence involving long-distance dependencies. Consequently, a more general point of comparison presents itself with respect to the encoding of question words' discourse functions, which in turn provides the basis for the formulation of a hypothesis. We have seen that question words that have either of the two types of discourse functions that are classified as [+PROM] (Questioning Focus and Sorting Key) appear ex situ and involve long-distance dependencies in English. By contrast, question words that have either of the two types of discourse functions that are classified as [−PROM] (Echo Question and Non-Sorting Key) appear in situ; they are not syntactically highlighted or marked in any way. It seems that in English constituent questions, greater relative prominence is signalled syntactically by long-distance dependencies. Given this correlation, in §5 I seek to test a hypothesis concerning prominence and how it is encoded against data from a preliminary survey of cross-linguistic data.

(13) PRINCIPLE OF RELATIVE PROMINENCE ENCODING
A [−PROM] question word will only be syntactically ‘highlighted’ in a language (i.e. appear ex situ, as the filler element in a long-distance dependency) if its [+PROM] question word counterpart is also by default syntactically highlighted.

5 [±PROM] and the syntax of constituent questions: a preliminary survey

The preliminary survey of cross-linguistic data presented in this section, against which the hypothesis given in §4.5 is tested, is necessarily small, comprising English and 14 other languages. The criteria for selecting a language for inclusion were that data were available on the syntax of all of the following: (i) constituent questions containing a single question word,[7] (ii) multiple constituent questions and (iii) echo questions.

The primary reason for the relatively small sample size is the fact that investigation of echo question formation cross-linguistically is made difficult because this type of question is often overlooked in descriptive work. An important exception, and the mainstay of the survey presented in this paper, is some of the research based on Comrie & Smith’s (1977) questionnaire. These works, however, rarely describe the prosody of echo (or sometimes any) questions in detail. For this reason, it was unfortunately not possible to consider how prosody interacts with syntax in relation to the discourse functions of question words in this preliminary survey.[8]

With the exception of English, the data referred to in the rest of this section come from the 14 descriptive grammars listed in Table 1, which were

[7] For the purposes of this preliminary work, I confined the survey to languages that were reported in the relevant descriptive grammar as having one main strategy for forming constituent questions. This meant that Japanese (Hinds 1986), for instance, was included, whereas Maori (Bauer 1993) was not. In Japanese, the main constituent question formation strategy is ‘wh in situ’, but in Maori the strategy employed varies depending on the grammatical function of the question word. Mycock (2006: 382–383) provides a brief discussion concerning the analysis of Maori constituent question formation within LFG.

[8] On the prosodic marking of question words in a ‘wh-in-situ’ language, see Mycock (2006), who provides an LFG analysis of non-echo constituent questions in Japanese. Further research is required to determine if such an analysis is also appropriate for other wh-in-situ languages.

written by authors whose research was guided by Comrie & Smith's (1977) questionnaire.

Language	**Classification** (Lewis et al 2013)	**Reference**
Cairene Egyptian Colloquial Arabic	Afro-Asiatic, Semitic	Olmstead Gary & Gamal-Eldin (1982)
Catalan	Indo-European, Italic	Hualde (1992)
Gulf Arabic	Afro-Asiatic, Semitic	Holes (1990)
Hungarian	Uralic	Kenesei et al (1998)
Japanese	Japonic	Hinds (1986)
Kannada	Dravidian	Sridhar (1990)
Kashmiri	Indo-European, Indo-Iranian	Wail & Koul (1997)
Kobon	Trans-New Guinea, Madang	Davies (1981)
Korean	Language isolate	Sohn (1994)
Koromfe	Niger-Congo	Rennison (1997)
Modern Greek	Indo-European, Greek, Attic	Joseph & Philippaki-Warburton (1987)
Persian	Indo-European, Indo-Iranian	Mahootian (1997)
Punjabi	Indo-European, Indo-Iranian	Bhatia (1993)
Turkish	Altaic, Turkic	Kornfilt (1997)

Table 1. Details of the 14 languages included in the preliminary survey (along with English) and the descriptive grammars from which the data on constituent questions come

5.1 The syntax of Questioning Focus and Echo Question

Table 2 summarizes the findings for Questioning Focus and Echo Question in the 15-language sample. One key issue was considered: Did question words appear ex situ or in situ? These data reveal a correlation between relative prominence and syntactic 'highlighting' of a question word.

The sample shows that question words with either discourse function – Questioning Focus or Echo Question – may appear in situ or ex situ, although one particular combination was not found. We find languages in which question words with either of these discourse functions appear in situ (e.g. Japanese) or ex situ (e.g. Hungarian), i.e. regardless of their value for the information feature [±PROM]. There are also languages, like English, in which only [+PROM] question words, i.e. those with the discourse function Questioning Focus, can appear ex situ; in such languages a [−PROM] question word (i.e. with Echo Question status) appears in situ. In these languages therefore, we find a syntactic correlate of the proposed difference in the relative information structure prominence of question words with these discourse functions. What is most striking though is the lack of a language in which a [−PROM] question word (Echo Question) appears ex situ while a [+PROM] question word (Questioning Focus) appears in situ. This is consistent with the Principle of Relative Prominence Encoding presented as (13) in §4.5.

QUESTIONING FOCUS [+NEW, **+PROM**]	ECHO QUESTION [−NEW, **−PROM**]	Languages
QW in situ	QW in situ	Cairene Egyptian Colloquial Arabic, Gulf Arabic, Japanese, Kannada, Kobon, Korean, Persian, Punjabi
QW ex situ	QW ex situ	Hungarian, Kashmiri, Turkish
QW ex situ	QW in situ	Catalan, English, Koromfe, Modern Greek
QW in situ	QW ex situ	

Table 2. A survey of the syntax of question words (QWs) with the discourse functions Questioning Focus and Echo Question in a sample of 15 languages

5.2 The syntax of Sorting Key and Non-Sorting Key

The remaining two discourse functions, Sorting Key and Non-Sorting Key, also differ in terms of their specified relative prominence, and are particularly interesting because, by definition, they co-occur in a multiple constituent question. Table 3 shows whether a question word with the relevant discourse function appears by default in situ or ex situ in the 15-language sample. The three groups of languages shown in Table 3 represent the three main types of question formation strategy that are regularly identified in the literature, viz. wh in situ (both Sorting Key and Non-Sorting Key question words appear in situ), 'multiple fronting' (both Sorting Key and Non-Sorting Key question words appear ex situ) and the English-type strategy (Sorting Key appears ex situ, any Non-Sorting Key appears in situ).[9]

Table 2 and Table 3 are for all intents and purposes identical: we see the same alignment between relative prominence and syntactic encoding, consistent with the Principle of Relative Prominence Encoding that was

[9] For an LFG analysis of the typology of constituent questions, see Mycock (2006).

presented as (13) in §4.5. The syntax does not differ according to the discourse function of the question word in the case of the first two groups of languages (both in situ, both ex situ), while in the third group a question word is only ex situ – and a long-distance dependency is involved – when its information feature specification includes [+PROM] (i.e. its discourse function is Sorting Key). Directly comparable with the findings summarized in Table 2 that relate to the syntax of Questioning Focus and Echo Question in the sample, no language in this survey had a [−PROM] Non-Sorting Key question word that appeared ex situ with a [+PROM] Sorting Key question word in situ. Once again, we see a correlation between relative prominence and how it is encoded.

SORTING KEY [−NEW, **+PROM**]	NON-SORTING KEY [+NEW, **−PROM**]	Languages
QW in situ	QW in situ	Cairene Egyptian Colloquial Arabic, Gulf Arabic, Japanese, Kannada, Kobon, Korean, Persian[10], Punjabi
QW ex situ	QW ex situ	Hungarian, Kashmiri, Turkish
QW ex situ	QW in situ	Catalan, English, Koromfe, Modern Greek
QW in situ	QW ex situ	

Table 3. A survey of the syntax of question words (QWs) with the discourse functions Sorting Key and Non-Sorting Key in a sample of 15 languages

It is interesting to see that even in ex-situ languages, there may be a distinction in the syntax corresponding to the distinction in information structure status between a Sorting Key and Non-Sorting Key question words. For instance, Rudin (1988) shows that in certain ex-situ Slavic languages, the first question word can be separated from the rest (see also Mycock 2006: 376–378). It must also be remembered that when multiple ex-situ question

[10] The neutral constituent question formation strategy in Persian presented in Mahootian (1997) is wh in situ. Other sources present a slightly different picture. According to Raghibdoust (1994) and Lotfi (2003), for instance, all three constituent question formation strategies – wh in situ, multiple fronting and the English type – are possible in Persian. However, it should be noted that questions formed according to the three different strategies "differ from each other with respect to the degree of acceptability" (Raghibdoust 1994: 36), hinting that context may play a role which remains to be fully explored. For this reason, Mahootian's (1997) Persian data have been included in this preliminary survey.

words appear to target the same syntactic position, it does not follow that they must all have the same discourse function. Recall the Hungarian examples in (12), in which all question words appear immediately before the verb, in what is often referred to in the literature as ‘Focus position’.[11] Clearly, some principle(s) must determine the order in which the question words appear. I would argue that key to understanding such data are the relative values of the relevant information features for each question word (see §4.3), possibly amongst other factors. Simply designating every constituent in preverbal position as, by definition, having the discourse function ‘Focus’ does not capture the complexities involved. In this respect, Simpson’s (2007) discussion and analysis of the pragmatic constraints on word order in Warlpiri offer a potentially illuminating perspective. Simpson (2007: 421) argues that in Warlpiri “prominence and newness apply to spans within a clause, rather than to a single phrase structure position”. A similar approach may be appropriate in the analysis of multiple preverbal question words and their discourse functions in Hungarian.

5.3 Findings and future research

Taken together, the findings of the preliminary survey reported in §5.1 and §5.2 support the hypothesis that a [−PROM] question word will only be syntactically ‘highlighted’ in a language (i.e. appear ex situ, as the filler element in a long-distance dependency) if its [+PROM] question word counterpart is also by default syntactically highlighted. Of course, further research is required to determine whether the empty cell in Table 2 or Table 3 can be filled, and whether any in-situ/ex-situ difference identified relates to the relative prominence of the question words concerned or to some other factor or factors.

6 Conclusion and related issues

I have argued that question words can have the same values as non-interrogatives for the information features [±NEW] and [±PROM] proposed by Butt & King (1996). However, data show that it is still important to make a distinction between interrogative and non-interrogative constituents. In order to account for the distinct properties of question words as well as the information structural features that they share with their non-interrogative counterparts, I proposed to augment Butt & King’s (1996) system by introducing the interface feature **Q**, which will be part of a question word’s lexical entry. An analysis incorporating **Q** means that question words can

[11] Forst et al (2010) and Mycock (2006), working within the LFG framework, analyse the relevant position in Hungarian as being SpecVP.

fully populate the feature space but are not conflated with non-interrogatives that have identical values for the two relevant information features. This approach better covers the relevant data than two previous LFG treatments of the discourse functions of question words (Mycock 2006, Gazdik 2011), both of which restricted the discourse function that question words can bear in some way, and both of which were, as a result, inconsistent with Butt's (2012) [−NEW, −PROM] analysis of question words in Urdu/Hindi echo questions. A preliminary survey of data from a small sample of 15 languages supports the hypothesis that there is a correlation between relative prominence and the means by which prominence may be encoded. Both [+PROM] and [−PROM] question words may appear ex situ and be involved in a long-distance dependency, but the latter can only be syntactically highlighted in this way if the former are too, i.e. such syntactic highlighting is not used to mark [−PROM] alone.

The matter of whether long-distance dependencies should be regarded as somehow greater in terms of the degree of highlighting that they involve compared to non-syntactic marking of relative values for, e.g., prominence, warrants further consideration. In English, a [+PROM] question word appears ex situ in clause-initial position; by contrast, a [−PROM] question word appears in situ but is prosodically prominent to some degree. It appears that in some sense syntactic highlighting is itself 'more prominent' than other non-syntactic alternatives. This seems a reasonable hypothesis given that long-distance dependencies are likely to be more costly in processing terms.

The analysis of discourse functions of question words presented in this paper represents a starting point. Its inadequacies, particularly with respect to capturing a category like Sorting Key as outlined in §4.3, highlight an important issue, also raised by others such as Dalrymple & Nikolaeva (2011: 66) and Simpson (2007), in relation to the definition of discourse functions in terms of binary-valued information features such as [±NEW] and [±PROM]. It is clear that such an approach to information structure will ultimately prove to be inadequate. It is too simplistic to classify elements as being either new or not, prominent or not. An analysis purely in terms of binary features obscures the fine-grained distinctions that need to be made between elements *relative to one another* with regard to their information structural status. Progress in this area will mean that future treatments of discourse functions are able to capture more accurately the information structure of sentences, including constituent questions.

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THE PROSODIC MARKING OF DISCOURSE FUNCTIONS

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Abstract

The prosodic marking of Discourse Functions such as Focus presents a challenge to theories that seek to model grammar in a modular way because distinct components of linguistic structure must be permitted to interact but they must be neither conflated nor assumed to be isomorphic. We present an account of prosodic Focus marking within the modular grammatical architecture of Lexical-Functional Grammar, building on the model of the syntax-prosody interface developed by Dalrymple and Mycock (2011).

1 Introduction

We hold that an absolute modularity and strict separation of, for example, phonology from syntax, semantics and pragmatics is a theoretical desideratum, and that this is best captured within the framework of Lexical-Functional Grammar (LFG), in which separate levels of linguistic representation are connected by projection functions. Motivated by this commitment to modularity and domain specificity, our main objective is to capture the fundamental differences that distinguish various aspects of linguistic structure whilst permitting these distinct elements of the grammar to interact in an appropriately restricted way. The prosodic marking of Discourse Functions presents a challenge to grammatical modelling because of the interaction of a number of distinct components of the grammar: prosody, syntax, semantics and information structure. This challenge is particularly serious for a grammatical architecture that aims for strict modularity, i.e. in which distinct components of the grammar, such as syntax and phonology, are organized according to their own rules and primitives and are effectively 'blind' to the rules and primitives of other components. The prosodic marking of Focus also represents a challenge because of the types of mismatches that arise: it is not necessarily the case that the prosodic exponent of Focus marking will be coterminous with the string of syntactic elements that represent the Focus of the sentence in information structural terms. In this paper we present an account of prosodic marking of the Discourse Function (DF) Focus in English, building on the model of the syntax-prosody interface presented in Dalrymple and Mycock (2011).

We account for the prosodic indication of Focus by marking Information Structure category status on string elements. When signalled prosodically, a label indicating Focus will be associated with a p-string element bearing main stress. The principle of Interface Harmony (Dalrymple and Mycock 2011) will require a corresponding syntactic label to be associated with a corresponding s-string element;

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this will ultimately correlate with the meaning of the relevant lexical item(s) being categorized as a member of the Focus set at the level of information structure, following Dalrymple and Nikolaeva (2011). We streamline the architecture proposed in Dalrymple and Mycock (2011) and show how it can account for prosodic marking of Focus. In §2 we present the data for Focus marking in English that we will analyse in this paper. In §3 we describe the model of the syntax-prosody interface that we assume. We then present our formal account of prosodic Focus marking in English in §4. Finally, in §5, we conclude and highlight directions for future work.

2 Focus in English

In analysing the marking of Focus in English (and other languages) one must make the key distinction between *Extent of Focus* (Foc-Extent) and *Exponent of Focus* (Foc-Exponent). Foc-Extent (also known as the Focus Domain) refers to how much of a sentence can be said to have DF Focus status, while Foc-Exponent is the indication at some level of representation, e.g. syntactic (c-structure) or prosodic (p-structure), of the Focus status of part or all of a sentence. In the examples in (1), the square brackets enclose the syntactic elements that constitute the Foc-Extent, while boldface marks the word that carries the Focus marking (the main stress in the sentence).

(1) a. Q: Who hit Norman?
A: [**Anna**] hit Norman.

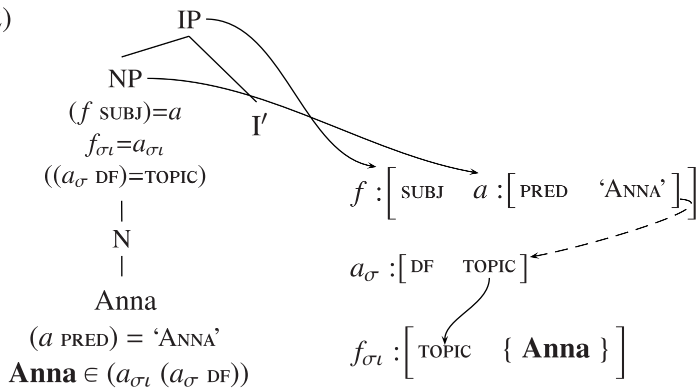
b. Q: Who hit Norman?
A: [Some old **woman**] hit Norman.

In this paper we propose an analysis which captures the relationship between Foc-Extent and Foc-Exponent when the latter is marked only by prosodic means. We confine our discussion to the prosodic encoding of Focus in English, but the analysis we propose can be extended in a straightforward manner to cover prosodic marking of Discourse Functions more generally.[1] For English, on which we concentrate in this paper, we identify the Foc-Exponent as the element in an utterance which bears the main or nuclear stress (see, for instance, Ladd 2008). We identify this element as bearing the Nuclear Tone (though we do not assume that stress need comprise a pitch cue alone). This is the final pitch accent within the relevant domain. This pitch accent is perceived as being the most prominent within the intonational contour under consideration.

[1]More specifically, and for consistency in our analysis, we treat only a single sub-type of Focus, that found in answers to wh-questions ('New Information Focus'). We do not explore the variety of sub-types of Focus which have been posited, e.g. Dik's (1997) taxonomy based on communicative purpose, but such sub-types could be distinguished in our model given a more fine-grained view of Discourse Functions, possibly building on the information feature space as defined in Butt and King (1996) and discussed in Mycock (2013).

The Foc-Extent, on the other hand, refers to how much of a sentence can be said to have Focus status; in more precise terms, the Foc-Extent is the set of syntactic elements that are associated with the DF Focus. The precise definition of Foc-Extent will be dependent on the general approach taken towards information structure and its relation to other aspects of linguistic structure within the grammar. We adopt Dalrymple and Nikolaeva's (2011) approach to information structure within LFG's parallel architecture, according to which elements of a sentence's meaning, i.e. meaning constructors (which appear in bold in (2) and throughout), are categorized according to their DF at s(emantic)-structure and consequently belong to the relevant set (e.g. Topic, Focus) at the level of i(nformation)-structure. In the following English example, based on Dalrymple and Nikolaeva (2011: 83), *Anna* is the subject of a clause, and is also the Topic at i-structure by virtue of occupying SpecIP. Key to this analysis is the attribute-value pair DF TOPIC included in the s-structure for 'Anna', a_σ. This information, combined with the annotations on the terminal and SpecIP nodes in the c-structure, serves to categorize the relevant meaning constructor as belonging to the Topic set in the clause's i-structure, $f_{\sigma\iota}$.

(2)



Given the approach to i-structure exemplified in (2), Foc-Extent is defined as those meaning constructors which are members of the set that is the value of the attribute FOCUS at i-structure. These meaning constructors are semantic units and thus correspond, imperfectly in some cases, to units at other levels of representation, e.g. syntactic elements. We take the position that the correspondence between syntax and prosody is similarly characterized by a lack of isomorphism (see, with references, Dalrymple and Mycock 2011). While it is possible to provide a relatively straightforward informal generalization concerning the relationship between Foc-Extent and Foc-Exponent in English,[2] a formal analysis presents a number of challenges. The extensive misalignment that is a feature of the correspondences between units belonging to different structural levels means that the prosodic encoding of Focus and other DFs represents a complex phenomenon whose formal analysis requires sophisticated modelling of the interfaces between these structural levels.

[2]The Foc-Exponent is associated with the Prosodic Word which corresponds to the rightmost syntactic word that is the syntactic realization of the Foc-Extent.

Central to previous analyses of prosodic Focus marking has been the difference between 'narrow' Focus, which can be characterized as those cases in which the Foc-Extent and Foc-Exponent are a close match (Exponent$\approx$Extent), and 'broad' or 'projecting' Focus, in which the Foc-Exponent correlates with only a part of the Foc-Extent (Extent>Exponent). This distinction can be seen in (1): the answer in (1a) represents 'narrow' Focus, and the answer in (1b) 'broad' Focus.

The distinction between 'narrow' and 'broad' Focus misses an important generalization, however. Based purely on their syntax, the two types of Focus shown in (1) are fundamentally the same: in both instances the Foc-Extent is an XP constituent. Similarly, the basic facts about the Foc-Exponent are the same in both cases (and can be stated as p-structure rules of the type employed in Dalrymple and Mycock 2011): the rightmost Prosodic Word of the Focus constituent bears the Nuclear Tone. With the syntactic and prosodic aspects of Focus marking suitably captured, the challenge is to define how c-structure and p-structure are properly related, both to each other and to i-structure, in cases of prosody-only Focus marking in English. In this paper, we propose an analysis which captures the relevant interactions based on a streamlined version of the syntax-prosody interface in LFG as first introduced in Dalrymple and Mycock (2011).

3 The Architecture

A number of different approaches to prosody and how it should be integrated into the LFG architecture have been proposed, including Butt and King (1998), Mycock (2006), O'Connor (2006), Bögel et al. (2009), Lowe (2011) and Bögel (2012). In this paper, we build on the model of the syntax-prosody interface within LFG proposed in Dalrymple and Mycock (2011). Their strictly modular approach is rooted in the lexicon, with a characterization of lexical entries as comprising (among other things) a s(yntactic)-form and a p(honological)-form. These form values, linked to each other via their association in the lexicon, are the basis for two distinct but related aspects of any string, namely the syntactic string (s-string) and the prosodic or phonological string (p-string, represented using the IPA). Linear precedence relations between atomic syntactic elements are encoded in the s-string and between atomic prosodic elements in the p-string.[3] Parsing of a string therefore involves the association of p-string sequences with p-forms in lexical entries, and concomitant association of p-forms with s-forms to produce the s-string, meaning that within this model the string represents the sole point of interface between syntax and phonology/prosody. The units of the p-string group together to form hierarchical units at the level of p(rosodic)-structure, following the approach to prosodic structure advocated in Lahiri and Plank (2010).

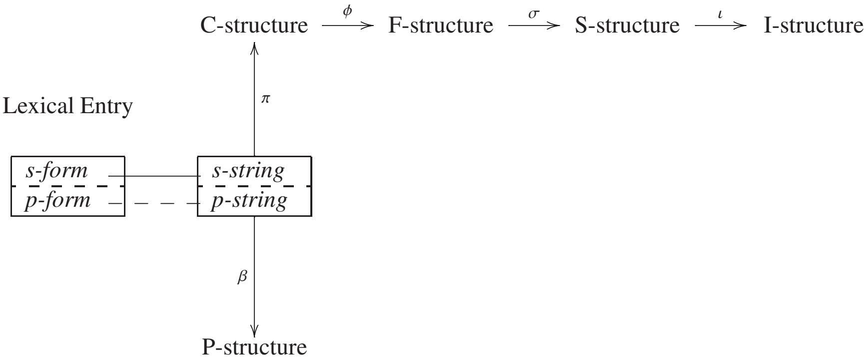
[3]Treating syllables as the minimal prosodic unit is sufficient for the data treated here. Nevertheless there is nothing to prevent the mora being used as the minimal prosodic unit in languages where this is relevant, nor, for example, the addition of a foot level in the Prosodic Hierarchy, which is abstracted away from here as being not strictly necessary for present purposes.

Dalrymple and Mycock propose this approach to the syntax-prosody interface in order to model the contributions that prosody can make to meaning. Their key proposals are that: (i) the ‘line of communication’ between prosody and semantics is mediated by syntax; (ii) while syntax is effectively blind to objects native to phonology/prosody and vice versa, the edges of syntactic and prosodic constituents represent points of contact between the two separate modules; and (iii) a principle of Interface Harmony exists which requires certain sorts of information associated with constituent edges in distinct modules to match at the string. Information potentially relevant at the interface is ‘passed down’ the syntactic and prosodic trees by means of separate ‘interface structures’ – e(psilon)-structure on the syntactic side, chi-structure on the prosodic side – and, as a result, is made available at the interface, namely in the e-structure and chi-structure projections that are associated with the units of the s-string and p-string, respectively. E-structures and chi-structures appear as attribute-value matrices (AVMs) projected from the relevant units. Each interface structure contains a L(eft) and R(ight) attribute whose value is a set whose members represent information that is potentially relevant at other levels of representation, e.g. constituent edge location. For instance, [L {IP}] denotes ‘left edge of an Inflection Phrase’, and [R {PhP, InP}] denotes ‘right edge of a Phonological Phrase and an Intonational Phrase’. Ultimately, this information about constituent edges is associated with the relevant units in the respective aspect of the string (s-string or p-string). Here, at the point of interface, the principle of Interface Harmony applies to enforce alignment as appropriate (though the default is mass misalignment; see Dalrymple and Mycock, 2011 for discussion and references). In this way, the Dalrymple and Mycock model allows for a full investigation of an important issue: which types of information are relevant at the syntax-prosody interface and under which circumstances? We contribute to this research programme by proposing that, just like the semantic contributions discussed by Dalrymple and Mycock (2011), DFs such as Focus are a type of information that should be available at the interface between the two modules, because it is relevant at other levels of representation. However, before we come to formalize the prosodic encoding of Focus in §4, we propose some emendations to the model described in this section which both streamline the architecture and, more importantly, enable it to capture the complexities of Focus marking.

The status of e- and chi-structure in the model of Dalrymple and Mycock (2011) is in certain respects ambiguous. They are, in principle, structures or projections with status equal to that of other structures, yet their purpose is merely to mediate the interface between two other structures. Moreover, these interface structures do not correspond to separate modules of the grammar in the same way that e.g. p-structure, c-structure and s-structure correspond to the separate modules of prosody, syntax and semantics. In particular, the e- and chi-structures projected respectively from c- and p-structure nodes have no independent function: they are purely mediatory, passing information from mother nodes to daughter nodes. Only the e-/chi-structures projected from string elements have any independent (and, indeed, important) function, in mediating the interface, but even these are more ‘metastructures’ than independent structures per se.

The alterations to the Dalrymple and Mycock (2011) model proposed in this section result in a more streamlined grammatical architecture by eliminating e- and chi-structure, and enable this approach to account for the Focus marking phenomena treated in this paper. At the same time, the underlying principles of the model, including its commitment to strict modularity and the principle of edge-inheritance, are fully maintained. We assume the grammatical architecture given in (3), which is largely identical to that of Dalrymple and Mycock (2011) except for the absence of e- and chi-structure.[4] Note that the units of the s-string are not the terminal nodes of the c-structure. For an example, see (4).

(3)

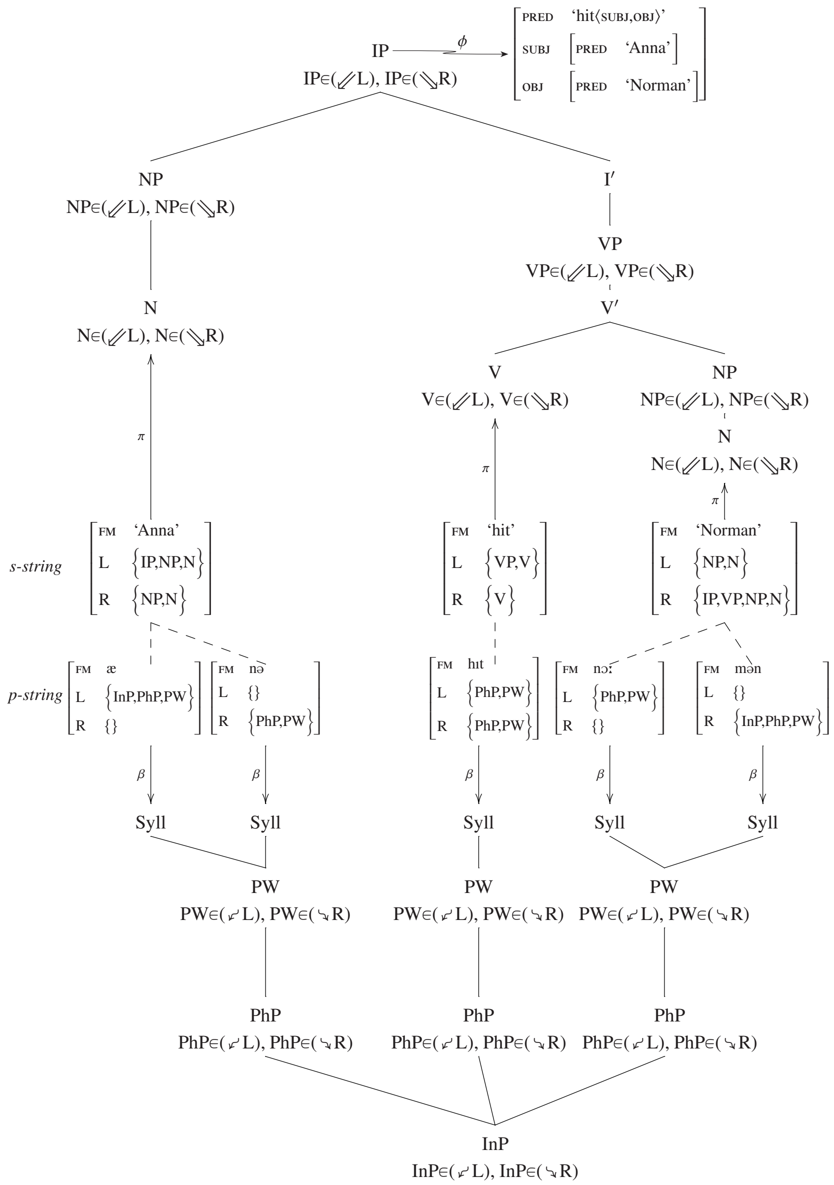


In order to dispense with e- and chi-structure we propose that s- and p-string elements be represented not as atomic elements, but as AVMs. As well as an attribute FM whose value represents the form of the relevant unit in the s- or p-string, each AVM contains among other things the L { } and R { } Attribute-Value (AV) pairs previously allocated to e- and chi-structure. This is illustrated in (4).[5] Thus the AVMs that comprise the s- and p-strings include both information about the content of the string and the interface information associated with the respective

[4]We also specify the relation between the p-string and p-structure, which Dalrymple and Mycock (2011) simply denote with a dashed line, as the mapping β (Mycock 2010: 292).

[5]Following Dalrymple and Mycock (2011), the syntax-prosody interface is represented using a ‘double tree’ diagram. This type of diagram includes the two aspects of the string, the s-string and the p-string, which are analysed in terms of their hierarchical structure (c-structure and p-structure, respectively). Thus the syntactic analysis is projected from the syntactically parsed ‘side’ of the string, while the prosodic analysis, the p(rosodic)-structure, is projected from the prosodically parsed ‘side’. The syntactic analysis is given above the string in the upside-down c-structure tree, per convention, while the prosodic analysis has its root at the bottom of the diagram, below the string. Although represented together in a double tree, the projections and resulting structures are entirely separate and formed according to their own principles and primitives; i.e. there is nothing syntactic about the bottom half of the tree, nor anything prosodic about the top half. S- and p-string elements are associated via their co-occurrence in lexical entries; the string is parsed by matching prosodic and syntactic units in the string to lexical entries. This ‘double tree’ diagram is useful in representing the simultaneous analyses of different aspects of the linguistic structure of the utterance concerned, but this is a matter of presentation alone; the analyses belong to different modules of the grammar, they analyse different aspects of the string, and therefore they could equally be represented entirely separately.

(4) *Anna hit Norman*



edges of that unit. This means that the two aspects of the string in this revised model truly represent the sole point of possible interface between the syntax and phonology modules, mediated and constrained by information stored in the lexicon.

So that interface information can be included in the AVMs of the s- and p-strings, we need a mechanism by which the relevant edge information can be passed to string elements. Observe that the passing of edge information to string elements occurs as it were in the 'opposite' direction from the projection from c-structure to f-structure. In the latter case, projection works 'up the tree': usually, f-structures projected from lower nodes are identical to or included within f-structures projected from higher nodes, and the f-structure projected from the top node of any tree is identical to or contains every f-structure projected from all other nodes in the tree. On the other hand, if we return to the original Dalrymple and Mycock conception of passing edge information in terms of e-structures, there is no single e-structure for any one c-structure, but rather there are as many e-structures as there are c-structure nodes. In contrast to the projection out to f-structure, AV pairs at e-structure which are projected from higher c-structure nodes are incorporated into e-structures projected from lower nodes. This is highly important when it comes to formalizing the passing of edge information. Projection to f-structure, insofar as its direction is 'up the tree', requires reference only to the current node and its mother, symbolized as $*$ and $\hat{*}$. The f-structures corresponding to these nodes are obtained by applying the function ϕ, giving $\phi(*)$ and $\phi(\hat{*})$, regularly abbreviated as $\downarrow$ and $\uparrow$ respectively. But since the passing of edge information to the string works 'down the tree', as it were, these familiar annotations are insufficient; specifically, we require reference not to the current node and its mother, but to the current node and its (leftmost and rightmost) daughters. We define a relation D, which finds the set of daughter nodes of the current node; we then represent the leftmost and rightmost immediate daughters of $*$ by the functions $D_l(*)$ and $D_r(*)$ respectively, defined as in (5). The leftmost and rightmost *terminal* nodes projected from $*$, which we represent by the functions $T_l(*)$ and $T_r(*)$ respectively, are defined in (6).[6] Finally, the s-string elements corresponding to these terminal nodes are simply obtained by applying the function π^{-1}. In the spirit of $\uparrow \equiv \phi(\hat{*})$, we propose the abbreviations in (7).

(5) a. $D_l(*) \equiv$ node n, where $n \in D(*) \wedge \neg\exists x.x \in D(*) \wedge x \prec n$.

b. $D_r(*) \equiv$ node n, where $n \in D(*) \wedge \neg\exists x.x \in D(*) \wedge x \succ n$.

(6) a. $T_l(*) \equiv \begin{cases} * \text{ if } D(*) = \varnothing \\ \text{else } T_l(D_l(*)) \end{cases}$ b. $T_r(*) \equiv \begin{cases} * \text{ if } D(*) = \varnothing \\ \text{else } T_r(D_r(*)) \end{cases}$

(7) a. $\Swarrow \equiv \pi^{-1}(T_l(*))$ b. $\Searrow \equiv \pi^{-1}(T_r(*))$

These arrows, then, permit direct reference from any c-structure node to the s-string elements corresponding to the leftmost and rightmost terminal c-structure nodes that are descendants of the node in question.[7] We can therefore pass syntactic category information to string elements by means of simple rules such as those in

[6] These rules can be informally read as follows: the leftmost/rightmost terminal node from the current node is the current node if the current node has no daughters, else it is the leftmost/rightmost terminal node from the leftmost/rightmost (respectively) daughter of the current node. The rule will apply recursively to find the appropriate terminal descendant from any node.

[7] Note that this model permits simple reference only to constituent edges. In principle it may be possible to make reference to constituent-internal elements, but given the edge-oriented nature of prosody we believe that in general it is edges that will be crucial in the analysis of interface phenomena such as Focus marking.

(8). These rules are given under the nodes in (4) in order to be explicit, but we assume they can be stated as more general principles, and we omit them from subsequent trees.

(8) a. For any XP, XP $\in(\Swarrow$ L) and XP $\in$ ($\Searrow$ R)

b. For any X, X $\in(\Swarrow$ L) and X $\in$ ($\Searrow$ R)

We can do precisely the equivalent, of course, for the passing of information down the prosodic structure to the p-string. Using $\diamond$ for the current node in the p-structure, the functions $\swarrow$ and $\searrow$, equivalents for syntactic $\Swarrow$ and $\Searrow$, can be defined along entirely parallel lines, that is:

(9) a. $\swarrow \equiv \beta^{-1}(T_l(\diamond))$ b. $\searrow \equiv \beta^{-1}(T_r(\diamond))$

This will allow us to pass prosodic category (and other) information directly from nodes in the p-structure to the relevant p-string elements (syllables, cf. fn. 3), e.g. for any PhP, PhP $\in(\swarrow$ L) and PhP $\in$ ($\searrow$ R), and so on. In order to account for Focus marking, we also need to be able to refer to the rightmost and leftmost p-string elements in a prosodic projection *that are marked for primary stress*, that is the leftmost and rightmost syllables within a projection that are specified as being the location of primary stress (represented as the p-string feature SYLLSTRESS p).[8,9]

(10) a. $\swarrow^{s} \equiv \beta^{-1}(T_{ls}(\diamond))$ b. $\searrow^{s} \equiv \beta^{-1}(T_{rs}(\diamond))$

(11) a. $T_{ls}(\diamond) \equiv \begin{cases} T_l(\diamond) \text{ if } (\beta^{-1}(T_l(\diamond))\text{SYLLSTRESS}) = \text{p} \\ \text{else } T_{ls}(\beta(N(\beta^{-1}(T_l(\diamond))))) \end{cases}$

b. $T_{rs}(\diamond) \equiv \begin{cases} T_r(\diamond) \text{ if } (\beta^{-1}(T_r(\diamond))\text{SYLLSTRESS}) = \text{p} \\ \text{else } T_{rs}(\beta(N^{-1}(\beta^{-1}(T_r(\diamond))))) \end{cases}$

In this way, potentially relevant information can be passed to s-string and p-string elements directly, without the need for additional structures, such as Dalrymple and Mycock's e-structure and chi-structure, to mediate the passing.[10]

---

[8] In fact, in the examples discussed below, there is only ever one stressed syllable in the relevant prosodic projections, such that it might have been possible to define only a single arrow under (10); nevertheless we define both on the grounds that it is possible for more than one stressed syllable to appear in some prosodic projections and Focus marking seems to be edge-oriented cross-linguistically. We utilize only $\searrow^{s}$ in the rules below, since English Focus marking seems to be consistently oriented to the right edge, but using $\swarrow^{s}$ would have made no difference here, at least.

[9] The function *N*, which appears in (11), finds the next element in linear order when applied to string elements, as defined in Asudeh (2009: 111); N^{-1} finds the preceding element.

[10] It is possible to retain e- and chi-structure in the current model, but as structures projected only from string elements. The conceptual justification for this would be that Left and Right edge information is not information about string elements, but information associated with string elements,

4 Formalizing Focus

In formalizing the prosodic marking of Focus in English, the parallel architecture of LFG, comprising distinct but related levels of linguistic representation, requires us to simultaneously provide an analysis purely in terms of prosody and an analysis purely in terms of syntax. This means that there will be a rule or rules treating the relationship between a unit or units at p-structure and the DF Focus at i-structure; this covers the Foc-Exponent (§4.1). Similarly, there will be a rule or rules treating the relationship between a unit or units at c-structure and DF Focus at i-structure; this covers the Foc-Extent (§4.2). The principle of Interface Harmony will ensure that the appropriate relationship exists between the Foc-Exponent, corresponding to some prosodic cue(s), and the Foc-Extent, corresponding to some syntactic unit(s). In this way, our analysis truly models prosodic marking of Discourse Functions as an interface phenomenon, sited at the one point in the grammar – the string – where the phonology and syntax macromodules are in contact.

4.1 Foc-Exponent

We assume the rule in (12) for declarative intonation in English. The rightmost Phonological Phrase (PhP) in an Intonational Phrase (InP) is specified as having (in default cases) N_TONE = H (a Nuclear Tone whose value is High) associated with its rightmost stressed syllable, and RB_TONE = L (a Right Boundary Tone whose value is Low) associated with its rightmost syllable. These features are related to the label *DeclSem* that appears in the relevant p-string AVM and is required to interface with an equivalent property in the corresponding s-string AVM, which will mark the sentence as semantically declarative. The rule for Focus presented in (13) will apply alongside the rule in (12), since the type of Focus we are discussing involves declaratives. (We include the *DeclSem* label for the sake of completeness, but do not otherwise utilize it here.)

(12)

$$
\begin{array}{llll}
\text{InP} & \rightarrow & \text{PhP*} & \text{PhP} \\
 & & & ((⤥^{s}\text{N\_TONE}) = \text{H}) \\
 & & & (⤥\,\text{RB\_TONE}) = \text{L} \\
 & & & \textit{DeclSem} \in (⤥\,\text{R})
\end{array}
$$

It is possible to formulate a single p(rosodic)-structure rule (13) to account for nearly all types of intonational Focus marking. This rule states that any Prosodic Word (PW) in a Phonological Phrase may be marked for N_TONE = H, and if so, the label *DF_Focus* appears as a value of the attribute R of the corresponding p-string

such that it should not really be represented in the string AVMs (which we would retain in any case), but in AVMs associated with string elements. If such a model were pursued, all of the above equations and symbols could remain, but with the addition of projection out to e- and chi- structure from the s- and p-string elements respectively in the definitions of ⇙, ⇘, ⤶ and ⤥; so e.g. ⇙ $\equiv \epsilon(\pi^{-1}(T_r(*)))$, etc. For simplicity we do not make use of e- and chi-structure, but we leave it an open question which representation is conceptually and architecturally most desirable.

element that carries the Nuclear Tone.[11] The p-string element in which this feature appears is, specifically, the rightmost syllable that bears primary stress ($\searrow^{s}$) in the relevant PW.[12]

(13) $$\begin{array}{llccc} \text{PhP} & \rightarrow & \text{PW*} & \text{PW} & \text{PW*} \\ & & & ((\searrow^{s}\textsc{n\_tone}) = \textsc{h}) \Rightarrow & \\ & & & \mathit{DF\_Focus} \in (\searrow^{s}\textsc{r}) & \end{array}$$

The Foc-Exponent serves to delimit the Foc-Extent. Foc-Extent is captured by separate c-structure rules which, together with the p-structure rule in (13) and the principle of Interface Harmony, play an equally important role in the analysis of prosodic marking of Focus as an interface phenomenon. We now turn to these c-structure rules.

4.2 Foc-Extent

As discussed in §2, most examples of Focus in English, including not only Extent>Exponent Focus (broad or projecting Focus), but also many examples of Exponent≈Extent Focus (narrow Focus), correlate to an XP at c-structure. It is also possible for the Foc-Extent to correlate with an X′, although examples are harder to come by (14–15).

(14) V′ Focus:
Q: What did Anna do for Norman?
A: Anna [bought **fudge**] for Norman.

(15) N′ Focus:
Q: What/Which blue thing did you find?
A: I found a blue [piece of **pa**per].

We therefore assume that in principle any phrasal category at c-structure may delimit the Foc-Extent in a clause. The PS rule in (16) licenses this: any non-terminal node in the syntactic structure may be classified as in Focus, i.e. its semantic structure may include the feature DF FOCUS. If this is the case, the label DF_Focus is specified as a value of the attribute R of the s-string element corresponding to the rightmost terminal daughter of the phrasal category.[13]

[11] It is important to note that the value *DF_Focus* is simply a label associated with a prosodic feature, and does not represent semantic information within the prosodic component. The fact that we call the label *DF_Focus* and not, say, *xyz*, is intended to make the requirement of Interface Harmony – that *DF_Focus* in the p-string match with (the equally meaningless) DF_Focus in the s-string – as clear and obvious as possible, and nothing more. This does not, therefore, conflict with our stated aim of absolute modularity. The same applies, of course, to other labels such as *DeclSem* in (12) and the labels for constituent edges (PW, NP, etc.) used in Dalrymple and Mycock (2011). Interface Harmony requires label matching, which will have consequences; it does not involve storage or 'passing' of semantic or any other type of information.

[12] It is sufficient for the present purposes that we specify and require harmony for only the R features in the s-string and p-string, which reflects the fact that Focus marking in English is fundamentally right-edge based. See also Dalrymple and Mycock (2011) on declarative questions, in which the crucial meaning constructor is similarly proposed to be right-edge based.

[13] We distinguish labels on the prosodic side from labels on the syntactic side by giving the former

(16) C-structure rule for phrasal Focus:

$$\Sigma \quad \rightarrow \quad \Sigma^* \qquad \underset{\begin{pmatrix}(\uparrow_\sigma \text{DF}) = \textsc{focus} \\ \text{DF\_Focus} \in (\searrow \text{R})\end{pmatrix}}{\Sigma}$$

Due to the principles governing the passing of semantic information through syntax in LFG, it is not in fact enough to state that the XP concerned is marked for Focus at s-structure. The f-structure projected from an XP is identical to or contains the f-structures related to its subordinate nodes at c-structure, but the corresponding semantic structure projected from the XP's f-structure does not include s-structures projected from subordinate f-structures.[14] The rule in (17) applies alongside that in (16), extending the feature DF FOCUS to the semantic structures projected from any node that is a daughter of a node which is itself marked for Focus.

(17) C-structure rule for cascading Focus:

$$\Sigma \quad \rightarrow \quad \underset{\left\{ (\uparrow_\sigma \text{DF}) \neq \textsc{focus} \;\middle|\; \begin{matrix}(\uparrow_\sigma \text{DF}) =_c \textsc{focus} \\ (\downarrow_\sigma \text{DF}) = \textsc{focus}\end{matrix} \right\}}{\Sigma^*}$$

The implementation of phrasal Foc-Extent by means of these rules, and the prosodic structure rule given above, is exemplified in (25) and (26) in the Appendix.[15]

It is also possible, though rare, that the Foc-Extent may correlate with an X^0, i.e. non-phrasal, category at c-structure. The clearest example of X^0 Foc-Extent is Exponent≈Extent verb Focus, as in example (18a). Here, the complement to the verb, *Norman*, is backgrounded and therefore not included in the Foc-Extent, meaning that in syntactic terms only the V^0 constituent is focused.[16] In (18b) the

in italics, hence *DF_Focus* in (13) but DF_Focus in (16). This is purely for the purpose of clarity in representing the fact that these labels relate to distinct aspects of the grammar, one to prosody, the other to syntax.

[14]This is necessary to overcome the granularity problem; see King (1997).

[15]Note that the example analysed in (26) would be problematic under an approach that defined Foc-Exponent in terms of PWs because in this case the relevant PW also includes an enclitic (related via the lexicon to the s-string unit *for*) which does not constitute part of the Foc-Extent.

[16]Verb Focus is somewhat more complicated than simple XP Focus. In question-answer pairs such as we have here, the event (EV) element of a verb's meaning is presupposed in the question, and hence is not focused in the answer; rather, what is questioned, and hence focused in the answer, is the *type* of event (REL) that occurred, see Mycock (2006). We abstract away from the formal details of this here (details which will in fact apply in all cases where a verb is focused, including, for example, IP focus). In formal terms, distinct meaning constructors will correspond to the EV and REL elements of a verb's meaning, and only the latter will appear as a value of FOCUS at i-structure. We believe this is pragmatically determined, i.e. the EV element is excluded from Focus specifically because it is presupposed in the preceding discourse. While some work has been done on cross-sentential discourse structure in LFG (King and Zaenen 2004, Gazdik 2011), a simple integration with Dalrymple and Nikolaeva's i-structure, which would permit us to account for the issue under discussion, is beyond the scope of the present paper. We therefore set this problem aside for present purposes and assume that, when a verb is focused, all its associated meaning constructors are focused, just like all other categories of words.

Foc-Extent includes only the D^0 head/specifier of the verb's complement.

(18) a. Q: What did Anna do to Norman?
A: Anna [**hit**] Norman.

b. Q: Which car did you damage?
A: I damaged [**your**] car.

It is difficult or impossible to focus other X^0 categories when only New Information Focus is considered. However, it is clear that for other types of Focus any X^0 can function as the Foc-Extent, e.g. when contrast is involved as in *This letter is [**to**] my sister (not from her)*.[17] We therefore frame a phrase-structure rule that permits X^0 Foc-Extent of any sort (19); X^0 Foc-Extent is exemplified in (27) in the Appendix.

(19) C-structure rule for X^0 Focus:

$$\Sigma \quad \rightarrow \quad \Sigma^* \qquad \underset{\begin{pmatrix} (\downarrow_{\sigma}\text{DF}) = \textsc{focus} \\ \text{DF\_Focus} \in (\searrow_{\text{R}}) \end{pmatrix}}{X} \qquad \Sigma^*$$

4.3 Single-syllable Exponent>Extent

Examples such as the ones in (20) appear to represent Exponent>Extent Focus, that is cases in which the Foc-Extent corresponds to only a part of the Foc-Exponent. This appears problematic for our model, since we define the Foc-Exponent as the stressed syllable, which here appears to correspond to two elements in the s-string, only one of which is semantically focused.

(20) a. Q: Who's gone?
A: [**Kay**]**'s** gone.

b. Q: Who'll help?
A: [**I**]**'ll** help.

Instances of this phenomenon in English are in fact rare and lexically restricted (which may account for the lack of attention paid to them in the literature): they prototypically involve reduced auxiliaries. The restricted inventory of forms involved means this can be treated most efficiently via a lexical restriction. For example, we assume the lexical entry in (21) for *'s* (= *has*), seen in (20a). In (21), $\bullet$ refers to any s-string element with which the lexical entry is associated; $\bullet_\pi$ therefore refers to the c-structure exponent of the corresponding s-string element, and $\bullet_{\pi\phi}$ to the corresponding f-structure element. $\blacklozenge$ refers to any p-string element with which the lexical entry is associated. As stated in §3, the feature FM represents the form of the unit in the s-/p-string.

[17] We do not consider here cases such as *No, don't retie it, **un**tie it!*; as argued by Vallduví and Engdahl (1996: pp. 504–505) these are best treated as metalinguistic corrections, rather than instances of the type of Focus phenomena analysed in this paper.

(21)

$(\bullet\textsc{fm})$ = ''s'
$\bullet_\pi = \mathrm{I}$
$(\bullet_{\pi\phi}$ TENSE-ASPECT$)$ = PRES-PERF
DF_Focus $\notin (\bullet\mathrm{R})$
$(\blacklozenge\textsc{fm}) = /\mathrm{z}/$

This lexical entry prevents DF_Focus from being a value of the attributes L and R in an s-string exponent of the auxiliary *'s* (= *has*). In terms of Interface Harmony, in cases where *'s* is part of a stressed syllable which is the Foc-Exponent, this will enforce the appearance of DF_Focus as a value of L and R in the s-string element directly preceding *'s*, meaning that only the word preceding the auxiliary, and not the auxiliary itself, will have an s-structure that contains the AV pair DF FOCUS.[18] This is illustrated in (28) in the Appendix. In this example, the Foc-Exponent is /keɪz/ in the p-string, so this syllable's R attribute-value set includes *DF_Focus*. According to Interface Harmony as applied thus far, this R value should match with the R value of either (or perhaps both) of the corresponding s-string units, which are *Kay* and *'s*. A match with the s-string unit for *Kay* is unproblematic, and is in fact what we want, but a match with the s-string unit for *'s* must be excluded: *'s* (= *has*) is not part of the Foc-Extent. The lexical entry in (21) deals with this issue by stating (in line 4) that in no case can DF_Focus appear as a member of the attribute-value set R in an s-string unit associated with the lexical entry for *'s*. Therefore there is only one possibility that will satisfy Interface Harmony in (28), namely to have the R *DF_Focus* AV pair in the p-string unit for /keɪz/ match with an R DF_Focus AV pair in the s-string unit for *Kay*. Therefore in (28), DF_Focus is necessarily a member of the R attribute-value set in the AVM for *Kay* in the s-string.

5 Further Issues and Conclusion

In this paper we have concentrated on the formal mechanisms of the syntax-prosody interface and the specifics of modelling prosodic Focus marking in general terms. In doing this we have abstracted away from some more complex data. We noted above (fn. 16) that the technical details of verb Focus are in fact more complex than we have assumed for the present purposes. Similarly, we have intentionally avoided treating examples of non-edge-marked Focus (22–23), and examples of discontinuous Foc-Extent (24).

(22) Q: What did Anna do?
A: Anna [put the **cat** out].[19]

(23) Q:What happened?
A: [Anna **hit** me].

[18]Note that it is still possible for *'s* to appear within a Foc-Extent, e.g. within a focused IP, since the restriction is on s-string labels, not i-structure categorization.

[19]It is not the case that a particle like *out* cannot be the Foc-Exponent. Indeed, if the answer were *Anna put it **out***, as in a reply to *What did Anna do with the cat?*, this would be the default production pattern. Any future analysis will have to be able to account for these two possibilities.

(24) Q: What did Charlie do with the cake?
A: He [put] it [in the **cup**board].

A more comprehensive analysis of Focus marking in English must, of course, account for the entire range of data. As noted above this requires some reference to inter-sentential discourse relations, which is beyond the scope of the present paper. We have shown that it is relatively simple to model many examples of Focus marking in English in the architecture proposed here, and it is only a more sophisticated articulation of the rules governing English Focus marking that would be required to enable it to model the entire range of data. We contend that this also holds for extending this approach to the prosodic marking of DFs in other languages as well. We have not attempted this here as we seek to emphasize and explore the architectural issues. Our aim has been the demonstration that it is possible to model prosodic contributions to information structure in the streamlined version of Dalrymple and Mycock's (2011) architecture presented here, representing this challenging phenomenon while maintaining strong modularity of the grammatical architecture.

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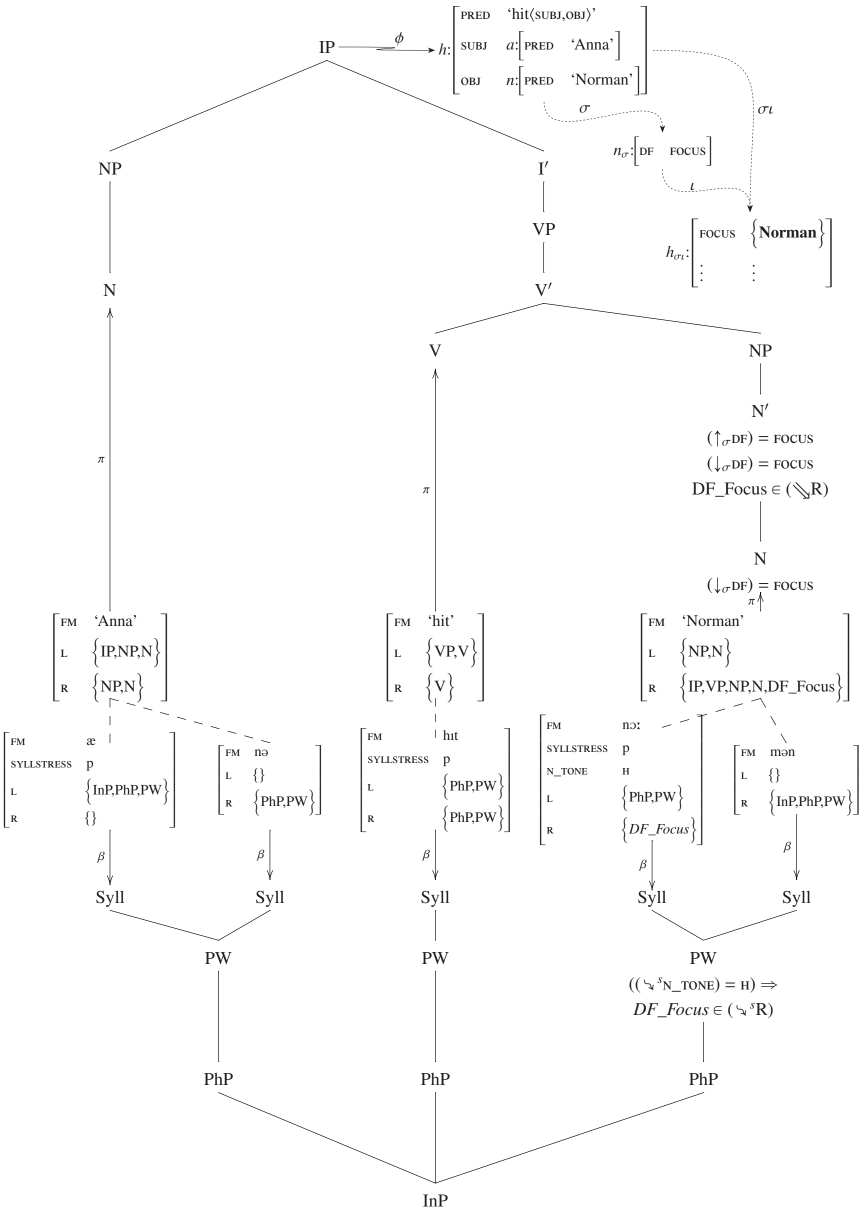
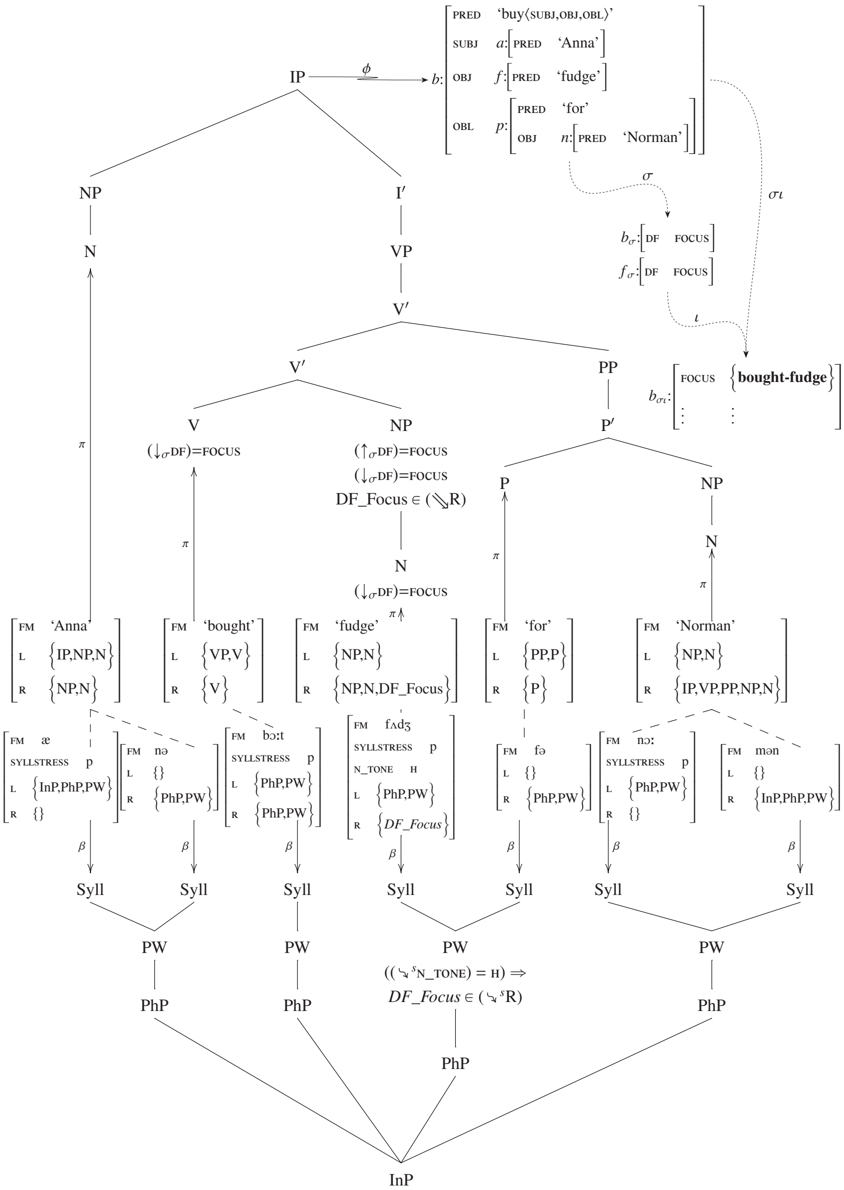
Appendix: 'double-tree' analyses of prosodic Focus marking in English

The examples in this Appendix show utterances spoken at a regular tempo. As Dalrymple and Mycock (2011) point out, p-structure (and the extent of its alignment with c-structure) can vary depending on a number of factors including speech tempo, even in the case of a single sentence. While the diagrams included in this Appendix depict cases in which there is a one-to-one relationship between PWs and PhPs, this need not be the case; our analysis can be extended in a straightforward manner based on the proposals in Dalrymple and Mycock (2011), which allow for such variation to be captured. At syllable level, the stress indicated in a p-string AVM indicates the location of primary prominence in the relevant prosodic word.

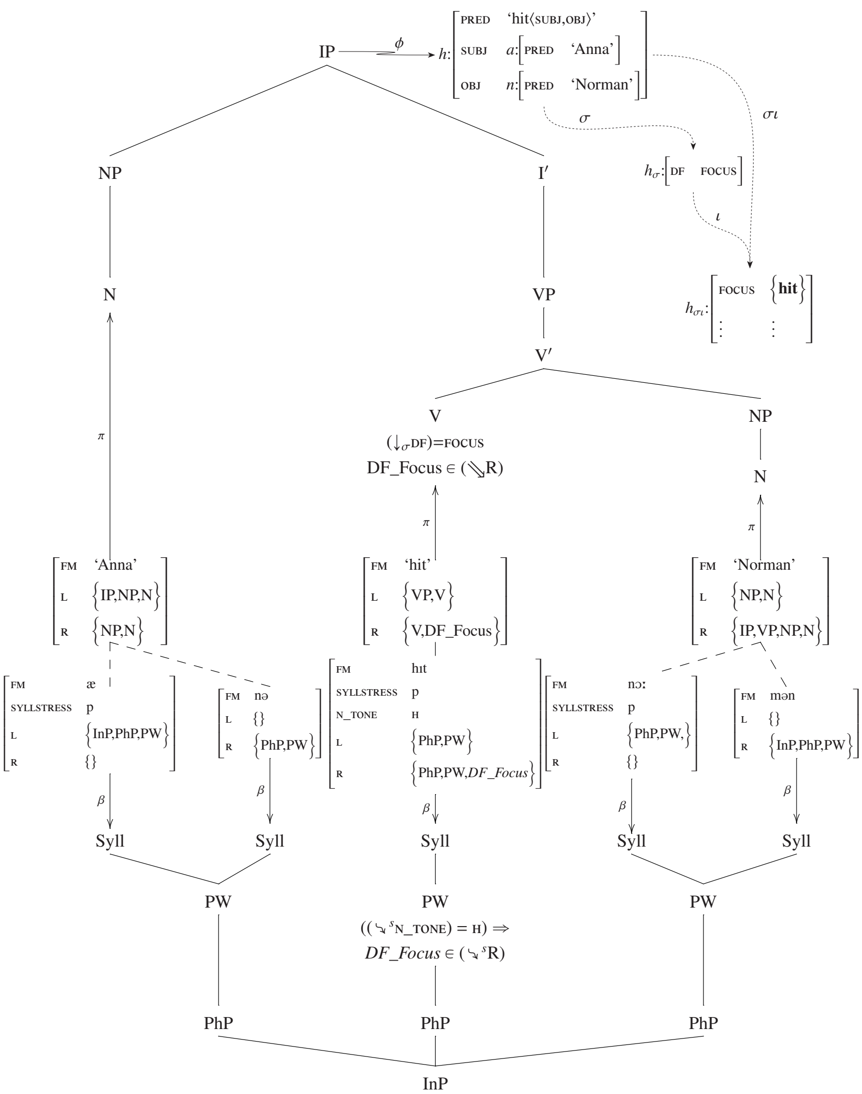
(25) XP Focus: *Anna hit [**Nor**man]*



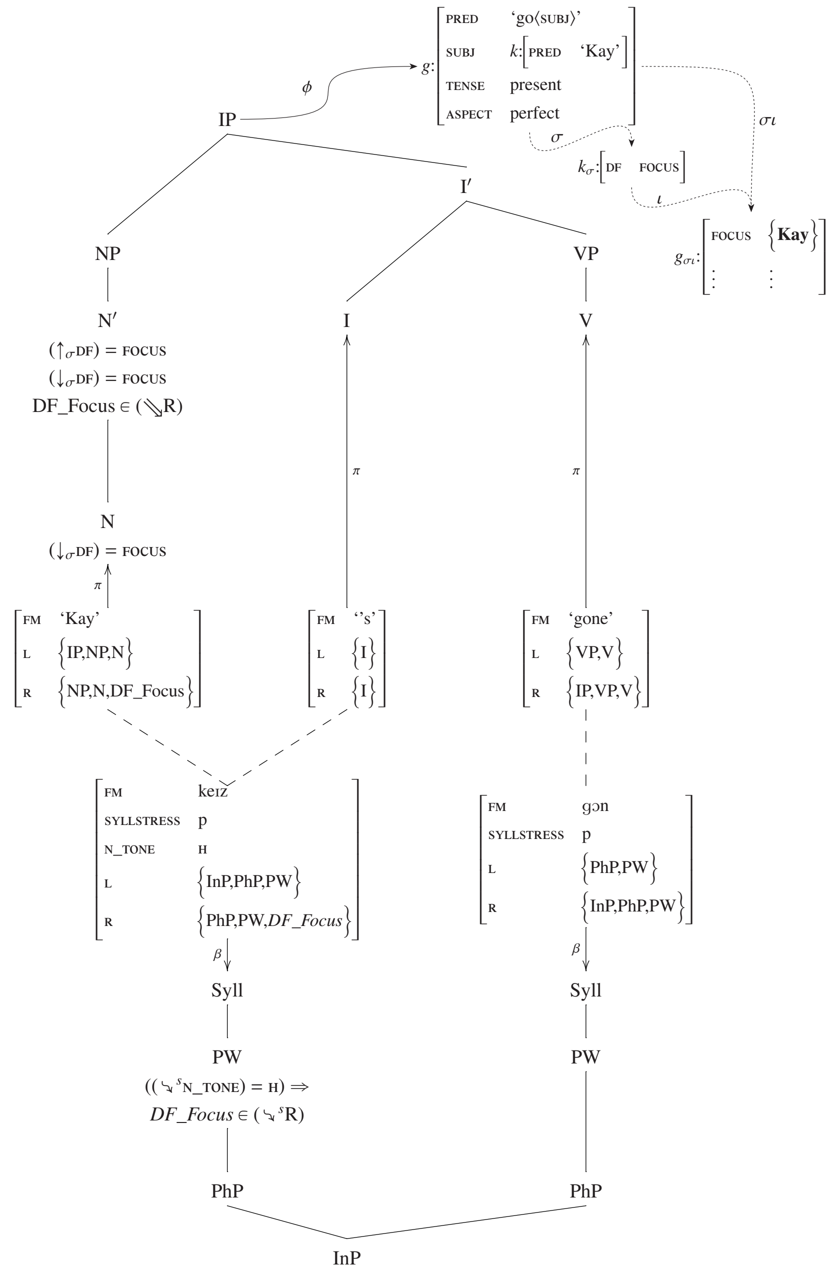
(26) X′ Focus: *Anna [bought **fudge**] for Norman*



(27) X^0 Focus: *Anna [**hit**] Norman*



(28) Single-Syllable Exponent>Extent: *[**Kay**]'s gone*



WEAK CROSSOVER AND THE DIRECT ASSOCIATION HYPOTHESIS

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Abstract

Weak crossover has figured prominently in the debate over the existence of traces, as it has been claimed to provide evidence for their necessity in long-distance dependencies. This paper argues against this claim by providing a treatment of weak crossover that does away with the need for empty categories. This is achieved by use of the Direct Association Hypothesis (Pickering and Barry 1991), which proposes that filler-gap dependencies are characterized by a direct link between an extracted element and its subcategorizer. I show that the new treatment not only accounts for uncontroversial crossover data, but also fares better than the preceding LFG treatments on some key examples. Finally, I outline some consequences of the new proposal, as well as directions for further inquiry, and argue that direct association may provide a robust starting point for reexamining a number of phenomena involving filler-gap dependencies.

1 Introduction

The existence of traces and their role in the establishment of long-distance dependencies has for some time been a subject of debate in syntax, and moreover one that spans the divide between transformational theories of grammar and non-configurational ones. First introduced by Postal (1971), the phenomenon of weak crossover has figured prominently in this debate, as it has been thought to provide evidence for the necessity of traces in long-distance dependencies in *wh*-questions.

On a transformational theory of syntax, *wh*-questions are formed when a *wh*-operator, assumed to be base-generated in the canonical position associated with its grammatical function, moves to the front of a sentence. So-called weak crossover "violations" occur when, in so doing, the operator passes over a coreferential pronoun, and in particular over a pronoun which does not c-command[1] the operator's original position.[2]

(1) a. His$_i$ mother greeted him$_i$.

b. *Who$_i$ did his$_i$ mother greet?

[†]I thank the 2012-13 Syntax Working Group at Oxford and the attendees of the SE-LFG09 meeting in London for their feedback on earlier versions of the work presented here. Special thanks are also due to two anonymous reviewers for comments and criticism on the draft of this paper that was presented at the LFG13 conference this year, to Ash Asudeh for his comments on an earlier manuscript, and to Mary Dalrymple for her helpful suggestions and guidance at each stage of this project. All errors and oversights are, of course, mine.

[1]In a syntactic tree, a node A c-commands another node B if neither A nor B dominate one another, and all nodes dominating A also dominate B. Informally, A c-commands its sister nodes and all children of its sister nodes. (Adapted from Carnie 2007). See Reinhart (1976) for original definition.

[2]When the pronoun *does* c-command the operator's position, the phenomenon is known as strong crossover. This distinction is due to Wasow (1972).

The puzzle presented by example (1) is the following: while the coreferenced reading of pronouns in (1)a is readily available, such a reading is impossible in (1)b, despite the fact that the operator "who" in (1)b is assumed to have been generated in the same position as "him" in (1)a. This difference in acceptability between the *wh*-question and its associated declarative, crucially, only occurs when operator movement involves "crossing" the pronoun. Thus, the pair in (2) are both available as indexed:

(2) a. He$_i$ greeted his$_i$ mother.

b. Who$_i$ greeted his$_i$ mother?

At least at first blush, the difference between (1) and (2) suggests that the significant structural relationship with respect to weak crossover is that between the pronoun and the base position of the *wh*-operator. It has therefore been argued that there must be something in this position that enters into the relationship with the pronoun – that is, that a trace must be left behind by the fronting operator.[3] Weak crossover, on this view, seems to provide strong evidence for the involvement of traces in *wh*-questions and thus by extension in other long-distance dependency phenomena.

Although the notion of a trace as "left behind" is obviously most at home in a transformational grammar, traces are, up to a point, also compatible with non-derivational syntax. For instance, in Kaplan and Bresnan's (1982) treatment of long-distance dependencies, the trace is regarded as an unpronounced variable or marker that enters into certain functional relationships with other elements in a sentence. On the whole, however, frameworks such as Lexical Functional Grammar (Kaplan and Bresnan 1982, Bresnan 2001) have preferred traceless theories. There are a number of reasons for this: one, presented by Dalrymple, Kaplan and King (2001), is that adjunct-fronting, for instance, often involves multiple possible extraction sites and thus the structural position of a hypothetical trace is ambiguous at best.[4]

Any robust account of long-distance dependencies must also provide a treatment of the weak crossover phenomenon. A traceless treatment, perforce, differs in nontrivial ways from a trace-based account. In the following, I provide a brief overview of two accounts of weak crossover, both situated in the LFG framework (with which I assume general familiarity). One relies on traces (Bresnan 1995), while the other eschews them (Dalrymple et al. 2001). I then propose a third, alternative account, which makes use of Pickering and Barry's (1991) "Direct Association Hypothesis" to do away with traces while maintaining some of their effects. I argue that this third account fares better on some crucial data than either of the other two. Finally, I examine some possible consequences of the new proposal, and propose some directions for further inquiry.

[3] Chomsky (1976) and Reinhart (1983), among others, provide such arguments.

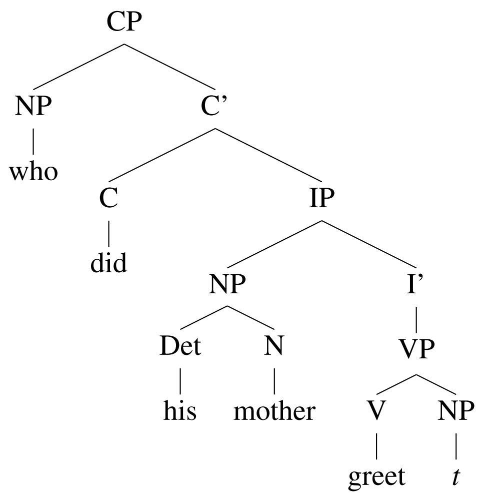
[4] Dalrymple et al. (2001) provide a number of other arguments against traces, citing crosslinguistic evidence from Kaplan and Zaenen (1989) and Sag (1998).

2 Two LFG accounts of weak crossover

2.1 A trace-based account

Kaplan and Bresnan (1982) provide an account of long-distance dependencies which adapts traces to the LFG framework.[5] Crucially, the node to be filled by a trace is represented in their proposed c-structure. Thus, it corresponds to an f-structure, and in particular to the same f-structure as the *wh*-operator. Example (1)b, then, would have the following c- and f-structures:

(3) a.



b.
$$\begin{bmatrix} \textsc{pred} & \text{`greet}\left\langle f_1, f_2 \right\rangle\text{'} \\ \textsc{focus} & f_2\!: \begin{bmatrix} \textsc{pred} & \text{`who'} \end{bmatrix} \\ \textsc{subj} & f_1\!: \begin{bmatrix} \textsc{spec} & \begin{bmatrix} \textsc{pred} & \text{`pro'} \end{bmatrix} \\ \textsc{pred} & \text{`mother'} \end{bmatrix} \\ \textsc{obj} & f_2 \end{bmatrix}$$

In transformational theories, the tree is the essential object of study, and thus accounts of weak crossover have sought to handle the data in terms of c-command configurations between the pronoun and trace.[6] LFG, on the other hand, regards f-structure as an equally significant level of representation. Thus, Bresnan's (1995) account of weak crossover, although it aligns with its transformational cousins in terms of traces, locates the governing principles at the f-structure level.

According to Bresnan, coreference phenomena are broadly governed crosslinguistically by two principles: syntactic rank and linear order. Syntactic rank comes

[5]See Kaplan and Bresnan (1982, 82–113) for details.

[6]Reinhart (1983), Farmer et al. (1986), Lasnik and Stowell (1991), and Postal (1993) all provide examples of this approach.

from the functional hierarchy (Keenan and Comrie 1977):[7] subject is ranked highest, followed by object, and so on. Linear order is governed by f-precedence,[8] which compares f-structures in terms of the position of the corresponding c-structure nodes, and thus allows a c-structure relationship to be handled at f-structure.

Insofar as these two principles come to bear on weak crossover, Bresnan refers to them as "prominence" constraints. The versions presented here are adapted from Bresnan's formulation (p.252).

(4) **Syntactic prominence:** An f-structure containing the pronoun may not be higher in syntactic rank than an f-structure containing the operator.

(5) **Linear prominence:** The pronoun must not f-precede the operator.

Example (3), then, is ungrammatical because it fails to satisfy either prominence constraint. The f-structure containing the operator is identified with the trace node, and so has rank OBJ. The pronoun appears within the SUBJ f-structure, and so outranks the operator, contravening (4). Similarly, because the trace and operator share an f-structure, we find that the pronoun f-precedes the operator because it appears before the trace. In example (2)b, on the other hand, the operator has rank SUBJ, while the pronoun appears in OBJ. Since the operator is fronted[9] and the trace appears in canonical subject position ("Who$_i$ (t_i) greeted his$_i$ mother?"), the pronoun does not f-precede the operator in this case. Thus, Bresnan's account correctly predicts the unacceptability of (3) as well as the grammaticality of (2)b.[10]

2.2 A traceless account

Dalrymple et al. (2001) propose a revision of Bresnan's account that maintains her intuitions about multidimensional prominence constraints, while doing away with any reliance on traces. This move is bolstered by Kaplan and Zaenan's (1989) proposal to handle long-distance dependencies in LFG via functional uncertainty.

[7] Bresnan provides the truncated hierarchy SUBJ $>$ OBJ $>$ OBL $>$ COMP ... The hierarchy originates with Keenan and Comrie (1977), who describe it as SUBJ $>$ DOBJ $>$ IOBJ $>$ OBL $>$ GEN $>$ OCOMP (p.66). There is some debate as to the appropriate ranking of objects. Whether or not direct objects outrank indirect objects, or if the correct distinction is actually between "primary" and "secondary" objects (see Dryer 1986), are both open questions.

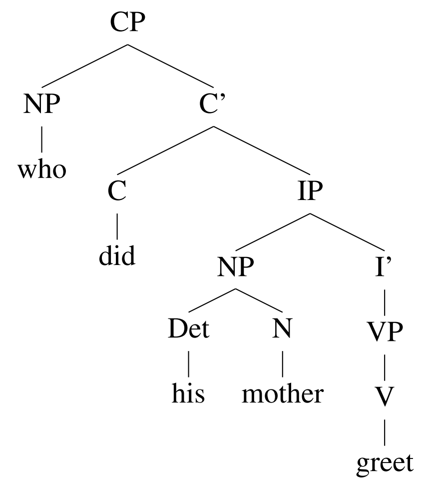
[8] F-precedence, or $\forall\exists$ f-precedence, is defined as follows: Let μ be the mapping from c-structure nodes to f-structures. Then an f-structure f f-precedes another f-structure g if and only if $\mu^{-1}(f)$ and $\mu^{-1}(g)$ are nonempty and all nodes in $\mu^{-1}(f)$ precede some node in $\mu^{-1}(g)$. See Bresnan (1995, 249).

[9] Since operators are always fronted in English *wh*-questions, we need only consider whether the trace or pronoun appears first in a sentence for Bresnan's linear prominence constraint.

[10] I have only considered English data here. It is worth noting, however, that Bresnan supports her two-dimensional analysis with crosslinguistic data, arguing that the dimensions vary in significance from language to language. For instance, she argues that weak crossover Malayalam is sensitive only to linear prominence. Postulating syntactic rank and linear order as general governing principles for coreference, thus is intended to allow for an elegant explanation of crosslinguistic variation. This issue is revisited in Section 5.

Functional uncertainty allows an extracted element to be associated with a path of indeterminate length, which contains the requisite information about the grammatical function of the position from which the element was extracted. Thus an extracted NP node is able to bear, for example, both FOCUS and OBJ roles, without relying on an unpronounced trace at c-structure. Dalrymple et al., then, have the following c- and f-structures for (3).

(6) a.



b.
$$\begin{bmatrix} \text{PRED} & \text{`greet}\left\langle f_1, f_2 \right\rangle\text{'} \\ \text{FOCUS} & f_2{:}\begin{bmatrix}\text{PRED} & \text{`who'}\end{bmatrix} \\ \text{SUBJ} & f_1{:}\begin{bmatrix}\text{SPEC} & \begin{bmatrix}\text{PRED} & \text{`pro'}\end{bmatrix} \\ \text{PRED} & \text{`mother'}\end{bmatrix} \\ \text{OBJ} & f_2 \end{bmatrix}$$

According to Dalrymple et al., the intuition underlying their revision is that "linear prominence requirements between an operator and a pronoun are determined by overt material which indicates the syntactic role of the displaced phrase" (p.71). This is in opposition to a covert trace. Indeed, we can see from (6) that the syntactic prominence constraint may be applied without revision, but the absence of a trace alters f-precedence relations. Example (6), as previously noted, is ruled out due to its violation of the syntactic prominence constraint. I consider instead an example where linear prominence plays the determining role.

(7) *Who$_i$ did Sue talk about his$_i$ mother to (t_i)?

The extracted element here is an oblique, as is the f-structure containing the pronoun, so (7) satisfies syntactic prominence. On Bresnan's version of linear prominence, however, the trace appears at the end of the sentence (as marked), and so the pronoun f-precedes the operator. Dalrymple et al. consider instead overt material: the preposition "to" gives the extracted element its oblique rank and hence syntactic position. In essence, Dalrymple et al. proposes that it is the presence of the preposition after the pronoun that rules out (7).

To formalize this idea, Dalrymple et al. introduce the notion of *coarguments*, or the set of arguments and adjuncts of a single predicate. This allows the definition of *CoargOp* and *CoargPro*, coargument f-structures containing operator and pronoun, respectively. With these tools, the prominence constraints are reformulated as follows (adapted slightly from Dalrymple et al.).[11]

(8) **Syntactic prominence:** CoargOp must be at least as high as CoargPro on the functional hierarchy.[12]

(9) **Linear prominence:** CoargOp must f-precede the pronoun.

To see how this works, consider the f-structure associated with (7):

(10)
$$\left[\begin{array}{ll}
\text{PRED} & \text{`talk}\left\langle \text{SUBJ}, \text{OBL}_{\text{TO}}, \text{OBL}_{\text{ABOUT}} \right\rangle\text{'} \\
\text{FOCUS} & f_1\text{:}\left[\begin{array}{ll} \text{PRED} & \text{`who'} \end{array}\right] \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{`Sue'} \end{array}\right] \\
\text{OBL}_{\text{TO}} & \left[\begin{array}{ll} \text{PRED} & \text{`to}\left\langle \text{OBJ} \right\rangle\text{'} \\ \text{OBJ} & f_1 \end{array}\right] \\
\text{OBL}_{\text{ABOUT}} & \left[\begin{array}{ll} \text{PRED} & \text{`about}\left\langle \text{OBJ} \right\rangle\text{'} \\ \text{OBJ} & \left[\begin{array}{ll} \text{SPEC} & \left[\begin{array}{ll} \text{PRED} & \text{`pro'} \end{array}\right] \\ \text{PRED} & \text{`mother'} \end{array}\right] \end{array}\right]
\end{array}\right]$$

CoargPro and CoargOp are, respectively, the matrices corresponding to the values of $\text{OBL}_{\text{ABOUT}}$ and OBL_{TO}. In particular, "to" is in CoargOp. Thus, because the pronoun appears before "to," linear prominence rules out (7), as in Bresnan's account. The shift to the coargument level, then, allows Dalrymple et al. to maintain the syntactic prominence constraint while handling linear prominence *sans* empty categories. It is easily verified that the revised account makes the correct predictions for (2)b and (3), as well as (11) (following).

(11) Who$_i$ did Sue talk to (t_i) about his$_i$ mother?[13]

[11] Again, weak crossover in English is governed by both constraints, but this can vary from language to language.

[12] This is in practice identical to (4).

[13] Bresnan's predictions hold here as well.

(11) and (7) share the f-structure given in (10). Thus, both examples satisfy syntactic prominence. In (11), however, the pronoun appears after both the operator and the c-structure node associated with OBL_{TO}, and thus CoargOp f-precedes the pronoun. (11) is therefore permitted by linear prominence as well as syntactic prominence, and is grammatical on the Dalrymple et al. account.

3 A more "direct" account of weak crossover

As noted above, the crucial difference between the Bresnan and Dalrymple et al. accounts is that where the former considers the order in which the pronoun and trace appear, the latter considers the position of the pronoun with respect to overt syntactic material associated with the operator's coargument role.

The Dalrymple et al. account, in particular, suggests that the important element for linear prominence may be, at least in the case of obliques, the "selecting" element: that is, the element that subcategorizes for the displaced *wh*-operator. While coarguments are evidently useful for achieving this result, it is worth considering whether the same facts about weak crossover can be captured more directly. Pickering and Barry's (1991) "Direct Association Hypothesis" provides a way to do just this.[14]

The Direct Association Hypothesis (DAH) proposes that a link is made directly between an extracted element and the predicate or preposition that selects for it. According to Pickering and Barry (1991), a direct link of this sort is more parsimonious from a processing perspective than a trace-based account of long-distance dependencies, and is moreover supported by experimental evidence. The semblance of traces in psycholinguistic data, such as that from Swinney et al. (1988), Crain and Fodor (1985), and Stowe (1986), comes about because the extracted element is retrieved or mentally reactivated during processing of the selecting predicate, which is often adjacent to the proposed trace location. This adjacency can be seen in examples (3), (7), and (11).

A direct link between operator and subcategorizer also captures Dalrymple et al's intuition that it is overt syntactic material which enters into the structural relationship relevant for linearity constraints. Moreover, it does so without the need to reference the coargument structures. It also goes one step farther: where Dalrymple et al. only consider the operator and pronoun in (3), the DAH mandates consideration of the location of "greet," which subcategorizes for the displaced element in (3). In considering how this works, we adopt Dalrymple and King's (2013) terminology, and refer to the subcategorizer of an extracted element as its *anchor*.

[14] Dalrymple and King (2013) themselves adopt it to handle facts about multiple dependencies.

3.1 Weak crossover via direct association

I propose to treat the structural relationship between anchor and pronoun as the important one for a linear prominence constraint on weak crossover (as in Dalrymple et al's revision of Bresnan's account, syntactic prominence remains unchanged). In so doing, I assume that the anchoring relationship is established at f-structure (or some equivalent level for other theoretical frameworks); i.e. that it is part of the mental representation of sentences involving extraction. Dalrymple and King (2013) propose a mechanism for establishing the anchor in LFG; I will not address this question here.

Consider again the examples so far provided:

(12) *[Who$_i$]$_{\text{Op}}$ did [his$_i$]$_{\text{Pro}}$ mother [greet]$_{\text{Anch}}$?

(13) [Who$_i$]$_{\text{Op}}$ [greeted]$_{\text{Anch}}$ [his$_i$]$_{\text{Pro}}$ mother?

(14) *[Who$_i$]$_{\text{Op}}$ did Sue talk about [his$_i$]$_{\text{Pro}}$ mother [to]$_{\text{Anch}}$?

(15) [Who$_i$]$_{\text{Op}}$ did Sue talk [to]$_{\text{Anch}}$ about [his$_i$]$_{\text{Pro}}$ mother?

It may be observed that those examples in which the anchor precedes the pronoun ((12), (14)) are precisely those in which coreference is disallowed. Thus, I propose the following revision of the linear prominence constraint:

(16) **Linear prominence:** the anchor (of the operator) must precede the pronoun.[15]

Insofar as the DAH holds that the displaced phrase in some sense reoccurs at the anchor position,[16] this version of linear prominence requires that the argument referred to occurs prior to a coreferent pronoun. This is generally found to be true of sentences containing an NP and coreferent pronoun, and so a DAH account of weak crossover has in its favour that it aligns with general patterns of coreference.

3.2 Some comparisons

In each of (12)-(15), a trace, if present, would appear adjacent to the anchor. Thus, we get the same predictions from Bresnan's account as from the anchor account. At the same time, if the example in question contains a fronted oblique, or fronts the object of a preposition while leaving the preposition itself stranded, we will get aligned predictions from Dalrymple et al. and the anchor account.[17] This can be

[15]"Precedence" here may be regarded as f-precedence. However, since there is only one anchor and one pronoun, the precise specification is not of major significance. When a formal mechanism for establishing the anchor is presented, it may be of interest to formalize this as well. I leave it undefined for the time being as the account in its present state is not restricted to the LFG framework.

[16]See Pickering and Barry (1991) for this argument.

[17]Of course, I do not assume an actual process of fronting, but it is nevertheless convenient to use this terminology.

seen in examples (14) and (15). While (12) is ruled out by linear prominence in both the Bresnan and anchor accounts, Dalrymple et al. rule it out only on the basis of syntactic prominence. Indeed, for examples such as (12) and (13), where the extracted element has function SUBJ or OBJ and leaves no "overt material" behind when fronted, the Dalrymple et al. account relies heavily on syntactic prominence. In this it differs sharply from the other two, which give the correct predictions for (12)-(15) on the basis of linear prominence alone.[18] For the most part, I regard the anchor account as a "sharpening" of the Dalrymple et al. account, and so focus in this paper on the distinctions that can be made between the former and Bresnan's account. However, this difference in reliance on syntactic prominence highlights the fact that the anchor account is *not* equivalent to the Dalrymple et al. account, and a few remarks on the expected differences are in order.

3.2.1 Distinguishing anchoring from coargument order

To reiterate, the anchor account holds that any extracted element is linked to its subcategorizer. In the case of an example such as (12), this means that the *wh*-word is linked to the predicate: linear prominence thus rules this out because the pronoun precedes the verb. The Dalrymple et al. account only enforces a link between an extracted element and overt *non-verbal* material that subcategorizes for it – thus, linear prominence permits (12). The significance of syntactic prominence in English produces a unified judgment here: in the absence of such a constraint, the two accounts predict different judgements.

It is suggested in Bresnan (1995), following data from Mahajan (1990), that weak crossover in Hindi may be sensitive only to linear prominence. If this is the case, then the following example is correctly predicted to be ungrammatical on both the anchor and Dalrymple et al. accounts:

(17)	$*[uskii_i]_{Pro}$	*bahin*	$[kisko_i]_{Op}$	*[pyaar*	$kartii]_{Anch}$	*thii?*
	his	sister	who.ACC	love	do.IMP.F	PST.F

'Who$_i$ did his$_i$ sister love?'

This judgement follows from the anchor account because the pronoun precedes the anchor; it follows from the Dalrymple et al account because the pronoun f-precedes CoargOp, which in this case is the OBJ f-structure associated with the

[18] Bresnan mostly requires the syntactic prominence constraint to handle examples of weak crossover-type phenomena involving quantification. I have excluded such examples from consideration here as it is not at all clear to me that the rules governing them need be the same as the rules governing weak crossover in *wh*-questions. This may well be the case, but it is a topic for later study.

Syntactic prominence also features heavily in Bresnan's account as a crosslinguistic constraint of varying importance. In English, it more often than not provides a prediction in keeping with that provided by linear prominence. This is due to the fact that English word order typically requires that more syntactically prominent elements precede less prominent ones. This convergence raises the question of whether or not the Bresnan and anchor accounts in fact need to take syntactic prominence into consideration. I return to this question below.

single node *kisko*. Thus, if the order of the pronoun and operator are reversed, the anchor account will continue to predict ungrammaticality, but the Dalrymple et al. account will predict acceptability. My informants found the following such example to be ungrammatical:

(18)	**[kisko$_i$]$_{Op}$*	*[uskii$_i$]$_{Pro}$*	*bahin*	*[pyaar*	*kartii]$_{Anch}$*	*thii?*
	who.ACC	his	sister	love	do.IMP.F	PST.F

‘Who$_i$ did his$_i$ sister love?’

This is, of course, far from conclusive. My informants were certain about the judgement given above, but also noted a bias against the unusual word order of (18). Conversely, Mahajan (1990) marks this example as grammatical. Much more systematic investigation is evidently required before any strong claims can be made: my intention in presenting (17) and (18) here is simply to illustrate the type of data that might provide a basis for adjudicating between the anchor and Dalrymple et al. accounts.

Another such example may come from German. Dalrymple et al. (2001) claim that German permits examples that satisfy *either* of the constraints, but does not require both to be satisfied. Consequently, the following example from Fanselow et al. (2005) is predicted to be acceptable, despite violation of syntactic prominence:

(19)	*[Wen$_i$]$_{Op}$*	*[liebt]$_{Anch}$*	*[seine$_i$]$_{Pro}$*	*Mutter?*
	who.ACC	loves	his	mother?

‘Who$_i$ does his$_i$ mother love?’

The Dalrymple et al account predicts grammaticality here because CoargOp (associated here only with the node *wen*) precedes the pronoun. The anchor account predicts grammaticality because the anchor precedes the pronoun. Switching the order of the operator and the pronoun, then, will reverse the prediction of the anchor account, while maintaining the prediction of the Dalrymple account. This affect can potentially be achieved by embedding the question, as in (20):

(20)	**Lisa*	*fragt,*	*[wen$_i$]$_{Op}$*	*[seine$_i$]$_{Pro}$*	*Mutter*	*[liebt]$_{Anch}$?*
	Lisa	asks	who.ACC	his	mother	loves

‘Lisa asks, who$_i$ does his$_i$ mother love?’

My informants found (20) to be ungrammatical, but this is again informal.

These examples illustrate potential points of divergence. In general, if we consider a language that is constrained only by linear prominence, and for which the word order constraints permit a sentence in which the anchor precedes the pronoun but the operator follows it (or a sentence in which the anchor follows the pronoun but the operator precedes it), the accounts will make different predictions for the equivalent of the (ungrammatical) English sentence (12). The final section of this paper provides a more systematic look at “synthetic” data of this type, and such divergences are noted more carefully there.

3.2.2 Distinguishing between anchor and trace

It is clear that only examples in which the anchor and trace are not immediately adjacent are likely to draw out any differences between the anchor and trace accounts. In English, a reliable way to achieve distance between anchor and trace is through "pied-piping" of prepositional phrases. The following examples have been marked for anchor, operator, and pronoun, and the proposed trace has been included in parentheses.

(21) [To whom$_i$]$_{\text{Op}}$ did you [give]$_{\text{Anch}}$ [her$_i$]$_{\text{Pro}}$ book (t_i) ?

(22) [In whose$_i$ hand]$_{\text{Op}}$ did you [put]$_{\text{Anch}}$ [his$_i$]$_{\text{Pro}}$ pen (t_i)?

(23) (?) [To whom$_i$]$_{\text{Op}}$ did you [introduce]$_{\text{Anch}}$ [her$_i$]$_{\text{Pro}}$ neighbors (t_i)?

In each of these examples, the anchor occurs before the pronoun, while the trace follows it.[19] Thus the anchor account predicts acceptability (on linear prominence), but the Bresnan account predicts ungrammaticality. Thus, if these are grammatical, they will support the anchor account, while their ungrammaticality will provide support for the Bresnan account.

I elicited judgments on these and similar examples from a number of speakers of American English.[20] (21) was ruled grammatical in all instances, (22) in a majority of cases, and (23) was ruled grammatical approximately half the time. I take it that (21) and (22) may thus be considered grammatical, while (23) is questioned (as marked). On the basis of (21) and (22), then, the anchor account outperforms the trace account.

The disagreement over grammaticality here may be attributable to the role played by syntactic prominence. For double-object constructions, English permits the so-called "dative alternation" in (24):

(24) a. John gave Mary the book.
b. John gave the book to Mary.

With respect to the functional hierarchy, this brings the status of direct and indirect objects into question. Traditionally, "book" has been classified as the direct object, and "Mary" as the (underlying) indirect object. Some analyses hold that the two objects have equal rank in (24)a, but that the preposition in (24)b lowers "Mary" to

[19] For an argument that pied-piped elements are anchored, see Pickering and Barry (1991) and Pickering (1993).

[20] Each example was shown to four or five individuals, and no individual was shown more than five examples. Judgments were elicited by asking a question along the following lines:

(i) *A asked B:* Who did you give her book to?
By the phrasing of the question which of the following could B have given the book to: the book's owner, someone besides the book's owner, or either?

oblique status. Others argue that "Mary" is syntactically an indirect object in both cases, but that direct objects automatically rank higher (despite the linear order of (24)a). A third possibility, suggested by Dryer (1986), is that English "give"-type constructions distinguish between primary and secondary objects, rather than between direct and indirect objects.[21] On this view, "Mary" is classified as the higher-ranked primary object in (24)a. (24)b represents a secondary object advancement (analogous to the object to subject advancement in passive constructions), and so "book" has become the primary object, and is ranked higher than the oblique "Mary."

The status of the two objects in examples (22) and (23) is similarly conflicted. "Put"-type verbs require a location argument. This often appears under a preposition, but it does not have to. Consider (25):

(25) I put the book down.

The location argument, then, may not necessarily be an oblique. This matches the (admittedly nonuniversal) acceptability judgement for (22). "Introduce," in (23), also requires two objects, but *can* be presented with only one, as in (26):

(26) I introduced her neighbors.

In this case, a reciprocal object, such as "to each other," is implied; this may suggest that the two objects in "introduce" constructions have equal rank.[22]

The debate over the status of English double objects may represent an actual ambiguity in their mental representation. Dryer's account, although it resolves the rankings in (24)a and b, concedes that English seems to have "split objectivity," and in certain other instances makes a direct/indirect object distinction, which can reverse the rankings a primary/secondary object assignment would produce. This confusion may be reflected in the judgements for (21)-(23): genuine uncertainty about syntactic rank might interfere with grammaticality judgements.

These issues can to a certain extent be circumvented by considering examples in which neither argument takes a preposition, or both arguments do. Both (27) and (28) were ruled grammatical by my informants.

(27) [Whose$_i$ book]$_{\text{Op}}$ did you [give]$_{\text{Anch}}$ [her$_i$]$_{\text{Pro}}$ friend (t_i)?

(28) [To whom$_i$]$_{\text{Op}}$ did Sue [talk]$_{\text{Anch}}$ (t_i) about [his$_i$]$_{\text{Pro}}$ mother (t_i)?

[21]Primary objectivity is also consistent with the traditional LFG analysis of double object constructions, as presented in Kaplan and Bresnan (1982).

[22]An anonymous reviewer points out there is an additional interpretation of this type of sentence, as in "Let me introduce the speaker." Although this event is clearly asymmetric, I suspect that this usage of "introduce" is to be considered separately from a construction such as (23), and does not bear on the comments made here.

The judgment for (27) unequivocally supports the anchor account over the trace account. (28) encounters the additional problem of an ambiguous extraction site: if the trace is located between "talk" and "about," Bresnan's account predicts grammaticality alongside the anchor account, but if the trace occurs at the end of the sentence, Bresnan's account fails to predict (28) as well. Ambiguity itself seems to be a mark against traces. On the whole, then, evidence from examples in which the anchor and trace are separated tends to favour the anchor account.

With respect to object type distinctions and the anchor account, it is interesting to compare the following examples, for which the underlying declarative is structured like (24)a:

(29) a. [Who$_i$]$_{\text{Op}}$ did you [give]$_{\text{Anch}}$ (t_i) [her$_i$]$_{\text{Pro}}$ book?
b. [Whose$_i$ book]$_{\text{Op}}$ did you [give]$_{\text{Anch}}$ [her$_i$]$_{\text{Pro}}$ (t_i)?

As far as the anchor account goes, (29)a and b both satisfy linear prominence. Given the traditional ranking of direct objects above indirect objects, a direct/indirect assignment would block (29)a on syntactic prominence, but permit (29)b. Dryer's primary/secondary object assignment, by contrast, would allow (29)a, since "who," as the primary object outranks "book" as the secondary, but would block (29)b for much the same reason. My intuitions about these examples align with the primary/secondary object distinction, as does the solicited judgement for (27), which mirrors (29)b. This issue, however, is in need of further investigation.

4 Additional Considerations

4.1 Adjuncts and syntactic prominence

Given the uncertainty surrounding the predictions of the syntactic prominence constraint in examples (21)-(23), it is worth considering the merits of this constraint independently. In order to do this, we must look at examples which would be ruled out on syntactic prominence and not otherwise; these will primarily involve adjunct-fronting.[23]

(30) *[With whom$_i$]$_{\text{Op}}$ did Jessica [visit]$_{\text{(Anch)}}$ [his$_i$]$_{\text{Pro}}$ cousin (t_i)?

(31) *[In whose$_i$ car]$_{\text{Op}}$ did Anne [meet]$_{\text{(Anch)}}$ [him$_i$]$_{\text{Pro}}$ (t_i)?

(32) *[From whose$_i$ house]$_{\text{Op}}$ did George [call]$_{\text{(Anch)}}$ [her$_i$]$_{\text{Pro}}$ (t_i)?

[23]It is an open question whether or not adjuncts are anchored when pied-piped; since they are not subcategorized for, it seems plausible they are not, and this is the view suggested by Dalrymple and King (2013). The potential anchor is marked in (30)-(32), but the predictions of the anchor account are not affected either way. Observe that here, as in (21)-(23), (27), and (28), the predictions of the anchor account align with those of the Dalrymple et al. account.

My informants universally regarded (30)-(32) as ungrammatical. As these all pass the linear prominence requirement for the anchor account, it is thus syntactic prominence which (readily) rules them out: objects rank higher than (oblique) adjuncts. This argues for the robustness of the syntactic prominence constraint.

The Bresnan account, however, does not need syntactic prominence to rule (30)-(32) ungrammatical, as the trace in each case appears at the end of the sentence. Given the infrequency with which the Bresnan account appeals to syntactic prominence (for *wh*-questions), this has a sort of simplifying elegance. However, the judgments in examples (21), (22), (27), and (28) are impossible to explain on Bresnan's linear prominence alone. It may be recalled that Bresnan posited syntactic rank (whence the prominence constraint) as a general, crosslinguistic principle affecting coreference. In addition, the functional hierarchy plays a role in several other syntactic phenomena, which is perhaps an argument for its potential here.

Taking the view that syntactic prominence is significant for weak crossover, it is a simple extrapolation to say that it plays the suggested role in the judgments in (22) and (23). This view, then, lends further support to the anchor account: linear prominence allows (21)-(23), (27), (28), and (30)-(32), while syntactic prominence rules out absolutely (30)-(32), allows (21), (27) and (28), and is shaky on (22) and (23). This matches exactly the quality of the judgments for these examples.

4.2 Multiple-gap constructions

In addition to the examples so far examined, it is worth considering examples involving multiple gap sites. Parasitic gap constructions are a particularly well-known case of this. Following Engdahl (1986), I have marked the parasitic gap with a subscript p.

(33) (?) Who$_i$ did you advise (t_i) before his$_i$ wife divorced $\_\_{i,p}$?[24]

The first difficulty with (33) is determining which element is the anchor. Both "advise" and "divorced" are possibilities, as both have an extracted argument gap which is filled by the *wh*-operator. Given the well-observed asymmetry between main and parasitic gaps,[25] it seems likely that "advise" is the relevant anchor, but it is at least possible that "divorced" represents a second (or perhaps even the only) site of reactivation for the operator.

If "advise" does represent the anchor in (33), we get the following predictions. Assuming the parasitic gap is associated with its own c-structure node, the preimage of the operator's f-structure (that is, the set of nodes that share an f-structure with the operator) will contain the operator, the trace, and the gap. Bresnan's linear

[24]Extracting in this way is unacceptable to some speakers, regardless of indexing. I consider this example only insofar as some speakers accept it.

[25]Examples containing obligatory parasitic gaps, in which the parasitic gap occurs before the main gap, could help to shed light on this issue. However, it has so far proven difficult to construct examples in which the coreferential pronoun does not occur prior to both gaps; this remains a task for future work.

prominence will rule (33) out, then, because the pronoun precedes the gap. On the other hand, since "advise" precedes the pronoun, the anchor account allows (33). This is far from conclusive, of course.

Another construction involving multiple gap sites is the "tough"-construction:

(34) Who$_i$ (t_i) will be easy for us to get his$_i$ mother to talk to (t_i)?

Since the final trace occurs after the pronoun, this example would be ruled out by Bresnan's linear prominence. Again, if "easy" represents the relevant anchoring site of the *wh*-operator, the anchor account predicts acceptability for (34). However, as before, we have a second potential anchoring site ("talk"); if this should prove to be the relevant position, both linear and syntactic prominence should rule this example out.[26]

Insofar as the DAH is a processing account of long-distance dependencies, it argues that a fronted operator somehow becomes "salient" for coreference by reactivation at the anchor position. It seems reasonable to assume that this type of reactivation takes place, in both (33) and (34), at the site of the first subcategorizer ("advise" and "easy," respectively), thus leading to the acceptability judgement. On this view, it does not matter whether or not the second subcategorizer represents a genuine anchor site for the pronoun – by the time we arrive at this point in the sentence, coreference has in a sense already been achieved. Thus, we might reformulate the syntactic prominence constraint to specify that it is the initial anchor of the operator that must precede the pronoun; subsequent anchors are irrelevant.[27] This view matches up with the spirit of the DAH – the first position triggers "reactivation," thus making the operator available for coreference. This data, then, may provide a good argument for both the practical results of the anchor account as well as its motivations; of course, a great deal of further investigation into multiple gap constructions will be required.

5 Concluding observations

5.1 Directions for further inquiry

Bresnan (1995) and Dalrymple et al. (2001) both consider some crosslinguistic data bearing on their formulations of the two crossover constraints. In particular, both examine data from German and Malayalam, proposing that weak crossover

[26]In considering examples like (34) more completely, Dalrymple and King's (2000) work on the "tough"-construction will be relevant. Their account assumes a second operator for the more deeply embedded trace, and thus involves two separate filler-gap dependencies – it is clear that this may significantly alter the predictions made here.

[27]Depending on our structural analysis of both parasitic gaps and the "tough"-construction (see Dalrymple and King 2000), we might in the same vein wish to specify that it is the initial grammatical function of the operator which is relevant to syntactic prominence. Alternatively, it might be the highest grammatical function of an extracted element which matters; either explanation works for (33) and (34). This point will bear further examination.

in German need only satisfy one of the two constraints, and weak crossover in Malayalam is concerned only with linear prominence. Considering the predictions of the anchor account against data from either of these languages, then, would provide an excellent testing ground for the version of linear prominence I have proposed above.

As we have seen, it is sometimes difficult to draw out distinctions between the accounts in English, and this is in part due to the rigidity of English word order. Crosslinguistic data (including but not limited to the type sketched in section 3.2.1) could assist in this; moreover, if the anchor account proves workable against such data, it may be used to shed light on the differences in mental representation between adjuncts and arguments. For instance, examples of weak crossover in Malayalam (insofar as it is only concerned with linear order) might provide data helpful for determining whether or not adjuncts are anchored to their predicate in the same or a similar way as arguments appear to be. Similarly, examples from a language in which only syntactic prominence matters might help resolve the debate over the relative ranking of object types on the functional hierarchy.

Within English, as well, there are several potentially fruitful directions for inquiry. As noted above, Dalrymple and King (2013) have used the DAH to handle data involving nested and crossing dependencies. This suggests that the DAH has some versatility. As a starting point, it would be worth considering whether or not examples of weak crossover involving quantification could be handled in the same way as the *wh*-questions treated here; moving on from there, the DAH may be found to play a role in other coreference phenomena, such as strong crossover.

Relatedly, Postal (1993) points out the existence of examples such as the following:

(35) a. *Who$_i$ did his$_i$ clients hate?
b. Who$_i$ did even his$_i$ clients hate?
c. Who$_i$ did only his$_i$ clients hate?
d. Who$_i$ did his$_i$ own clients hate?

(35)b-c differ from (35)a only by the presence of a focus-type particle. Consequently, a purely structural account of weak crossover will have difficulty predicting any difference between these examples and (35)a. The presence of focus, however, appears to mitigate the crossover problem. In their current form, I do not believe any of the accounts discussed in this paper predict these results. Insofar as it is predicated on a processing treatment, the anchor account seems to me to offer the most scope for reconciling and accounting for focus-affected data. In particular, investigation and consideration of how a principle such as the DAH might interact with the effects of focus on sentence processing offers a way forward here.[28]

Finally, I have not presented a formal mechanism here for establishing the anchor. Dalrymple and King (2013), as mentioned, propose a method for doing so in

[28] In a similar vein, an anonymous reviewer brings the following empirical example to my attention:

LFG; this will bear further scrutiny. It would also be useful to consider how this relationship might be formalized in other theories of syntax, as the anchor account proposed here need not be tied to the LFG framework.

5.2 Synthetic data

Following Dalrymple et al. (2001), I present here some "data" from hypothetical languages that would help to adjudicate more sharply between the three accounts of weak crossover discussed above. These are by no means exhaustive.

I. Consider a language in which, unlike English, only linear prominence applies; let this language have fixed SVO word order and *wh*-fronting. Where the object would usually occur last, a *wh*-object would instead appear in initial position, giving a structure like (36).

(36) [[who$_i$]$_{\text{Op}}$]$_{\text{CoargOp, OBJ}}$ did [[his$_i$]$_{\text{Pro}}$ mother]$_{\text{CoargPro, SUBJ}}$ [see]$_{\text{Anch}}$ (t_i)?

This is ungrammatical on the Bresnan account because the proposed trace occurs at the end of the sentence, after the pronoun; as the anchor is immediately adjacent to the trace, the anchor account agrees with Bresnan here. Dalrymple et al, on the other hand, predict grammaticality. CoargOp in (36) is associated only with the operator node, and thus f-precedes the pronoun.

II. Let Language II be the same as Language I in all respects except that it has SOV word order.

(37) [[who$_i$]$_{\text{Op}}$]$_{\text{CoargOp, SUBJ}}$ (t_i) [[his$_i$]$_{\text{Pro}}$ mother]$_{\text{CoargPro, OBJ}}$ [saw]$_{\text{Anch}}$?

Extracting from the subject position, as in example (37), leaves the trace prior to the OBJ pronoun, yielding a prediction of grammaticality from the Bresnan account. Dalrymple et al. agree with this, since CoargOp is again only associated with the *wh*-operator, which f-precedes the pronoun. Since Language II is verb-final, however, the anchor follows the pronoun, and the anchor account predicts ungrammaticality.

(38) [[who$_i$]$_{\text{Op}}$]$_{\text{CoargOp, OBJ}}$ [[his$_i$]$_{\text{Pro}}$ mother]$_{\text{CoargPro, SUBJ}}$ (t_i) [saw]$_{\text{Anch}}$?

The predictions of the anchor and Dalrymple et al. accounts remain the same when extracting from object position. The trace in (38), however, appears in OBJ position, after the pronoun, giving a prediction of ungrammaticality from the Bresnan account.

(ii) I've just finished a book$_i$ that I'm sure not even its$_i$ own author could defend (t_i).

While this is not strictly speaking an example of weak crossover, it seems desirable that relative clause extraction of this type should have theoretical common ground with the phenomena discussed here: an understanding of effect that focus has on examples such as those in (35) will hopefully also shed light on data of this type.

III. Language III is again the same as the previous two, but has VSO word order. Extracting from object position gives (39):

(39) [[who$_i$]$_{\text{Op}}$]$_{\text{CoargOp, OBJ}}$ [saw]$_{\text{Anch}}$ [[his$_i$]$_{\text{Pro}}$ mother]$_{\text{CoargPro, SUBJ}}$ (t_i)?

Again, CoargOp is associated only with the extracted element, thus predicting grammaticality on the Dalrymple et al. account. Since Language III is underlyingly verb-initial, the anchor precedes the pronoun, and thus the anchor account also predicts grammaticality. The object trace, however, occurs in final position, which means that the operator is f-preceded by the pronoun on Bresnan's account; (39) is therefore ungrammatical for Bresnan.

IV. Consider now a language in which both linear and syntactic prominence must be satisfied; let it have fixed SOV word order, and *wh*-fronting.

(40) [[who$_i$]$_{\text{Op}}$]$_{\text{CoargOp, SUBJ}}$ (t_i) [[his$_i$]$_{\text{Pro}}$ mother]$_{\text{CoargPro, OBJ}}$ [saw]$_{\text{Anch}}$?

When extraction is from subject position, the trace occurs before the pronoun. This gives grammaticality from the Bresnan account. Dalrymple et al. agree with this because CoargOp, again, is associated only with the operator node. As Language IV is verb-final, the anchor occurs at the end of the sentence, and so the anchor account predicts that (40) will be ungrammatical.

V. Lastly, suppose there is a language which requires only that *one* of the constraints be satisfied. Observe that if an example satisfies syntactic prominence in such a language, all three accounts will predict grammaticality; thus it would only be helpful to consider examples that violate syntactic prominence. This would mean using linear prominence to adjudicate between the accounts, yielding the same predictions as for Languages I-III, depending on word order.

5.3 Summary

I have examined here three accounts of weak crossover, and compared them on a wide range of data in English. The anchor account I have proposed appears to handle successfully all of the data that is explained by the older Bresnan and Dalrymple et al. accounts, and has been seen to fare better than either on some unusual examples. As the facts about coreference can be explained by direct association between an extracted element and its subcategorizer, I conclude that traces are not strongly motivated by weak crossover. There is, of course, a great deal of work to be done, both in exploring this proposed association, and in formalizing the mechanisms outlined here; this paper provides a starting point for this work.

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THE SYNTAX OF DISTANCE DISTRIBUTIVITY IN POLISH: WEAK HEADS IN LFG VIA RESTRICTION

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Abstract

In this paper we describe the syntax of distance distributivity in Polish, where the challenge is to uniformly analyse a number of function lexemes PO 'each' which share their form and semantic contribution, but differ in their syntactic behaviour. To this end we employ the LFG mechanisms of *templates* and *restriction*, as well as the HPSG notion of *weak heads*.

1 Introduction

The empirical aim of this paper is to discuss a phenomenon in Polish which is somewhat similar to the behaviour of English EACH, as in: *I gave the boys two apples each*.[1] The phenomenon where the so-called binominal EACH (Safir and Stowell, 1988) attaches to the noun phrase (NP) denoting the distributed quantity (*two apples*) and looks elsewhere in the sentence for the set to distribute over (*the boys*) is called *distance distributivity* (Zimmermann, 2002). As we will see below, distance distributivity in Polish involves not one but a number of simultaneously homophonous and homosemous[2] elements which differ in their syntactic behaviour.

The theoretical goal is to provide an LFG analysis of Polish distance distributivity that does not miss generalisations, i.e., one that relates the form PO to the distributive semantics only once in the grammar, even though there are a few distinct lexical items sharing this form and meaning. To this end we – rather trivially – employ the LFG mechanism of *templates* (Dalrymple et al., 2004; Asudeh et al., 2013) and – perhaps less trivially – build on the HPSG idea of *weak heads* (Tseng, 2002; Abeillé, 2003, 2006), formalised here with the use of the *restriction* mechanism (Kaplan and Wedekind, 1993).

There are two main sections corresponding to the two aims mentioned above: section 2 introduces the phenomenon in gory detail and section 3 proposes an LFG analysis. This paper is strongly coupled with Przepiórkowski 2013b, which presents an HPSG account of the same facts; correspondingly, the empirical section 2 is shared between these two papers (with apologies to readers). Moreover, Przepiórkowski 2013a provides the semantic half of the complete syntactico-semantic LFG analysis of distributivity in Polish, couched in Glue Semantics (Dalrymple, 1999, 2001).

[†]We thank both the internal reviewer – Tracy Holloway King – and the anonymous external reviewer for their valuable comments on this paper. Unfortunately, due to the page limit some of these comments could not be taken into consideration here, but will be addressed in the planned book-length treatment of distributivity in Polish.

[1]A note on some conventions used in this paper: in the running text, lexemes are typeset in SMALL CAPITALS and word forms and example sentences – in *italics*. Numbered examples, as in (1)–(2) below, are typeset in ordinary upright font, with grammatical information in SMALL CAPITALS. Grammatical abbreviations mostly adhere to those recommended in Leipzig Glossing Rules (`http://www.eva.mpg.de/lingua/resources/glossing-rules.php`).

[2]We use the term *homosemous* as in Harley 2006, pp. 146ff., i.e., as referring to function (as opposed to content) morphemes or words which are not necessarily interchangeable in a given context but have the same meaning.

2 Distance distributivity in Polish

2.1 Preliminaries

The most basic use of the distributive PO is illustrated below:

(1) Dałem im po jabłku.
gave-I them.DAT DISTR apple.LOC
'I gave them an apple each.'

(2) Dałem im po dwa jabłka.
gave-I them.DAT DISTR two.ACC apples.ACC
'I gave them two apples each.'

These examples already illustrate one curious fact about PO: it may combine with the locative case (cf. (1)), reserved to arguments of prepositions in Polish, or with the accusative (cf. (2)). So at least some uses of PO must be treated as prepositional, as otherwise the overwhelming generalistion that in Polish locative only occurs on arguments of prepositions would be violated.

The first article-length treatment of the distributive PO in Polish linguistics is Łojasiewicz 1979.[3] That paper suggests that the case of the phrase coocurring with PO depends on the type of this phrase (NP in (1) and numeral phrase, or NumP, in (2); cf. Łojasiewicz 1979, p. 155), rather than on its grammatical number (singular in (1), plural in (2)). The matter should be easy to decide by considering plural noun phrases or singular numeral phrases. Unfortunately, the latter arguably do not exist in Polish; Przepiórkowski 2006b claims that all Polish numerals are plural, even those meaning 'a half' (Pol. PÓŁ) or 'a quarter' (Pol. ĆWIERĆ). Moreover, there seems to be a semantic restriction at work (cf. Łojasiewicz 1979; Przepiórkowski 2008; Bogusławski 2012) which prohibits the locative NP argument of PO from denoting aggregate entities of unspecified cardinality, as in:

(3) *Dałem im po jabłkach.
gave-I them.DAT DISTR apples.LOC
'I gave them some apples each.' *(intended)*

Nevertheless, the issue may be resolved by considering plural NPs denoting non-aggregate entities, i.e., *plurale tantum* nouns such as SPODNIE 'trousers', PERFUMY 'perfumes', etc. As shown in Przepiórkowski 2006a, and contra Łojasiewicz 1979, such NPs may co-occur with PO and, when they do, they bear the locative case. This shows that the locative is indeed conditioned by the categorial status of the noun phrase and not by its singular grammatical number. Hence, from now on, we will refer to PO in (1) (and similar contexts) as *adnominal*, PO_{N}, and to PO in (2) (and such) as *adnumeral*, PO_{NUM}.

Łojasiewicz 1979, p. 154, also notes that the distribution of the distributive PO is limited to the accusative (as in (1)–(2) above), nominative and "secondary genitive"

[3]See also Franks 1995, §5.2.1, for a generative account and comparison with the distributive PO in other Slavic languages.

positions. What is meant by a "secondary genitive" position is a genitive dependent of a negated (cf. (5))[4] or nominalised (cf. (6)) verb corresponding to the accusative dependent of the affirmative verb form (cf. (4)):

(4) Dałem im jabłko.
gave-I them.DAT apple.ACC
'I gave them an apple.'

(5) Nie dałem im jabłka / *jabłko.
NEG gave-I them.DAT apple.GEN/*ACC
'I didn't give them an apple.'

(6) Myśleliśmy o daniu im jabłka / *jabłko.
thought-we about giving them.DAT apple.GEN/*ACC
'We were thinking about giving them an apple.'

For the adnominal PO$_{N}$, Łojasiewicz 1979 gives the following example of its occurrence in the otherwise nominative (subject) position:

(7) Z drzew spadło po jabłku.
from trees fell.3.N.SG DISTR apple.LOC
'An apple fell from each tree.'

To this, the following examples of PO$_{N}$ in "secondary genitive" positions could be adduced, parallel to (5)–(6) above:

(8) Nie dałem im po jabłku.
NEG gave-I them.DAT DISTR apple.LOC
'I didn't give them an apple each.'

(9) Myśleliśmy o daniu im po jabłku.
thought-we about giving them.DAT DISTR apple.LOC
'We were thinking about giving them an apple each.'

On the other hand, PO$_{N}$ cannot occur in other case positions, including dative, instrumental and "primary genitive". This is illustrated in (10a)–(12a), involving verbs subcategorising for dative, instrumental and genitive complements, contrasted with (10b)–(12b) involving roughly synonymous verbs subcategorising for accusative complements:[5,6,7]

(10) a. *Każdy z nich przyglądał się po (jednym) obrazie. *(dative)*
each.NOM of them watched RM DISTR one.LOC painting.LOC

[4] Genitive of negation in Polish, while more regular than in Russian, is more complex than would transpire from the remarks in this paper; see Przepiórkowski 2000.

[5] RM stands here for *reflexive marker*, a part of the inherently reflexive verbs PRZYGLĄDAĆ SIĘ 'observe' and CHWYCIĆ SIĘ 'grab'.

[6] Note that the forms of JEDEN 'one' in these examples are not numerals, but rather adjectives, pace Saloni 1974 and Gruszczyński and Saloni 1978; see also Przepiórkowski 2006a for the reaffirmation of this position based on the cooccurrence of PO and JEDEN.

[7] (11a) sounds acceptable to one of the authors.

'Each of them watched a/one painting.' *(intended)*

b. Każdy z nich oglądał po (jednym) obrazie.
each.NOM of them watched DISTR one.LOC painting.LOC
'Each of them watched a/one painting.'

(11) a. *Każdy z nich kierował po (jednej) firmie. *(instrumental)*
each.NOM of them ran DISTR one.LOC company.LOC
'Each of them directed a/one company.' *(intended)*

b. Każdy z nich nadzorował po (jednej) firmie.
each.NOM of them supervised DISTR one.LOC company.LOC
'Each of them supervised a/one company.'

(12) a. *Każdy z nich chwycił się po (jednej) linie. *(genitive)*
each.NOM of them grabbed RM DISTR one.LOC rope.LOC
'Each of them grabbed a/one rope.' *(intended)*

b. Każdy z nich chwycił po (jednej) linie.
each.NOM of them grabbed DISTR one.LOC rope.LOC
'Each of them grabbed a/one rope.'

At first glance facts seem to be similar for the adnumeral PO_{NUM}. Its occurrence in an accusative position is illustrated in (2) above, and the following examples, all from Łojasiewicz 1979, illustrate a (normally, see below) nominative position (cf. (13)), a genitive of negation position (cf. (14)) and an ad-gerundial genitive position (cf. (15)):

(13) Na moich drzewach dojrzewa dziennie po kilka owoców.
on my trees ripen.3.SG daily DISTR several.ACC fruit.GEN
'Several pieces of fruit ripen every day on each of my trees.'

(14) Dzieci nie dostały po dwa pączki.
children.NOM NEG received.3.PL DISTR two.ACC donuts.ACC
'The children did not get two donuts each.'

(15) Myśleliśmy o daniu dzieciom po trzy pączki.
thought-we about giving children.DAT DISTR three.ACC donuts.ACC
'We thought about giving the children three donuts each.'

It should be noted that, while the accusative case of *dwa jabłka* 'two apples' in (2) could in principle reflect the fact that the PO_{NUM}-phrase occupies an accusative position (PO_{NUM} would be transparent to case assignment), examples (14)–(15), where such PO_{NUM}-phrases occur in genitive positions, show that PO_{NUM} does (or *may*, see below) assign the accusative case, i.e., that it does (or may) behave like a preposition.

All these considerations lead to the conclusion that there must be (at least) two different distributive elements PO: one assigning the locative to NPs, and another assigning the accusative to NumPs. In fact, Łojasiewicz 1979, p. 158, discusses the possibility of a single distributive PO assigning a separate case, *distributivus*, which would always be syncretic with locative or accusative, depending on the grammatical class.[8] She rejects this idea, though, on the basis of the apparent impossibility of such NP and NumP *distributivus* phrases to be coordinated into a single argument of PO and claims that the following example should only mean *You'll get one apple each, as well as two pears and five plums*, and not – as intended – *Each of you will get one apple, two pears and five plums*:

(16) Dostaniecie po jednym jabłku, dwie gruszki i pięć śliwek.
receive-you.FUT DISTR one.LOC apple.LOC two.ACC pears.ACC and five.ACC plums.GEN
'Each of you will get one apple, two pears and five plums.' *(intended)*
'You will get one apple each, as well as two pears and five plums.' *(actual)*

While remaining agnostic about such examples, we concur with Łojasiewicz 1979 that PO$_{\mathrm{N}}$ and PO$_{\mathrm{NUM}}$ should not be conflated into a single lexeme. In the remainder of this empirical section we will have nothing more to say about the adnominal PO$_{\mathrm{N}}$ and will concentrate on PO$_{\mathrm{NUM}}$.

2.2 Three distributive elements PO

2.2.1 Adnumeral PO in subject positions

As in other Indo-European languages, finite verbs agree with nominative subjects in Polish, and otherwise occur in the default third person singular neuter form (Dziwirek, 1990). This generalisation is upheld in (7) and (13) above, where the subjects headed by PO$_{\mathrm{N}}$ and PO$_{\mathrm{NUM}}$, respectively, are prepositional phrases and, hence, caseless. From this perspective, the following examples from Łojasiewicz 1979, p. 154, are surprising:[9]

(17) W pokojach będą po dwa fotele.
in rooms be.FUT.PL DISTR two.NOM.PL armchair.NOM.PL
'There will be two armchairs in each room.'

(18) Na ławkach leżały po trzy arkusze papieru.
on benches lay.PL PO three.NOM.PL sheet.NOM.PL paper.GEN.SG
'There lay three sheets of paper on each bench.'

Here, the verb clearly agrees with the numeral phrase following PO$_{\mathrm{NUM}}$. Łojasiewicz 1979 does not draw the obvious conclusion from these examples, but if the overwhelming generalisation concerning subject–verb agreement in Polish is to be maintained, (17)–(18) must be analysed as involving nominative subjects. In particular, such subjects cannot be run-of-the-mill prepositional phrases.

[8] She also considers the two fossilised expressions *po czemu* 'how much each' and *po złotemu* 'one zloty each', where *czemu* and *złotemu* are dative forms.

[9] Case values indicated in glosses reflect the received wisdom. In the analysis presented below we will claim that the numeral (*dwa*, *trzy*) and the noun heading the following NP (*fotele*, *arkusze*) are in the accusative, and that PO is the sole bearer of the nominative case; see §2.3.

The issue is somewhat obfuscated by the fact that numeral phrases following PO$_{\text{NUM}}$ in all examples above are syncretic between nominative and accusative, at least in the sense that they may occur in subject positions and in (accusative) direct object positions.[10] So perhaps all numeral phrases ocurring after PO$_{\text{NUM}}$ should be analysed as nominative, rather than accusative?

Fortunately, there exist non-syncretic nominative forms of the paucal numerals DWA 'two', TRZY 'three' and CZTERY 'four', namely, the human-masculine forms *dwaj*, *trzej* and *czterej*, as in the following example:

(19) Radę tworzyli dwaj przedstawiciele regionu.
council.ACC constituted.PL two.NOM representatives.NOM region.GEN
'Two region representatives constituted the council.'

Crucially, such nominative forms cannot occur after PO$_{\text{NUM}}$ in accusative or "secondary genitive" positions, which confirms the analysis of PO$_{\text{NUM}}$ as governing the accusative – not nominative – case there:

(20) (Nie) przydzieliłem im po dwóch przedstawicieli.
NEG assigned-I them.DAT DISTR two.ACC representatives.ACC/GEN
'I (did not) assign(ed) them two representatives each.'

(21) *(Nie) przydzieliłem im po dwaj przedstawiciele.
NEG assigned-I them.DAT DISTR two.NOM representatives.NOM

On the other hand, phrases headed by such unambiguously nominative paucal numerals may co-occur with PO$_{\text{NUM}}$ in the subject position, duly resulting in subject–verb agreement; although in some publications they are regarded marginal (Łojasiewicz, 1979, p. 158), doubtful or even downright unacceptable (Derwojedowa, 2011, pp. 144–145), they do occur in texts, as in the following attested examples:[11]

(22) Prezydent proponuje, aby Radę Federacji tworzyli po
president proposes that council.ACC federation.GEN constitute.PL DISTR
dwaj przedstawiciele każdego regionu…
two.NOM representatives.NOM each.GEN region.GEN
'The President proposes that two representatives of each region constitute the Federation Council.' (NKJP)

[10] See Przepiórkowski 1999 for arguments that non-paucal numerals (as well as some human-masculine paucal numerals) in the subject position are in fact accusative; e.g., (13) without the *po* would still be grammatical and the subject *kilka owoców* would be analysed as accusative. On the other hand, (non-human-masculine) paucal numeral forms like *dwa* 'two' and *trzy* 'three' in (17)–(18), would be analysed as nominative. The observation that some numeral phrases in the subject position occur in the accusative has a long history, dating back at least to Małecki 1863 and Krasnowolski 1897, and – more recently – Franks 1995, but it is also very controversial in Polish linguistics; see, e.g., Saloni 2005 and Miechowicz-Mathiasen and Witkoś 2007 for discussion, and Przepiórkowski and Patejuk 2012a,b for an LFG analysis.

[11] The first example comes from the National Corpus of Polish (NKJP; Przepiórkowski et al. 2012; `http://nkjp.pl`), the second – from the Internet (found via Google; `http://historia.pgi.pl/demokracja.php`, last accessed on 30 September 2013).

(23) Do Senatu wybierani są po dwaj senatorzy z każdego stanu.
to Senate elected.PL are.PL DISTR two.NOM senators.NOM from each state
'Two senators from each state are elected to the Senate.' (Google)

(24) …awans uzyskali po trzej najlepsi z każdej kategorii.
promotion obtained.PL DISTR three.NOM best.NOM.PL from each category
'Three best ones from each category qualified.' (Google)

Also Łojasiewicz 1979, p. 158, admits forms such as *dwaj* "in some constructions", citing as grammatical the following example:

(25) Stańcie tu, po dwaj z każdej strony.
stand.IMP.PL here DISTR two.NOM from each side
'Stand here, two on each side!'

In summary, the data discussed in this subsection calls for distinguishing (at least) two adnumeral elements PO_{NUM}: one, which we will call $\text{PO}^{\text{ACC}}_{\text{NUM}}$, assigns the accusative case, even in the "secondary genitive" positions, and another one, $\text{PO}^{\text{MOD}}_{\text{NUM}}$, which may occur with nominative numeral phrases. The relative distribution of these two distributive adnumeral elements will be discussed in §2.3, but first we provide additional arguments for the existence of a separate $\text{PO}^{\text{MOD}}_{\text{NUM}}$ and some justification for the superscript MOD (for *modifier*).

2.2.2 Adnumeral PO in other positions

As apparently first noted in Przepiórkowski 2010, PO_{NUM} sometimes occurs also in dative positions. When it does, the numeral phrase must also bear the dative case. The following attested examples illustrate this:

(26) …nagroda należy się po trzem osobom z każdej klasy…
reward is due to DISTR three.DAT person.DAT.PL from each class
'Three people from each class deserve a reward.' (NKJP)

(27) Broń… została przekazana po dwóm osobom z każdego ugrupowania.
weapon AUX transferred.PASS DISTR two.DAT person.DAT.PL from each group
'The weapon was handed in to two people from each group.' (Google)

(28) …cyklicznie dawał odpoczywać po dwóm zawodnikom…
cyclically let.SG rest DISTR two.DAT players.DAT
'He cyclically let two players take rest.' (Google)

While perhaps less frequent, analogous examples may be found involving instrumental positions,[12] cf. (29)–(31), and even an occasional genitive or locative position, cf. (32) and (33), respectively.

(29) Obie strony dysponują w końcu po czterema armiami.
both sides have at their disposal in the end DISTR four.INST armies.INST

[12] We are grateful to Anna Kibort for pointing this out.

‘Both sides have at their disposal four armies each in the end.’ (Google)

(30) Każde z nich w białym kitlu, dużych okularach, z po dwiema
each of them in white lab coat big glasses with DISTR two.INST
teczkami – w jednej są narzędzia, w drugiej dokumentacja.
briefcases.INST in one are tools in second documentation
‘Each of them in a white lab coat, big glasses, with two briefcases each – tools are in the first one, documentation in the other.’ (Google)

(31) Jego… uszy są… ozdobione po trzema złotymi kolczykami u
his ears are ornamented DISTR three.INST gold.INST earrings.INST at
dołu małżowiny.
bottom auricle
‘His ears are ornamented with three gold earrings each at the bottom of the auricle.’ (Google)

(32) Komisja pracuje w zespołach złożonych z po dwóch
Commission works in teams consisting of DISTR two.GEN
przedstawicieli strony kościelnej i strony rządowej oraz po
representatives.GEN side church and side governmental and DISTR
jednym przedstawicielu organów nadrzędnych nad uczestnikami
one.LOC representative.LOC authorities superior to participants
postępowania.
proceedings
‘(Church Property) Commission works in teams consisting of two representatives each of the church side and the government side and of one representative each of authorities superior to the participants of the proceedings.’ (NKJP)

(33) Prawie wszyscy zawodnicy występowali w po dwóch formacjach.
almost all players played in DISTR two.LOC formations.LOC
‘Almost all players played in two formations each.’ (Google)

Similarly to (22)–(25), such examples are often judged marginal or even unacceptable by many native speakers, and as fully acceptable by others. It seems reasonable, then, to assume that the same lexical item is responsible for all these occurrences and that it is internalised in the grammars of different native speakers to various extents. The most conspicuous feature of this $\text{PO}^{\text{MOD}}_{\text{NUM}}$ is that it is transparent to case assignment and simply transmits the case assigned to its position: nominative in (22)–(25) (and, perhaps, in the earlier (17)–(18), but see below), dative in (26)–(28), instrumental in (29)–(31), genitive in (32) and locative in (33). We conclude that $\text{PO}^{\text{MOD}}_{\text{NUM}}$ cannot be analysed as a case-assigning preposition, but should rather be treated as an element transparent to case assignment, perhaps an “adnumeral operator” in the sense of Grochowski 1997, §2.4.10. Below, in §3.2, we provide an LFG analysis which – while preserving this intuition – still treats $\text{PO}^{\text{MOD}}_{\text{NUM}}$ as a syntactic head, on a par with $\text{PO}^{\text{ACC}}_{\text{NUM}}$ and PO_{N}.

2.3 The distribution of the three elements PO

It is easy to recognise $\textsc{po}_{\textrm{N}}$ – it occurs with nominal, not numeral phrases. On the other hand, it is not always clear which of the two adnumeral elements, $\textsc{po}^{\textrm{ACC}}_{\textrm{NUM}}$ or $\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$, surfaces in a given context. Consider the basic example (2). In the previous subsection we established that $\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$ is transparent to case assignment, so it could be claimed that *po* in this example is a form of $\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$ and that the accusative case on *dwa jabłka* 'two apples' reflects the accusative case assignment to the direct object. On the other hand, we also saw that at least in some adnumeral positions, namely (14)–(15), a different PO is needed, $\textsc{po}^{\textrm{ACC}}_{\textrm{NUM}}$, which assigns the accusative case, and this $\textsc{po}^{\textrm{ACC}}_{\textrm{NUM}}$ could also be claimed to occur in (2). So now we have three ways of analysing (2): as involving $\textsc{po}^{\textrm{ACC}}_{\textrm{NUM}}$, as involving $\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$, or as ambiguous between the two analyses.

Similarly, (13) could be analysed as involving $\textsc{po}^{\textrm{ACC}}_{\textrm{NUM}}$, which assigns the accusative to *kilka owoców* 'several fruit', or as involving $\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$, transparent to the assignment of the accusative case to such numeral phrases in the subject position (cf. fn. 10), or as ambiguous between the two.

When deciding such cases, we take as crucial the observation of the previous subsection, namely, that occurrences of $\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$ are rare, often judged as marginal or unacceptable. That is, since both (2) and (13) are fully acceptable, we assume that they involve $\textsc{po}^{\textrm{ACC}}_{\textrm{NUM}}$. Note that this in principle does not exclude the possibility of the ambiguity between $\textsc{po}^{\textrm{ACC}}_{\textrm{NUM}}$ and $\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$, but the latter analysis will be more marginal than the former, perhaps altogether inaccessible to some speakers.[13]

On the basis of these considerations we assume that the three elements PO surface in the following examples:

$\textsc{po}_{\textrm{N}}$ – (1), (7)–(9), (10b)–(12b);

$\textsc{po}^{\textrm{ACC}}_{\textrm{NUM}}$ – (2), (13)–(15), (20);

$\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$ – (22)–(33).

The only two examples involving PO not classified here are (17)–(18), with paucal non-human-masculine numeral phrases following PO in the subject position. Such examples, while exhibiting subject–verb agreement and, hence, a nominative subject, are judged as acceptable by Łojasiewicz (1979, p. 154) and as significantly more acceptable than the clear cases of $\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$ in (23) and (27) by Derwojedowa (2011, p. 145). As such, they seem to contradict the generalisation just proposed: since they occur in the nominative position and apparently contain a nominative NumP they should involve $\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$, but since they are acceptable, or at least clearly more acceptable than uncontroversial uses of $\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$, they should involve $\textsc{po}^{\textrm{ACC}}_{\textrm{NUM}}$.

The following section presents an analysis which eliminates this contradiction. According to this analysis, the acceptable (17)–(18) involve the accusative-assigning $\textsc{po}^{\textrm{ACC}}_{\textrm{NUM}}$, so the numeral phrases *dwa fotele* 'two armchairs' and *trzy arkusze*

[13] However, if $\textsc{po}^{\textrm{MOD}}_{\textrm{NUM}}$ surfaced in (2), we would expect – contrary to facts – the numeral phrase to be able to occur in the genitive when the verb is negated or nominalised; see the discussion in §3.4 below, esp., under (47).

papieru 'three sheets of paper' are taken to be accusative here. However, $\text{PO}^{\text{ACC}}_{\text{NUM}}$ is not treated as an ordinary preposition here, but rather an element which may receive its own case – here nominative – and agree with the verb in number and gender.

3 LFG Analysis

3.1 Grammatical classes of the three elements PO

What are the grammatical classes – or parts of speech – of the three elements established above? They are all clearly function – rather than content – words, so we employ here the comprehensive classification of Polish function expressions of Grochowski 1997.

First of all, PO_{N} must be classified as a preposition (P), as it governs the – strictly prepositional – locative case.

Secondly, $\text{PO}^{\text{MOD}}_{\text{NUM}}$ rather easily falls into the class of "adnumeral operators" (abbreviated to ADNUM here). Grochowski 1997, §2.4.10, defines adnumeral operators as noninflecting lexemes which cannot function independently as utterances, which cannot relate constituents (in the sense in which conjunctions and prepositions do relate constituents), which have a fixed linear position and which do not combine with a verb but do combine with a numeral. Prototypical examples include BLISKO 'nearly' (as in *blisko trzy miesiące* 'nearly three months'), OKOŁO 'around' (e.g., *około dwa tygodnie* 'around two weeks') and PRZESZŁO 'over' (e.g., *przeszło sto osób* 'over a hundred people'). While it is not a defining characteristic of adnumeral operators, they are usually taken to have an approximative meaning (Grochowski 1997, Duszkin 2010, Doboszyńska-Markiewicz 2012). The distributional elements PO do not share this approximative feature with prototypical adnumeral operators, but otherwise $\text{PO}^{\text{MOD}}_{\text{NUM}}$ satisfies all strictly defining properties of adnumeral operators.

Finally, $\text{PO}^{\text{ACC}}_{\text{NUM}}$ is a little harder to fit into Grochowski's (1997) classification: it occurs strictly adnumerally, like adnumeral operators, but it also governs a specific case (accusative), like prepositions. This situation is somewhat similar to that of OKOŁO 'around' which may govern the genitive case or may be transparent to case assignment. For this reason, Grochowski 1997, pp. 73–74, distinguishes two lexemes OKOŁO, even though both occur adnumerally: a preposition and an adnumeral operator.Following this example, one should classify $\text{PO}^{\text{ACC}}_{\text{NUM}}$ as a preposition. However, in LFG, grammatical class labels such as N, P or – here – ADNUM are used mainly in syntactic (c-structure) rules. In the syntactic analysis proposed in §3.3 below, $\text{PO}^{\text{ACC}}_{\text{NUM}}$ and $\text{PO}^{\text{MOD}}_{\text{NUM}}$, but not PO_{N}, are handled by the same syntactic rule, namely, the rule for numeral phrases involving adnumeral operators. Hence, we decide to include $\text{PO}^{\text{ACC}}_{\text{NUM}}$ in the class of adnumeral operators, together with $\text{PO}^{\text{MOD}}_{\text{NUM}}$.

3.2 Lexical entries of the three elements PO

The immediate problem when constructing lexical entries for the three elements PO is how not to miss obvious generalisations. In particular, the three entries share at least the form (*po*), the distributive semantics, and the part of the PRED value specifying that the predicate is PO, regardless of its arity (i.e., that $(\uparrow$ PRED FN$) =$ PO, cf. Asudeh et al. 2013, p. 23).[14]

The standard LFG way to handle such potential redundancies is to employ the mechanism of templates (Dalrymple et al., 2004; Asudeh et al., 2013). The first version of the common template for the three lexical entries is given in (34), and the general schema of the entries is presented in (35).

(34) PODIST = $(\uparrow$ PRED FN$) =$ PO *(provisional)*
DISTRIBUTIVE-SEMANTICS

(35) PO P @PODIST … *(general schema)*
ADNUM @PODIST …
ADNUM @PODIST …

Note that the form *po* is specified once in the lexical entries (35), and the predicate and the semantic constructor – in the shared PODIST template in (34). We do not have anything to say about the semantics of distance distributivity here (DISTRIBUTIVE-SEMANTICS is just a placeholder in (34)), but see Przepiórkowski 2013a for an account compatible with the current syntactic analysis.

As a preposition, PO_{N} is a head which takes an object and assigns (or checks) the locative case: $(\uparrow$ OBJ CASE$) =$ LOC. The PRED value of PO_{N} will thus be 'PO⟨OBJ⟩'.

Also $\text{PO}^{\text{ACC}}_{\text{NUM}}$ must be analysed as the head of the "$\text{PO}^{\text{ACC}}_{\text{NUM}}$ + NumP[ACC]" construction; otherwise, if NumP[ACC] were the head, the construction would be expected to occur only in accusative positions. Hence, the lexical entry of $\text{PO}^{\text{ACC}}_{\text{NUM}}$ will contain the equations $(\uparrow$ OBJ CASE$) =$ ACC and PRED $=$ 'PO⟨OBJ⟩'.

Finally, since we would like $\text{PO}^{\text{MOD}}_{\text{NUM}}$ to be handled by the same c-structure rule as $\text{PO}^{\text{ACC}}_{\text{NUM}}$ (cf. §3.3 below), they should ideally both have the same headedness status with respect to the following numeral phrase, so we should have PRED $=$ 'PO⟨OBJ⟩' again. Hence, since the complete PRED value of the three elements PO is the same, we can make it part of the template:

(36) PODIST = $(\uparrow$ PRED$) =$ 'PO⟨OBJ⟩' *(final)*
DISTRIBUTIVE-SEMANTICS

(37) PO P @PODIST *(all not final)*
$(\uparrow$ OBJ CASE$) =$ LOC …
ADNUM @PODIST
$(\uparrow$ OBJ CASE$) =$ ACC …
ADNUM @PODIST …

However, if $\text{PO}^{\text{MOD}}_{\text{NUM}}$ is the head of the "$\text{PO}^{\text{MOD}}_{\text{NUM}}$ + NumP" construction, how can we explain the subject–verb agreement in (22)–(24)? Evidently, $\text{PO}^{\text{MOD}}_{\text{NUM}}$ in such environments must bear the nominative case (a precondition for the subject–verb agreement in Polish) and, moreover, must "inherit" number and gender features from its NumP

[14]We assume here that the distributive PO, which – unlike "case-marking prepositions" arbitrarily governed by verbs – contributes to the semantics of the sentence, has its own PRED value.

OBJ. To this end, we treat PO$^{\text{MOD}}_{\text{NUM}}$ roughly as a weak head in the sense in which this term is used in Head-driven Phrase Structure Grammar.

Tseng 2002, p. 273, defines a weak head as an element which inherits from its complement all morphosyntactic featues (the HEAD value), as well as semantics and any unsatisfied valence properties, and adds a specific marking. Such weak heads are to be used *in lieu* of the standard HPSG markers, e.g., in the analysis of complementisers such as THAT. Such a weak head complementiser takes a clause as its argument, inherits the HEAD value of this clause, i.e., all morphosyntactic properties of the verb heading the clause, and introduces the MARKING attribute with the value *that*. Tseng 2002, p. 279, advocates the use of this mechanism in the analysis of German non-predicative prepositions, to some extent similar to the distributive PO discussed here. Further, Abeillé 2003, 2006, building on this idea, proposes to treat French coordinate conjunctions as weak heads, *sans* the requirement of sharing the semantics. In this paper, we will call such elements – inheriting morphosyntactic properties of their complements, but not their semantics – *weakish heads*.

In LFG, a natural way to encode the HPSG idea of weak(ish) heads is to use the mechanism of restriction, as defined in Kaplan and Wedekind 1993. Since we do not want to equate the 'PO⟨OBJ⟩' PRED value of PO$^{\text{MOD}}_{\text{NUM}}$ with the PRED value of its numeral object, nor do we want to say that the OBJ of PO$^{\text{MOD}}_{\text{NUM}}$ (i.e., the NumP argument) is the same as the OBJ of the following numeral (i.e., the NP argument of the numeral), the relevant equation to add to the lexical entry of PO$^{\text{MOD}}_{\text{NUM}}$ is: $\uparrow\backslash\text{PRED}\backslash\text{OBJ} = (\uparrow\ \text{OBJ})\backslash\text{PRED}\backslash\text{OBJ}$. As the values of all other features are shared between PO$^{\text{MOD}}_{\text{NUM}}$ and its numeral object, the whole "PO$^{\text{MOD}}_{\text{NUM}}$ + NumP" construction will have the same case (nominative in (22)–(25), but, e.g., instrumental in (29)–(31), etc.), number and gender as the object NumP.

This brings us back to the promise made at the end of §2.3 concerning (17)–(18). As noted above, these examples exhibit subject–verb agreement, implying that the whole subject PO-phrase is in the nominative case, but – unlike, e.g., (22)–(24) – they are fully acceptable, suggesting that these examples involve PO$^{\text{ACC}}_{\text{NUM}}$ rather than the marginal PO$^{\text{MOD}}_{\text{NUM}}$. The analysis we would like to propose here is to treat PO$^{\text{ACC}}_{\text{NUM}}$ as a weakish head, on a par with PO$^{\text{MOD}}_{\text{NUM}}$. But, since PO$^{\text{ACC}}_{\text{NUM}}$ assigns the accusative case and may itself occur also in non-accusative positions (nominative and "secondary genitive"), we assume that PO$^{\text{ACC}}_{\text{NUM}}$ does not inherit CASE value from its OBJ. The next version of the lexical entries of the distributive PO summarises these considerations:

(38)	PO	P	@PODIST $(\uparrow\ \text{OBJ CASE}) = \text{LOC}\ \ldots$	*(all not final)*
		ADNUM	@PODIST $(\uparrow\ \text{OBJ CASE}) = \text{ACC}$ $\uparrow\backslash\text{PRED}\backslash\text{OBJ}\backslash\text{CASE} = (\uparrow\ \text{OBJ})\backslash\text{PRED}\backslash\text{OBJ}\backslash\text{CASE}\ \ldots$	
		ADNUM	@PODIST $\uparrow\backslash\text{PRED}\backslash\text{OBJ} = (\uparrow\ \text{OBJ})\backslash\text{PRED}\backslash\text{OBJ}\ \ldots$	

The final issue to be formalised in such lexical entries is the limited distribution of various elements po. As repeatedly noted, po_{N} and $\text{po}^{\text{ACC}}_{\text{NUM}}$ may only occur in nominative, accusative and "secondary genitive" positions. Przepiórkowski 1999, §5.1.4.3, notes that these positions seem to be exactly the structural case positions in Polish – in the sense of the structural vs. lexical (or inherent) case dichotomy long discussed in the generative literature – and we will assume here that this observation is essentially correct. Hence, the first two lexical entries must include equations encoding this restriction.

Technically, we follow Przepiórkowski and Patejuk 2012a,b in assuming the presence of an attribute like SC on cased phrases, whose value is + if and only if this phrase bears a structural case. Separate principles of the grammar will have the effect of constraining structural case positions to nominative, accusative and "secondary genitive", and lexical case positions to "primary genitive", dative, instrumental and locative;[15] see Przepiórkowski 1999 for a more comprehensive HPSG formalisation of the structural/lexical case dichotomy.

As to $\text{po}^{\text{MOD}}_{\text{NUM}}$, (22)–(33) show that it may occur at least in nominative, dative and instrumental positions, with some examples found also for the genitive and locative. Hence, it is reasonable to adopt as the first approximation the hypothesis that $\text{po}^{\text{MOD}}_{\text{NUM}}$ may, in principle, marginally occur in any case position, perhaps with stronger dispreferences for some positions than for other.[16]

The relevant parts of the final (but see (41) below) lexical entries for the three distributive elements po are given below:[17]

(39)	po	P	@poDist	*(almost final)*
			$(\uparrow \text{SC}) = +$	
			$(\uparrow \text{OBJ CASE}) = \text{LOC}$	
		AdNum	@poDist	*(final)*
			$(\uparrow \text{SC}) = +$	
			$(\uparrow \text{OBJ CASE}) = \text{ACC}$	
			$\uparrow\backslash\text{PRED}\backslash\text{OBJ}\backslash\text{CASE} = (\uparrow \text{OBJ})\backslash\text{PRED}\backslash\text{OBJ}\backslash\text{CASE}$	
		AdNum	@poDist	*(final)*
			$\uparrow\backslash\text{PRED}\backslash\text{OBJ} = (\uparrow \text{OBJ})\backslash\text{PRED}\backslash\text{OBJ}$	

3.3 po at c-structure

We do not assume any special syntactic rules involving po_{N}. Categorially, it is a preposition, and it combines with the following NP via the usual rules forming prepositional phrases. In particular, we claim that any restrictions on the argument

[15] We do not consider the seventh case in Polish, vocative, which is never assigned in the lexicon.

[16] In particular, we have not found any examples of $\text{po}^{\text{MOD}}_{\text{NUM}}$ in structural (or "secondary") genitive positions, and it seems impossible to decide whether such $\text{po}^{\text{MOD}}_{\text{NUM}}$ may occur in accusative positions, as it is indistinguishable from $\text{po}^{\text{ACC}}_{\text{NUM}}$ in such environments; see §3.4 below.

[17] It is possible to factor out the equation $(\uparrow \text{SC}) = +$ into a subtemplate of the poDist template, to further reduce redundancy in these lexical entries.

of PO$_N$ are best formulated at levels different than c-structure. One such restriction, concerning cardinality, was mentioned in §2.1 and it is clearly a semantic constraint (Przepiórkowski, 2008; Bogusławski, 2012). Another, however, looks like a c-structure constraint: PO$_N$ may apparently only combine with NPs, not with NumPs. This could be naturally encoded via a special c-structure rule to the effect that the phrase following PO$_N$ must be an NP, or – perhaps less naturally – by an f-structure rule saying the OBJ of PO$_N$ cannot be numeral. We choose here the latter option, also because the object of PO$_N$ – just as nominal objects of other prepositions – may actually also be realised as an adjective phrase such as *najlepsza z ofert* '(the) best of offers' in the following example:

(40) Komisja… wybrała… po najlepszej… ze złożonych ofert
commission.NOM chose DISTR best.LOC.SG of submitted.GEN offers.GEN
każdego wykonawcy.
every.GEN contractor.GEN
'The commission selected the best offer each from those submitted by every contractor.' (Google)

In Polish, numerals may be identified at f-structure via the attribute ACM ("accommodability"), whose exact meaning is explained in Przepiórkowski and Patejuk 2012a,b, so the exclusion of numeral phrases may be encoded via $\neg(\uparrow$ OBJ ACM$)$:

(41) PO P @PODIST *(final)*
$(\uparrow$ SC$) = +$
$(\uparrow$ OBJ CASE$) =$ LOC
$\neg(\uparrow$ OBJ ACM$)$

On the other hand, a special c-structure rule is needed for introducing an adnumeral operator, such as PO$^{\text{ACC}}_{\text{NUM}}$ and PO$^{\text{MOD}}_{\text{NUM}}$, into a numeral phrase:[18]

(42) NumP $\rightarrow$ AdNum Num NP
$\downarrow=\uparrow$ $(\uparrow$ OBJ$) = \downarrow$ $(\uparrow$ OBJ OBJ$) = \downarrow$

One thing to note about this rule is that, while it is a rule for a numeral phrase, the actual head (in the sense of the $\downarrow=\uparrow$ equation) is the adnumeral operator. This is possible due to the weakish head status of AdNum elements, which inherit all relevant feature values from the numeral argument.

Note also that, according to this rule, the numeral is adjacent to the preceding adnumeral operator. This reflects the following judgements from Przepiórkowski 2010 (attributed to Jadwiga Linde-Usiekniewicz and Paweł Rutkowski, p.c.):

(43) a. Posłał go po 2 smaczne jabłka.
sent-he him for 2.ACC tasty.ACC apples.ACC
'He sent him to fetch 2 tasty apples.'

b. Posłał go po smaczne 2 jabłka.
sent-he him for tasty.ACC 2.ACC apples.ACC

[18] As is standard in Polish and Slavic linguistics, we assume that the NP following a numeral is its argument, i.e., that numeral phrases are normally headed by the numeral.

(44) a. Dał każdemu po 2 smaczne jabłka.
gave-he everyone DISTR 2.ACC tasty.ACC apples.ACC
'He gave each of them 2 tasty apples.'

b. *Dał każdemu po smaczne 2 jabłka.
gave-he everyone DISTR tasty.ACC 2.ACC apples.ACC

While (44b) perhaps does not really deserve the asterisk (Derwojedowa, 2011, pp. 145–146), there is a palpable acceptability contrast between the fully acceptable (43b), involving the run-of-the-mill preposition PO homophonous with the distributive elements considered in this paper, and the adnumeral $\text{PO}^{\text{ACC}}_{\text{NUM}}$ in (44b). When the adnumeral operator is present, the adjective may only occur NP-internally, as in (44a), in concordance with rule (42). On the other hand, in case of the usual (AdNum-less) numeral phrase, adjectives may occur either NP-internally, as in (43a), or they may immediately precede the numeral, as in (43b), in concordance with the main rule for numeral phrases, given in (45):[19]

(45) NumP $\rightarrow$ AdjP* Num NP
$\downarrow \in (\uparrow (\text{OBJ})\ \text{ADJ})$ $\downarrow = \uparrow$ $(\uparrow \text{OBJ}) = \downarrow$

As also noted in Przepiórkowski 2010, other adnumeral operators, such as z 'some, about', seem to follow the pattern of (44), supporting the analysis just sketched:[20]

(46) a. Dałem każdemu z 5 moich książek.
gave-I everyone.DAT about 5.ACC my.GEN books.GEN
'I gave each of them around 5 books of mine.'

b. *Dałem każdemu z moich 5 książek.
gave-I everyone.DAT about my.GEN 5.ACC books.GEN

3.4 Analysis at work

Let us illustrate the analysis of this section with a few examples, starting with the most basic (1)–(2).

In (1), the usual c-structure rule for prepositional phrases (not given in this paper) may be used to form the PP *po jabłku* 'DISTR apple' headed by the preposition PO_N: the locative case of *jabłku* is consistent with case requirements in (41), the lexical entry of PO_N. On the other hand, this c-structure rule cannot be used to form an analogous PP *po dwa jabłka* 'DISTR two apples' in (2), as *dwa jabłka* is a numeral phrase bearing the ACM attribute and (41) contains the constraint $\neg(\uparrow \text{OBJ ACM})$ (and another, specifying the locative case). Moreover, none of the adnumerative operators PO may form a constituent with *jabłku*, as the relevant c-structure rule (42) requires the presence of a numeral (and, additionally, $\text{PO}^{\text{ACC}}_{\text{NUM}}$ requires its object to be in the accusative). Hence, the only distributive analysis of *po jabłku* must involve PO_N. While categorially *po jabłku* is a PP, it bears the SC = + attribute introduced

[19]The OBJ is optional on AdjP* because such adjectival phrases may modify either the numeral directly or its NP argument.

[20]A related contrast is reported in Doboszyńska-Markiewicz 2012, p. 132.

in (41), so – unlike typical prepositional phrases – it may occur in structural case positions, including the accusative in (1).

On the other hand, in (2), involving the apparent numeral phrase *dwa jabłka*, the c-structure rule (42) may form the actual numeral phrase consisting of an adnumeral operator *po*, the numeral *dwa* and the NP *jabłka*. Note that either $\textsc{po}^{\textsc{acc}}_{\textsc{num}}$ or $\textsc{po}^{\textsc{mod}}_{\textsc{num}}$ may be employed here and that either may combine with the accusative numeral *dwa*. $\textsc{po}^{\textsc{acc}}_{\textsc{num}}$ forms a NumP whose case is constrained by the equation $\textsc{sc} = +$, and $\textsc{po}^{\textsc{mod}}_{\textsc{num}}$ forms a NumP specified as accusative (as it shares case with its object). Thus, either NumP may occur in the structural accusative position in (2), rendering the sentence spuriously ambiguous. We stipulate that the reading involving the marginal $\textsc{po}^{\textsc{mod}}_{\textsc{num}}$ is blocked by the fully acceptable structure with $\textsc{po}^{\textsc{acc}}_{\textsc{num}}$, but we may also extend the lexical entry of $\textsc{po}^{\textsc{mod}}_{\textsc{num}}$ by a constraint to the effect that $\textsc{po}^{\textsc{mod}}_{\textsc{num}}$ cannot bear the structural accusative or the structural genitive case (see fn. 21 below).

Considering the negated version of (1) in (8), the analysis proceeds in a way fully analogous to that of (1); the PP *po jabłku* now occurs in the genitive of negation position, which is also a structural case ($\textsc{sc} = +$) position.

Turning to the negated version of (2), given below (see (14) for an analogous example), we note that it does not exhibit the ambiguity seen in (2).

(47) Nie dałem im po dwa jabłka.
NEG gave-I them.DAT DISTR two.ACC apples.ACC
'I didn't give them two apples each.'

Only the numeral phrase formed with $\textsc{po}^{\textsc{acc}}_{\textsc{num}}$ may occur here, bearing the $\textsc{sc} = +$ constraint and having its case resolved to genitive. In contrast, $\textsc{po}^{\textsc{mod}}_{\textsc{num}}$ would transmit the genitive case to its object, resulting with a clash with the accusative *dwa jabłka*.[21]

Let us move to the subject position. In (7), involving the $\textsc{po}_{\textsc{n}}$, the PP *po jabłku* bears again the $\textsc{sc} = +$ specification, so it may occur in the structural subject position, possibly receiving the nominative case. This calls for an explanation of the subject–verb non-agreement observed in (7) – the verb occurs in the default third person singular neuter form, apparently contrary to the generalisation that in Polish (as in other Indo-European languages) verbs agree with nominative subjects. The simplest stipulation would be that, while possibly bearing the CASE feature, such a PP headed by $\textsc{po}_{\textsc{n}}$ still does not bear number and gender (recall that $\textsc{po}_{\textsc{n}}$ is not a weakish head), so the verb cannot agree with it, reverting to the "default" form.[22]

Also the PO-phrase *po kilka owoców* 'DISTR several fruits' does not agree with the verb in (13), but the reason for this lack of agreement is different here. The numeral *kilka* 'several' is a non-paucal numeral governing a genitive NP (*owoców*

[21] However, the unacceptable **Nie dałem im po dwóch jabłek*, with the genitive *dwóch jabłek* 'two apples', should be grammatical with $\textsc{po}^{\textsc{mod}}_{\textsc{num}}$, unless we introduce the abovementioned constraint implying that $\textsc{po}^{\textsc{mod}}_{\textsc{num}}$ cannot bear the structural genitive case.

[22] Another stipulation, more consistent with the current XLE implementation (Patejuk and Przepiórkowski, 2012), would be to say that verbs only agree with broadly nominal subjects, excluding clausal subjects, infnitival subjects and – crucially – PPs regardless of case.

here) and, as such, it would receive the accusative case in the subject position (Przepiórkowski, 1999; Przepiórkowski and Patejuk, 2012a,b). Both adnumeral operators $\text{PO}^{\text{ACC}}_{\text{NUM}}$ and $\text{PO}^{\text{MOD}}_{\text{NUM}}$ are weakish heads inheriting, among other features, the ACM feature of numerals, crucial for the case assignment principles of Przepiórkowski and Patejuk 2012a,b. On the basis of the REC ("governing") value of this feature, the whole PO-phrase *po kilka owoców* in the subject position receives the accusative case, just as the NumP *kilka owoców* would. So now the subject is broadly nominal (specifically, numeral), but it is in the accusative, hence, it does not agree with the verb, which again occurs in the default third person singular form (the neuter gender is not visible on present tense forms). Note that the same spurious ambiguity may be observed here as in the case of the object position in (2), and that it could be dealt with by the same constraint prohibiting $\text{PO}^{\text{MOD}}_{\text{NUM}}$ from occurring in structural accusative positions.

This constraint cannot be extended to just any structural positions, as $\text{PO}^{\text{MOD}}_{\text{NUM}}$ must be allowed to occur in nominative positions, to account for the marginal (22)–(24), which involve uncontroversially nominative paucal numerals agreeing with the verb. As $\text{PO}^{\text{ACC}}_{\text{NUM}}$ assigns the accusative to its object, only $\text{PO}^{\text{MOD}}_{\text{NUM}}$ is possible in here. This PO is a weakish head sharing all morphosyntactic features with its object. In particular, it bears the ACM feature *not* equal to REC (*dwaj* and *trzej* are agreeing paucal numerals, unlike the governing *kilka* and non-paucal numerals) and, hence, receives the nominative case via principles presented in Przepiórkowski and Patejuk 2012a,b and shares this case value with the nominative numeral and further with the NP object of the numeral. Moreover, as adnumeral operators PO also share number and gender with the numeral, they may participate in the subject–verb agreement, resulting in the grammatical (22)–(24).

Finally, let us consider the acceptable examples (17)–(18) involving numerals and NPs syncretic between nominative and accusative. The end of §2.3 promised an analysis of such sentences with $\text{PO}^{\text{ACC}}_{\text{NUM}}$ and it should be clear now how such an analysis should proceed. Concentrating on (17), we note that $\text{PO}^{\text{ACC}}_{\text{NUM}}$ assigns the accusative to *dwa fotele* 'two armchairs', itself bearing the specification SC = +; all other morphosyntactic features are shared between *po* and the numeral *dwa*. Since *dwa* is a paucal agreeing numeral and the whole PO-phrase occurs in the subject position, the phrase receives the nominative case. Hence, contrary to the initial grammatical glosses in (17), case values of particular words in the subject phrase are as indicated below:

(17′) W pokojach będą po dwa fotele.
in rooms be.FUT.PL DISTR.NOM.PL two.ACC.PL armchair.ACC.PL
'There will be two armchairs in each room.'

Again, an analysis involving $\text{PO}^{\text{MOD}}_{\text{NUM}}$ is in principle also possible here, but we assume that it is either blocked by the more acceptable analysis involving $\text{PO}^{\text{ACC}}_{\text{NUM}}$ or that a relevant constraint is added to the lexical entry of $\text{PO}^{\text{MOD}}_{\text{NUM}}$ blocking its occurrence with non-human-masculine nominative numerals.

4 Conclusion

This paper deals with a very infrequent but intriguing phenomenon of distance distributivity in Polish involving function lexemes PO. We demonstrated that (at least) three distinct lexemes are need to handle the variety of distributive constructions, but we also showed how these homophonoous and at the same time homosemous lexemes may be encoded in a way that – via the use of templates – minimises redundancy in the lexicon and in the grammar. In particular, although the case assignment properties of the three elements differ widely, with one of them actually being transparent to such case assignment, all three are analysed as heads of PO-phrases – the two adnumeral elements as so-called weak(ish) heads, in the HPSG sense of the term, encoded in LFG with the use of the restriction mechanism.

Although the analysis presented here interacts closely with the analysis of numeral phrases given in Przepiórkowski and Patejuk 2012a,b, we strived to make the current paper self-contained, with only occasional references to those analyses, perhaps at the cost of oversimplifying slightly at places. We also had nothing to say here about the semantics of such distance distributivity in Polish, instead referring the reader to Przepiórkowski 2013a. While the topic of this paper is empirically negligible in the sense that the proposed analysis of the facts considered here will certainly not improve the results of any wide scope parser of Polish significantly, the complexity of the phenomenon is fascinating and deserves a book-length treatment.

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ENGLISH BENEFACTIVE NPS

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Abstract

English benefactive NPs pattern with arguments in some ways and with adjuncts in others. This paper proposes an analysis of benefactive NPs that accounts for this dual behavior. In particular, I argue that benefactive NPs are generally not included in the basic argument structure of verbs. Instead, they are added by an argument structure rule. In other words, English benefactive NPs are *derived arguments*, in the sense of Needham and Toivonen (2011).[1]

1 Introduction: Benefactive NPs and argumenthood

English benefactives can be expressed with *for*-PPs as in (1) or with NPs (DPs) as in (2) (Fillmore 1965, Green 1974, Oehrle 1976, Allerton 1978, Larson 1988, Jackendoff 1990, Emonds 1993, Wechsler 1995, Shibatani 1996, and others).

(1) a. John baked cookies *for Mary*.
    b. Sandy sang a song *for the children*.

(2) a. John baked *Mary* cookies.
    b. Sandy sang *the children* a song.

This paper addresses the following question: Are benefactive NPs such as *Mary* in (2a) and *the children* in (2b) arguments or adjuncts of the verb? Consider some textbook definitions of arguments and adjuncts.

> "Adjuncts are always optional, whereas complements are frequently obligatory. The difference between them is that a complement is a phrase which is *selected* by the head, and therefore has an especially close relationship with the head; adjuncts, on the other hand, are more like 'bolt-on' extra pieces of information and don't have a particularly close relationship with the head." (Tallerman 2005,98)
>
> "This distinction between arguments and adjuncts is important, but not always easy to make. The basic difference is that arguments are closely associated with the meaning of the predicate itself, while adjuncts are not." (Kroeger 2004,10)
>
> "The arguments are the participants minimally involved in the activity or state expressed by the predicate." (Haegeman 1994,44)

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These quotes illustrate that definitions of argumenthood tend to rely on intuitions that arguments have a close relationship with the predicate, or they are core or necessary participants in the event expressed by the predicate. Benefactives then do not seem to be arguments. Consider again examples (1–2): surely one can bake cookies without baking them for somebody, and one can also sing without an audience. Benefactives thus pattern with adjuncts in that they are not core participants of the predicate.

Another frequently cited criterion for argumenthood is obligatoriness: while adjuncts typically are optional, some arguments are obligatory (3a). However, many uncontroversial arguments are also optional (3b–c):

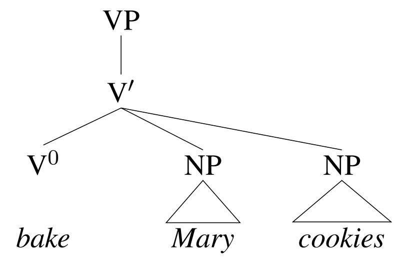
(3) a. Sally was constructing *(an argument).
b. Sandy loves eating (cookies).
c. Susie is outside playing (ice hockey).

Benefactives are optional, compare (2a–b) to (4a–b):

(4) a. John baked cookies.
b. Sandy sang a song.

We can conclude that benefactives pattern with adjuncts in terms of optionality, with the caveat that optionality as a criterion for testing argumenthood is questionable since many arguments are also optional.

The validity of the core criteria for argumenthood can be questioned, but they nevertheless indicate that benefactives are adjuncts and not arguments. However, benefactive NPs are naturally assumed to be complements of the verb in the phrase structure; that is, they appear in an argument position at c-structure:

(5)


Moreover, since benefactives are NPs that appear between the verb and the second object, they are normally treated as f-structure (first) OBJECTS (e.g., Bresnan 2001, ch 14), which is an argument function.[2] In short, it is not clear whether benefactive NPs should be treated as arguments or adjuncts.

Previous work on benefactives has shown that these phrases display a number of interesting characteristics (Green 1974, Oehrle 1976, and others). The goal of this paper is to propose an explicit LFG analysis of benefactive NPs in English that captures their behavior and that also sheds light on the fact that they do not pattern

[2]But see Kibort (2007, 2008), Hudson (1992) and others for discussion of issues that arise when determining the grammatical function of "indirect objects".

clearly with either arguments or adjuncts. The remainder of this paper is structured as follows: Section 2 applies a number of argumenthood tests to benefactive NPs. Section 3 provides a Lexical Mapping Theory analysis of English benefactive NPs. Section 4 discusses the strengths and weaknesses of the proposed analysis.

2 Argumenthood tests

Benefactive NPs pattern with adjuncts in that they do not seem to be core arguments and they are optional, as discussed above. This section subjects English benefactive NPs to a number of other argumenthood tests that have been previously proposed in the literature (see Pollard and Sag 1987, Dalrymple 2001, Needham and Toivonen 2011, and references cited in those works).

2.1 The adjunct island test

It is possible to extract out of arguments (6), but not out of adjuncts (7):

(6) a. I told Mandy to fix the car.
b. What did you tell Mandy to fix?

(7) a. Bill cried after annoying Susan.
b. *Who did Bill cry after annoying?

Adjuncts are 'islands' to extraction, in the terms of Ross (1967). Chomsky (1986), Johnson (2003), and others provide more examples and discussion of adjunct islands.

It is not possible to extract out of benefactive NPs:

(8) a. I cooked the parents of the bride an amazing meal.
b. *Who did you cook the parents of an amazing meal?

The ungrammaticality of (8b) shows that benefactive NPs pattern with adjuncts with respect to extraction. However, extraction out of NPs is independently restricted (see Ross 1967, Huang 1982, Chomsky 1986, Bošković to appear). In (9), the NP *the parents of the bride* is not a benefactive, but extraction is still impossible:

(9) a. I liked the parents of the bride.
b. *Who did you like the parents of?

Since extraction out of NPs is independently restricted, it is problematic to make use of the adjunct island test to gauge the argumenthood status of benefactive NPs.

2.2 The alternation test

Benefactive NPs can alternate with *for*-PPs:

(10) a. John baked *Mary* cookies.
b. John baked cookies *for Mary*.

(11) a. Sandy sang *the children* a song.
b. Sandy sang a song *for the children*.

By what Needham and Toivonen (2011) call the alternation test, PPs that alternate with subject or object NPs are arguments (Lewis 2004).[3] However, the *for*-PP is not examined here, we are instead interested in the status of the benefactive NP. But if we appeal to the possibility of *for*-benefactives to alternate with benefactive NPs as evidence that the *for*-benefactives are arguments, we presuppose that benefactive NPs are clear arguments. It therefore seems that if the test shows anything at all, it gives evidence in favor of an analysis of the benefactive NP as an argument, not an adjunct.

2.3 The relative ordering test

The relative ordering of arguments in a sentence is generally stricter than the ordering of adjuncts; internal arguments (complements) are typically directly adjacent to the verb (Jackendoff 1977, Pollard and Sag 1987, Dalrymple 2001). This is illustrated with the adjunct *cheerfully* in (12) and the argument *an apple* in (13):

(12) a. *Cheerfully*, Tobias ate an apple.
b. Tobias *cheerfully* ate an apple.
c. Tobias ate an apple *cheerfully*.

(13) a. Tobias ate *an apple*.
b. *Tobias *an apple* ate.
c. *Tobias ate cheerfully *an apple*.

Benefactive NPs are not easily ordered anywhere except immediately beside the verb:

(14) a. Nancy poured Kendra some milk.
b. *Nancy *Kendra* poured ___some milk.
c. *Nancy poured ___ some milk *Kendra*.

The positioning of benefactive NPs is quite strict, so they are arguments by the relative ordering test.

Pollard and Sag (1987) point out that the relative ordering of adjuncts and other phrases can affect the truth-conditional meaning of the sentence. They illustrate this with sentences like (15); see also Dalrymple (2001):

[3] See also Van Valin and LaPolla (1997, 162, 382–384), who classify *for*-benefactives as 'argument-adjuncts', between arguments and adjuncts. They discuss examples where *for*-benefactives alternate with NPs, as illustrated in (10–11) here.

(15) a. Kim ran twice a day reluctantly.

b. Kim ran reluctantly twice a day.

When an argument is reordered, by topicalization for example, the truth-conditional meaning is not affected. In other words, the interpretation of an adjunct may depend on its relative position in the clause, but this is not true for arguments. It is then possible that the NP *Kendra* in (14) is, in fact, an adjunct, but the benefactive meaning is only available in the position between the verb and the second NP, *some milk*. Some support for this view comes from the observation that benefactive NPs cannot occur in intransitive clauses, even though *for*-benefactives can. The sentence *Shawn sang for Lisa* cannot alternate with **Shawn sang Lisa*, which is ungrammatical, at least with the intended reading where *Lisa* is a benefactive.

I conclude that the relative ordering test classifies benefactive NPs as arguments, but it is not clear that this test is appropriate here.

2.4 The *wh*-word conjunction test

Two *wh*-words that refer to arguments with different semantic roles cannot be conjoined (16). Two *wh*-adjuncts with different semantic roles can be conjoined (17). An argument *wh*-word cannot be conjoined with an adjunct *wh*-word (18).

(16) a. Sam showed the picture to Kim.

b. *What and to who(m) did Sam show?

(17) a. Jolanda met a friend in Minneapolis on Friday.

b. Where and when did Jolanda meet a friend?

(18) a. Linus wrecked his car last year.

b. *What and when did Linus wreck?

The generalizations illustrated by examples (16–18) grossly oversimplify data which are quite complex; for example, the coordination of adjunct and argument *wh*-words is sometimes allowed (see, e.g., Gračanin Yuksek 2007 and Larson 2013). I set these complications aside here.

Example (19) shows that a benefactive *wh*-word cannot be co-ordinated with another phrase:

(19) a. I baked Tonya some cookies yesterday.

b. *When and who did you bake cookies yesterday?

c. *Who and when did you bake cookies yesterday?

Examples (19b–c) are infelicitous, and the benefactive *who* thus patterns as an argument, not an adjunct. However, even without *wh*-word conjunction, it is not possible to construct questions with a benefactive NP as a *wh*-word:

(20) *Who did I bake some cookies yesterday?

Since (20) is ungrammatical, (19b-c) cannot be expected to be grammatical, regardless of the argumenthood status of benefactive NPs. I conclude that *wh*-word benefactives pattern with arguments in that they cannot be coordinated with other *wh*-words, but since benefactive NPs cannot be *wh*-words at all, we cannot use this observation as evidence for argumenthood.

2.5 The VP-anaphora test

In sentences with VP-anaphora, adjuncts may be added to 'do so' phrases, but arguments may not (Lakoff and Ross 1966, Baker 1978, Jackendoff 1977).

(21) Susie sold her stocks yesterday and Pat did so today.

(22) *Susie washed her feet and Pat did so her hands.

Benefactive NPs cannot be added to 'do so' phrases:

(23) *Pete baked Linda a cake and Tom did so Susie some cookies.

Example (23) is ungrammatical, indicating that benefactive NPs pattern with arguments. However, independently of the benefactive NP, the second object (*a cake* and *some cookies* in (23)) will cause a problem: the second object is an argument and cannot be added to 'do so', which replaces a verb and its arguments. Examples similar to (23–25) but without benefactives are also not grammatical:

(24) *Pete baked a cake and Tom did so some cookies.

Example (23) includes two theme objects with different referents: *cake* and *some cookies*. It does not help to repeat the same second object, or to drop it completely:

(25) *Pete baked Linda a cake and Tom did so Susie (a cake).

The fact that the second object must be there in order to get a benefactive reading (see the discussion in section 2.2) is problematic: it does not seem possible to make use of the VP-anaphora test for benefactives without creating examples that are ungrammatical independent of the benefactive NP. I conclude that benefactive NPs pattern with arguments with respect to VP-anaphora, but the reasons for this may have nothing to do with the argumenthood status of benefactive NPs.

2.6 The pseudo-cleft test

Adjuncts can occur after *do* in a VP-focussed pseudo-cleft (26), arguments cannot (27–28); see Hedberg and DeArmond (2009):

(26) a. Mia slept in her room.
b. What Mia did in her room was sleep.

(27) a. Claire discussed the problem.
b. *What Claire did the problem was discuss.

(28) a. Francis trusted in his mentor.
b. *What Francis did in his mentor was trust.

Benefactive NPs cannot occur after *do* in pseudo-clefts:

(29) a. Lance cooked Dorothy a lovely meal.
b. *What Lance did Dorothy was cook a lovely meal.

By this diagnostic, benefactive NPs pattern with arguments.

2.7 Summary

English benefactive NPs are adjunct-like in that they are not core participants of the verb, and they are not obligatory. However, benefactive NPs are nevertheless c- and f-structure arguments: they are complements of the verb at c-structure and objects at f-structure. This section has explored benefactive NPs in the light of a number of previously proposed argumenthood tests. Very few (if any) of the diagnostics can be applied unproblematically to benefactives, so it could be argued that the traditional argumenthood tests cannot be used to test the status of benefactives. It is important to keep this in mind, but the table in (30) is nevertheless included here to give an overview of the results:

(30)

Argumenthood test	Result	
The core participant test	adjunct	(section 1)
The optionality test	adjunct	(section 1)
The adjunct island test	adjunct	(section 2.1)
The alternation test	argument	(section 2.2)
The relative ordering test	argument	(section 2.3)
The *wh*-word conjunction test	argument	(section 2.4)
The VP anaphora test	argument	(section 2.5)
The pseudo-cleft test	argument	(section 2.6)

A generalization emerges if the relative ordering test, the *wh*-word conjunction test, the VP anaphora test and the pseudo-cleft test are considered together: the benefactive NP must occur immediately beside the verb. In fact, it must occur between the verb and the direct object.

Previous researchers have noted that some classes of phrases, for example, passive *by*-phrases and instrumentals, are difficult to classify as clear arguments or clear adjuncts (Grimshaw 1990, Whaley 1993, Larson 1998, Croft 2001, McKercher 2001, Needham and Toivonen 2011, Williams 1994,25, Schütze and Gibson 1999, Dowty 2003, Donohue and Donohue 2004, Koenig et al. 2003, Van Valin and LaPolla 1997, Rákosi 2006b, Bosse et al. 2012 Asudeh and Toivonen 2012, Ágel and Fischer 2009, Schütze 1995, Larson 1998). The English benefactive NP is also difficult to classify. In LFG, as in many other frameworks, it is important to determine whether or not a participant is an argument or an adjunct. In the lexicon, adjuncts are not included on the argument structure list of lexical entries. At a-structure, Lexical Mapping Theory handles the mapping to argument functions only (Levin 1986, Bresnan and Kanerva 1989, Alsina and Mchombo 1989). At f-structure, the classification of grammatical functions is partially dependent on whether or not they are argument functions. At c-structure, arguments and adjuncts appear in different phrase-structural configurations. In what follows, I attempt to develop an explicit analysis in LFG that sheds light on the unclear argumenthood status of benefactive NPs.

3 An LMT analysis of English benefactives

Native speakers typically do not intuit that benefactive NPs are core arguments of the verb. This was already discussed above, but let us nevertheless consider a few additional examples here:

(31) a. Liz carved a statue for Tom.
b. Liz carved John a statue.

(32) a. We built a playhouse for the kids.
b. We built the kids a playhouse.

(33) a. Cassie drew a picture for Emily
b. Cassie drew Emily a picture.

The verbs *carve, build* and *draw* can occur with benefactive PPs and NPs, but the verbs do not call for such participants. The activities can easily be performed without any actual or intended benefactor. There seems to be no reason to include benefactives as members of the original argument structure lists of these verbs.

As part of an overview of Lexical Mapping Theory, Bresnan (2001) considers some examples with benefactives, including (34):

(34) Both parents cooked the children supper.

She remarks: "The ditransitive of cook has an added beneficiary role, which is a patientlike internal argument" (Bresnan 2001, 315). She does not discuss in detail exactly how this beneficiary is added, but, given the rest of the discussion in the chapter, there seem to be two possibilities: 1) The beneficiary is not really added, it is just there in an alternative lexical entry. We then have two lexical entries for *cook*; one with and one without a beneficiary argument. 2) The beneficiary is added by a lexical rule.[4] As we will see, there is actually reason to assume that a limited number

[4]But see the discussion in section 4 below: if lexical rules are conceptualized as lexical redundancy rules, there is no clear distinction between option (1) and (2).

of verbs have an alternative lexical entry with a beneficiary. However, we want to account for the productivity of these ditransitives: beneficiary NPs can occur quite freely with a large set of verbs.

Following Bresnan's discussion, I propose that benefactive NPs may be added by a benefactive lexical rule at argument structure. Benefactive NPs are thus what Needham and Toivonen (2011) call *derived arguments*. They are then neither core, initial arguments nor adjuncts. This accounts for their mixed argumenthood characteristics.

The rule for adding benefactives is productive but cannot apply completely freely. It does not apply to all verbs. First of all, it cannot apply to intransitive verbs (as also noted in section 2.3 above):

(35) a. Molly danced/died/tidied for her friends.
b. *Molly danced/died/tidied her friends.

Beneficiary NPs can only be added to transitive verbs, but not to all transitive verbs:

(36) a. Gordon changed his hairstyle for Rex.
b. *Gordon changed Rex his hairstyle.

These observations are explained by the following generalization (Green 1974, Allerton 1978, Shibatani 1996, and others): *Beneficiary NPs are only allowed where they can be interpreted as the actual or intended recipient of the second object (the theme).* Example (35b) above is ungrammatical because there is no second object theme. In (36), it is not possible to construe Rex as the recipient of the hairstyle. A benefactive NP is permitted in (37b), but only with a recipient interpretation:

(37) a. Cleo boiled some eggs for Patrick.
b. Cleo boiled Patrick some eggs.

There are several different possible interpretations of *for Patrick* in (37a): Cleo could have intended for Patrick to have the eggs (presumably in order to eat them), or she could have boiled eggs for somebody else on Patrick's behalf (instead of Patrick), or she might have done it in order to make Patrick happy but with the intention of giving the eggs to someone else as a present. These different interpretations have been discussed in several of the works cited above, for example in Allerton (1978). *Patrick* in (37b), in contrast, has only one possible interpretation: Cleo intended to give Patrick the eggs. Some transfer of possession was intended, the eggs were to become Patrick's. The rule that introduces benefactive NPs must indicate that the benefactive is also a recipient. When the *for*-PP is not a recipient, the benefactive NP and the *for*-PP can co-occur:

(38) I cooked the happy couple some food for my mother.

In (38), the happy couple will receive the food, but the mother will benefit in some other way; perhaps the cooking was done for her sake, or on her behalf.

English ditransitives are similar to applicatives, and they are sometimes treated as a kind of applicative. The beneficiary rule is therefore modelled on applicative rule of Bresnan and Moshi (1990):

(39)

$$
\begin{array}{ccccc}
 & & \emptyset & & \\
 & & \downarrow & & \\
\langle & \hat{\theta} & \theta & \theta & \rangle \\
 & [-o] & [+o] & [+o] &
\end{array}
$$

The applicative rule adds an "applied" object; an argument which is otherwise typically expressed as an adjunct PP. With (39) as a model, I propose the following rule for benefactives in English:

(40) English benefactive NP rule:

$$
\begin{array}{ccccc}
 & & \emptyset & & \\
 & & \downarrow & & \\
\langle & \hat{\theta} & \theta_{rec} & \theta_{th} & \rangle \\
 & [-o] & [+o] & [+o] &
\end{array}
$$

The arguments on the argument list will map to SUBJECT, OBJECT and OBJECT$_\theta$, according to the mapping principles of Lexical Mapping Theory, which I will not review here.

Rule (40) is formulated so as to allow a recipient to be expressed together with any transitive verb. So far, the discussion has been centered around recipient/benefactive NPs that can also be expressed as *for*-PPs, but the formulation of the rule in (40) raises the question of whether recipient NPs that correspond to *to*-NPs are also products of the same rule:

(41) a. Joe gave a gift to Pete.
b. Joe gave Pete a gift.

Recipient NPs that correspond to *to*-NPs have previously received much more attention in the literature than the ones corresponding to *for*-NPs, but I set them aside here.

The very general rule in (40) does not restrict its input to a specific type or class of verb. In other words, the rule can apply freely to transitive verbs with an expressed theme/patient object, where that object can be construed as a gift for the beneficiary. The effect of the rule then is quite similar to a *construction* in the sense of Construction Grammar (Fillmore 1988, Kay and Fillmore 1999, Goldberg 1995, 2006, Boas and Sag 2012): when an NP appears as the first object in a double object frame in English, that NP will be interpreted as the recipient of the second NP. This generally holds, unless the double NPs occur with a small number of specific verbs, e.g., *call* ('I call my husband Bubs'). Examples like (42b), or (36b) above, are infelicitous because *Rex* and *her*cannot be interpreted as recipients:

(42) a. He sailed the seven seas for her.

b. *He sailed her the seven seas.

The following examples, all retrieved from the internet, are only felicitous with a recipient interpretation (figurative or literal) of the first VP-internal NP:

(43) a. I'll butter you some bread.

b. Three weeks before, when Boston was in Raleigh, Carolina stole them a point by getting a tie

c. We serve breakfast all day, so no matter what time you get here we'll scramble you some eggs, fry some bacon, or...

In (43a), the first object will receive (and presumably eat) the bread. In (43b), the point will go to the referent of *them*. In (43c), the referent of *you* will get the eggs.

Wechsler (1995), Kay (2005) and others have noted that benefactive-recipient NPs cannot passivize.[5] Kay (2005) marks (44) as ungrammatical:

(44) *My sister was carved a soap statue of Bugs Bunny (by a famous sculptor).

Under the present analysis, the recipient-beneficiary cannot passivize because it is a $[+o]$ argument. If the first argument is suppressed in a passive, the second argument should automatically become the passive subject. However, the $[+o]$ specification is incompatible with the subject grammatical function by Lexical Mapping Theory. Therefore, the beneficiary marked $[+o]$ cannot passivize.

Schnoebelen (undated) takes issue with the judgements given by Kay and others. He shows that many speakers allow passivization of benefactives quite freely. I propose that speakers that allow passivization have the rule in (45), which differs from (40) in that the second role is specified as $[-r]$.

(45) English benefactive NP rule, dialect 2:

$$\begin{array}{ccccc} & & \emptyset & & \\ & & \downarrow & & \\ \langle & \hat{\theta} & \theta_{rec} & \theta_{th} & \rangle \\ & [-o] & [-r] & [+o] & \end{array}$$

Speakers who allow passivization of beneficiary-recipients have the rule in (45), and speakers who do not allow passivization have the rule in (40), given above.

To complicate matters further: the literature indicates that all speakers allow passivization of benefactive NPs for a subset of verbs, such as *cook* (cf. (8)); see Bresnan's (2001) example (48b), repeated here as (46):

(46) The children were cooked supper by both parents.

[5]Benefactive NPs corresponding to *for*-PPs differ in this way from recipient NPs corresponding to *to*-PPs that passivize easily: *you were given a second chance; you should have been sent a message*.

In order to account for this, I follow Wechsler (1995, 90–91) in assuming that the speakers with rule (40) also have a lexicalized ditransitive variant of certain verbs, e.g., *cook* and *bake*. This is a regular ditransitive and the object can passivize.

The analysis of benefactive NPs proposed here is consistent with the observation that they display characteristics of both arguments and adjuncts. Benefactive NPs are not original, basic arguments of the verb, instead they are optionally added as arguments in a-structure by a lexical rule. In other words, recipient-benefactives are arguments, but they are not core arguments.

4 Discussion

Benefactive NPs fall in between arguments and adjuncts. Section 3 presented an explicit Lexical Mapping Theory analysis of benefactive NPs. The analysis made use of a lexical rule, or rather two different lexical rules, in order to account for various characteristics of recipient-benefactives that have previously been noted in the literature. The second lexical rule was posited in order to account for speaker variation regarding the possibility to passivize benefactives. According to the analysis presented here, the mixed argumenthood status of benefactive NPs follows from the fact that they are not original arguments, but instead added or derived arguments, in the sense of Needham and Toivonen (2011). This analysis raises a number of questions and introduces some potential problems, which I will discuss here.

4.1 Some remaining questions

The idea behind my proposal is that the mixed argumenthood characteristics follow from the fact that benefactive NPs are not core arguments closely tied to the basic meaning of the verb, but instead, they are added by a rule. However, do the exact characteristics in fact follow? I believe they do. Native speakers do not classify benefactives as necessary participants of verbs like *butter, carve* and *build*. Benefactive NPs are also optional. These two observations are consistent with the analysis proposed here: benefactives are not part of the original lexical entries. In other respects, the benefactive behaves as an argument, which is expected, since the benefactive NPs, when present, are analyzed as arguments. The adjunct island test yields an unexpected result, as it classifies benefactive NPs as adjuncts. However, as noted in section 2.1, there are independent restrictions on extraction out of NPs, so this test does not reveal much about the argumenthood status of benefactives. In general, the analysis proposed in section 3 captures the argumenthood generalizations pertaining to benefactive NPs described in section 2.

The verbs *cook* and *bake* deserve special mention, as they can passivize even though many speakers generally dislike passives where the subject is a benefactive. Following Wechsler (1995), I posited that some verbs have an alternative lexical entry with a benefactive NP on the original argument structure list. For the relevant speakers,[6] the benefactives of these verbs should then show only argument-like characteristics. Benefactives should still be optional, since there is a transitive lexical entry in addition to the ditransitive one. However, what about the core participant intuition? The present analysis predicts that speakers with rule (40) should have the intuition that *cook* and *bake* are different from, e.g., *carve* and *sand* in that it is intuitively natural to think that baking something is done with a benefactive-recipient in mind. I am not sure that there are data to show that the prediction is accurate.

As noted in section 2.4, it is not possible to *wh*-question benefactives:

(47) a. I baked Linda cookies.
b. *Who did I bake cookies?

(48) a. The kids drew their teacher a picture.
b. *Which teacher did the kids draw a picture?

The analysis presented in section 3 neither predicts nor conflicts with the data in (47–48). I cannot explain these facts, but they form part of a larger generalization, already noted at the end of section 2: benefactive NPs must appear between the verb and the second object. The manipulations involved in several of the argumenthood diagnostics involve breaking up the basic word order. The manipulations that involve the word order consistently render the examples ungrammatical; see section 2.3 for the relative ordering test, section 2.4 and examples (47–48) for *wh*-extraction, section 2.5 for VP anaphora, and section 2.6 for pseudo-clefts. The distribution of benefactive NPs is thus very limited: it can only occur in the frame given in (5). This does not directly follow from the analysis given in section 3, and I will not attempt to offer an explanation for these intriguing facts here. However, it is perhaps possible to adopt an analysis simlar to the one Asudeh et al. (2013) propose for the Swedish directed motion construction (Toivonen 2002). Asudeh et al. (2013) posit a template that is directly associated with a construction-specific phrase structure rule.

Lexical rules in LFG are not thought of as derivational rules with a defined input and an output. Instead, they are Lexical Redundancy Rules, in the sense of Jackendoff (1975). These rules relate lexical entries and state the regularities between them to avoid redundancy in the lexicon. The following is a quote from Kaplan and Bresnan (1982), discussing the f-structural lexical rules that were commonplace in LFG before the explicit proposals were developed for handling "relation-changing" phenomena with Lexical Mapping Theory at a-structure:

> "It is important to note that these relation-changing rules are not applied in the syntactic derivation of individual sentences. They merely express patterns of redundancy that obtain among large but finite classes of lexical entries and presumably simplify the child's language acquisition task [...]"

[6] Recall that some speakers can passivize all (or most) benefactives. That dialect is captured by the rule in (45) and no alternative lexical entries are needed.

This conceptualization of lexical rules is very natural in a lexicalist, non-transformational, constraint-based framework like LFG. Consider, for example, the passive rule in LFG. The passive rule states that the most prominent role on the a-structure is suppressed and therefore cannot be mapped to a syntactic function. If the most prominent role is in some sense there in some 'basic' input (either in the passive verb or in the active counterpart), and the passive rule actually suppresses it in a less basic version of the form, then the mapping is non-monotonic. However, a lexical redundancy rule simply relates two lexical entries, neither one more basic than the other, and they have different argument structures. Monotonicity is a fundamental computational constraint on LFG grammars.

The notion of derived arguments, discussed above and in Christie and Toivonen (2013) and Needham and Toivonen (2011), relies on the intuition that predicates have a basic argument structure. Even though *kick* can occur in a number of argument frames, one of those frames is basic: *kick* is a transitive verb which takes a subject (a kicker) and an object (something that gets kicked). This intuition is clear and widely shared; see, for example, Tesnière (1959, Ch. 111, §6), Levin and Rappaport Hovav (1995), Ágel and Fischer (2009, 243) and Goldberg (1995). Nevertheless, it is important to recognize that an appeal to basic and derived arguments or verbs will lead to non-monotonic mappings in Lexical Mapping Theory. The specific benefactive rule, as formulated above, is not directly problematic: the rule adds an argument and so the mapping is monotonic.[7] However, it is problematic for other relation-changing correspondences; for example, the passive and unspecified object deletion. We could posit that lexical rules that *add* arguments can appeal to basic and derived lexical entries, whereas rules that delete or change argument structures cannot. However, this does not seem to be independently motivated. A better alternative is to explore other proposals for how to understand phrases that fall between arguments and adjuncts.

4.2 Alternative views on arguments and adjuncts

Györgi Rákosi has proposed that what he calls *non-core participant PPs* should be treated as thematic adjuncts (Rákosi 2006a,b, 2012). The analysis is cast within Reinhart's (2002) Theta System, and the basic intuition is that non-core participants are adjuncts that bear a thematic role. Benefactive NPs are not good candidates for thematic adjuncts, as they are c-structure complements and f-structure OBJECTs. In fact, Rákosi (2012, 525–526) classifies benefactive NPs as syntactic arguments of the verb, and does not include them on the list of expressions that are thematic adjuncts.

Asudeh and Giorgolo (2012) and Giorgolo and Asudeh (2012) argue that different types of dependents differ in how they compose with the verb semantically. The analysis in Asudeh and Giorgolo (2012) is cast in LFG with Glue Semantics. The analysis of Giorgolo and Asudeh (2012) uses monads in the meaning language, drawing upon a propsal by Blom et al. (2012) for Categorial Grammar. Asudeh and Giorgolo mainly focus on optional arguments, like for example the object of *eat*, but they

[7] Kibort (2007) provides further discussion of dative shift and monotonicity.

also discuss other types of examples, such as the passive *by*-phrase. An exploration of the semantic composition of verbs with benefactives might shed light on the behavior of benefactive NPs.

Manning (2003) proposes that the distinction between arguments and adjuncts is gradient. Some previous work in OT-LFG incorporates gradient constraints. Also, Joan Bresnan and collaborators have in a number of recent papers explored gradience in the grammar using statistical models compatible with LFG (Bresnan et al. 2007, Bresnan and Hay 2008, and others). This work focusses on what words or senses are compatible with particular constructions or phrase structure configurations. The issue of a potentially gradient distinction between arguments and adjuncts is a different type of question, as it concerns how classes of expressions (e.g., benefactive NPs, passive agent PPs) should be classified in terms of argumenthood. For example, we are not asking whether definite NPs are more or less likely to be arguments than adjuncts, and we are not considering gradient grammaticality. The research questions thus seem quite distinct, but it might still be worthwhile to pursue Manning's proposal in light of previous LFG-compatible work on gradience in the grammar.

Dowty (2003) proposes a dual analysis within the framework of Categorial Grammar, and he states that "virtually all" complements can be analyzed as adjuncts, and adjuncts can be analyzed as complements. This does not seem like a promising venue within a framework like LFG, where the argument-adjunct distinction is relevant at all levels of grammar.

I conclude that there are a number of other proposals that are concerned with expressions that are difficult to classify as arguments or adjuncts. Some proposals seem more compatible with the LFG framework than others. I leave it to future research to determine whether one of them can help shed light on the characteristics of benefactives, including their mixed argument-adjunct behavior, without running into the problems of the derived arguments proposal of the present paper.

5 Conclusion

English benefactive NPs display a number of interesting properties, and there is some disagreement in the literature about the basic data conerning their passivization. This paper has proposed an explicit Lexical Mapping Theory analysis of benefactive NPs. The analysis is consistent with the mixed argumenthood characteristics of benefactives, and relies on the intuition that some arguments are basic and others are added.

Needham and Toivonen (2011) suggest that phrases that fall in between arguments and adjuncts are best analyzed as derived arguments in LFG. This paper is a case study of a specific type of derived arguments, benefactive NPs. This more detailed examination of a specific case shows that the argumenthood diagnostics reviewed in Needham and Toivonen (2011) are in fact often difficult to apply. In addition, the discussion section points to some potential theoretical problems for the treatment of benefactives as derived arguments. However, it seems natural in LFG to treat benefactive NPs as added first objects (or "applied" objects), and this analysis straightforwardly identifies benefactives as a member of Needham and Toivonen's class of derived arguments.

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