Proceedings of the HPSG07 Conference

Stanford Department of Linguistics and CSLI's LinGO Lab

Stefan Müller (Editor)

2007

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Contents

1 Editor's Note

The 14th International Conference on Head-Driven Phrase Structure Grammar (2007) was held in Stanford and organized by the Stanford Department of Linguistics and CSLI's LinGO Lab.

The conference featured 2 invited talks and 18 papers selected by the program committee (Doug Arnold, Emily M. Bender, Olivier Bonami, Ann Copestake, Berthold Crysmann, Dan Flickinger, Tibor Kiss, Jong-Bok Kim, Robert Levine, Tsuneko Nakazawa, Stefan Müller (chair), Gerald Penn, Adam Przepiorkowski, Ivan Sag, Jesse Tseng, Detmar Meurers, Frank Van Eynde, Gertjan van Noord, Gert Webelhuth, Stephen Wechsler).

A workshop about *Constructions and Grammatical Theory* was attached to the conference. It featured three invited talks and 4 papers, selected by the program committee.

In total there were 38 submissions to the main conference and to the workshop. We want to thank the respective program committee for putting this nice program together.

Thanks go to Ivan Sag, who was in charge of local arrangements.

As in the past years the contributions to the conference proceedings are based on the five page abstract that was reviewed by the respective program committees, but there is no additional reviewing of the longer contribution to the proceedings. To ensure easy access and fast publication we have chosen an electronic format.

The proceedings include all the papers except those by Adele Goldberg and Christopher Manning.

Part I

Contributions to the Main Conference

Pseudocoordination in Danish

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Abstract

In this paper we propose an analysis of Danish pseudocoordination constructions. The analysis is based on a hybrid phrase hierarchy where phrase types are assumed to be subtypes of types that cut across the traditional division of phrasal types, allowing the phrasal type of pseudocoordinations to be a subtype of both coordinate phrases and headed phrases, and consequently inherit properties from both types. The analysis is linearization-based. We further develop a set of constraints on the phrasal types in the hierarchy.

The hybrid phrase hierarchy and the set of constraints on the various types in the hierarchy explain why, on the one hand, pseudocoordinations contain conjunctions and the conjuncts must have the same form and tense, and on the other, have a fixed order, allow extraction out of the second conjunct, do not allow overt subjects in the second conjunct and allow transitive verbs to appear in *there*-constructions.

1 Introduction[1]

The Danish *sidder og* construction is an example of a pseudocoordination. The construction has not received that much attention in the Danish literature, but cf. Diderichsen (1946, p. 156), Hansen (1967, vol. 3, pp. 30–31), Jensen (1985, p. 113), Brandt (1992) and Jørgensen (2001). The *sidder og* construction is also found in the other Nordic languages, cf. e.g. Johnsen (1988), Josefsson (1991), Johannessen (1998), Lødrup (2002), Vannebo (2003) and Wiklund (2005).

Pseudocoordinations are constructions that exhibit properties of both coordination and subordination, and conseqently the discussion in the Nordic literature has, among other things, been concerned with whether the construction is really a coordination or whether it may better be treated as a construction involving subordination.

(1) gives examples of the Danish *sidder og* construction.

(1) a. Peter sidder og synger en sang.
Peter sits and sings a song

b. Peter står og spiser et æble.
Peter stands and eats an apple

On the surface the *sidder og* construction consists of two verbal conjuncts and the conjunction *og*, ‘and’. The verb in the first conjunct is an intransitive motion or position verb, primarily *sidder*, ‘sit’, *ligger*, ‘lie’, *går*, ‘walk’, *løber*, ‘run’, and *står*, ‘stand’.

(2) gives examples of a Swedish and a Norwegian *sidder og* construction.

(2) a. Henry sitter och fiskar abborre.
Henry sits and fishes perches
Josefsson (1991)

[1] Tavs Bjerre’s research was carried out as part of the project *Object Positions - comparative syntax in a cross-theoretical perspective* (www.hum.au.dk/engelsk/engsv/objectpositions/index.htm).

b. Han sitter og skriver dikt.
He sits and writes poems
Lødrup (2002)

Contrary to the above-mentioned proposals, the analysis presented in this paper rests on the assumption that the construction is both a coordination and a subordination at the same time. The main idea is based on a further development of a constructional approach to phrasal types, as presented in Ginzburg and Sag (2000).

The *sidder og* construction is syntactically related to the English examples in (3) which are labelled *coordinatively marked serials* by Zwicky (1990), *quasi-serial constructions* by Pullum (1990) and *non-symmetric coordinations* by Maxwell and Manning (1996).

(3) a. They'll up and bite you.
b. Go and get the paper.
c. Bill went and took the test.

The English examples could also be labelled pseudocoordinations. The Danish *sidder og* construction is, however, a special subtype of pseudocoordinations, characterized among other things by their aspectual semantics, cf. 2.

In German we find the socalled SGF constructions ('subject gaps in finite / frontal clauses') also related to the Danish pseudocoordinations, c.f. 7.

(4) In den Wald ging der Jäger und fing einen Hasen.
into the forest went the hunter and caught a rabbit
Kathol (1995)

2 The semantics of *sidder og*

The *sidder og* construction is mainly characterized by the aspectual information that it introduces, i.e. whether the event expressed by the second conjunct is regarded as completed or not, c.f. e.g. Brandt (1992) and Hansen (1967). The *sidder og* construction is used to remove any ambiguity that may be present in a certain context wrt. aspect. This is exemplified in (5).

(5) a. Peter lavede mad da jeg kom hjem.
Peter cooked when I came home
b. Peter stod og lavede mad da jeg kom hjem.
Peter stood and cooked when I came home

(5a) is ambiguous. Either the cooking event started before and was still in progress at the time of the arriving event, or the cooking event started at the time of the arriving event. (5b), on the other hand, is not ambiguous. In this case the cooking event was in progress at the time of the arriving event. The reader is referred to Bjerre and Bjerre (2007b) for a more detailed account of the semantics of the *sidder og* construction.

3 Coordination properties of the *sidder og* construction

There are two facts which suggest that the *sidder og* construction is a coordinate structure: It contains a coordinating conjunction, and the verbs in the two conjuncts must have the same form.

The conjunction is, however, restricted to *og*, ‘and’, as shown in (6).

(6) a. Peter sidder og sover.
Peter sits and sleeps

b. *Peter sidder eller / men sover.
Peter sits or but sleeps

With respect to verb form, as shown in (7), the two conjuncts must have the same value for finiteness.

(7) a. Peter har *siddet* og *sovet*.
Peter has sit and slept

b. *Peter har *siddet* og *sover*.
Peter has sit and sleeps

The two conjuncts must also have the same value for tense, as shown in (8).

(8) a. Peter sidder og spiser.
Peter sits and eats

b. *Peter sidder og spiste.
Peter sits and ate

The constraint on tense does not always hold for ordinary coordinations, though, as the example in (9) shows.

(9) Peter kom i går og tager afsted i morgen.
Peter came yesterday and leaves tomorrow

4 Subordination properties of *sidder og*

Other facts favour an analysis of the *sidder og* construction as a subordinate structure. We will discuss its behaviour wrt. order of constituents, extraction, overt subjects and *there*-constructions.

4.1 Order of constituents

An important characteristics of pseudocoordinations is that, unlike ordinary coordinations, (10), the order of the conjuncts is fixed, (11).

(10) a. Peter sang og dansede.
Peter sang and danced

b. Peter dansede og sang.
Peter danced and sang

(11) a. Peter sad og læste.
Peter sat and read

b. *Peter læste og sad.
Peter read and sat

4.2 Extraction and *sidder og*

According to the Coordinate Structure Constraint, Ross (1967), a conjunct cannot contain a gap except in 'Across-the-Board' cases where each conjunct has a gap that refers to one and the same filler. (12a) is an example of the *sidder og* construction clearly violating this constraint, whereas the constraint is obeyed in the coordination without *sidder*, (12b).

(12) a. Pigen$_i$ Peter sad og kyssede e_i.
Girl-the Peter sat and kissed

b. *Pigen$_i$ Peter dansede og kyssede e_i.
Girl-the Peter danced and kissed

4.3 No overt subject in second conjunct in *sidder og*

In pseudocoordinations, the second conjunct cannot have an overt subject, cf. (13).

(13) a. Han sidder og læser.
He sits and reads

b. *Han sidder og han læser.
He sits and he reads

In ordinary coordinations the overt expression of the second subject is optional, cf. (14).

(14) a. Han synger og danser.
He sings and dances

b. Han synger og han danser.
He sings and he dances

In some cases the subject of the second conjunct may be overtly expressed in what may look like a *sidder og* construction, but in that case the construction loses its characteristic aspectual meaning and is not a *sidder og* construction, but an ordinary coordination.

4.4 *There*-constructions and the *sidder og* construction

A restricted set of verbs, typically intransitive verbs, may appear in *there*-constructions. This set includes the verb *sidder*. Transitive verbs typically do not appear in *there*-constructions.

(15) a. Der sad en mand i bilen.
There sat a man in car-the

b. *Der læste en mand en bog.
There read a man a book

However, *sidder og* constructions with a transitive verb in the second conjunct do occur in *there*-constructions, as shown in (16).

(16) Der sidder en mand og læser en bog.
There sits a man and reads a book

It should be noted that *en mand* in (15a) and (16) is in object and not in subject position. This can be seen by the different positions of the negations in (17a) and (17b).

(17) a. Der sidder ikke en mand og læser en bog.
There sits not a man and reads a book

b. Sidder manden ikke og læser en bog?
Sits man-the not and reads a book.

In Danish main clauses, the negation appears after the subject, but before the object.

5 Complex predicate analysis

In the previous sections we showed that the *sidder og* construction has both subordination and coordination properties. In this section we suggest that the *sidder og* construction, in addition to being a coordination construction, is also a complex predicate construction consisting of a host predicate, the verb in the first conjunct, and a copredicate, the second conjunct.

(18) shows examples of other complex predicates. In each case the finite verb is the host and the adjective or nonfinite verb is the copredicate.

(18) a. Manuskriptet blev færdigt.
Manuscript-the was finished

b. Manuskriptet var færdigt.
Manuscript-the was finished

c. Peter skulle læse manuskriptet.
Peter should read manuscript-the

d. Peter havde læst manskriptet.
Peter had read manuscript-the

It can be seen that in complex predicate constructions the copredicate is the most contentful part of the predicate, while the host predicate contributes with information on tense, aspect, modality etc. This also applies to the *sidder og* construction in (19).

(19) Peter sidder og råber.
Peter sits and yells

In (19) the most contentful part of the construction is the second conjunct. It is more about yelling than about sitting, in other words. The main purpose of the first conjunct is to add aspectual content even though the verb does have conceptual content, Peter is actually sitting.

6 Sentence coordination

Ellipsis analyses of coordination along the lines of Beavers and Sag (2004) account for examples like (20).

(20) Arbejdsløse drak sjældent og købte aldrig cognac i 30'erne.
Unemployed drank seldom and bought never cognac in thirties-the

(20) is the result of coordinating the two sentences in (21), deleting shared peripheral material in either the first or the second conjunct.

(21) a. Arbejdsløse drak sjældent ~~cognac i 30'erne~~.
Unemployed drank seldom cognac in thirties-the

b. Og ~~arbejdsløse~~ købte aldrig cognac i 30'erne.
And unemployed bought never cognac in thirties-the

The following examples of sentence coordinations should also be well-formed on an ellipsis analysis.

(22) *Ude i skoven så Peter og plukkede Ole en sjælden orkide.
Out in wood-the saw Peter and picked Ole a rare orchid

(23) a. Ude i skoven så Peter ~~en sjælden orkide~~.
Out in wood-the saw Peter a rare orchid

b. Og ~~ude i skoven~~ plukkede Ole en sjælden orkide.
And out in wood-the picked Ole a rare orchid

(24) *Heldigvis vandt Peter og blev Ole diskvalificeret.
Fortunately won Peter and was Ole disqualified

(25) a. Heldigvis vandt Peter.
Fortunately won Peter

b. Og ~~heldigvis~~ blev Ole diskvalificeret.
and fortunately was Ole disqualified

We suggest that the reason they are not, is that only subjects preceding the finite verb in the second conjunct may be elided, other material preceding the finite verb may not.

On the ellipsis analysis, only peripheral material may be elided. This means that it does not account for medial verb gapping, (26). We will not go into that here.

(26) Peter væltede sin øl og Ole sin vin.
Peter knocked over his beer and Ole his wine

It also means that in V2 languages like German and Danish, the subject cannot be elided when another element occurs in first position, and the subject consequently occurs in the position following the finite verb.

(27) *Kl. 5 drak Peter ud og lidt senere gik hjem.
5 o'clock drank Peter out and a little later went home

(28) a. Kl. 5 drak **Peter** ud.
5 o'clock drank Peter out

b. Og lidt senere gik **Peter** hjem.
and a little later went Peter home

The subject *Peter* is shared material but cannot be elided because it does not occur peripherally. Instead the subject has to be repeated, e.g. with a pronoun as in (29).

(29) Kl. 5 drak Peter$_i$ ud og lidt senere gik **han**$_i$ hjem.
5 o'clock drank Peter out and a little later went he home

In the next section we will discuss SGF and pseudocoordination which are examples of non-constituent coordination which cannot be handled in terms of peripheral sharing, cf. e.g. Crysmann (2006), and therefore cannot be handled by the ellipsis analyses of non-consituent coordinations.

7 SGFs and the *sidder og* phrase

In this section we will relate the Danish *sidder og* construction to subject gaps in finite/frontal sentences, Höhle (1983) or SGF coordinations, Wunderlich (1988).

SGF coordinations are coordinations where two conjuncts share a subject that appears inside the first conjunct. This is illustrated in (30).

(30) In den Wald ging der Jäger und fing einen Hasen.
Into the forest went the hunter and caught a rabbit
Kathol (1995)

Der Jäger is the understood subject of both the verb *ging* and the verb *fing*.

According to Kathol (1995), the SGF coordination does not allow a further object gap in the second conjunct, coindexed with either a topicalized or non-topicalized object in the first conjunct. Further, German does not allow corresponding coordinations with only an object gap. This is shown in (31) which are examples from Kathol (1995)[2].

(31) *Die Briefmarken$_j$ zeigte Hans$_i$ dem Onkel t_j und verkaufte
the stamps-ACC showed Hans-NOM the uncle-DAT and sold
e_i t_j der Tante.
the aunt-DAT

*Gestern zeigte Hans$_i$ die Briefmarken$_j$ dem Onkel und
yesterday showed Hans-NOM the stamps-ACC the uncle-DAT and
verkaufte e_i e_j der Tante.
sold the aunt-DAT

*Gestern zeigte Hans die Briefmarken$_j$ dem Onkel und
yesterday showed Hans-NOM the stamps-ACC the uncle-DAT and
verkaufte Otto e_j der Tante.
sold Otto-NOM the aunt-DAT

In Danish there are wellformed sentences apparently similar to the ungrammatical sentence in (27).

(32) Kl. 5 drak Peter ud og gik hjem.
5 o'clock drank Peter out and went home

We suggest that the difference between (27) and (32) is that in the former we have sentence coordination while in the latter we have VP coordination. The latter type is very similar to the German constructions, so we call such Danish examples SGF constructions.

The *sidder og* construction may also resemble SGF coordinations. This is illustrated in (33).

(33) a. I går sad Peter og kyssede en pige.
Yesterday sat Peter and kissed a girl

b. Sad Peter og kyssede en pige?
Sat Peter and kissed a girl

In these Danish examples we also have a shared subject appearing inside the first conjunct. However, the Danish pseudocoordinaitons differ from the German SGF coordinations in that they allow extraction of the object out of the second conjunct, as in (34).

[2] Kathol uses t for extraction sites.

(34) a. Den pige$_j$ sad Peter$_i$ og kyssede e_i e_j i går.
That girl sat Peter and kissed yesterday

b. Var det den pige$_j$ Peter$_i$ sad og kyssede e_i e_j?
Was it that girl Peter sat and kissed

In Danish it is not possible to have an object gap in the second conjunct co-indexed with a non-topicalized object. However, in the Norwegian so-called empty object constructions, cf. e.g. Larson (2005), we get a coordination with a non-topicalized object gap in the second conjunct as shown in (35).

(35) Jens$_i$ skrev to brev$_j$ og e_i sendte e_j til England. (Norwegian)
Jens wrote two letters and sent to England

Even though the Danish *sidder og* construction does not behave exactly like the German SGF coordination, we nevertheless want to say that it is related to the German SGF coordination in that they are both non-sentence coordinations.

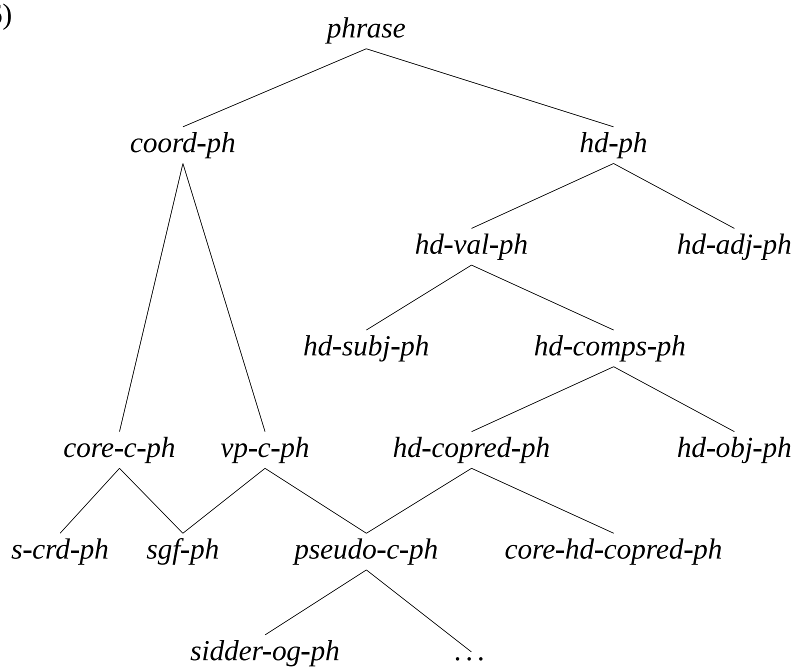
Kathol (1995) provides a linearization-based account of the German SGF coordinations. In the next section we will present a linearization-based account of the Danish data.

8 Formalization

In this section we will show a formalization that explains the behavior of the *sidder og* construction wrt. the range of phenomena outlined in previous sections. The formalization further develops the hybrid phrase hierarchy in Bjerre and Bjerre (2007a) and provides formal constraints on the types in the hierarcy.

To account for the *sidder og* construction as both a coordination and a complex predicate construction, we will develop constraints on the types in the hierarchy shown in (36).

(36)



The hierachy allows the *sidder-og-ph*, and other pseudocoordination constructions, to inherit contraints expressed on headed as well as on coordinate phrases.

Based on a strong tradition in Danish grammar originating with Diderichsen (1946), and Linearization-based HPSG, Reape (1994), Kathol (1995, 2000), we describe word order with a list-valued DOM-feature, allowing separation of word order from immediate constituency. Further, for any headed phrase in Danish, the elements on this list must, if present, occur in the order given (37).

(37) $\textit{headed-ph} \longrightarrow \left[\textsc{dom}\ \left\langle C \prec F \prec v \prec s \prec l{*} \prec a1{*} \prec V \prec O{*} \prec P \prec a2{*} \right\rangle\right]$[3]

The constraint on *coord-ph* in the hierarchy is given in (38).

[3]

C	coordinating conjunction
F	the subject or information structurally salient constituents
v	the finite verb or the subordinate conjunction
v	the subject
l	light (pronominal, unstressed) objects
a1	adverbials
V	the finite verb when the *v* slot is blocked by a conjunction
O	objects
P	copredicate
a2	adverbials

Elements marked with * may occur more that once.

(38) *coord-ph* $\longrightarrow$

$$\left[\begin{array}{l} \text{SS} \mid \text{LOC} \mid \text{CAT} \left[\begin{array}{ll} \text{HEAD} & \boxed{1} \\ \text{MARKING} & \boxed{2} \\ \text{CRD} & - \end{array}\right] \\ \text{DTRS} \left\langle \begin{array}{l} \left[\text{SS} \mid \text{LOC} \mid \text{CAT} \left[\begin{array}{ll} \text{HEAD} & \boxed{1} \\ \text{MARKING} & \boxed{2} \\ \text{CRD} & - \end{array}\right]\right], \\ \left[\text{SS} \mid \text{LOC} \mid \text{CAT} \left[\begin{array}{ll} \text{HEAD} & \boxed{1} \\ \text{MARKING} & \boxed{2} \\ \text{CRD} & + \end{array}\right]\right] \end{array} \right\rangle \end{array}\right]$$

This constraint ensures that conjuncts and their mother have the same value for FORM (assumed to be defined as a head feature), by structure-sharing the value of HEAD between the two daughters and the mother. Cf. Sag (2003) for a discussion of the HEAD feature in connection with coordination. The second daughter but not the mother or the first daughter is introduced by a coordinating conjunction. Also the MARKING values are identical for the daughters and the mother prohibiting the coordination of a main and a subordinate clause.

(39) shows the constraints on *core-coord-ph*.

(39) *core-coord-ph* $\longrightarrow$

$$\left[\begin{array}{l} \text{SS} \left[\begin{array}{l} \text{LOC} \mid \text{CAT} \mid \text{VAL} \ \boxed{1} \\ \text{NONLOC} \mid \text{SLASH} \ \boxed{2} \end{array}\right] \\ \text{DTRS} \left\langle \begin{array}{l} \left[\text{SS} \left[\begin{array}{l} \text{LOC} \mid \text{CAT} \mid \text{VAL} \ \boxed{1} \\ \text{NONLOC} \mid \text{SLASH} \ \boxed{2} \end{array}\right]\right], \\ \left[\text{SS} \left[\begin{array}{l} \text{LOC} \mid \text{CAT} \mid \text{VAL} \ \boxed{1} \\ \text{NONLOC} \mid \text{SLASH} \ \boxed{2} \end{array}\right]\right] \end{array} \right\rangle \end{array}\right]$$

It says that valence information is identical for the daughters and the mother, and that the value for SLASH is identical: Either there is no extraction or the same element is extracted from both conjuncts. Importantly, the *sidder-og-ph* is not a subtype of the *core-coord-ph*, and consequently it does not inherit the constraint formalizing the coordinate structure contraint, explaining why they allow extraction from the second conjunct.

We assume that something like the following constraint from Beavers and Sag (2004) can be made to work for those coordinations that are not SGFs or pseudo-coorodinations (that is, our type *s-coord-ph* in (36)).

(40) *cnj-cxt* $\longrightarrow$

$$\left[\begin{array}{ll}
\text{MTR} & \left[\begin{array}{ll}\text{DOM} & \boxed{A}\oplus\boxed{B_1}\oplus\boxed{C}\oplus\boxed{B_2}\oplus\boxed{D}\\ \text{SYN} & \boxed{0}\end{array}\right]\\
\text{DTRS} & \left\langle \left[\begin{array}{ll}\text{DOM} & \boxed{A}\left\langle\left[\begin{array}{ll}\text{FRM}&\boxed{F_1}\\ \text{HD}&\boxed{H_1}\end{array}\right],\ldots,\left[\begin{array}{ll}\text{FRM}&\boxed{F_n}\\ \text{HD}&\boxed{H_n}\end{array}\right]\right\rangle\oplus\\ & \boxed{B_1}\mathit{ne\text{-}list}\oplus\left\langle\left[\begin{array}{ll}\text{FRM}&\boxed{G_1}\\ \text{HD}&\boxed{I_1}\end{array}\right],\ldots,\left[\begin{array}{ll}\text{FRM}&\boxed{G_m}\\ \text{HD}&\boxed{I_m}\end{array}\right]\right\rangle\\ \text{SYN}&\boxed{0}\\ \text{CRD}& -\end{array}\right], \left[\begin{array}{ll}\text{DOM}&\boxed{C}\left\langle\left(\left[\text{SYN}\ \mathit{cnj}\right]\right)\right\rangle\oplus\left\langle\left[\begin{array}{ll}\text{FRM}&\boxed{F_1}\\ \text{HD}&\boxed{I_1}\end{array}\right],\ldots,\left[\begin{array}{ll}\text{FRM}&\boxed{F_n}\\ \text{HD}&\boxed{I_n}\end{array}\right]\right\rangle\oplus\\ & \boxed{B_2}\mathit{ne\text{-}list}\oplus\boxed{D}\left\langle\left[\begin{array}{ll}\text{FRM}&\boxed{G_1}\\ \text{HD}&\boxed{I_1}\end{array}\right],\ldots,\left[\begin{array}{ll}\text{FRM}&\boxed{G_m}\\ \text{HD}&\boxed{I_m}\end{array}\right]\right\rangle\\ \text{SYN}&\boxed{0}\\ \text{CRD}&+\end{array}\right]\right\rangle
\end{array}\right]$$

The effect of this constraint is that identical peripheral material in the two conjuncts is elided in one of the conjuncts. The relation between the two described situations may be looser than in non-sentence coordinations, and topologically the second conjunct is appended at the end of it.

Both *sgf-ph* and *pseudo-coord-ph* are non-sentence coordinations, i.e. they both have an unrealized subject. The two conjuncts describe two subevents of the same overall situation, this is reflected in the topological structure, the second conjunct is inserted into a slot in the first conjunct.

(41) shows the constraint on *non-s-coord-ph*.

(41) *non-s-coord-ph* $\longrightarrow$

$$\left[\begin{array}{ll}
\multicolumn{2}{l}{\text{DOM}\ \boxed{1}\bigcirc\boxed{2}}\\
\multicolumn{2}{l}{\text{SS}\mid\text{LOC}\mid\text{CONT}\mid\text{INDEX}\mid\text{TENSE}\ \boxed{4}}\\
\text{DTRS} & \left\langle\left[\begin{array}{ll}\text{DOM}\ \boxed{1} & \\ \text{SS}\mid\text{LOC} & \left[\begin{array}{l}\text{CAT}\mid\text{VAL}\mid\text{SUBJ}\left\langle[\ ]\right\rangle\\ \text{CONT}\mid\text{INDEX}\mid\text{TENSE}\ \boxed{4}\end{array}\right]\end{array}\right], \left[\begin{array}{ll}\text{DOM}\ \boxed{3} & \\ \text{SS}\mid\text{LOC} & \left[\begin{array}{l}\text{CAT}\mid\text{VAL}\mid\text{SUBJ}\left\langle[\ ]\right\rangle\\ \text{CONT}\mid\text{INDEX}\mid\text{TENSE}\ \boxed{4}\end{array}\right]\end{array}\right]\right\rangle
\end{array}\right]$$
$$\wedge\ \mathit{compaction}(\boxed{3},\boxed{2}\langle \mathit{a2}\rangle)$$

Both daughters have unrealized subjects. The second conjunct is compacted and inserted into the *a2* slot of the first conjunct. The conjuncts must also have the same value for tense. We assume that tense is a semantic feature defined as an index feature.

All that needs to be said about the type *sgf-ph* is that it must have an empty SLASH list, there can be no extraction out of an *sgf-ph*.

(42) *sgf-ph* $\longrightarrow$

$$\left[\text{SS}\mid\text{NONLOC}\mid\text{SLASH}\left\langle\right\rangle\right]$$

sgf-ph is a subtype of both *non-s-coord-ph* and *core-coord-ph*. From the former it inherits the constraint that the two daughters must have unrealized subjects, from the latter the constraint that the mother and the two daughters must have identical valence values.

pseudo-coord-ph is not a subtype of *core-coord-ph* but instead inherits from *hd-copred-ph* which is constrained as shown in (43).

(43) *hd-copred-ph* $\longrightarrow$

$$\left[\begin{array}{ll} \textsc{dom} & \boxed{1} \bigcirc \boxed{2} \\ \textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \mid \textsc{val} & \left[\begin{array}{ll} \textsc{copred} & \langle\rangle \\ \textsc{subj} & \boxed{3} \\ \textsc{comps} & \boxed{4} \end{array}\right] \\ \textsc{dtrs} & \left\langle \left[\begin{array}{ll} \textsc{dom} & \boxed{1} \\ \textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \mid \textsc{val} & \left[\begin{array}{ll} \textsc{copred} & \langle \boxed{5} \rangle \\ \textsc{subj} & \boxed{3} \\ \textsc{comps} & \boxed{4} \end{array}\right] \end{array}\right], \left[\begin{array}{ll} \textsc{dom} & \boxed{6} \\ \textsc{ss} & \boxed{5} \end{array}\right] \right\rangle \end{array}\right]$$
$$\wedge\ \textit{compaction}(\boxed{6}, \boxed{2}\langle P \vee a2 \rangle)$$

The head selects the copredicate which is compacted and inserted into *P* or *a2* of the head. Unlike in *core-coord-ph*, the SUBJ feature is only structure-shared between mother and head-daughter.

In a *pseudo-coord-ph* the head daughter must express either a *motion-rel* or a *position-rel*.

(44) *pseudo-coord-ph* $\longrightarrow$

$$\left[\textsc{dtrs} \left\langle \begin{array}{l} \left[\textsc{ss} \mid \textsc{loc} \mid \textsc{cont} \mid \textsc{rels} \langle \textit{mot-pos-rel} \mid \textit{list} \rangle\right], \\ \left[\textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \mid \textsc{crd}\ \ \textit{and}\right] \end{array} \right\rangle \right]$$

The second daughter of a *pseudo-coord-ph* has the value *and* for the feature CRD excluding the conjunctions *or* and *but*. The constraints in (43) and (44) together explain why the order of the order of the conjuncts in pseudocoordinations is fixed. The left conjunct is the head and restricted to have a *mot-pos-rel* and the head precedes its copredicate (the right conjunct).

Before we discuss *there*-constructions, we need to look at the lexical entry for *sidder*, 'sit'. We analyse *sidder* in a *sidder og* construction as a control verb requiring an unsaturated co-predicate, cf. (45). Cf. also Lødrup (2002) for a control analysis of pseudocoordination.

(45)
$$\left[\begin{array}{ll} \textsc{phon} & \langle \textit{sidder} \rangle \\ \textsc{synsem} \mid \textsc{loc} \mid \textsc{cat} & \left[\begin{array}{l} \textsc{val} \mid \textsc{co-pred} \left\langle \left[\textsc{ss} \mid \textsc{loc} \mid \textsc{cat} \mid \textsc{val} \mid \textsc{subj} \langle \mathrm{NP}_i \rangle\right] \right\rangle \\ \textsc{arg-st} \langle \mathrm{NP}_i \rangle \end{array}\right] \end{array}\right]$$

Sidder selects a VP copredicate whose unrealized subject is coindexed with the argument of *sidder*. This also means that the co-predicate, or right conjucnt, cannot have an overt subject.

This argument may appear on the SUBJ list.

(46)
$$\begin{bmatrix} \text{PHON}\ \langle \textit{sidder} \rangle \\ \text{SYNSEM}\,|\,\text{LOC}\,|\,\text{CAT} \begin{bmatrix} \text{VAL}\ |\ \text{SUBJ} & \langle \boxed{1} \rangle \\ \text{ARG-ST} & \langle \boxed{1}\text{NP} \rangle \end{bmatrix} \end{bmatrix}$$

If the argument is indefinite, it may appear on the COMPS list in which case *der*, 'there', appears on the SUBJ list.

(47)
$$\begin{bmatrix} \text{PHON}\ \langle \textit{sidder} \rangle \\ \text{SYNSEM}\,|\,\text{LOC}\,|\,\text{CAT} \begin{bmatrix} \text{VAL} \begin{bmatrix} \text{SUBJ} & \langle \textit{der} \rangle \\ \text{COMPS} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{ARG-ST}\ \langle \boxed{1}\text{NP}_{indef} \rangle \end{bmatrix} \end{bmatrix}$$

In 4.4 we pointed out that transitive verbs typically do not appear in *there*-constructions, but that transitive verbs may appear in the second conjunct in a *there*-construction version of a *sidder og* construction, cf. (16). With the lexical entry for *sidder* in (47) and the constraints above we get an explanation why we may have a transitive verb in the second conjunct.

The unrealized subject of the second conjunct is coindexed with the element on the ARG-ST list, not on the SUBJ list. The unsaturated subject of the co-predicate, the right conjunct, becomes structure-shared with an element on the COMPS list in a there-construction, and the *der* subject of the head daughter is structure shared with the mother, because a *pseudo-coord-ph* is a subtype of the *hd-copred-ph*, in which the mother and the head daughter structure share the value of the SUBJ feature. In this way the conjunct with the transitive verb appears 'parasitically' on the first verb in the phrase in *there*-constructions with pseudocoordination.

Finally, we want to show how our analysis handles a subject appearing inside the first conjunct of an SFG og pseudo-coordination, or indeed after the finite verb in any structure where the subject does not appear in *F*, cf. the schema in (37).

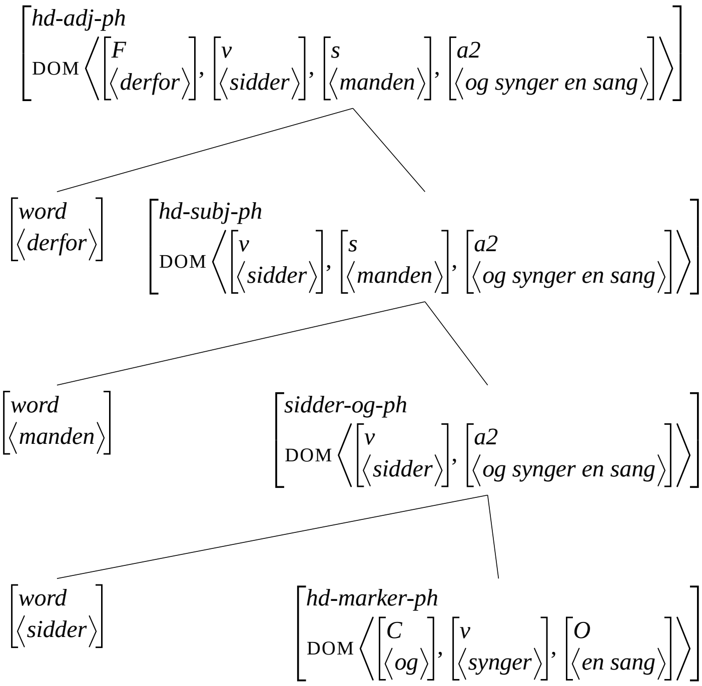
(48) shows part of the constraint on the type *head-subj-ph*.

(48) *hd-subj-ph* $\longrightarrow$
$$\begin{bmatrix} \text{DOM} & \boxed{1} \bigcirc \langle \boxed{2} \rangle \\ \text{DTRS} & \left\langle \begin{bmatrix} \text{DOM}\ \boxed{1} \\ \text{SS}\ |\ \text{LOC}\ |\ \text{CAT}\ |\ \text{VAL}\ |\ \text{SUBJ}\langle \boxed{3} \rangle \end{bmatrix}, \begin{bmatrix} \text{DOM} & \boxed{4} \\ \text{SS} & \boxed{3} \end{bmatrix} \right\rangle \end{bmatrix}$$
$\wedge$ *compaction*($\boxed{4}$,$\boxed{2}\langle F \vee s \rangle$)

It says that the DOM list of the subject daughter, $\boxed{4}$, is compacted to a *dom* element of type *F* or *s* which is then inserted into the DOM list of the head daughter through the *shuffle* function ($\bigcirc$). This means that the subject will occur either immediately before or immediately after the finite verb in *v*. In SFGs and pseudo-coordinations this *v* is the finite verb of the first conjunct, as the copredicate (right conjunct), is inserted as a whole into the topological structure of the head daughter (left conjunct). (49) shows the topological structure of a pseudocoordination with a subject inside the first conjunct.

(49) a. Derfor sidder manden og synger en sang.
Therefore sits mand-the and sings a song

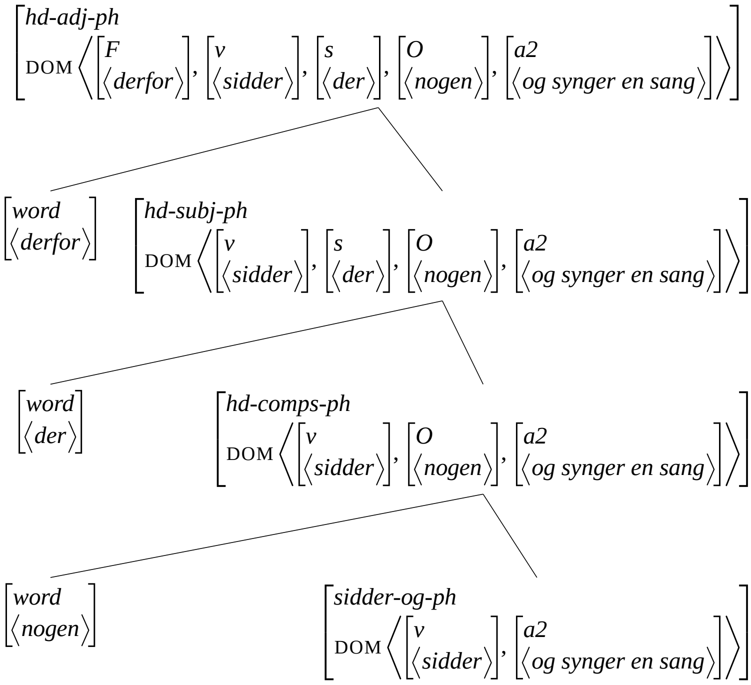
b.



(50) shows the corresponding sentence with *der*, ‘there’.

(50) a. Derfor sidder der nogen og synger en sang.
Therefore sits there someone and sings a song

b.



As can be seen, the linearization-based approach allows the treatment of the coordinations as constituent coordinations, only at the topological level does the subject appear inside the first conjunct.

9 Conclusion

Building on Bjerre and Bjerre (2007a), we have proposed a hybrid phrase analysis of pseudocoordinations. In this paper we have further developed the hierarchy and formalized a set of constraints on the phrase types in the hierarchy where the type *pseudo-coord-ph* is a subtype of both *coord-ph* and *hd-copred-ph*, and consequently inherits properties from both types. The analysis is linearization-based.

The phrase hierarchy and the constraints on the various types in the hierarchy explain why, on the one hand, pseudocoordinations contain conjunctions and the conjuncts must have the same form and tense, and on the other, have a fixed order, allow extraction out of the second conjunct, do not allow overt subjects in the second conjunct and allow transitive verbs to appear in there-constructions.

We believe that this hybrid analysis sheds some light on the nature of pseudocoordinations. It turns out that the properties involved in the constraints on the *coord-ph* and its subtypes are maninly properties of form, ie. the features HEAD, FORM and TENSE. The properties involved in the constraints on *hd-copred-ph* and its subtypes are mainly properties of valence, i.e. SUBJ, CO-PRED and COMPS. Thus we may say that from the point of view of form, pseudocoordinations are coordinations, but from the point of view of valence, pseudocoordinations are head-copredicate constructions.

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Integrating Linguistic Dimensions: The Scope of Adverbs

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Abstract

Three distinctions seem relevant for the scope properties of adverbs: their function (adjuncts or complements), their prosody (incidental or integrated) and their lexical semantics (parenthetical or non parenthetical). We propose an analysis in which the scope of French adverbs is aligned with their syntactic properties, relying on a view of adjuncts as loci for quantification, a linearization approach to the word order, and an explicit modelling of dialogue.

1 Introduction

Adverbs in general are scopal elements.[1] They contrast with other scopal elements such as quantified NPs in the way their scope properties interact with other linguistic dimensions: syntax, prosody, lexical semantics and pragmatics. Since these properties are not strictly correlated, a formalism which relies on one type of distinction, such as dominance (e.g. Dik (1997), Cinque (1999)), fails to do justice to the complexity of the data. The HPSG architecture, where the different dimensions are both distinguished and articulated in feature structures, offers a chance for stating such interactions.

In previous work, after pulling apart the prosodic properties of adverbs, which interact directly with their syntax and compositional semantics, from their pragmatic properties, which depend crucially on their lexical semantics (Bonami et al., 2004), we proposed HPSG analyses of *parenthetical* adverbs, that is, adverbs which do not contribute directly to the main content of an utterance (Bonami and Godard, in press, a, b). Here we concentrate on modelling the interaction between prosody, syntax and scope, improving on the proposals of Bonami and Godard (2003). We show that a linearization-based approach to adverb placement eases the modelling of the observed syntax-semantics interface constraints. We use a conservative, STORE-based HPSG approach to quantifier scope, in the style of Ginzburg and Sag (2000), but nothing crucial hinges on this choice.

We follow a solid tradition in distinguishing a number of semantic classes (for French, see (Molinier and Levrier (2000), Bonami et al. (2004)): connectives (*donc* 'therefore'), speech act adverbs (*franchement* 'frankly'), evaluatives (*malheureusement* 'unfortunately'), modals (*peut-être*, 'perhaps'), sentential agentives (*intelligemment* 'intelligently' in *Il a intelligemment refusé de répondre* 'He intelligently declined to answer'), habitual adverbs (*généralement* 'generally'), domain adverbs (*syntaxiquement* 'syntactically'), frequency adverbs (*souvent* 'often'), duration adverbs (*longtemps* 'for a long time') temporal location adverbs (*récemment* 'recently'), aspectual adverbs (*déjà* 'already'), manner adverbs (*intelligemment* 'intelligently' in *Il a répondu intelligemment* 'He answered intelligently'), degree

[1]Some adverbs, in particular manner adverbs, are often said to be scopally inert. This lexical semantic property is debatable, and, in any case, does not change the scopal character of the category as a whole; see (Parsons, 1972; Peterson, 1997; Schäfer, 2005).

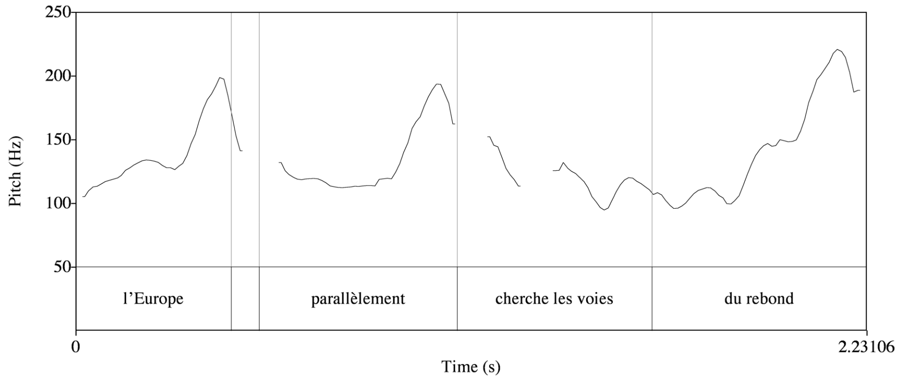


Figure 1: Pitch track of a canonical incidental realization

adverbs (*beaucoup* 'a lot', *intensément* 'intensely'), and associative adverbs (*seulement* 'only'). We also follow common practice in regrouping the first six classes, which share some properties, under the term 'sentence adverb'. Our analysis takes into account all classes, except for connectives and associative adverbs, which have special interface properties linked to their relational semantics. It is based on French adverbs, but should apply to other languages; that is, although the details of the behavior are different (for instance, as is well known, the syntax of adverbs is different in French and English), the different dimensions and the types of interactions that are relevant are expected to be similar.

2 What is incidentality?

The distinction between incidental and integrated constituents correlates prosodic properties of realizations of constituents with constraints on their syntactic positions.[2] In the case of adverbs, it also correlates crucially with scope, as we will see below. Incidental constituents are usually set apart by commas in French orthography, although usage is far from being consistent on this point. For clarity, we explicitly mark incidentality in the examples by adding the symbol '↑' at the boundaries of incidental constituents. '(↑)' signals optional incidentality.

2.1 Incidental vs integrated adverbs: A prosodic property

Existing studies of incidental constituents in French (Fagyal, 2002; Mertens, 2004; Delais-Roussarie, 2005) state that they are prosodically 'autonomous', and are set

[2]Note that incidentality is not a property specific to adverbs, nor to adjuncts. A few examples of incidental constituents are: dislocated phrases, topicalized phrases, vocatives, interpolated clauses, appositions, some realizations of complements (*Il a ↑ à son frère ↑ donné à lire Proust !* 'He has, to his brother, given Proust to read').

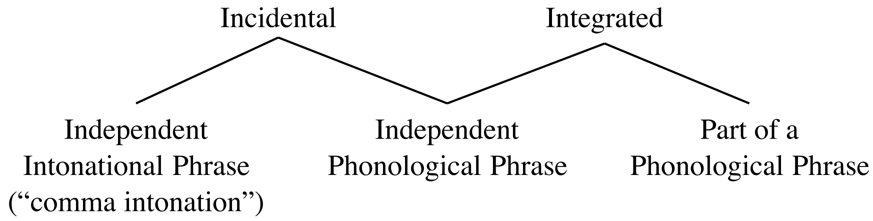


Figure 2: Realizations of incidental and integrated prosody

apart from their environment by a number of factors, illustrated in the typical pitch track in Fig. 1: optional pauses, lengthening of the last syllable preceding the incidental, of the last syllable of the incidental, F_0 modification at the boundaries, register change. However none of these manifestations of incidentality appears to be categorically necessary, as confirmed by an ongoing study by Bonami and Delais-Roussarie on the speech corpus ESTER (Galliano et al., 2006). This suggests that the distinction is phonological rather than phonetic, and, accordingly, that neutralization phenomena make the distinction opaque in certain cases. As Fig. 2 illustrates, in terms of familiar prosodic categories (Selkirk, 1984), we observe three types of realizations, one of which (*Independent Phonological Phrase*) is compatible both with incidental and integrated status.

2.2 Incidentality and Adverb Classes

Most adverbs can occur with either an incidental or an integrated prosody, as illustrated in (1) with a few examples, although there are some constraints.

(1) a. Paul a (↑) heureusement (↑) bien répondu. (evaluative)
'Paul has fortunately answered well.'

b. Paul avait (↑) habituellement (↑) un avis tranché. (habitual)
'Paul had usually a clear-cut advice.'

c. Paul avait (↑) souvent (↑) un avis tranché. (frequency)
'Paul has often a clear-cut advice.'

d. Paul a (↑) silencieusement (↑) quitté la pièce. (manner)
'Paul has silently left the room.'

The dual prosodic realizations in (1) show that incidentality is a property of occurrences, not of lexemes *per se*, although some adverb classes (or subclasses) are specified regarding their prosody: degree adverbs are not incidentals, speech act adverbs are always incidentals; light (Abeillé and Godard, 2001) and resultative (Geuder, 2000) manner adverbs cannot be incidentals.

2.3 Incidental adverbs and Position

There are constraints on the prosodic realization of adverbs depending on their position. Consider the following schema, where the potential position for the adverb is noted –px–. We distinguish between 4 positions: the adverb can occur initially (–p1–), before the verb (–p2–), between the auxiliary verb and the past participle (–p3–), and after the participle (–p4–).[3]

(2) –p1– Paul –p2– a –p3– envoyé –p4– ses voeux –p4– à un vieil ami –p4–.
'Paul has sent his best wishes to an old friend.'

The generalizations are as follows. First, adverbs are normally incidental in –p1–, with a few exceptions that we leave aside for the purposes of this paper.[4] We illustrate the property with both sentential (3a,b) and non-sentential (3c) adverbs:

(3) a. Franchement ↑ cela n'en vaut pas la peine.
'Frankly, it is not worth it.'

b. Malheureusement/ Naturellement/ Officiellement/ Habituellement/ Intelligemment ↑ nous allons au cinéma.
'Unfortunately/ Naturally/ Officially/ Usually/ Intelligently we go to the movies.'

c. Récemment/ Souvent/ Lentement ↑ il est allé à l'opéra.
'Recently/ Often/ Slowly he went to the opera.'

Second, adverbs are incidental in –p2– if the verb is finite (4), but integrated if the verb is infinitival (5):

(4) a. Paul ↑ malheureusement/ naturellement/ officiellement/ habituellement ↑ ne peut pas s'en passer.
'Paul unfortunately/ naturally/ officially/ usually cannot do without it.'

b. Paul ↑ souvent ↑ préfère rester chez lui.
'Paul often prefers to stay home.'

(5) a. Paul se promettait de souvent aller au cinéma.
'Paul promised himself to often go to the movies'

b. Paul disait habituellement aller au cinéma le dimanche.
'Paul pretended to usually go to the movies on Sundays'

Third, adverbs may be either incidental or integrated in –p3– and –p4– (1), with two constraints. Light adverbs do not occur in –p4– (6) (Abeillé and Godard 1997),

[3]There is no evidence for distinction among positions for constituents after the participle.

[4]Nonincidental adverbs are found in –p1– in two constructions: the reinforced assertions construction discussed below and the complex clitic inversion construction, which is compatible only with a few adverbs (e.g. *Peut-être Paul viendra-t-il* 'Perhaps Paul will.come-he'. In addition, subject NP inversion disallows realizing an utterance initial adverb as an independent IP (e.g. *alors arriva Paul* 'then arrived Paul'). It remains to be seen whether the adverb is integrated in this case, or whether general prosodic factors disfavor an IP realization.

and sentential adverbs can appear in –p4– only if incidentals (7). This pattern shows that incidentals are *not* outside the realm of syntax, contrary to what is often assumed, since they are sensitive to syntactic position. Note, however, that there is no complementary distribution: sentential adverbs occur either as integrated or incidental in –p3–, and the others occur either as integrated or incidental in –p3– and –p4–.

(6) a. Paul a mal répondu à la question.
'Paul badly answered the question'

b. Paul a répondu à la question *(très) mal.
'Paul answered the question (pretty) badly.'

(7) a. Paul a répondu *(↑) forcément *(↑) à la question.
'Paul necessarily answered the question.'

b. Paul a répondu / répondra à la question *(↑) forcément.

We formalize the distinction with the feature INCID ±, which is a syntactic HEAD feature, with a prosodic correlate. The reason why we need a HEAD feature (pending a more elaborate conception of phonological properties) is that an incidental expression can be a phrase, such as a modified adverb (*Paul ↑ fort malheureusement ↑ a oublié le cadeau*, lit. 'Paul, most unfortunately, has forgotten the gift').

3 Scope, Syntactic Functions and Incidentality

Adverbs may have four distinct functions: they can be heads of a clause, fillers, adjuncts or complements. We discuss adjunct and complement adverbs below. As heads of a clause, adverbs occur with a clausal complement which they scope over, although a quantifier in the complement may outscope the adverb (see *Probablement que tu as vu un de mes étudiants*, lit. 'Probably that you have met one of my students'). Non-wh adverb fillers are found in two constructions. First, in adverb topicalization, as illustrated in (8a).[5] In such cases the adverb receives incidental prosody, and takes its scope at the extraction site—in (8a), the extracted adverb *récemment* scopes below in-situ *sûrement*. Second, in the *reinforced assertion* construction, where a clause initial adverb receives a special prosody, the

[5]Note that clause-initial incidental adverbs may be either adjuncts or fillers. That the two analyses are possible is shown by the adverbs, such as frequency adverbs, that cannot be fillers, but do occur clause initially (i-ii). See Bonami and Godard (2007) for details, and Maekawa (2006) for an analysis of parallel data in English.

(i) # Fréquemment, je sais qu'il va à Paris
(intended) 'I know he frequently goes to Paris.'

(ii) Fréquemment, il va à Paris
'He frequently goes to Paris.'

rest of the sentence being deaccented. The construction signals that the speaker amends a proposition in the common ground with respect to that part of the proposition which is expressed by the filler.[6] It occurs only in root clauses, and does not involve the same classes of adverbs as topicalizations. We leave aside the analysis of these constructions, although a standard view of extraction and quantifier scope clearly predicts the correct scopal properties.

(8) a. Récemment, je pense qu'il a sûrement été au théatre.
‘Recently, I think he certainly went to the theater.’

b. Prudemmment, il m'avait promis qu' il parlerait !
Prudently he promised that he would-talk

3.1 Integrated adjuncts

We start with the case of integrated adjuncts, although it is statistically less prominent, because it is most straightforwardly accounted for. In our analysis, integrated adjunct adverbs are found mostly to the left of infinitival VPs (not of finite VPs). They have scope over an adverb included in the VP (9), but they are not scopally ordered with respect to quantified NPs (10).

(9) a. Il se souvenait de [longtemps [s'être souvent retiré chez ses parents]]
(longtemps > souvent,*souvent > longtemps)
‘He remembered having often retired to his parents’ house.’

b. Il se souvenait de [souvent [s'être longtemps retiré chez ses parents]]
(souvent > longtemps,*longtemps > souvent)

(10) Il se promettait de [souvent [lire un journal]] (souvent > un, un > souvent)
‘He promised himself to often read a newspaper.’

The data concerning the two adverbs is taken care of by the usual constraint on head-adjunct phrases: the content of the phrase is identified with that of the adjunct, which takes as its argument the content of the head, and the content of the head VP is identified with that of the integrated postverbal adverb (see section3.2).

(11) *hd-adj-ph*→ $\begin{bmatrix}\text{CONT} & \boxed{2}\end{bmatrix}$

H

$\boxed{1}$ $\begin{bmatrix}\text{HEAD}|\text{MOD} & \langle\boxed{1}\rangle \\ \text{CONT} & \boxed{2}\end{bmatrix}$

The data concerning the quantifier NP shows that the adjoined adverb must be considered as a locus for quantification. Ginzburg and Sag (2000) analyzes only heads as such loci: they inherit the store of their arguments, and either transmit their store to the construction they head, or interpret the scopal elements (some or

[6]See Godard and Marandin (2006) on a syntactically different, but pragmatically similar, construction of Italian.

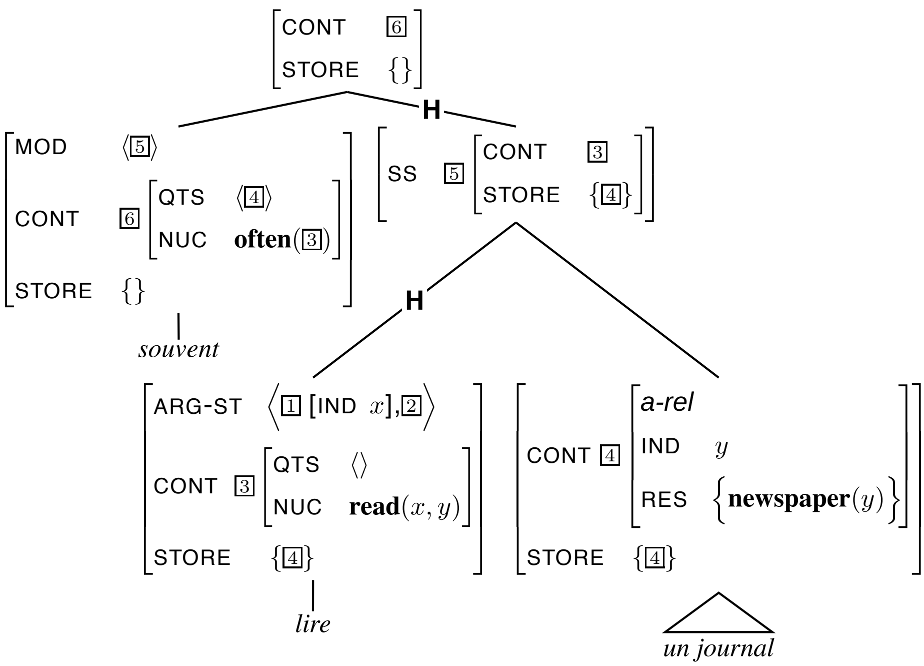


Figure 3: (9a) with narrow scope for *souvent*

all), putting them in the value of their QUANTS. We extend this analysis to adjoined constituents with the following constraint, which says that the store comes not only from arguments, but also from a modified constituent.

(12) a. *ordinary-lexeme*→ $\begin{bmatrix} \text{HEAD|MOD} & \left\langle \left([\text{STORE} \ \boxed{0}] \right) \right\rangle \\ \text{ARG-ST} & \left\langle [\text{STORE} \ \boxed{1}], \ldots, [\text{STORE} \ \boxed{n}] \right\rangle \\ \text{STORE} & ((\boxed{0}) \cup \boxed{1} \cup \cdots \cup \boxed{n}) \setminus \boxed{S} \\ \text{CONT|QUANTS} & \textbf{order}(\boxed{S}) \end{bmatrix}$

b. *quantifier-lexeme*→ $\begin{bmatrix} \text{CONT} & \boxed{1} \\ \text{STORE} & \{\boxed{1}\} \end{bmatrix}$

Accordingly, a quantifier such as *un journal* in (9a) can be scoped at the verb, that is put in its QUANTS, in which case the adverb *souvent* has scope over it (see Fig. 4). Alternatively, the quantifier remains in the store of the verb and the VP, and is scoped at the adjunct. In this case, it has scope over the adverb, because it is not part of the content of the VP, which the adverb takes as its argument. (see Fig. 3).

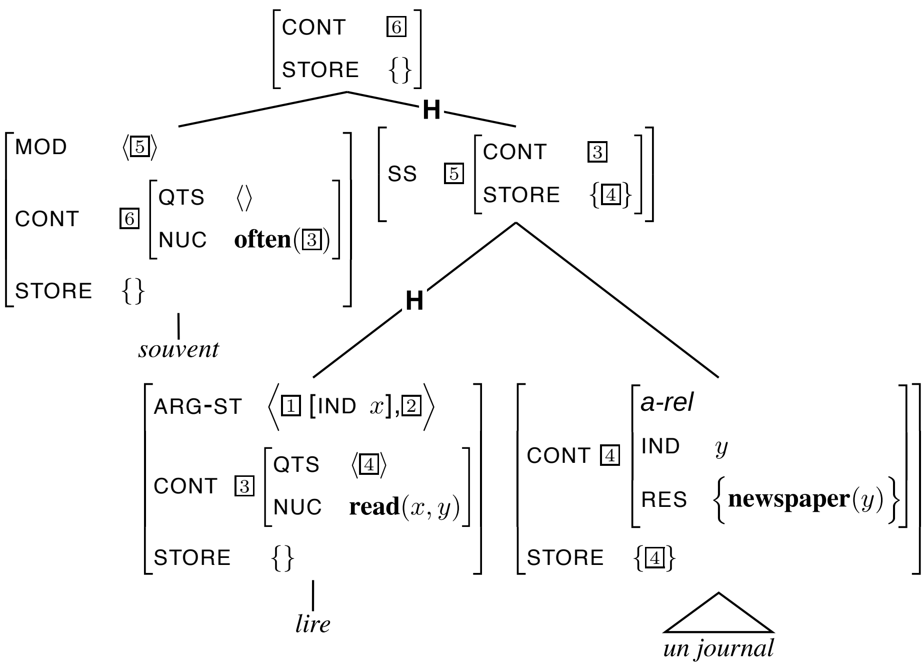


Figure 4: (9a) with wide scope for *souvent*

3.2 Complements

As is largely accepted in HPSG analyses of various languages, we treat integrated post-verbal adverbs or adverbials as complements (e.g. Miller, 1992; Noord and Bouma, 1994; Abeillé and Godard, 1997; Bouma et al., 2001). We adopt such a treatment mainly for coherence with existing HPSG accounts of French grammar, in particular the grammar of pronominal affixation and extraction. Locative adverbials can be pronominal prefixes on the verb like complements (as in *Paul l'y a rencontrée*, P. CL-CL has met, 'Paul has met her there'). Similarly, many adverbs can be extracted. Thus, if we assume that only valents can be extracted or realized as pronominal affixes, adverbs must be valents at least in some of their uses. Since postverbal integrated adverbs have the same distribution as argumental complements, it is natural to analyze them as complements.[7]

The particular analysis we assume here relies on a lexical rule (13), which includes a modifier into the argument structure, and updates the content, to be the same as that of the modifier.[8] The rule can be applied several times, the iteration being constrained by the lexical semantics of the adverbs. For instance, if a manner

[7]In fact, our analysis is mostly orthogonal to the debate between traceless, adverb-as-complement and trace-based, adverbs-as-adjuncts analyses, since the function of integrated adverbs plays no role in determining their position or their scope.

[8]This lexical rule provides the same effects as the version of Argument Structure Extension in Bonami and Godard (in press, b), without the overhead of an MRS-based semantics.

and a modal adverb are added in the argument structure of the same verb (as in *venir probablement rapidement* 'to probably come rapidly'), the rule must apply first to the manner adverb, since it cannot have scope over the content of a modal adverb. As an illustration, (14) shows the lexical entry obtained by applying the rule twice to the verb *vient* 'comes', which is then used in the analysis of a sentence in Fig.5.

(13) *arg-extension-lr*→

$$\begin{bmatrix} \textit{word} & \\ \text{ARG-ST} & \boxed{2} \oplus \left\langle \begin{bmatrix} \text{INCID} & - \\ \text{MOD} & \langle \boxed{1} \rangle \\ \text{CONT} & \boxed{3} \\ \text{STORE} & \boxed{4} \end{bmatrix} \right\rangle \\ \text{CONT} & \boxed{3} \\ \text{STORE} & \boxed{4} \end{bmatrix}$$
$$|$$
$$\begin{bmatrix} \textit{word} & \\ \text{SS} & \boxed{1} \begin{bmatrix} \text{ARG-ST} & \boxed{2} \end{bmatrix} \end{bmatrix}$$

(14) The rule applied twice to the verb *vient* 'comes':

$$\begin{bmatrix} \text{A-S} & \left\langle \text{NP}_i, \begin{bmatrix} \text{INCID} & - \\ \text{MOD} & \left\langle \begin{bmatrix} \text{CONT}|\text{NUC} & \begin{bmatrix} \textit{come-rel} & \\ \text{ACT} & i \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{CONT} & \boxed{3} \end{bmatrix}, \begin{bmatrix} \text{INCID} & - \\ \text{MOD} & \left\langle \begin{bmatrix} \text{CONT} & \boxed{3} \end{bmatrix} \right\rangle \\ \text{CONT} & \boxed{5} \end{bmatrix} \right\rangle \\ \text{CONT} & \boxed{5} \end{bmatrix}$$

The main fact regarding the scope of postverbal integrated adverbs in French is its correlation with order: an adverb to the left has scope over an adverb to the right. For instance, the lexical semantics of *souvent* 'often' and *longtemps* 'for a long time' are such that either one can take scope over the other. Thus, the adverb on the left has scope in (15a,b). On the other hand, the lexical semantics of *probablement* 'probably' and *silencieusement* 'silently' are such that the second cannot take scope over the first. Hence one ordering only is grammatical.

(15) a. Paul s'est souvent$_1$ longtemps$_2$ retiré chez ses parents. $(1 > 2, *2 > 1)$
'Paul often retired to his parents' home for a long time.'

b. Paul s'est longtemps$_2$ souvent$_1$ retiré chez ses parents. $(2 > 1, *1 > 2)$

c. Paul a probablement silencieusement quitté la pièce.
'Paul probably silently left the room.'

d. *Paul a silencieusement probablement quitté la pièce.

The segregation of scopal material under the features QUANTS and NUCLEUS allows us to model this constraint directly as an order rule. Quantifiers may scope

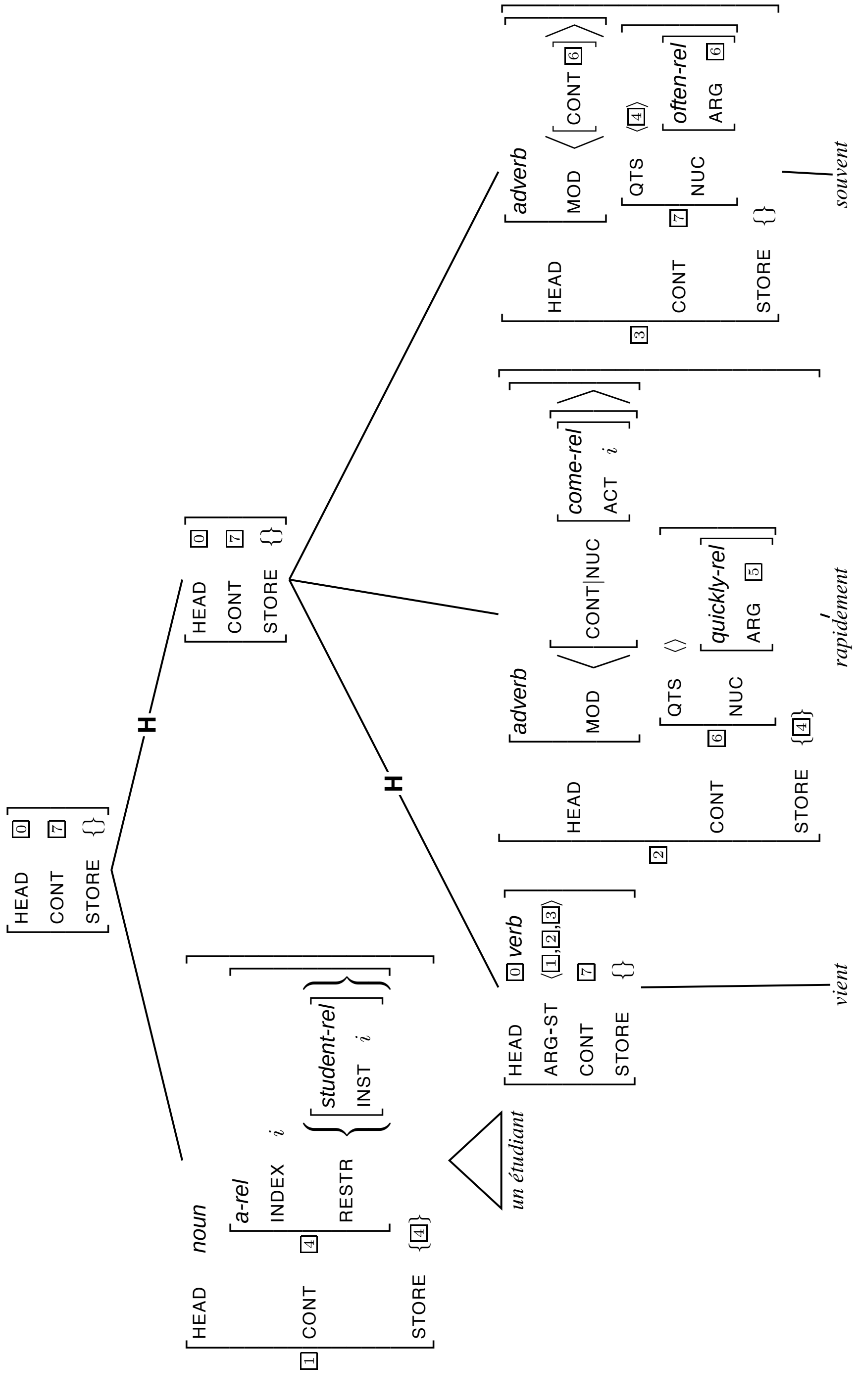


Figure 5: Using the lexical entry in (14)

between two integrated adverbs, but these will show up under QUANTS. Thus within a clause, each integrated adverb takes as its ARG the CONT of the next scopally highest integrated adverb, except the last one which takes as its ARG the lexical CONT of the verb (that is, its CONT before the application of argument structure extension). Thus the following rule takes stock of this situation by telling that an integrated adverb precedes the integrated adverb it modifies if any.

(16) $$\begin{bmatrix} \text{MOD} & \left\langle \begin{bmatrix} \text{HEAD} & \boxed{1} \\ \text{CONT} & \boxed{2} \end{bmatrix} \right\rangle \\ \text{INCID} & - \end{bmatrix} \prec \begin{bmatrix} \text{MOD} & \left\langle \begin{bmatrix} \text{HEAD} & \boxed{1} \end{bmatrix} \right\rangle \\ \text{INCID} & - \\ \text{CONT} & \boxed{2} \end{bmatrix}$$

3.3 Incidental adverbs

3.3.1 The issue

The distinction between integrated and incidental prosody has a correlate in terms of scope:

(i) Scope among integrated adverbs follows linear order.

(ii) Incidental adverbs take scope over integrated adverbs.

(iii) Scope among incidental adverbs is syntactically unconstrained.

We have already illustrated and discussed point (i). We see that (17) contrast with examples in (15a,b): when there is one incidental and one integrated adverb, the incidental has scope over the integrated one, irrespective of order; when both adverbs are incidental, both scopings are possible, again irrespective of order.

(17) a. Paul s'est $\uparrow$ souvent$_1$ $\uparrow$ longtemps$_2$ retiré chez ses parents. ($1 > 2$, $*2 > 1$)

b. Paul s'est $\uparrow$ longtemps$_2$ $\uparrow$ souvent$_1$ retiré chez ses parents. ($2 > 1$, $*1 > 2$)

c. Paul s'est longtemps$_2$ retiré chez ses parents $\uparrow$ souvent$_1$. ($1 > 2$, $*2 > 1$)

d. Paul s'est souvent$_1$ retiré chez ses parents $\uparrow$ longtemps$_2$. ($2 > 1$, $*1 > 2$)

e. Paul s'est $\uparrow$ souvent$_1$ $\uparrow$ retiré chez ses parents $\uparrow$ longtemps$_2$. ($1 > 2$, $2 > 1$)

f. Paul s'est $\uparrow$ longtemps$_2$ $\uparrow$ retiré chez ses parents $\uparrow$ souvent$_1$. ($1 > 2$, $2 > 1$)

The examples in (18) also contrast with parallel examples with integrated adverbs (15c,d). If the modal adverb is incidental and the manner adverb integrated, the sentence is grammatical, since the scope properties due to the prosodic status of the adverb co-incide with the semantic constraint (the modal has scope over the manner) (see (18a,c). If the manner adverb is incidental and the modal integrated, the sentence is ungrammatical, irrespective of order, because the manner adverb should have scope over the modal, which violates the semantic constraint (18b,d). If both are incidental, the sentence is grammatical, although only one scoping is possible, because the scope is not syntactically constrained (18e,f).

(18) a. Paul a ↑ probablement ↑ silencieusement quitté la pièce.
b. *Paul a ↑ silencieusement ↑ probablement quitté la pièce.
c. Paul a silencieusement quitté la pièce ↑ probablement.
d. *Paul a probablement quitté la pièce ↑ silencieusement.
e. Paul a ↑ probablement ↑ quitté la pièce ↑ silencieusement.
f. Paul a ↑ silencieusement ↑ quitté la pièce ↑ probablement.

It should be clear from this data that the scope of incidental adverbs is indifferent to their linear position. Two types of analysis can be pursued to account for that fact. In one approach, incidental adverbs are analyzed syntactically on a par with integrated adverbs, but they have different properties at the syntax-semantics interface—for instance, in the current setup, their content could be put in STORE. The other approach assumes that incidental adverbs are syntactically special: their linear position does not reflect in a direct way their structural relation to the rest of the sentence. In such an approach, the syntax-semantics interface can be quite straightforward because constituent structure relations are aligned with semantic scope. Both approaches to the scope of incidental adverbs can be pursued, and we do not have any strong argument, empirical or otherwise, against one of these. In this paper we pursue the second approach—we will mention a few advantages of that choice at the end of the section.

3.3.2 Linearization in the French sentence

The free placement of incidental adverbs leads us to reconsider the relation between constituency and order in a general way for French. We adopt a linearization-based approach in the spirit of (Reape, 1994; Kathol, 2000), which can be summarized in the three following points:

- Each word or phrase is associated with an *order domain*, a linearly-ordered list of signs, the value of the feature DOM.
- Order rules apply to domains rather than daughters.
- In French, the domain of a phrase is obtained by shuffling the domain of the head with the signs it combines with.

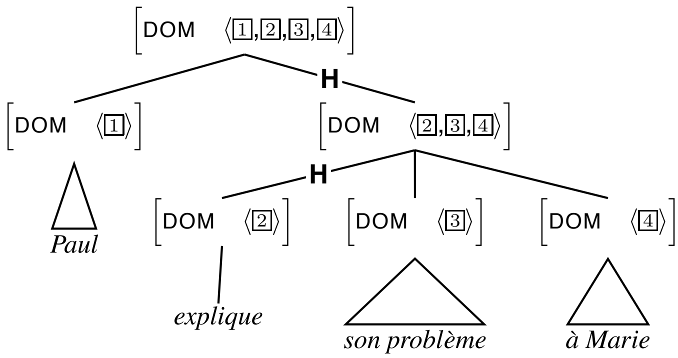
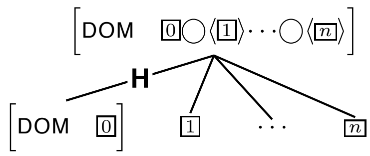


Figure 6: Domains in a simple sentence

(19) *headed-ph* →

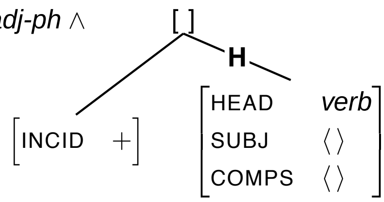


Description (19) amounts to assuming that there is no partial compaction in French (it would have to be amended if (Bonami et al., 1999)'s domain-based analysis of subject inversion is to be integrated in the current framework). As a result, a typical finite sentence has in its DOMAIN a flat list consisting of the verb, its valents, and the adjuncts or fillers it has combined with (see Fig. 6). The placement of the integrated constituents (subject NP, and complements including integrated adverbials) with respect to the verb results from constraints on the domain rather than from the existence of a compacted finite VP. This entails that order rules will be needed to position subjects, adjuncts and fillers in the correct place, an issue we will not address here.[9]

3.3.3 Linearization based Analysis of Incidentals

Incidental adverbs are adjoined to the sentence. We propose a construction which inherits from the usual *hd-adj-ph* (11), adding another constraint :

(20) *v-hd-incid-adj-ph* → *hd-adj-ph* ∧



The sentence domain is flattened, as proposed above. There is no constraint on the position of incidental modifier adverbs. Hence, they occur anywhere in this

[9] It is tempting to propose a topological approach to order in the French clause; and such an approach will definitely make sense in the context of a general grammar of incidental constituents (Marandin, 1998). A full discussion is outside the scope of this paper.

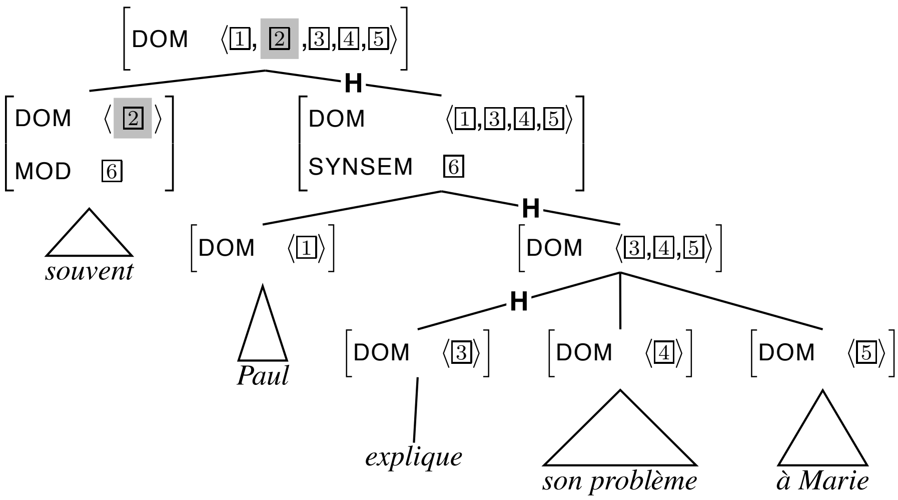


Figure 7: The phrase-structure position of an incidental adverb

domain. An example is given in Fig. 7. The tree corresponds to the constituency, and the nodes are annotated with the feature DOM which indicates how the signs are ordered. Here the incidental adverb *souvent* is adjoined to the sentence node, but this tree representation corresponds to the sentential expression where it occurs between the subject and the finite verb.

The proposed approach to incidental adverbs amounts to stating that the scopal properties of those adverb occurrences are aligned with their syntactic positions, but that this has no consequence on linear order. Thus when two incidental adverbs occur in a sentence, it is their scope relation, and not their linear position, which is reflected by the constituent structure. This is in sharp contrast with our approach to the scope of integrated adverbs, where there is no structural contrast between two adverbs, and their relative scope is determined by a linear order rule. This use of different analytic devices directly reflects the difference in observed scope properties.

At the beginning of this section we discussed the fact that incidental adjunct scope could be approached either by relaxing the syntax-semantics interface or the constituent structure-linear order relation. We can now justify our choice briefly. One advantage of the current approach is that it allows for more streamlined syntactic rules for French: if we were to generate incidental adverbs on a par with integrated adverbs, we would need a number of arbitrary limitations on the prosodic realizations associated with various syntactic positions; in the current setup, nothing specific has to be said either for incidentals (they linearize freely) or integrated complements (they linearize just like other complements). Only in the case of integrated adjuncts do we need some explicit constraint. Second, if incidental adverbs were put in STORE, we would expect them to be able to scope out of their clauses, as quantifiers do. Although of course appropriate restrictions on STORE values could be proposed, our analysis avoids such stipulations, as clause boundedness follows from independent constraints on linearization: as nonheads, embedded clauses are compacted, and thus there is no way for an incidental adverb to scope outside its clause.

4 Parentheticals and scope

It is largely accepted that parenthetical material is not part of the main content (Jayez and Rossari, 2004; Potts, 2005): it corresponds to a commitment of the speaker, but is not part of the content that is taken into account by the speech act. Four classes of adverbs are parenthetical: speech act adverbs, connectives, evaluatives, sentential agentives (Bonami et al. (2004)). While parentheticality has often been confused with the prosodic property of incidentality (under the name of 'comma intonation'), it should be clear by now that these are two orthogonal distinctions. Going back to (1), we see that most adverbs can have both prosodic realizations, independent of parentheticality or other lexical distinctions.

We illustrate the pragmatic status of parentheticals with evaluative adverbs, which have been the focus of our work on the subject (Bonami and Godard, in press, a, b). The evaluative adverb in (21a) contrasts with the modal in (21b) in not participating in the truth conditions for the sentence. (22) makes it clear that the evaluative is not part of the assertion, since it cannot be refuted by normal means (such as 'it is false').

(21) a. Si Paul part en vacances, nous ne le saurons malheureusement pas.
'If Paul goes away on vacation, we will unfortunately not know it'
$\Leftrightarrow$ Si Paul part en vacances, nous ne le saurons pas.
'If Paul goes away on vacation, we will not know it.'

b. Si Paul part en vacances, nous ne le saurons probablement pas.
'If Paul goes away on vacation, we will probably not know it'
$\not\Leftrightarrow$ Si Paul part en vacances, nous ne le saurons pas.
'If Paul goes away on vacation, we will not know it.'

(22) A: Paul a malheureusement perdu l'élection.
'Paul unfortunately lost the election.'

B_1: # C'est faux, je trouve que c'est une très bonne nouvelle.
'That's not true, I think it is very good news'.

B_2: C'est vrai, mais moi, je trouve que c'est une très bonne nouvelle !
'Yes, but I personally think it is great news!'

What is of direct interest for us here is that, in spite of not being part of the main content, parenthetical adverbs may enter into scope interaction with the rest of the sentence. As shown in (Bonami and Godard, in press, a), the information contributed by an evaluative has a conditional structure (23), where '$\forall^*$' denotes a universal closure operator binding all free variables in its scope. The relevance of the quantifier is made visible by the occurrence of an evaluative in an interrogative sentence, where it bind variables corresponding to *wh-* elements.

(23) Lexical decomposition content of the evaluative adverb
$\lambda p.\forall^{*}[p \rightarrow \textbf{adjective}(p)]$

(24) a. Qui est curieusement arrivé à l'heure ?
'Who arrived on time, oddly'

b. *questions:* $\lambda x.[\textbf{arrive-on-time}(x)]$

c. *comments:* $\forall^{*}[\textbf{arrive-on-time}(x) \rightarrow \textbf{odd}(\textbf{arrive-on-time}(x))] \equiv$
$\forall x[\textbf{arrive-on-time}(x) \rightarrow \textbf{odd}(\textbf{arrive-on-time}(x))]$

Example (25) shows that there can be scope interaction between evaluatives and quantifiers: the adverb has or does not have scope over the quantifier. The second reading is in principle always available, but is more conspicuous if the adverb is postverbal (*la plupart des étudiants sont heureusement venus*).

(25) Heureusement, la plupart des étudiants sont venus.
'Fortunately , most students came'
asserts: $\textbf{most}(\lambda x.\textbf{student}(x), \lambda x.\textbf{come}(x))$
comments:

a. $\textbf{most}(\lambda x.\textbf{student}(x),$
$\lambda x.\textbf{come}(x)) \rightarrow \textbf{fortunate}(\textbf{most}(\lambda x.\textbf{student}(x), \lambda x.\textbf{come}(x)))$

b. $\forall x[\textbf{student}(x) \rightarrow [\textbf{come}(x) \rightarrow \textbf{fortunate}(\textbf{come}(x))]]$

Bonami and Godard(in press, a) provides an HPSG account of evaluative adverbs that accounts both for their special illocutionary status and their scopal behavior. [10] Parenthetical material is put under a special feature CMT ('commitments') within CONTEXT whose value is passed up the tree.

(26) *hd-ph*$\rightarrow$ $\left[\text{CMT} \quad \boxed{1} \cup \cdots \cup \boxed{n}\right]$

$\left[\text{CMT} \quad \boxed{1}\right] \quad \ldots \quad \left[\text{CMT} \quad \boxed{n}\right]$

The value of the feature CMT is then interpreted at utterance level by a unary rule (Ginzburg and Sag, 2000) whose role is to intepret the different semantic

[10]The analysis of Bonami and Godard(in press, a) has a few limitations: it does not allow for phrasal parentheticals, and does not account correctly for cases of evaluatives embedded in a speech report. Both problems are addressed in Bonami and Godard(in press, b), which uses a modified version of MRS to account for the relevant data. We have not yet produced a unified analysis that accounts for all the relevant data using a single syntax-semantics interface framework, although there is no reason it cannot be done. What should be clear however is that both versions of the analysis interact correctly with the analysis of integrated and incidental occurrences provided here, since all differences between parenthetical and non-parenthetical adverbs lie in the way material from MOD is used to construct CONT and CMT values, and nothing in the analysis of incidentality is sensitive to such distinctions.

bits contributed by the sentence in terms of dialogue gameboard update operations (Ginzburg, to appear). Fig. 8 illustrates this in an example. The adverb *heureusement* makes no contribution to CONT, and just identifies its content with that of the head. It does however contribute a conditional proposition ($\boxed{2}$) to the CMT set. This is passed up the tree. At sentence level, we see that the content of the clause ($\boxed{1}$) receives a version of Ginzburg's dual treatment for assertions: first, the speaker commits himself to the truth of *a student came*; second, the question whether a student came is put in discussion in QUD—only if the adressee accepts it will it become common ground. The contribution of the evaluative adverb is added to the commitment set, but not to QUD. This reflects the fact that parentheticals are solitary commitments: the speaker is committed to their truth, but does not call for an agreement of the adressee, and the dialogue can go on without that agreement being reached.

As we have seen in (25), parenthetical adverbs give rise to scope ambiguities. They depend essentially on the same mechanism as those of non-parentheticals (see (10)): as adjuncts, they take the content of the head as their argument (11), and they are a locus of quantification (12). If the quantifier is interpreted in the head daughter, it is included in the argument of the adverb (which has 'wide scope'), as in (25a); if the quantifier is in the store of the head daughter, it is not included in the argument of the adverb (which has 'narrow scope'), as in (25b). There are two differences which blurr this essential similarity. First, given their status as parenthetical, the scope interaction does not affect the main content, but only the commentary. Second, regarding evaluative adverbs, their implicative structure makes the predicate-argument relation less conspicuous.[11] However, it is clear that parenthetical adverbs transpose in their own contextual realm the same scope mechanism that is used by other adverbs in determining the main content.

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[11] For details of the HPSG implementation of the universal closure operator, see again Bonami and Godard, in press, a).

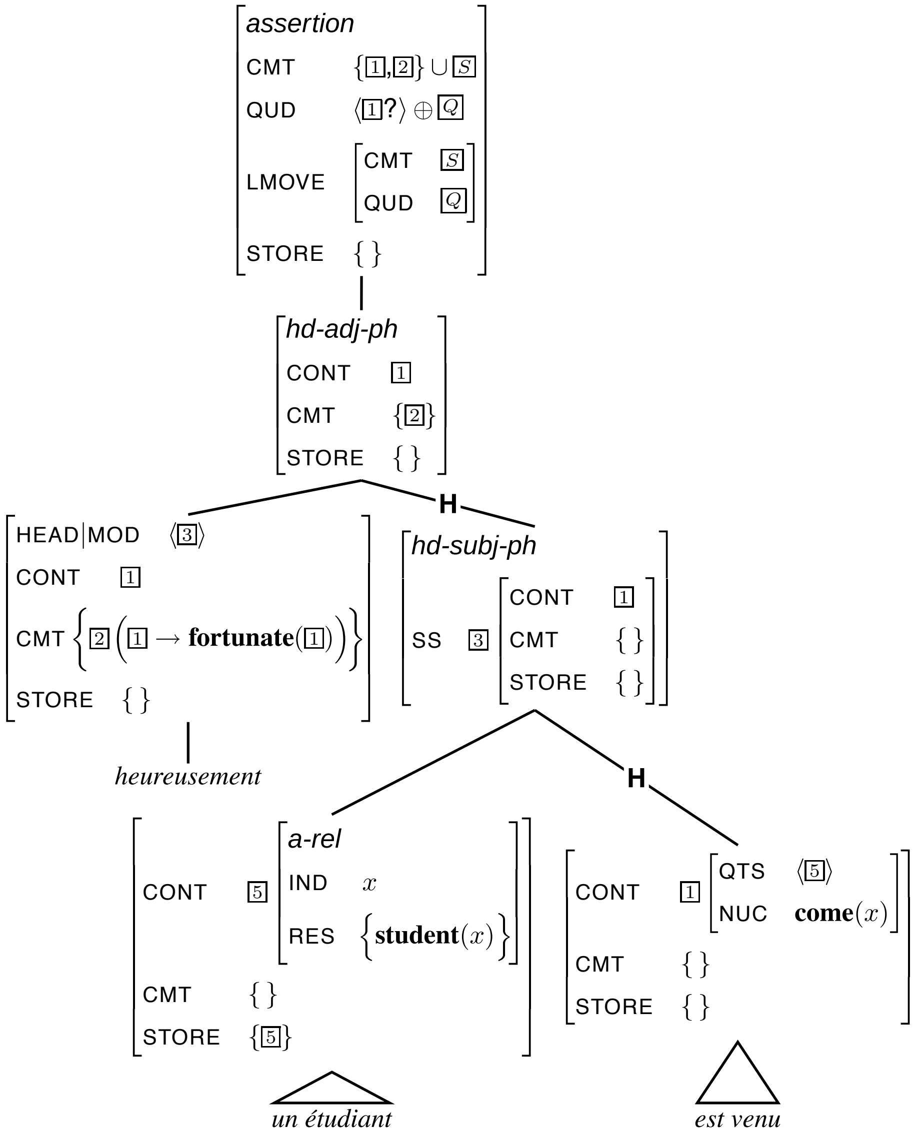

Figure 8: Analysis of an evaluative adverb

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On The Russian Hybrid Coordination Construction

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Abstract

This paper discusses a coordination construction that occurs in Russian in which constituents with different syntactic functions and different thematic roles are conjoined. These conjuncts are co-arguments of the same head and are subject to a number of idiosyncrasies.

We consider several alternative analyses of the phenomena, and conclude that these are unable to account for the full range of the facts. Thus, even though these conjuncts do not form a semantic unit with a unique grammatical role, there is evidence that they do form a kind of coordination structure. The phenomena are challenging for any theory of grammar, but the syntax-semantics account that we provide involves minimal changes to standard HPSG architecture.

1 Introduction

Russian is a relatively free word order language. A simple sentence like (1a) can be realized in six different ways as shown below. These realizations have essentially the same core semantics, even though these differ in frequency, pragmatic import and information structure.

(1) a. Vse znayut kogo-to.
everyone$_{nom}$ knows someone$_{acc}$

b. Kogo-to znayut vse.

c. Vse kogo-to znayut.

d. Kogo-to vse znayut.

e. Znayut vse kogo-to.

f. Znayut kogo-to vse.

The particular phenomenon addressed in this paper arises when a conjunction lexeme i ('and') is inserted between the co-arguments of the same head. Thus in (2) one can see what appears to be a coordination between the subject *vse* 'everyone' and the complement *vsyo* 'everything':

(2) a. Vse i vsyo znayut.
everyone$_{nom}$ and everything$_{acc}$ knows

[†]We thank our native informants residing in Moscow, as well as Olga Dmitrieva, Tatiana Nikitina, Petya Osenova, Svitlana Antonyuk-Yudina for various help and discussion. We are also most grateful to the anonymous referees from the HPSG07 programme committee for their comments, as well as to the HPSG07 audience for questions and suggestions. None of the above necessarily endorse or reject the ideas developed in this work, and we alone are responsible for any errors and unclarities.

b. Znayut vse i vsyo.
knows everyone$_{nom}$ and everything$_{acc}$

Note that the NPs bear the expected thematic roles and as such one would not be expected them to be conjoinable. However, when the conjunction marker is present the co-arguments are required to be adjacent. This is illustrated below, and suggests some kind of constituenthood:

(3) *Vse znayut i vsyo.
everyone$_{nom}$ knows and everything$_{acc}$

(4) a. Nikto i nikogo ne pobedit
nobody$_{nom}$ and nobody$_{acc}$ not win
'nobody could beat anyone'

b. *Nikto ne pobedit i nikogo
nobody$_{nom}$ not win and nobody$_{acc}$

This phenomenon has been noted before in Sannikov (1989), and we shall refer to it as *hybrid coordination* (henceforth HC). Although our proposal concerns Russian, our account can in principle be extended to other Slavic languages that also allow for HC, including Ukrainian and Polish. For perspicuity we include some examples from Ukrainian:[1]

(5) a. Vsi i vse pro vsikh znajut'
everybody and all about everyone know)
'everybody knows everything about everyone'

b. Vsi vse i pro vsikh znajut'
everyone all and about everyone know

(6) *vsi vse znayut' i pro vsikh
everyone all know and about everyone
'everybody knows everything about everybody'

One other crucial aspect of HC is that the presence of the conjunction does not alter the meaning of the sentence. In other words, *Nikto i nikogo ne pobedit* has basically the same meaning as *Nikto nikogo ne pobedit*. Consider some more data given in (7). Some of the native speakers that we consulted report that coordinations with indefinite conjuncts like (7c) are degraded, while other speakers accept them as grammatical. The remaining cases were accepted as fully grammatical.

[1]We are very thankful to Svitlana Antonyuk-Yudina for providing help with these data. All other examples given in this paper are from Russian.

(7) a. Vsem i vse do lampochki
everyone$_{dat}$ and everything$_{nom}$ don't care
'nobody cares about anything'

b. Kto i kogo pobedil?
who$_{nom}$ and whom$_{acc}$ won
'Who took over whom?'

c. Kto-to i kogo-to obidel
someone$_{nom}$ and someone$_{acc}$ offended
'someone offended somebody'

The fact that (7c) is degraded for some speakers is odd on itself, given that the non-coordinate counterpart *Kto-to kogo-to obidel* is perfectly grammatical. This may be due to pragmatic and/or information structure underpinnings of HC, which do seem to require contexts in which the 'conjuncts' are salient in some manner. It should be pointed out however that HC does not require any kind of prosodic focus. The exact nature of the pragmatic import associated to this phenomenon is unclear to us, but it does exist.

Our informants also report that HC is intuitively interpreted as a form of conjunction. There are several elements that are involved in a given state of affairs and one can list them by conjoining them. There are also preferential orderings of conjuncts, but the reverse orders are usually also acceptable.

One of the simplest possible analysis that could be pursued is one in which no actual coordination occurs. One may argue that the particle i is just homophonous with the conjunction lexeme, and that no actual coordination is realized. In fact, in Russian and in other Slavic languages the particle 'i' can also be a focus particle with the meaning '*also*' or '*even*'. The example in (8b) shows that the focus 'i' does not form a constituent with the preceding phrase, because [*i Vanya*] need not be adjacent to the other NP [*Petya*]:

(8) a. Petya i Vanyu pobedit
Peter and Vanyu win

b. Petya pobedit i Vanyu
Peter win and Vanyu
'Peter can beat Vania too' / 'Peter can beat even Vania'

Clearly, there is no coordination structure in these cases. The phrase adjacent to '*i*' is focused, and interpreted as an unexpected undergoer of the event, possibly contrasted with some other discourse-salient individual.

The HC data in (7) are rather different however. First, the 'conjuncts' must be adjacent if i is present. Secondly, there is no focus reading for (7a,b) and (7c) is ambiguous between a focus reading (in which *i obidel* can be realized non-adjacently to the other argument) and the reading one would obtain without the presence of the conjunction i. Thirdly, HC does not arise with proper nouns like (8a). These cases are necessarily interpreted with the focus reading.

This makes it unlikely that i is anything other than a coordination marker in HC because it does not explain the absence of a focus reading nor the fact that the co-arguments cannot appear discontinuously. In fact, the entire sequence of co-arguments behaves like a syntactic block in the presence of the conjunction. It can be fronted, extraposed and in general realized in any position that would be suitable for each of the conjuncts.

In section 2 we discuss the Russian data in more detail, and consider several other idiosyncrasies about HC that further indicate that some kind of syntactic constituency is formed. In section 3 we put forth a constructional account couched in HPSG, using Minimal Recursion Semantics Copestake et al. (2006). The adoption of a semantic underspecification framework will enable us to obtain a uniform syntax-semantics interface.

2 On the Syntactic Properties of HC

We start by pointing out that several of the trademarks of coordination are true of HC phenomena. As one would expect of a coordinate structure, conjuncts must be at least two. This is not surprising because if conjuncts are actually co-arguments then the presence of obligatory arguments is required by the head:

(9) a. Vse i vsyo znayut.
everyone and everything knows
'Everyone knows everything'

b.* I vsyo znayut.
And everything knows

Similarly, it is also natural that this phenomenon only occurs with conjunction, as disjoining co-arguments is nonsensical. Second, HC also allows for 'coordination of unlikes' phenomena (Gazdar et al., 1985) as shown in examples like (10a), in which conjuncts include adverbials:

(10) a. Vsem vezde i vse do lampochki
everyone$_{dat}$ everywhere and everything$_{nom}$ don't care
'nobody cares about anything anywhere'

b. Zdes' vse i vsegda est'
here everything and always is
'you can always find anything here'

c. Vas vse i vsegda ponimayut s poluslova
you$_{acc}$ everybody and always understand from half-word
'everybody always takes your hint'

d. Nikto nichto i nikogda nas ne slomit
noone nothing and never us not break
'Noone and nothing will ever take us over'

Further evidence for HC forming a constituent is that these coordination structures can be realized in virtually any position that a standard argument can. Thus, the 'unlike coordinate' HC structure can be fronted, for instance:

(11) a. etot professor rad pomoch' Vsem i Vsegda
this professor is-eager to-help everyone and always
'this professor is always eager to help everyone'

b. Vsem i vsegda etot professor rad pomoch'
everyone and always, this professor is-eager to-help

Given that adverbial conjuncts are admitted, it is not unexpected that PPs can also be conjoined in HC, although rare these are rare and often marked in some way as seen in (12).

(12) a. Ne sposoben [nikto i [ni s kem]] pomenyat'sya mestami
not able nobody and no with body change places
'nobody is able to change places with anyone'

b. Takim obrazom, [nikto i [nikakih novyh telekanalov]] ne sozdaet.
this way, [nobody and no new TV-channels] not creates
'So, no one creates any new TV channels'

Thus it seems that the apparent identity requirement that exists between conjuncts in HC is semantic or pragmatic in nature, rather than categorial or morphologic.

Another peculiar aspect of this phenomenon is that it is restricted in ways in which the non-coordinate counterpart is not. First of all, in the overwhelming majority of attested cases that were found in the Russian National Corpus, conjuncts were lexical rather than phrasal.[2] One reason for this is that neither of the conjuncts can contain modifier phrases, such as adjectives or prepositional phrases:[3]

(13) a. Vse lysye vsyo znayut
everyone bold everything knows

[2]In fact, Sannikov (1989) dubs this phenomenon as *lexical-semantic coordination*, even though the author uses the same term for other kinds of phenomena also.

[3]Note that one of our 20 informants accepted these data. Even though there is some speaker variability for HC, we were unable to find other informants with the same judgments as the former.

b.*Vse lysye i vsyo znayut
everyone bold and everything knows

(14) a. Vse vsyo interesnoe znayut
everyone everything interesting knows

b.*Vse i vsyo interesnoe znayut
everyone and everything interesting knows

(15) a. *Kto-to vysokii i kogo-to obidel?
someone$_{nom}$ tall and someone$_{acc}$ offended$_{3sg}$

b. *Nikto i nichto interesnoe dal
nobody and nothing interesting said

In general, the cases where an adjective is added to the leftmost conjunct are rendered utterly ungrammatical while the cases where an adjective is added to the rightmost conjunct are somewhat less odd, even if still deemed ungrammatical. Thus, (13b) is worse than (14b), which is in itself puzzling given that the non-coordinate counterparts are fully grammatical. This provides further evidence that some kind of constituency is at stake, which for some reason, possibly pragmatic in nature, disprefers complex conjuncts.

The presence of prepositional modifiers also has a similar effect, even though informants report that adding the modifier to the rightmost conjunct is somewhat less degraded than the adjectival examples. Still, they are deemed less than grammatical:

(16) a. ??Nikto i nikogo iz Odessy ne znaet
nobody and no one from Odessa not know

b. Nikto nikogo iz Odessy ne znaet
nobody no one from Odessa not know
’nobody knows anyone from Odessa’

It is important to note that this is not a matter of weight. If the PPs are larger structures the ungrammatical examples are not ameliorated. Intriguingly, the case of relative clauses is different. Cases involving relative clauses, although very rare and not easy to process, are considered grammatical:

(17) a. Vezde i vse chto mne pokazyvali mne nvavilos.
everywhere and everything that.Rel to-me showed to.me pleased
‘I liked whatever was shown to me anywhere’

b. Vezde i vse kto byl dobrozhelatelen pomogali mne.
everywhere and everyone who were friendly helped me
‘Everyone benevolent helped me everywhere’

Another aspect of HC is that conjuncts are required to be of the same semantic type. Thus, if one conjunct has universal quantificational force, so must all others, regardless of the part of speech:

(18) a. *vse i chto-to vidyat
everybody and something see

b. *vse i zdes' molyatsya
everybody and here pray

It is unclear to us what is the exact nature of this constraint, if semantic or pragmatic, for instance. It may be the case that this is similar to what Barwise and Cooper (1981) note for English, where conjuncts with different right monotone properties are degraded: *[*No woman and John*] *was/were invited*. It can be argued that hybrid coordination impose an even stronger constraint requiring that the semantics of the head of the conjunct be of the same type.

Many authors have argued that *wh*-constituents with different thematic roles can be coordinated in various languages, ranging from Slavic to English. If so, this would mean that Russian is not so special and that other languages allow for the same kind of phenomenon, but are somewhat more restricted in that only *wh*-conjuncts are allowed for. One example of this is given for English in (19):

(19) a. How many, where, and who are they?

b. Why and how do scientists study climate change in the Arctic?

c. Where and who is the cheapest cosmetic dentist in Manchester?

Whitman (2002) dubs such cases as 'mixed-WH interrogatives' and goes on to argue for a direct coordination analysis. The problem with such an analysis is that the data in (19) can be accounted for as a standard clausal coordination coupled with an ellipsis operation, either Right-Node Raising or backwards Sluicing.[4] In fact Whitman (2002,86) acknowledges that the ellipsis analysis captures all the English data but goes on to claim that a direct coordination analysis is superior on psycholinguistic grounds.

The ellipsis account however, makes correct predictions and dispenses with non-standard coordination assumptions. For example, cases that cannot be reduced to clausal coordination via RNR or Sluicing are ungrammatical:

(20) a. *Who and what found?

b. *Who ~~found~~ and what found?

(21) a. *Who and whom saw?

[4] See for instance Camacho (2003).

b. *Who ~~saw~~ and whom saw?

As far as we can tell, this argument in favor of an ellipsis account for (19) also carries over to all other languages that have been argued to exhibit the same kind of phenomena for the coordination of *wh*- phrases.

At this point one can ask whether ellipsis can also account for Russian hybrid coordination phenomena. The answer to this question is in the negative. First, we have already noted several peculiarities that would otherwise remain unexplained in an ellipsis analysis, such as the fact that only certain conjuncts headed by the same semantic operator can be realized, and the fact that HC conjuncts cannot contain certain modifier phrases. Secondly, clausal coordination and ellipsis simply fail to account for all the data. In particular, cases in which subjects and complement NPs are conjoined because the alleged underlying clausal coordinations are ungrammatical:[5]

(22) a.

Vsem,	i	vsyo	do lampochki
everyone$_{dat}$	and	everything$_{nom}$	don't care

'nobody cares about anything'

b.

*Vsem,	do lampochki	i	vsyo	do lampochki
everyone$_{dat}$	don't care	and	everything$_{nom}$	don't care

(23) a.

Tol'ko	takuiu	vlast'	[nikto	i	nikogda]	ne	oprokinet.
only	such$_{acc}$	power$_{acc}$	nobody$_{nom}$	and	never	not	throw-down

'only such power can never be thrown down by anybody'

b.

# Tol'ko	takuiu	vlast'	nikto	ne	oprokinet	i
only	such$_{acc}$	power$_{acc}$	nobody$_{nom}$	not	throw-down	and

(tol'ko	takuiu	vlast')	nikogda	ne	oprokinet.
(only	such$_{acc}$	power$_{acc}$)	never	not	throw-down

In conclusion, hybrid coordination does not lend itself to ellipsis accounts nor to particle accounts and exhibits a number of distributional idiosyncrasies which are best accounted for if a syntactic structure is formed. In what follows we will provide an explicit syntax-semantics account in HPSG, without major revisions to the grammar of Russian.

3 Analysis

Bloomfield (1933) views all constructions as endocentric, and distinguished coordination structures from subordination structures in that the latter contained a *head* daughter from which the category of the mother was obtained. In the case of coordinate structures, the category of the mother was seen as corresponding to the conjuncts. Consider the following passage:

[5]The same applies to hybrid coordination of *wh*- phrases in Russian, as in Kazenin (2001).

> Endocentric constructions are of two kinds, *co-ordinate* (or *serial*) and *subordinate* (or *attributive*). In the former type the resultant phrase belongs to the same form-class as two or more of the constituents. (...) In subordinative endocentric constructions, the resultant phrase belongs to the same form-class as one of the constituents, which we call the *head*.
>
> (Bloomfield, 1933, 195)

The hybrid coordination phenomenon suggests that there is a third kind of construction, exocentric in nature, in which the category of the mother is not determined by neither of the conjuncts. In this view, headedness in Russian can be of one of two kinds: endocentric (in the sense that the grammatical status of the mother is defined by at least one of the daughters) or exocentric (in which case the grammatical status of the mother is not determined by any of the daughters).

In the present account we will therefore capture HC as an exocentric coordination construction. Since conjuncts are co-arguments and do not form a semantic unit, the conjuncts are stored by the construction itself and thus made available to the governing head X as illustrated below:

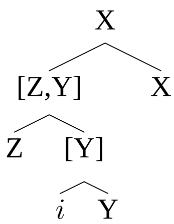

Figure 1: Clause with a hybrid coordination structure

In order to account for the exocentric phrase type and the fact that conjuncts are collected in the hybrid coordination node, we will propose an extra part of speech type *exocentr*(*ic*) that introduces a list-valued feature:

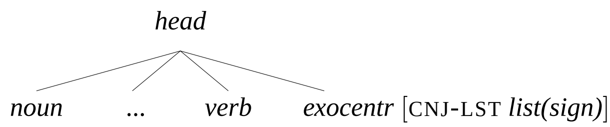

Figure 2: Part of speech hierarchy

The feature CNJ-LST allows the HC construction to collect the conjuncts inside the head value of the mother node, making them accessible to the head. Basically, the unsaturated valence of the head will be required to match the value of CNJ-LST.[6] The above tree structure can be obtained with three grammar rules. Two

[6] Yatabe (2004) proposes a similar feature ARGS, with the goal of accounting for Coordination of Unlikes phenomena. These two features differ only in that the latter takes only HEAD values of each

coordination rules add conjuncts to CNJ-LST, and a third rule allows a head to saturate valents with the elements in CNJ-LST:

(24) *Exocentric Conjunction*

a. [Y] → conj Y

b. [Z, K, . . . , Y] → Z [K, . . . , Y]

(25) *Head-Hybrid-Argument Phrase*

H → [Z, K, . . . , Y] **H**

3.1 Semantic matters

This work adopts Minimal Recursion Semantics (Copestake et al., 2006) for the semantic representations. The syntax-semantics interface will benefit greatly from this move as it will allow for a straightforward analysis of the semantics of HC constructions. We take the semantic representation of any node to quite simply correspond to the concatenation of the semantic representations contributed by each daughter:

(26)
$$cx \rightarrow \begin{bmatrix} \text{SYNS} \mid \text{CONT} \begin{bmatrix} \text{RELS } \boxed{R_1} \oplus \ldots \oplus \boxed{R_n} \\ \text{CONS } \boxed{C_1} \oplus \ldots \oplus \boxed{C_n} \end{bmatrix} \\ \text{DTRS} \left\langle \begin{bmatrix} \text{SYNS} \mid \text{CONT} \begin{bmatrix} \text{RELS } \boxed{R_1} \\ \text{CONS } \boxed{C_1} \end{bmatrix} \end{bmatrix}, \ldots, \begin{bmatrix} \text{SYNS} \mid \text{CONT} \begin{bmatrix} \text{RELS } \boxed{R_n} \\ \text{CONS } \boxed{C_n} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

In MRS representations, the RELS feature contains a list with the semantic relations contributed by signs and the CONS contains scope restrictions needed for combining the sub-formulas in the RELS list. Given the syntactic analysis that we propose, the semantics of hybrid coordination is obtained the same way as any other structures, without further stipulation: the semantic content of the HC node consists in the concatenation of the semantic content of each daughter.

The next move is to require that the main semantic relation associated to each conjunct is the same. In other words, to make sure that both conjuncts are '∀' (as in *everyone and everywhere*), or '∃' (*someone and something*), or '¬' (*nobody and no news TV channel* or *nobody and nothing*). It is unclear if this is a hard semantic constraint or it results from a different kind of effect, but it can be captured by reformulating the feature HOOK so that it singles out the relation of the semantic head. This is exemplified in the lexical entry for the noun vse (everything), with the new feature H-RELN:

conjunct, but we suspect that if Yatabe (2004) were to account for semantic aspects of coordination of unlikes that ARGS would be required to take lists of signs also. All in all, either feature can be used for the present purpose.

(27)

$$
\begin{bmatrix} \textit{word} \\ \text{PHON}\ \langle \textit{vse} \rangle \\ \text{SYNS} \begin{bmatrix} \text{CAT}\,|\,\text{HEAD} \begin{bmatrix}\textit{noun}\\ \text{CASE}\ nom\end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{GTOP}\ \textit{handle} \\ \text{HOOK} \begin{bmatrix} \text{LTOP}\ \textit{label} \\ \text{INDEX}\ \boxed{x} \\ \text{H-RELN}\ \boxed{1}\end{bmatrix} \\ \text{RELS} \left\langle \begin{bmatrix}\text{LABEL}\ \textit{handle}\\ \text{RELN}\ \boxed{1}\textit{every\_rel} \\ \text{ARG}_0\ \boxed{x} \\ \text{RESTR}\ \boxed{h}\end{bmatrix}, \begin{bmatrix}\text{LABEL}\ \boxed{h} \\ \text{RELN}\ \textit{thing\_rel}\\ \text{ARG}_0\ \boxed{x}\end{bmatrix}\right\rangle \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST}\ \langle\,\rangle \end{bmatrix}
$$

By requiring that HC conjuncts have the same HOOK|H-RELN value one can rule out cases like '*everybody and something*' and '*nobody and someone*'.

We will also make the assumption that the lexical entry for the conjunction marker '*i*' is makes no semantic contribution. The possible ranges of interpretation for conjunction are instead given by the construction in which they occur in. Since hybrid coordination does not yield a complex semantic unit, we do not need to say anything else about it. Note however that this could go either way. Either various lexical entries for conjunction are introduced, or conjunctions are underspecified semantically and it is the construction that determines the meaning. Various examples of conjunction are provided below, to illustrate the need for various different meanings:

(28) a. Suppose that two and two is five.
(arithmetic conj)

b. There were one hundred and thirty UFO sightings.
(numeral conj)

c. The sound became louder and louder.
(intensification conj)

d. Two ham rolls and a glass of milk was all I wanted.
(packaging conj)

3.2 Syntax-Semantics Interface

In this work we will adopt in general terms the feature geometry of Ginzburg and Sag (2000), with the exception of MRS representations, as discussed above. We also follow Bouma et al. (2001) and others in assuming that adjuncts are subcategorized as complements. Nothing in the account crucially hinges on this, but this allows us to keep the formalization simpler. Finally, we adopt the feature [CRD *bool*] from Beavers and Sag (2004) in order to control conjunct iteration in coordination structures.

The type hierarchy that includes the new grammar rules discussed consists in the following:

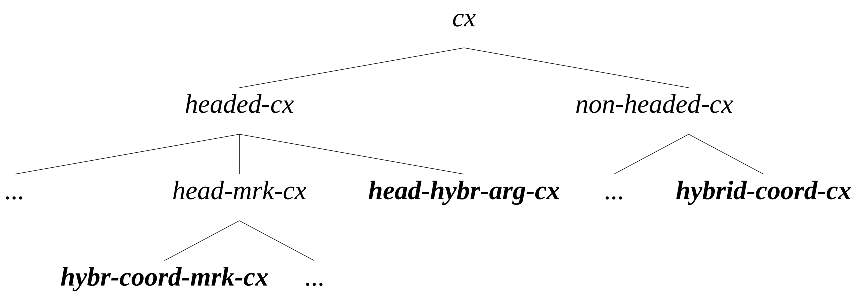

Figure 3: Extended type hierarchy

As discussed above, the feature CNJ-LIST is used to collect the conjoined co-argument signs. This is done via two coordination constructions that also capture a number of idiosyncrasies. In (29) one can observe the base case in which a conjunction marker is allowed to attach to a rightmost conjunct:

(29) *hybr-coord-mark-cx* →

$$\left[\begin{array}{l} \text{SYNS} \left[\begin{array}{l} \text{CAT} \mid \text{HEAD} \left[\begin{array}{l} \textit{hybrid} \\ \text{CNJ-LST} \ \langle \boxed{1} \rangle \end{array}\right] \\ \text{CONT} \mid \text{HOOK} \ \boxed{2} \\ \text{CRD}+ \end{array}\right] \\ \text{DTRS} \left\langle \left[\begin{array}{l} \text{PHON} \ \langle i \rangle \\ \text{SYNS} \left[\begin{array}{l} \text{CAT} \left[\begin{array}{l} \text{HEAD} \ \textit{cnj} \\ \text{SPEC} \ \boxed{1} \end{array}\right] \\ \text{CONT} \left[\begin{array}{ll} \text{RELS} & \langle\,\rangle \\ \text{HCONS} & \langle\,\rangle \end{array}\right] \end{array}\right] \end{array}\right], \left[\text{SYNS} \ \boxed{1} \left[\begin{array}{l} \text{CONT} \mid \text{HOOK} \ \boxed{2} \\ \text{CRD} - \end{array}\right] \right] \right\rangle \end{array}\right]$$

The *synsem* value $\boxed{1}$ of the conjunct is placed in the list of conjuncts of the hybrid phrase. The conjunct is the semantic daughter of the construction in the sense that the main semantic components are passed on to the mother via HOOK, which is necessary to guarantee that the other conjuncts are headed by the same semantic relation. The feature CRD is used to require that the conjunct is unmarked by a coordination particle, and states that the mother node is marked. This enables us to rule out various illegal coordination structures such as '*and and X*'. By virtue of the Semantic Inheritance Principle, the semantics of the conjuncts always percolates to the mother node.

The recursive rule for coordination adds more elements to the CNJ-LST. This is formalized with the non-headed construction given in (30). The shuffle '$\bigcirc$' relation from Reape (1994) is employed to allow the arguments of occur in any order.

(30) *hybr-coord-cx* $\rightarrow$

$$\left[\begin{array}{ll} \text{SYNS} & \left[\begin{array}{ll} \text{CAT}\,|\,\text{HEAD} & \left[\begin{array}{l} \textit{hybrid} \\ \text{CNJ-LST } \langle\boxed{1}\rangle \bigcirc \boxed{2}\end{array}\right] \\ \text{CONT}\,|\,\text{HOOK } \boxed{4} & \end{array}\right] \\ \text{DTRS} & \left\langle \begin{array}{l} \left[\begin{array}{l} \text{SYNS } \boxed{1}\left[\text{CONT}\,|\,\text{HOOK}\,|\,\text{H-RELN } \boxed{3}\right] \\ \text{CRD } - \end{array}\right], \\ \left[\begin{array}{ll} \text{SYNS} & \left[\begin{array}{ll} \text{CAT}\,|\,\text{HEAD} & \left[\begin{array}{l}\textit{hybrid}\\ \text{CNJ-LST } \boxed{2}\end{array}\right] \\ \text{CONT}\,|\,\text{HOOK} & \boxed{4}\left[\text{H-RELN } \boxed{3}\right]\end{array}\right] \\ \text{CRD } + & \end{array}\right] \end{array} \right\rangle \end{array}\right]$$

The non-deterministic shuffle relation joins lists freely, without changing the relative order by which elements occur in the argument lists. For example in (31) the shuffle of two lists each with two elements yields a total of six possible lists:

(31) $\bigcirc(\langle a, b\rangle, \langle c, d\rangle) =$

$$\langle a, b, c, d\rangle \vee \langle a, c, b, d\rangle \vee \langle a, c, d, b\rangle \vee \langle c, a, b, d\rangle \vee \langle c, a, d, b\rangle \vee \langle c, d, a, b\rangle$$

For an illustration of these constraints at work, consider the phrase [*vezde i vse*] ('everything and everyone') depicted in the AVM in (32):

(32)

$$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{hybr-coord-cx}} \\ \multicolumn{2}{l}{\text{PHON } \langle \textit{vezde, i, vse}\rangle} \\ \text{SYNS} & \left[\begin{array}{ll} \text{CAT}\,|\,\text{HEAD} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{hybrid}} \\ \text{CNJ-LST} & \left\langle \begin{array}{l} \left[\begin{array}{ll} \multicolumn{2}{l}{\text{CAT}\,|\,\text{HEAD } \textit{noun}} \\ \text{CONT} & \left[\begin{array}{l} \text{HOOK}\,|\,\text{INDEX } i \\ \text{RELS } \boxed{1}\end{array}\right]\end{array}\right], \\ \left[\begin{array}{ll} \multicolumn{2}{l}{\text{CAT}\,|\,\text{HEAD } \textit{noun}} \\ \text{CONT} & \left[\begin{array}{l} \text{HOOK}\,|\,\text{INDEX } j \\ \text{RELS } \boxed{2}\end{array}\right]\end{array}\right] \end{array} \right\rangle \end{array}\right] \\ \text{CONT} & \left[\begin{array}{l} \text{HOOK}\,|\,\text{INDEX } \textit{none} \\ \text{RELS } \boxed{1}\oplus\boxed{2}\end{array}\right] \end{array}\right] \end{array}\right]$$

The next step is to provide a way by which hybrid coordinate structures can satisfy the valence requirements imposed by subcategorizing heads. This can be achieved by a headed construction, typed *head-hybrid-argument-cx*, which basically maps the elements in CNJ-LST to valence lists:

(33) *head-hybrid-argument-cx* $\rightarrow$

$$\begin{bmatrix} \text{SYNS} \mid \text{CAT} \mid \text{VAL} \begin{bmatrix} \text{SUBJ} & \langle\rangle \\ \text{COMPS} & \langle\rangle \end{bmatrix} \\ \text{HEAD-DTR } \boxed{1} \begin{bmatrix} \textit{phrasal-cx} \\ \text{SYNS} \mid \text{CAT} \mid \text{VAL} \begin{bmatrix} \text{SUBJ} & \boxed{2} \\ \text{COMPS} & \boxed{3} \end{bmatrix} \end{bmatrix} \\ \text{DTRS} \left\langle \begin{bmatrix} \text{SYNS} \mid \text{CAT} \mid \text{HEAD} \begin{bmatrix} \textit{hybrid} \\ \text{CNJ-LST } \boxed{2} \oplus \boxed{3} \end{bmatrix} \end{bmatrix}, \boxed{1} \right\rangle \end{bmatrix}$$

The lexical entry of verbs can remain exactly the same since heads are not subcategorizing for any kind of coordinate structure. Rather, subcategorization precedes as usual. The rule in (33) simply offers an additional way by which valents can be saturated.

To illustrate how the proposal works, consider the analysis of the subject-complement coordination in (7c) (repeated below) in Figure 4.

(34) Kto-to i kogo-to obidel
someone$_{nom}$ and someone$_{acc}$ offended

Because variable binding and quantifier scope restrictions are handled lexically, this means that the semantic composition of hybrid conjuncts is obtained for free, without further assumptions. In other words, both (7c) seen above or the non-coordinate counterpart obtain basically the same (scopally underspecified) semantic representation:

(35) a. Kto-to obidel kogo-to
someone$_{nom}$ offended someone$_{acc}$

b.
$$\begin{bmatrix} \text{HOOK} \begin{bmatrix} \text{INDEX} & \boxed{e} \\ \text{LTOP} & \boxed{h2} \end{bmatrix} \\ \text{RELS} \left\langle \begin{bmatrix} \textit{someone\_rel} \\ \text{ARG0} & \boxed{x} \\ \text{BODY} & \textit{handle} \end{bmatrix}, \begin{bmatrix} \textit{offend\_rel} \\ \text{LABEL} & \boxed{h2} \\ \text{ARG0} & \boxed{e} \\ \text{ARG1} & \boxed{x} \\ \text{ARG2} & \boxed{y} \end{bmatrix}, \begin{bmatrix} \textit{someone\_rel} \\ \text{ARG0} & \boxed{y} \\ \text{BODY} & \textit{handle} \end{bmatrix} \right\rangle \end{bmatrix}$$

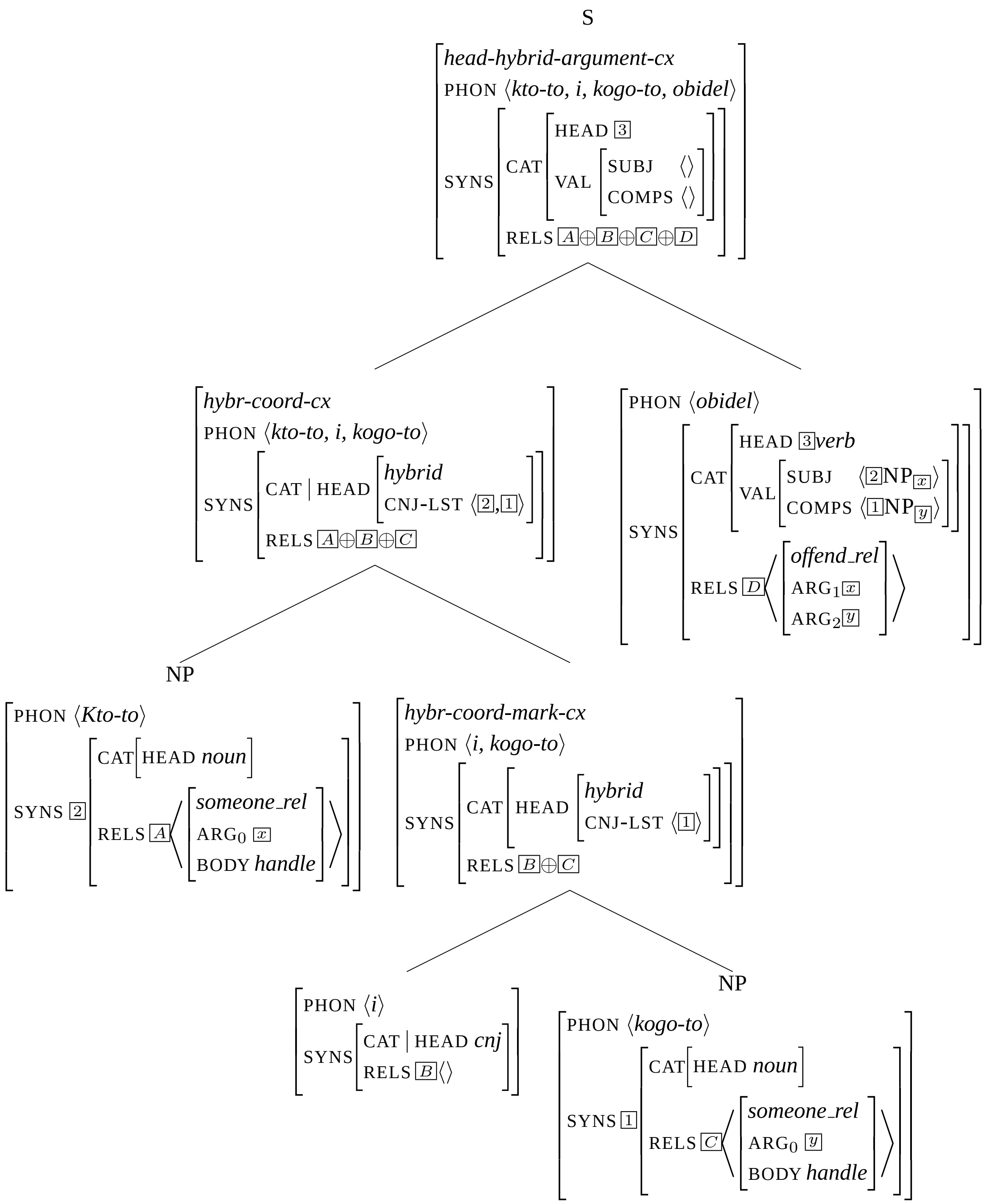

Figure 4: Hybrid coordination

Our account can also cope with cases in which the verbal head itself is conjoined. With a standard coordination construction in which valence is structure-shared, the subcategorization patterns of both conjuncts and the mother become the same. The rest of the analysis proceeds as before, via the constructions presently proposed:

(36)

Tancuyut	i	poyut	vezde	i	vse,	dazhe	v	pravoslavnoi	cerkvi
dance	and	sing	everywhere	and	everyone	even	in	orthodox	church

'Everybody dances and sings everywhere, even in the orthodox church.'

We presently have not account for the fact that certain complex conjuncts are allowed while others are not, as seen in (13)–(17) for example. For now we can only offer a condition that states that initial conjuncts are light (possibly lexical) and that non-initial conjuncts need not be light.

(37) $\textit{hybr-coord-cx} \rightarrow \left[\text{SYNS} \mid \text{CAT} \mid \text{CNJ-LST } \textit{ne-list}\Big(\left[\text{LIGHT } +\right]\Big) \oplus \textit{list}\right]$

4 Further Remarks

In this account we have introduced a separate kind of coordination construction, specifically for hybrid coordination. Although our move is empirically motivated, given the various peculiar aspects that HC exhibits, nothing in this account entails that canonical coordinations and headed coordinations need to be modeled by completely different grammar rules. It may be possible to blend the two kinds of construction in a more general construction, allowing coordination structures to be either resolved as standard coordination or as hybrid coordination. By using type-underspecification, the distinction between the two cases would then be recast in terms of different sort resolutions rather than in terms of different grammar rules.

There are some alternatives that we would like to briefly mention. One alternative take on the phenomena would be to adopt the machinery proposed in Penn (1999), where the elements in DOM are structured in terms of hierarchical regions and fields. HC could in principle be modeled in terms of such multi-dimensional domain objects. Put in simplified terms, the presence of a conjunction would enable a sequence of co-arguments to be compacted in the same topological region, without assuming that these are forming any kind of constituent. It is unclear to us however, what is the role of the coordination lexeme in such an analysis, given that no actual coordination would be going on. Our account offers a more natural account given that tries to make sense of the phenomena by analyzing HC as an exocentric coordination construction. Further support for the latter view comes from the fact that although there are various idiosyncrasies about HC, several of the trademarks of coordination are also visible.

A second alternative view on the HC construction would be to allow the conjunction to select the conjuncts as arguments. This way, no HC coordination rules would be needed. This however seems to entail a number of stipulations, namely that the conjunction lexeme has a non-empty and unbounded valence list. Somehow, the rightmost conjunct would have to be required to be realized after i while all other conjuncts (arbitrarily many) would have to be required to precede the i. In a language that does not exhibit subject and complement word order, one would be hard-pressed to justify endowing a conjunction with non-empty subject and complement lists. There are also issues with regard to anaphora, since having a non-empty argument list on the conjunction would make wrong predictions. All in all, it seems to us that the approach based on the coordinator raises more problems than it solves.

5 Conclusion

This paper provides evidence that Russian has a coordination construction in which conjuncts can have different grammatical roles. These structures are non-canonical and pragmatically marked, but have essentially the same meaning as their non-coordinate counterparts. Conjuncts are also subject to a number of particular constraints that standard coordination structures do not exhibit, and which provide further evidence that this is a special kind of coordination. The phenomena also occur in some other Slavic languages, and thus may be suggested to have some manifestations throughout so-called free word order languages.

The account that we provide makes minimal changes to the overall grammar. It amounts to two coordination rules and one head-argument rule. Semantic composition proceeds exactly in the same way as in other constructions, and no element in the grammar explicitly selects for this kind of coordinate structure. Rather, lexical subcategorization constraints are stated as usual, in a uniform way.

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A Semantic Interpretation of Modality in Counterfactual Conditionals

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Abstract

This project uses a model theoretic possible worlds approach, resembling classical Formal Semantic treatments (e.g. Kratzer 1977, 1981, 1989; Lewis 1973; Veltman 2005), to interpret counterfactual conditionals with respect to a world of evaluation. The model theoretic semantics are linked with the typed feature structures in an HPSG syntax (Pollard & Sag 1994) implemented in TRALE (Penn 2004) with the Constraint Language for Lexical Resource Semantics (Penn & Richter 2004, 2005). Sets of possible worlds interact with constraints on world knowledge and constraints defining counterfactual evaluation. The truth value for a counterfactual is returned to the grammar relative to a context of evaluation.

1 Introduction

An accurate semantic interpretation of counterfactual conditionals, and modals in general, depends, to a large extent, on world knowledge. It is not possible, for instance, to interpret whether the sentence *You must run a lot*, allows the inference that the addressee ran in the past or not to be true in the actual world without world knowledge. If the speaker's knowledge is accurate, it might be possible to interpret such an inference as true in the actual world. But, on another reading, it could be a command that the addressee start running a lot for the sake of his health, in which case, he might never have run before in his life and the inference that he ran in the past would be invalid. Trying to determine whether the intended interpretation is the deontic modality of the latter interpretation or the epistemic modality of the former depends on a number of contextual factors. Some of these contextual factors, which can help circumscribe the relevant subset of world knowledge needed to make valid inferences, reside in the sentence or dialogue surrounding the modal (Coulter unpublished; Crouch 1993).

The implementation described in this paper uses propositions in a model as the framework for conducting inference. The grammar is used in conjunction with the model to determine what type of inferences to look for and which propositions are relevant. The propositions, which are first order predicate-like representations of the sentences licensed by the grammar, form sets. Sets of such sets are constrained by their conformity to various knowledge base axioms. The argument structure of verbs, for instance, in the grammar can assist in locating a background context via their encoding in the mapping from the compositional semantics of the grammar to

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the propositions of the knowledge base. The use of a grammar in conjunction with knowledge base axioms and abstract propositions allows modals to have a more substantive interpretation than what would be provided by a grammar with compositional and lexical semantics alone. Although modals require such a knowledge base for accurate interpretation, they are not the only natural language phenomenon that can benefit from it: it would also facilitate natural language interpretation in what are typically considered to be intensional contexts.

The particular implementation described below represents a proof of concept and not a large-scale collaborative effort, though suggestions are given in the conclusion of how it could be incorporated into such a project. Though it supports some degree of modal interpretation in general, it focuses on achieving accuracy with counterfactual conditionals in a restricted domain. In a larger grammar, the domain restriction would limit sets of propositions in the interpretive component to those relating to the domain of the discourse under consideration. In this project only a limited domain is constructed in order to focus on the issue of modal interpretation. Modal entailment is a difficult phenomenon to characterize and remains unresolved in broad coverage entailment projects as well (MacCartney et al. 2006; Roxana Girju p.c., Mark Sammons p.c.).

The domain used in the current project is less complex than what would be required to deal with the issues and conundrums that have arisen in much of the formal semantic literature on counterfactual interpretation (e.g. Kanazawa et al. 2005, Kratzer 1989, Tichy 1976, Veltman 2005). Specifically, this project does not work with that intricate of a premise set. The propositions considered relevant for counterfactual evaluation are domain specific and somewhat general. While the implementation approach resembles relevance logic style reasoning about conditionals (e.g. Shapiro 1992), it is somewhat more intuitive and does not give the relevant world knowledge the same status as other propositions. Rather, world knowledge works as an abstract statement, similar to an axiom schema, that all plausible worlds for a given interpretation must be capable of satisfying before evaluation can precede.

The model of abstract propositions and knowledge base axioms is represented in a Prolog interpretive component. In this implementation, the Prolog interpreter works in conjunction with an HPSG syntax (Pollard & Sag 1994) implemented in TRALE (Penn 2004). The compositional semantics of the grammar is the Constraint Language for Lexical Resource Semantics (CLLRS) presented in Penn & Richter (2004, 2005). CLLRS was developed with the capability of supporting inference and entailment in typed feature structures especially with respect to semantic ambiguities involving scope and quantification. CLLRS distinguishes between lexical semantics and compositional semantics and is designed to handle the later leaving the former to standard HPSG constraints on the CONTENT value of signs (Penn & Richter 2004). But CLLRS is linked systematically to the grammar allowing some interaction between the two. This interaction is necessary for the general disambiguation of modals in that grammatical features of the sentence such as verb tense and the person value of the subject noun phrase can indicate which type of modality is involved (Crouch 1993; Coulter unpublished). Section 3 describes the role of the grammar and various semantic components in more detail.

The modal interpretation uses a possible worlds approach that limits the worlds in which the basic meaning of a modal, for example, 'necessity' or 'possibility', is evaluated in order to achieve a representation of possibility or necessity relative to a certain context. Generally speaking, the approach resembles traditional formal semantic approaches to counterfactual modality (Kratzer 1977, 1981, 1989; Lewis 1973; Veltman 2005), in that it evaluates counterfactuals in a background that the antecedent helps to define as relevant.

Counterfactual conditionals are evaluated to be plausibly true if they are supported in a subset of the knowledge base that conforms to the appropriate world knowledge axioms. The subset of propositions in which evaluation takes place is located by the subset's compliance with the world knowledge axioms which are circumscribed primarily by the antecedent's propositional form. The interpreter uses world knowledge axioms in conditional rules as constraints in order to delimit the relevant set of possible worlds. In the disambiguation of modals in general, locating the proper contexts would require multiple sentences of the discourse, but counterfactual conditionals constitute a more tractable subcase of the problem in that the antecedent provides sufficient information to locate a context of evaluation.

The result of a query concerning the truth value of a counterfactual in the program should be intuitively plausible to a human user. In addition to getting an intuitively accurate result, the axioms that define the context of evaluation should constitute the most restrictive deviation from actual world knowledge that accommodates the antecedent. Following the basic intuitions of Lewis' (1973) account of counterfactuals, it locates the closest world to the actual world in which the antecedent is true and evaluates the counterfactual as true if the consequent is also true in that world.

For example, the sentence *If Maurice fell off of the tightrope he would've hit the ground hard* is true, generally speaking, if, in a situation nearly identical to the actual one, it follows from Maurice's falling off of the tightrope that he hits the ground hard. It is not a plausible counterfactual, for instance, if there exists a net in the actual world which would clearly catch him and prevent his collision with the floor. Similarly, the interpreter described below evaluates the truth of a counterfactual relative to the contextual background that the antecedent indicates is relevant. Presumably, additional inferences can be conducted in the same context or in a context located by a combination of the counterfactual context and additional discourse information.

2 Disambiguating Modals: The Role of World Knowledge

Kratzer (1977) observed that a modal verb, such as *must*, can be described as having a consistent core meaning of necessity, if the necessity is relative to a particular set of contextually indicated facts. An unambiguous paraphrase of a sentence with *must* would include a phrase beginning with *in view of* followed by an indication of the relevant information. For instance, the sentence *Leor must leave the U.S.* could be paraphrased as *In view of the restrictions on visas, Leor must leave the U.S.* or *In view of what is known about Leor's interests abroad and long absences from work, Leor must leave the U.S.* The first paraphrase would be true if, in all possible worlds in which visa restrictions are as they are in the actual world, Leor leaves the U.S. The second would be true if in all possible worlds in which certain facts about Leor are known to be true, Leor leaves the U.S. Unfortunately, the context is rarely stated this concisely in natural language.[1] Other characterizations of modality are treated similarly in that they impose restrictions on the set of possible worlds in which a modal is evaluated or use accessibility relations to impose similar restrictions.

The difficulty posed for implementation is that such treatments, while providing deep analyses of the model theoretic semantics, assume a knowledge base. When trying to capture the intuitions computationally, questions of how to limit the set of possible worlds requires some simulation of the knowledge base. It is necessary, for instance, to get 'the set of all worlds in which visas work as they do' from sets of propositions and a set of world knowledge axioms. Trying to do this in an open domain is a daunting task, so it is an empirical question whether the Formal Semantic treatments of modals are feasible with an artificial knowledge base. The current paper constitutes an attempt to illustrate how the deeper principles of the formal treatments could work in a domain specific case.

It is important to note that the problem of modal disambiguation is far from being solved with broad coverage statistical methods. In textual entailment tasks, modals have been recognized to play a significant role and no entirely satisfactory way of handling them has been developed. In order to deal with the effects of modals, they have been characterized in relation to other modals or the absence of modals in sentences which are sufficiently similar otherwise (MacCartney et

[1] Even if the modal can be disambiguated between deontic and epistemic, there have been various attempts to model the context of evaluation, none of which is ideal for drawing the type of common sense inferences that broad coverage entailment projects attempt to capture. In the deontic case, the implication that the event will happen has been described as holding in all worlds in which people do as they are commanded (e.g. Heim 1982; Kratzer 1981), and the actual world is not considered to be one of these. It would be hard to define, in a realistic knowledge base, what the likelihood of actual world entailments (in a loose sense of the word) would be. Similarly, epistemic modals have plausible common sense conclusions to the degree that the speaker's world knowledge constitutes accurate premises. The problems clearly require world knowledge, the questions concern how to represent and manipulate it in order to capture the semantics of modals. The use of probabilities with conditionals has been discussed in Kaufmann (2005) and other works by the author, but the direction intended in the current work takes a different approach, primarily in that it treats world knowledge as constraints and intends to use probability for the relation between modalized propositions and the inferences that tend to be drawn about actual world propositions (e.g. For instance, to what degree does a sentence like *Sex offenders must leave their lights off on Halloween* (from Google news) corpus used in imply *Sex offenders leave their lights off on Halloween*? This type of 'inference' will never be anything but a likelihood of the event and can at best be represented as a probability based on who is enforcing the command and who is aware of it (Coulter unpublished.)

al. 2006; Girju & Roth, unpublished; Girju p.c.). For example, a modal with the core meaning of 'not possible' is predicted to entail a similar sentence without the modal, but retaining the negation (i.e. not actual). Though there has been some success with this method, it fails in a number of contexts. It is not the case, for instance, that the sentence, *There couldn't have been another shooting* entails that there was not another shooting, which is what the inferences in MacCartney et al. (2006) would predict. It can only be concluded from the sentence that, in view of what the speaker knows, it does not seem possible. The system does not take into account the fact that the conclusion is drawn from a falty premise if the speaker's world knowledge is inaccurate. A move towards implementation of a slightly deeper treatment of modality could shed light on these problems as well.

2.1 Counterfactual Conditionals as a Special Case

Counterfactual conditionals present a special case of modal interpretation in which the context of evaluation is partially identified by the antecedent. Counterfactuals form a good testing ground for locating modals in a context because the antecedent helps determine which world knowledge is necessary. The implementation described in this paper contains propositions which are generated from licit permutations of the constituents of parseable sentences from an HPSG grammar. Counterfactuals are evaluated relative to proposition-world pairs which fit certain restrictions defined based on world knowledge axioms and semantic overlap with respect to the set of actual world propositions. Given a counterfactual sentence, the program interprets it relative to the appropriate set of propositions and returns a truth value.

Counterfactual conditionals contain an antecedent clause which the speaker believes is false relative to the actual world. In order to represent the meaning of a counterfactual, it is not insightful to say it is automatically rendered true just because the antecedent is false. A counterfactual conditional with an antecedent that is false in the actual world is not considered to be true if the consequent is not true in a world like the actual world in which the antecedent is true. The counterfactual above, repeated in (1) serves as an illustration.

1. If Maurice fell off the tightrope, he would hit the ground hard.

The usual interpretation is that Maurice did not fall off the tightrope, but, imagining he had, he would have hit the ground. Part of the interpretation of counterfactuals requires that the evaluation is relative, not to the actual world, but to a similar world in which the antecedent is true. But there is the additional complexity that the world of evaluation must be similar enough to the actual world that the consequent follows fairly directly. Sentence (1) would be false, for example, if the speaker were aware of a large net spanning the floor.

In order to model this complex situation, Lewis provides a system of 'spheres'. A sphere, introduced to accommodate modal interpretation, is a set of worlds that meet a contextually defined restriction. For example, the sphere of accessible worlds for the actual world in a sentence such as *Unsupported mass must fall* is the set of worlds which are elements of all true propositions pertaining to the laws of nature.

A system of spheres is used to define relative closeness of worlds to a given world, for instance, the actual world. The set of propositions which have the actual world as an element (and, so by definition, are true in the actual world) are true with respect to the sphere containing only the actual world. This sphere is the center of the system of spheres. A larger sphere contains those worlds that differ minimally from the actual world and a yet larger sphere contains worlds that differ minimally from those, and so on. The system is closed under union and intersection and for any two spheres, one is a subset of the other. Moving out from the singleton set in the center sphere, each sphere contains the worlds which differ minimally from the previous sphere.

The result of the system of spheres is that relative closeness to the actual world is defined with set theoretic concepts; there is no need to use world knowledge as part of the theoretical construct that indicates which worlds are closer than others, it is encoded by propositions. By this description, worlds less like the actual world are in more distant spheres. For instance, the worlds in which gravity doesn't exist are more distant from the actual world than worlds in which cats do not exist because the effects of the former are of more consequence relative to the propositions which hold in the actual world than the latter. The result is that the accessible sphere for a counterfactual conditional is the smallest sphere which contains a world in which the antecedent is true. This system supports the intuition that counterfactuals are not restricted in acceptability with respect to how distant the antecedent world is from the actual world, but from whether or not, given the antecedent, the consequent follows.

A system of spheres is difficult to implement because the task of determining contextual restrictions on accessibility spheres is re-allocated to the task of ensuring that all the correct worlds are elements of the propositions conforming to general world knowledge axioms. With respect to accessibility relations, the present implementation resembles Kratzer's (1981) representation of ambiguity in modal verbs. Kratzer's theory not only involves an ordering relation on possible worlds, but also a 'contextual background' that specifies which of the ordered worlds are relevant for the evaluation of the proposition in the scope of the modal verb. The accessibility relations in this implementation are based on a combination of world knowledge, as described by axiom schemas, and ordering of worlds fitting the schemas by overlap of the propositions true in them with those true in the actual world. This program locates the sphere of evaluation for a counterfactual in much the same way that it is located in a system of spheres, capturing the intuitive meaning of counterfactuals, but world knowledge does not need to be as comprehensibly specified.[2]

[2]As an anonymous reviewer pointed out, it would be best if the implementation took into account

3 The Grammar Design

This section discusses the interpretive component of the semantics in relation to the syntax of the HPSG. While lexical semantics have standardly been located in the TFSs of the grammar and expressed in the SYNSEM value of the entry, there have been multiple approaches to incorporating a compositional semantics, as well as contextual information and model theoretic semantics (see, for instance, the summary in Copestake et al. 2006:324). This particular project will divide the semantics among the lexical semantics, the compositional semantics, and the modal logic interpreter. Other projects, such as Ginzburg & Sag (2000), have included contextual information, such as this project would allocate to the modal logic interpreter, in the TFSs of the grammar. Penn & Richter (2005) also suggest using event variables in the TFS grammar as well as including intensional types in the type signature. Possible worlds, as used for modals in this model, would then presumably involve combining propositions with world arguments in the compositional semantics. [3]

A considerable number of possible worlds are necessary to represent counterfactual interpretation. Any method of representing modals would have to consider substantial portions of hypothetical information, even if it were restricted to a discourse context. This project keeps track of the information outside of the TFSs of the grammar. A separate module with Prolog rules contains the worlds and allows logical interpretation of the first order logic like formulas in that module.

The interpretive module is ideal for allowing one to derive inferences from a disambiguated language with some reduction of the richness of structure represented in the grammar. Determining which division of labor is best for inferencing depends on what type of specification derives the most accurate inferences for a particular phenomenon and how much disambiguation or abstraction from natural language allows it to be best carried out.[4] The current implementation divides the semantics among three components, the lexical, the compositional, and the possible worlds semantics.

The HPSG in TRALE allows queries which parse the syntax of the grammar

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the problems with Lewis' (1973) and Kratzer's (1981) account. For instance, those problems dealt with in Kratzer (1989), Tichy (1976), Veltman (2005) and others, some of which are summarized in Condoravdi & Kaufmann (2005) and Kanazawa et al (2005). Because the treatment is still rather generally applied, the nuances described in the referred to works do not affect interpretation in the current project. As the project deepens, these facts need to be accounted for.

[3] It seems that there would need to be a set of rules to build small models on the fly that had sufficient complexity to allow modal interpretation. Then the implications and world knowledge could be written as constraints. It would likely be necessary to remove at least some of this from the TFSs, which starts to look a lot like what is done here, but with world labels on propositions in the grammar. This seems like a viable modification of the current proposal. It is important to note, as well, that CLLRS supports model theoretic interpretations (Penn & Richter 2005), the component described in this project is designed to deal with possible worlds semantics.

[4] The particular division of information into the interpreter here is somewhat similar to the AKR of Bobrow et al. (2007) which adds an additional level of abstraction for various inferences beyond the compositional semantics.

as well as queries producing compositional semantic parses using CLLRS. When a user enters a modal query in the grammar, the query is sent from the grammar to the Prolog interpretive module. First the query is mapped to propositions in a first order predicate logic like form. Then it is evaluated relative to the appropriate context. The query results are then returned to the grammar along with a semantic parse of the expression.

3.1 The Grammar

The syntax of modals and conditionals in the grammar is intended to be fairly uncontroversial. This work doesn't make any bold claims about their syntactic properties. In fact, the interpretive component should support grammar designs which allow various syntactic analyses, provided that they relate straightforwardly to the compositional semantics.[5]

The common modals in counterfactual conditionals are *could have* and *would have*. The past tense modals subcategorize for a main verb which subcategorizes for its arguments. The connective 'if' has a lexical entry which combines two clauses with finite verbal heads for conditional sentences, and a lexical entry which combines a clause with a finite verbal head and a clause with a modal head to represent counterfactual conditionals. The head of conditionals is 'if' and it subcategorizes for two saturated phrases. Alternative syntactic representations of conditionals, for instance, with one of the clauses subordinate, could just as easily have been mapped to predicates in the interpretation. Modal interpretation relies primarily on the mapping between CLLRS semantic values and propositions in Prolog. In this sense, the implementation is flexible with respect to the syntax of the grammar where modals and conditionals are concerned.

The compositional semantics, CLLRS, introduces a type signature for semantic typing and the attribute LF of signs. The typing is declared in the signature of the grammar and valid compositional semantic parses satisfy standard requirements on type interaction. A portion of the type declaration for the current implementation is shown below:

```
semtype [john,location,time]:(e).
semtype [temp_phrase, loc_phrase]: (e -> t).
semtype [change_loc]: (e -> e -> e-> t).
```

The elements in square brackets to the left of the colon are the abstract arguments of the compositional semantics. Their type is declared to the right of the colon.

[5]The syntactic analysis here might be unduly influenced by the semantic properties I was interested in capturing. If this is the case, it would only require modifing the mapping of the syntax to CLLRS, not the mapping of the CLLRS representation to the first order predicate logic forms of the modal interpreter. Unless it were shown to be the case that the accurate syntactic form could be shown not to work with the compositional semantics given here. Then this project would require a revision of the first order predicate logic forms as well.

The TRALE implementation constitutes an HPSG with CLLRS that the modal component works with. It has lexical entries that combine using phrase structure rules as a purely theoretical HPSG would. Built into the program are queries that provide the parts of the grammar. For instance, the query `lex` will give the TFS for the word following it. The query `rec` will give a syntactic parse and `srec` a compositional semantic parse as shown below. In this way, the grammar can be queried and the licit constructions displayed. These TFS's contain the lexical semantics of the constituents as well as the compositional semantics, in the case of the semantic parse.

The LF value of Penn & Richter's (2004, 2005) semantics consists of semantically typed expressions, square brackets, parenthesis, and ^. The semantics is encoded in the type hierarchy as *lrs* which has the attributes of INCONT, EXCONT, and PARTS. In a given grammar, possible values for these parts are built from the typed expressions declared in the semantic type declaration of that grammar's signature. The EXCONT value is preceded by the ^ symbol and represents the maximal projection of the particular semantic expression and the INCONT, the semantic expressions in square brackets, are the semantically selected arguments of the head (see Penn & Richter (2004) for a more in-depth description of their use and interaction in HPSGs).

In the grammar implemented here, the lexical expression *in* semantically selects a locational phrase as shown in its lexical entry below.

```
in ---> (synsem: category:
                 (head:preposition:temp,subcat:
                 [(synsem: category: (head:case:obl,subcat:[]),
                           content:index:X),
                           lf:@sem(^P))]),
                           content:(temporal_spatial:X)),
                 lf: @sem(^loc_phrase([(P)]))).
```

The LF feature has the value of *in* taking a variable as its INCONT value which is instantiated by the LF value of the noun phrase combined with it in the parse. For instance, when the grammar implementation parses a phrase such as *in Dallas*, the compositional semantics resulting is the combined semantic value of the expressions: `^in[location]`. The LF value for 'in' above combines with the LF value for 'Dallas'.

The semantic parse of a modalized sentence combines similarly when queried with the `srec` command, as shown below:[6]

```
?srec[john,would_have,arrived,in,dallas,at,three_o_clock].

^modal\\
(A:[change_loc(B:[C],D:[loc_phrase(E:[F])],G:[temp_phrase(H:[I])])])
```

[6]The parse is entered as a list of expression and is not intended to represent any of the structure in the HPSG. The structure is shown in the query results.

In order for the input to result in a compositional semantic parse, the combination of expressions must be compatible with the typing declared in the grammar's signature. The compositional semantics of modals and conditionals involve giving modals scope over the verbal head of the proposition. In the case of counterfactual conditionals, the modal takes scope over the consequent. The compositional semantics of *if* takes the the antecedent and consequent as semantic arguments. The CLLRS semantic forms provide a semantic parse of each sentence in the grammar and these forms can interact with scope of negation or quantification to capture semantic ambiguities. When a possible worlds semantic analysis is needed, the compositional semantic parse is mapped to a propositional representation that forms part of the sets of possible worlds. But the modal logic component is only involved when it is necessary for modal interpretation. A compositional semantic parse without an interpretation can be obtained directly from the HPSG component, but formulating the query for interpretation gives a modal logic interpretation as well as calling a compositional semantic parse in the CLLRS of the HPSG.

CLLRS provides a compositional semantics that is quite closely tied to the syntax in the grammar. By relating the compositional semantics' value for the attribute LF to the first order predicate logic forms of the modal logic interpreter, there are a series of links between the grammar and the knowledge base that can be exploited to describe the role of natural language expressions in modal disambiguation. [7]

Although modal verbs have a straightforward compositional semantics in the grammar, the lexical semantics of modals is somewhat difficult to specify since their meaning outside of a context is somewhat vague.[8] This is part of what makes disambiguation of modals a problem and why additional interpretation is helpful.

The modal intepreter is queried in the TRALE grammar and additional information about modal semantics is given. A counterfactual conditional with *could have* in the consequent is true relative to a world and a sphere if the sphere is accessible to the antecedent and the antecedent and the consequent are true in the world and there is no closer world in which the antecedent is true. The next section will describe this component in more detail.

4 The Model Theoretic Component

The model theoretic component consists of sets of propositions that represent possible worlds and world knowledge as constraints on those sets. The interpretation of counterfactual conditionals works with constraints on what constitutes a plausible world of evaluation given the antecedent. Given the set of plausible worlds of evaluation, the counterfactual with *could have* is evaluated to be true if the conse-

[7]There are other examples where this could be helpful. For instance, with discourse connectives. They could similarly be defined in the grammar and given constraints in the interpreter module for their meaning in a text.

[8]The WordNet lexicon, for instance, which is used for lexical disambiguation, does not contain modals since they can not be disambiguated with synsets.

quent is true in a world in which the antecedent is true, and there is no world more similar to the actual world, with respect to world knowledge axioms, in which the antecedent is true and the consequent is false. In the case of *would have*, it is true if there does not exist a world in which it is not the case that the antecedent is true and the consequent false, given the set of worlds identified by the world knowledge axioms. The rule for necessity also checks that there are no worlds more similar to the actual world in which the antecedent is true.

The possible worlds are built using proposition and world pairs in the interpretation as arguments of a predicate `is_true/2`. This works similarly to a characteristic function from propositions to $\{0,1\}$ with a world label on each function.[9] If a proposition does not hold in a world, this is represented by the absence of that proposition-world pair in the `is_true/2` predicate. A number of inferences are stated besides those relevant for counterfactual evaluation. For instance, from any world in which some event takes place, it is possible to derive that the event could take place.

A general mapping from the CLLRS compositional semantics to the propositional forms is written as a conditional rule which derives the propositional form from the semantic parse. Using this method has the additional advantage that propositions can form models built on the fly from user queries. However, in the current state, it just allows the propositions into the knowledge base. If they are not in the `is_true/2` predicate, they can not satisfy the counterfactual conditional query.

A possible world is defined as the set of propositions that are in a pair with that world.[10] The accessibility relations between worlds are defined by a number of interacting constraints. First, there are a sequence of constraints on the type of world knowledge each proposition represents. Given a domain of flight patterns, the first type of flights are Valid Flights.

Valid Flights constitute the flights which actually occur. In practical applica-

[9] A representative sample was permuted for the initial implementation. For certain arguments of a semantic type all possibilities were permuted to ensure a greater degree of objectivity. In other cases, the more absurd propositions were not listed for all possible arguments. So, in its current state, it is possible to get both *If John arrived in Dallas at noon then he could've departed from Chicago at noon* and *If Marry arrived in Dallas at noon then she could've departed from Chicago at noon* to fail to be possibly true counterfactuals in a query. But the latter fails because it is not in the set of true propositions for any world and the former because it is in the set of true propositions but, given the information in the antecedent, it is implausible because there are worlds more closer to reality in which John arrived in Dallas at noon and it doesn't follow in those worlds that he departed from Chicago at noon. This does not affect the practical results of the query, but could if working with larger premise sets than the antecedent. In order to get an interpretation that works equally well for any parseable sentence in the grammar, the possible worlds model needs to be implemented more efficiently. A number of methods exist for doing this, which are currently being explored in conjunction with model checking options.

[10] In order to represent this in a more traditional way, each proposition would have to correspond to the set of worlds it occurs in a proposition world pair with. This would help implement Formal Semantic treatments more literally, but I don't see any particular advantage in doing this in the current implementation.

tions, these could be built from an actual schedule in a database. The Valid Flights only include the flights in the actual world, not the individuals taking them. This arrangement allows conditionals such as *If John departed from Dallas at noon, he arrived in Chicago at 6:00* to be evaluated as true in the actual world if the event describes Valid Flights.

The Valid Flights form a subset of the Ordinary Flights and the specific subset differs based on the actual world facts represented.[11] But the set of Ordinary Flights, excepting engineering developments in increased airplane speed, does not change on a real world temporal axis. It consists of all flights which take a reasonable duration from one location to another.

The next set is not a superset of Ordinary Flights, but is disjoint from it. It is the set of Odd Flights which circle and land in the same location, but don't violate any laws of nature. They are conceivable flights in the actual world, but not the expected pattern in this domain.

Getting intuitively more distant from the actual world, there are Absurd Flights which violate basic laws of nature. For example, they allow someone to arrive and depart from the same place at the same time.

Of course, expanding this to an open domain is a large amount of work. However, it is promising that, if all possible worlds were generated from the sentences of these domain specific examples, there would be 2^{16} worlds and intuitive evaluation of counterfactuals is achieved with twelve world knowledge axioms.

4.1 Locating a Context in the Model

The accessibility relations are defined by the predicate `is_accessible` which takes as arguments, a constant which names a labeled sphere, then two world variables and a variable for a proposition.

Accessibility relations are defined in terms of the relevant world knowledge constraints. Given any two worlds, the two worlds are accessible to each other in a sphere if the proposition under evaluation conforms in those worlds to the stated constraints on world knowledge.[12] There are fourteen of these spheres defined. The first one simply states that the actual world is accessible to itself for any proposition which is true in it.[13]

```
is_accessible (sphere1,(wa,wa),Prop):-
is_true(Prop, wa).
```

For any proposition in the actual world, the fact that it is true in the knowledge base in that world is enough to derive that the actual world is accessible to itself for that proposition. This corresponds roughly to Lewis' (1973) center sphere containing only the actual world.

[11] A particular arbitrary set was chosen for this project.

[12] This accessibility relation is stated symmetrically, but could be stipulated not to be if it were necessary.

[13] The Prolog code is read with capital letters representing variables. The conditions occur to the right of :- with x :- y read as 'x is derivable from y.'

Moving out from the center, speaking figuratively in the system of spheres analogy, the constraints are used to allow a greater degree of accessibility. Though stated with variables for each world here, the counterfactual rule specifies the first world as the actual world. The more general statement, however, is useful for other natural language phenomena.

In sphere 6, one world is accessible to another for a proposition given that the proposition is an Ordinary Flight in each of the worlds. Since Valid Flights are Ordinary Flights, the relation is satisfied by the actual world proposition as well. This way of representing accessibilities gets some of the Lewis-style effect of having concentric spheres. It differs, however, in that the world knowledge axioms work as constraints on what worlds are accessible to each other. The particular selection of axioms limit the valid interpretations for a given sphere. In a more literal Lewis-style program, the axioms would have to be stated as propositions that, if removed, affect enough of the other propositions to constitute a significantly different set of sets of worlds. The design of the current program gives the axioms their intuitive prominence by stating them as constraints on sphere membership.

The mimicking of concentric spheres is not present in some spheres since Odd Flights are disjunct from Ordinary Flights. The intuition behind this is that other natural language expressions, like modal subordination, can locate a context as one of the Odd Flight supporting, or other non-actual spheres and reason about what would follow in such worlds, but the inferences do not hold in the actual world without the hypothetical premises. There remain in the system, however, Odd Flight containing spheres which allow accessibility to the actual world. These spheres are necessary for counterfactual evaluation.

The outermost sphere allows any proposition to be accessible to the actual world. A plausible counterfactual is not located here unless the consequent is equally absurd. This sphere captures cases like *If John were able to be in two places at the same time, and he departed from Dallas at noon, then he could've departed from Chicago at noon*.

An ordering, which is not reflexive, `is_immediately_closer/2`, is defined on the spheres as well as a transitive relation `is_closer/2`.

In order to evaluate a counterfactual, the program uses the following code, where `\+` is 'not':

```
poss_true_counterfactual(Prop1, Prop2, wa, Sphere):-
(is_accessible(Sphere,(wa,W2),Prop1),
(is_true(Prop1, W2),
(true_cond(Prop1,Prop2,W2),
is_closer(wa,OtherSphere,Sphere),
\+ poss_true_counterfactual(Prop1,Prop2,wa,OtherSphere).
```

This rule derives that a counterfactual with *could have* is possibly true for the antecedent and consequent in the actual world relative to a sphere if that sphere is accessible for the world in which the antecedent is true. This condition locates an antecedent-containing sphere. The next one checks that the consequent also follows in that sphere. Last, a condition ensures that there is no sphere closer than the one which instantiated it. Necessity for *would have* is defined similarly in terms of 'not possibly not'.

The `is_closer` line of code will satisfy the variable OtherSphere with the actual world if nothing else is in between the sphere of evaluation and the sphere containing only the actual world. This means that counterfactuals with true antecedents are evaluated to be implausible, contra Lewis'(1973) account. In order to capture the intuitions that counterfactuals which are true in the actual world reduce to material conditionals, a rule can be written which derives material conditionals from counterfactuals true in the actual world using the `true_cond/3` predicate.

The end result is that a query concerning the plausibility of a counterfactual is satisfied if the consequent holds in a world in a sphere nearest the actual world in which the antecedent holds. For example, when a user types in a query concerning the counterfactual *If John departed from Chicago at noon, he could have arrived in Dallas at 4:00*, it is satisfied as plausible. This evaluation is intuitively accurate even though there is no flight pattern on the actual itinerary under consideration in which a plane goes to the two locations at the stated times. But because it is a normal flight pattern, that is to say, nothing takes too short of a time and the claim conforms to the laws of nature, it is satisfied in the sphere of Ordinary Flights and is deemed plausible. A query such as that above is a valid counterfactual, but the non-modalized equivalent is only true if it is an actual world flight pattern. In this way, the module supports counterfactual and non-counterfactual conditional inferencing.

5 Conclusion

The model presented here constitutes a domain specific proof of concept of how traditional Formal Semantic insights can be implemented in such a way that inferencing about the plausibility of counterfactual conditionals is possible. The implementation described here invites development in either breadth or depth.

In the direction of broader coverage models, the implementation would need to be grafted into a larger grammar and made to work on broader domains. It is promising that a relatively small number of world knowledge axioms are needed when used in combination with ordering relations on propositions. It is possible that this way of handling world knowledge could have advantages in broad coverage systems. The knowledge bases used in the PASCAL RTE challenge entries, for instance, are generally built by the competitors using some degree of hard-coded world knowledge axioms. The world knowledge in the current project works as axiom schemas that propositions can satisfy. By considering only some of them to be applicable for each sphere, they limit the interpretations available in that set of worlds.

In order to get general modal interpretation, it is necessary to develop means of getting lexical semantic information to interact more intricately with the interpreter. The methods used by Bobrow et al. (2007) illustrate a promising method to emulate if the current implementation were to develop in the broad coverage grammar direction.

As far as developments in the interpretive component are concerned, it is important to expand the temporal representations in the model. A larger knowledge base for conducting inferences can be used with model checking techniques to handle natural language entailments in larger models. Current developments involve looking into representing more complex modal and temporal relations in the Prolog interpreter. And, after implementing such developments, applying model checking with the Maude model checking module, which promises to be particularly helpful with the temporal dimension (Clavel et al. 2007).[14] Along with these developments of the interpreter, greater depth can be achieved and more of the nuances of counterfactual interpretation recognized in the Formal Semantic literature can be supported. Particularly, a more precise model theoretic characterization can be developed and some of the useful intuitions from Premise Semantics and related developments can be implemented for more complex inferences.

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Using an HPSG grammar for the generation of prosody

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Abstract

In this paper, we report on an experiment showing how the introduction of prosodic information from detailed syntactic structures into synthetic speech leads to better disambiguation of structurally ambiguous sentences. Using modifier attachment (MA) ambiguities and subject/object fronting (OF) in German as test cases, we show that prosody which is automatically generated from deep syntactic information provided by an HPSG generator can lead to considerable disambiguation effects, and can even override a strong semantics-driven bias. The architecture used in the experiment, consisting of the LKB generator running a large-scale grammar for German, a syntax-prosody interface module, and the speech synthesis system MARY is shown to be a valuable platform for testing hypotheses in intonation studies.

1 Prosody and Generation

The inclusion of prosodic information is standardly believed to play a prominent role for the improvement of CTS and TTS applications, in terms of naturalness and intelligibility, see, e.g., McKeown and Pan (2000) and Olaszy & Nemeth (1997). Another added value of prosody lies with its potential for disambiguation: it is often observed that structural ambiguities found in written texts are absent from speech, which is prosodically structured. In order to assess this potential, we carried out an experiment to establish how and to what extent prosody can contribute to improved comprehension of automatically generated speech. We conjecture that disambiguating prosody will not only lead to better intelligibility, but also enhance overall naturalness, due to an improved correspondence between intended meaning and prosodic realisation.

Current TTS systems for German, such as MARY, typically only make use of shallow linguistic annotations like those provided by chunk parsers to control generation of prosody. Due to the limitations of shallow analysis, these TTS systems typically lack the kind of detailed and rich information that can be provided by deep parsers grounded in linguistic theory. By showing that substantial disambiguation effects can be obtained on the basis of prosody derived from HPSG trees, we believe to have made a case for the inclusion of deep syntactic analysis in TTS.

Finally, research at the syntax-prosody interface often involves construction of test data to verify hypotheses. With the help of HPSG processing connected to speech synthesis via a syntax-prosody module, construction of test stimuli can be greatly facilitated.

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1.1 System architecture

The prosody component we present here is part of a system that implements an entire concept-to-speech (CTS) pipeline from deep semantic input in MRS format, through tactical chart-based HPSG generation, to speech output.

1.1.1 Deep syntactic generation

The tactical syntactic generator used in the experiments consists of a linguistically grounded large-scale HPSG grammar of German (GG; http://gg.dfki.de; Müller and Kasper, 2000; Crysmann, 2003, 2005), running on the LKB system (Copestake, 2001). Both the grammar and processing system are fully reversible, i.e., they are suitable for parsing, as well as generation. Generation with the German grammar GG has recently been evaluated on the Babel test suite (Müller, 2004), a phenomenon-oriented regression test suite for German: currently, 99.6% of all sentences that can be parsed, can also be generated by the grammar.

The LKB chart generator takes as input sentence-semantic representations in the form of Minimal Recursion Semantics (Copestake et al., 2005). Given the reversibility of both grammar and processing system, the current architecture may also be used in a text-to-speech (TTS) scenario by simply running the grammar in parsing mode (see below).

As output the generator produces surface strings, together with two isomorphic tree structures, one containing traditional category labels derived from the underlying AVM representation, the other encoding functional notions, such as head, subject, complement or modifier, corresponding to the composition principles of the grammar.

1.1.2 Syntax-Prosody Interface

The two tree representations provided by the generator are folded into a single XML tree representation, where functional and categorial labels are represented as attributes on the nodes.

The information contained in the syntax trees is transformed into prosodic markup by means of XSLT, crucially using XPATH regular expressions. The prosodic markup generated on the basis of the syntactic representations comprises tonal and phrasing information, represented as GToBI annotations (Grice and Baumann, 2002).

For the phenomena discussed in this paper, information provided by the HPSG rule backbone and the category labels was sufficient for prosody planning. We are fully aware of the fact that this may easily prove insufficient for prosodic phenomena more tightly linked to semantics or information structure. However, given that the entire sentential feature structure is always accessible when processing with HPSG grammars, the necessary information can easily be extracted.

Realisation of the prosody module as a separate component was a design decision, since it supports a clean separation of syntactic and phonological aspects suitable for distributed development. In the context of a test platform for hypothesis testing in prosody, the usefulness of such a modular organisation cannot be underestimated, as it ensures that most grammar-internal details are effectively hidden from the phonologist primarily concerned with the syntax-prosody interface.

1.1.3 Phonetic realisation

The prosodically annotated text is submitted to the MARY synthesis system (Schröder and Trouvain, 2003) for phonetic realisation using diphone synthesis. MARY is a highly flexible TTS system, supporting annotation of the input data, ranging from low-level control over physical parameters to high-level phonological specification. For the experiments, we made use of GToBI-style tones and break indices, while disabling MARY default prosody rules.

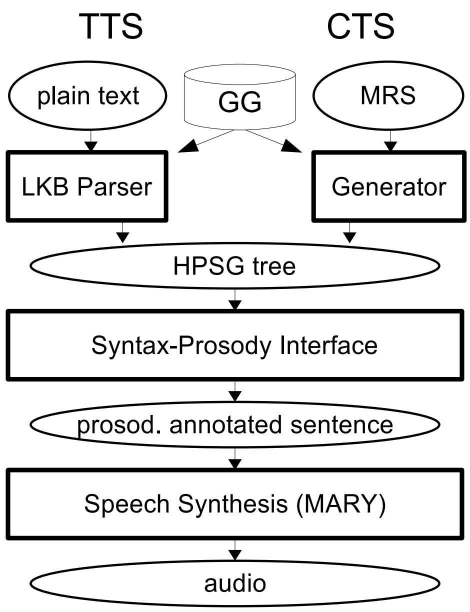

Figure 1: Architecture

1.2 Application scenarios

1.2.1 Platform for hypothesis testing at the syntax-prosody interface

For the purposes of the current experiment, input MRSs and corresponding surface realisations were chosen manually using the comparison tool provided by the LKB and [incr tsdb()] (Oepen, 2002)

This is probably the preferred procedure when using the HPSG-based syntax-prosody module as a tool for automatic and controlled generation of experimental stimuli, since precise control over the selected realisation is of utmost importance.

1.2.2 Text-to-Speech (TTS)

In a text-to-speech application scenario, however, manual selection is not really an option. Fortunately, though, the LKB and Pet (Callmeier, 2000) processing platforms both support maximum entropy discriminative parse selection models, on the basis of which syntactic disambiguation can be performed.

For the German grammar GG, exact match accuracy on dialogue data currently averages at around 81.3% (10-fold cross validation) compared to a random baseline of 25.4%. The model has been trained on a Redwoods-style treebank for German, derived from the Verbmobil corpus. Currently, the treebank consists of over 10,000 manually disambiguated trees. As features, the parse selection model uses local trees of depth 1 plus grand parenting. The parse selection results achieved for German are comparable to those reported by Oepen et al. (2002) and Toutanova and Manning (2002) for the English Resource Grammar (ERG) using similar data.

1.2.3 Concept-to-Speech (CTS)

The problem of realisation-ranking in a CTS scenario is related, though not identical to that of parse selection: here the task is to choose the most natural surface realisation given an input MRS. Fortunately again, models to perform this task can be derived quite cheaply, using a method suggested by (Velldal and Oepen, 2005): on the basis of a disambiguated parsing treebank they use the LKB generator to derive a corresponding generation treebank, taking the surface realisation found in the original corpus as gold standard. Combining a maximum entropy model trained on this generation bank with n-gram language models, they report an exact match accuracy in realisation ranking of 65%. Although we have not yet evaluated this for German, we expect to achieve similar results, given the comparatively similar performance of the two grammars in parse selection.

1.3 Background

1.3.1 Modifier attachment

Probably one of the most thoroughly studied types of structural ambiguity in human language are attachment ambiguities. While most research in this area has focused on written language, more recently, there has been a number of detailed studies of how prosody contributes to disambiguation, most notably the work of Schafer (1997) and Speer et al. (2003). Using task-oriented elicited speech, Schafer (1997) identified the prosodic parameters responsible for disambiguation of attachment ambiguities in English as follows: High attachments are perceived best when there is a prosodic break before the modifier, but not between the preceding object NP and the verb. Conversely, low attachment corresponded to the absence of a prosodic break between the modifier and the NP to which it is attached; the entire object NP, including the modifier, was preceded by a prosodic break. Speer et al. (2003) observe that, high attachment is characterised by an increased duration of the head noun and following pause, which was verified perceptually.

1.3.2 Object fronting

In German, both subjects and objects can appear in sentence-initial topic position, preceding the finite verb. Since nominative and accusative case are not always distinct, local or even global ambiguity can arise with regard to grammatical function. Subjects in topic position are generally considered unmarked. In an eye-tracking experiment using resynthesised speech, Weber et al. (2006) showed that prosodic information leads to Early Effects with sentences involving local ambiguity. Using an L+H* contour on fronted objects followed by a steep fall achieved early disambiguation, even against a strong bias for subject topics.

2 Perception Experiment

In order to quantify the potential for prosodic disambiguation, we carried out a perception experiment, comparing how subjects interpret prosodically disambiguated stimuli as compared to their ambiguous textual counterparts. Furthermore, we used different candidate contours for each of the intended interpretations in order to measure which combination of tones and breaks will perform best.

2.1 Method

The experiment was designed as an online study; subjects were not observed. To make sure that the task was clearly explained, the main study was preceded by a pilot, involving 5 subjects.

The main study was carried out with 58 subjects (27 female, 31 male). They were aged from 17 to 54, and came from all parts of Germany.

Subjects had to assign an interpretation each stimulus in a self-paced forced-choice test. Each stimulus could be heard as often as required.

In order to control for semantic or pragmatic preferences, subjects first had to judge stimuli presented in text form. 4 different sentences were used for modifier attachment and 2 for object fronting. From these sentences we generated 4 different speech stimuli for modifier attachment and 3 for object fronting, yielding a total of 6 textual and 22 randomised speech stimuli per subject.

2.1.1 Stimuli for Modifier Attachment Experiment

The sentences involving modifier attachment (MA) ambiguities all followed the same basic syntactic pattern subject-verb-object-modifier (S-V-O-M).

(1) a. Rainer verfolgt den Mann mit dem Motorrad.
Rainer chases the man on the motorbike
'Rainer chases the man on the motorbike.'

b. Er begutachtete den Tisch vor dem Schrank.
He inspected the table before/in front of the cupboard
'He inspected the table before/in front of the cupboard.'

c. Ich sehe den Mann mit dem Fernglas.
I see the man with the binoculars
'I see the man with the binoculars.'

d. Er schlug die Frau mit dem Spazierstock.
He beat the woman with the walking stick
'He beat the woman with the walking stick.'

For the generation of disambiguating auditive stimuli, we used a combination of prosodic breaks and tones (Grice and Baumann, 2002). In order to determine which prosody gives the best results in terms of naturalness and disambiguation, we tested 4 different tonal patterns, 2 each for high and low attachment.

High Modifier Attachment S [[V O] M]

- H1:
  - L* on object head noun
  - H- before modifier
- H2:
  - L+H* on object head noun
  - L- before modifier

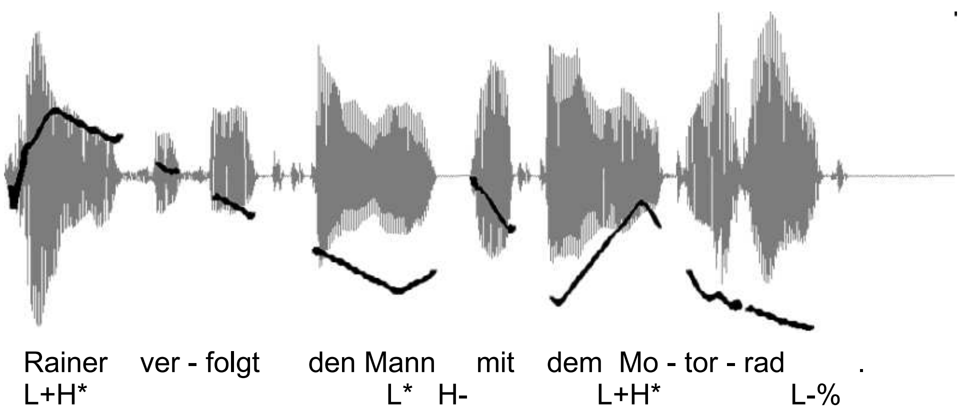

Figure 2: Tonal contour for high attachment: H1

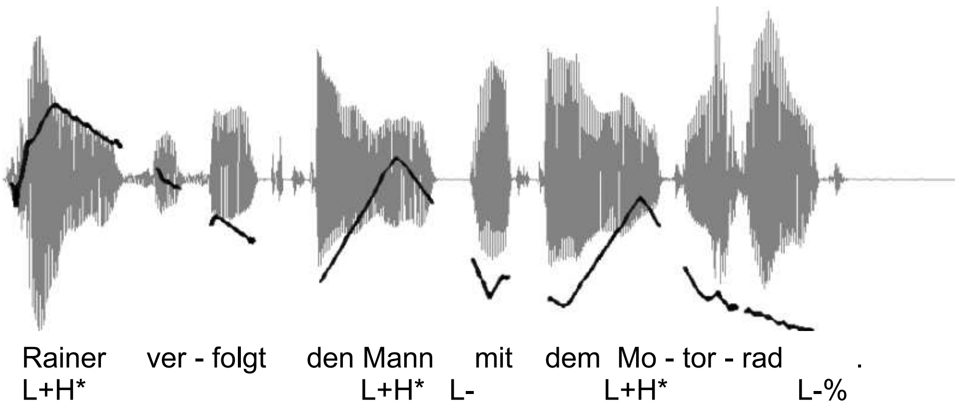

Figure 3: Tonal contour for high attachment: H2

Neither had any break before the direct object (O). The other two possible tone combinations, i.e., H* H- and L* L- sounded unnatural and were therefore discarded during the pilot study already.

Low Modifier Attachment S [V [O M]]

- L1: no break before object
- L2: H- before object

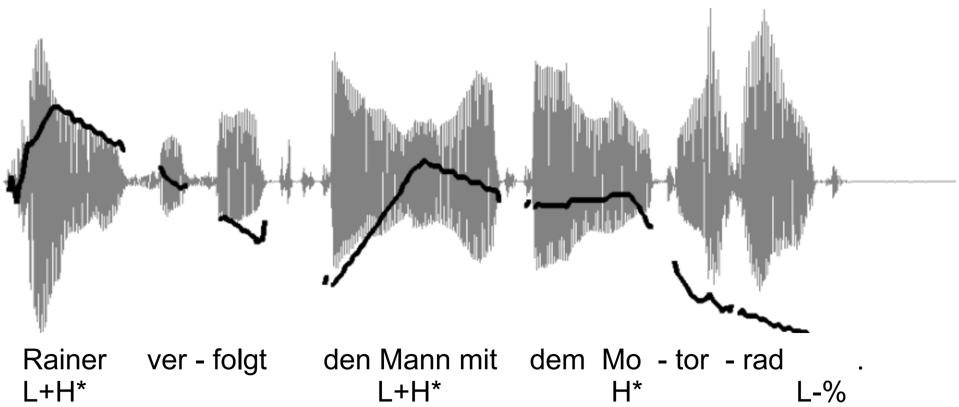

Figure 4: Tonal contour for low attachment: L1

Both versions contained an L+H* on the object and no break before the modifier.

2.1.2 Stimuli for Object Fronting Experiment

The disambiguating speech stimuli for the object vs. subject fronting subtask were based on Weber et al. (2006). Since timing was not an issue in our study, contrary

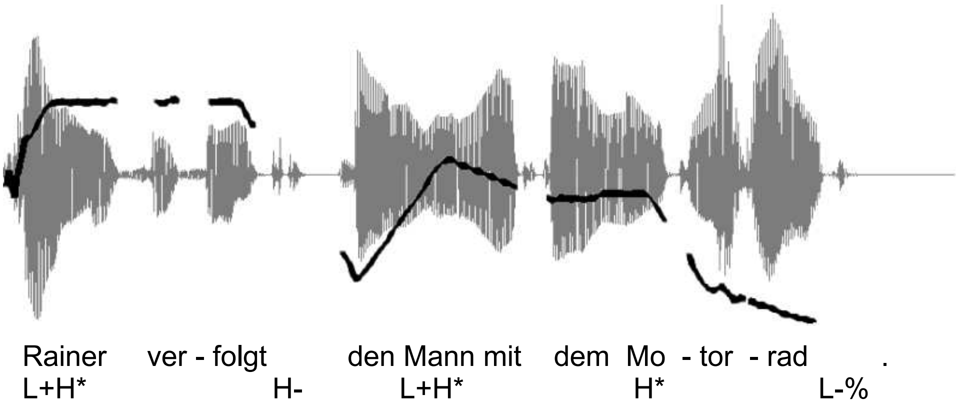

Figure 5: Tonal contour for low attachment: L2

to Weber et al. (2006), we inserted an additional intonation phrase break after the fronted object in OVS-sentences. Also in contrast to Weber et al. (2006), ambiguity was global, not local. The resulting utterances synthesized by use of the prosody module has the following prosody:

SVO no intonation phrase break after fronted subject

OVS
- OVS1: L- after fronted object
- OVS2: H- after fronted object

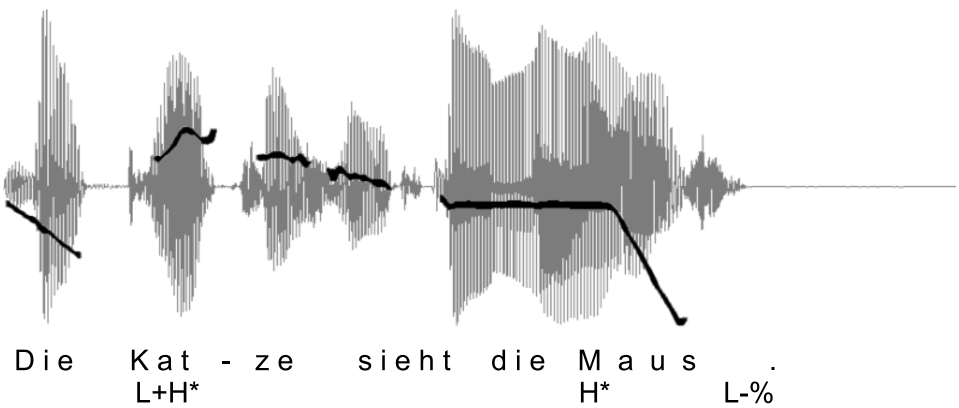

Figure 6: Tonal contour for subject fronting (SVO)

Both, SVO and OVS, ended in an L-% boundary tone and had an L+H* accent on the fronted constituent. In the OVS-versions this accent was additionally emphasized by raising the peak, thus strengthening accent-prominence. The tonal pattern used for SVO was based on the default contour in MARY.

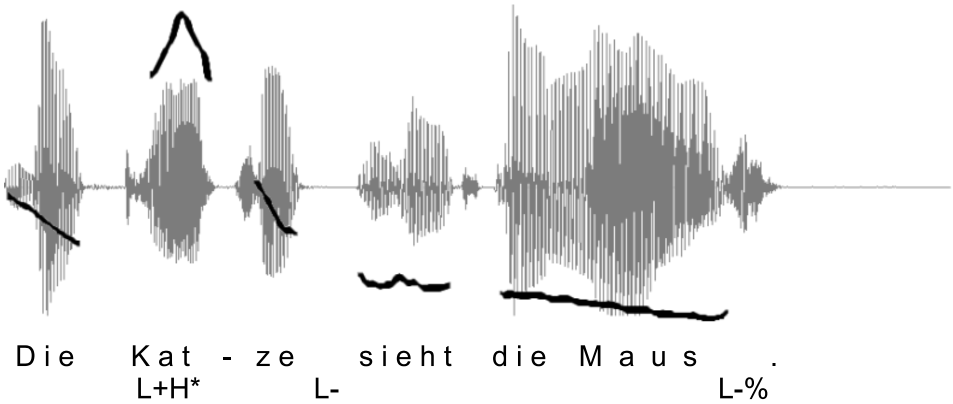

Figure 7: Tonal contour for object fronting (OVS1)

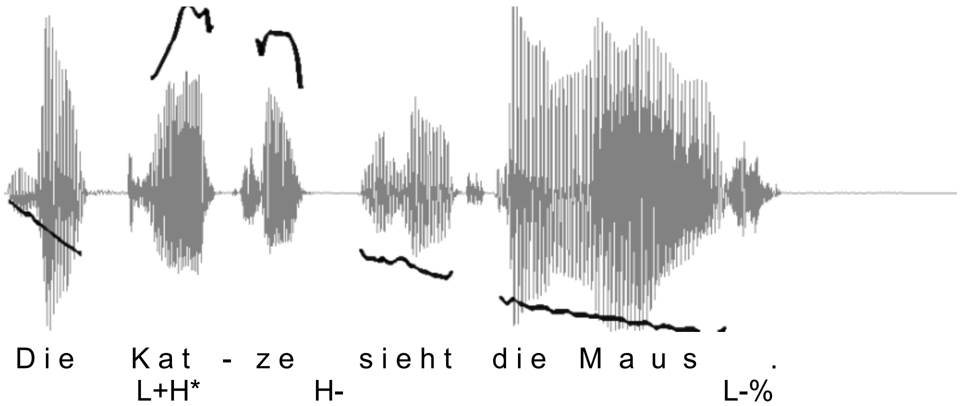

Figure 8: Tonal contour for object fronting (OVS2)

2.2 Results

The main experimental results are summarised in Figures 9 and 10. As compared to baseline obtained with textual stimuli (bias), the perception experiment shows a clear disambiguation effect with speech stimuli, for both modifier attachment and subject vs. object fronting. Our main claim that prosody automatically generated from deep syntactic structures can be used for the task of disambiguation in CTS and TTS was confirmed.

2.2.1 Modifier attachment

Best disambiguation results were obtained with contours H1 and L2, given in Figures 2 and 5. The results for these contours are summarised in Figure 9, where a value of 1 corresponds to perceived high attachment, and 0 to low. Interpretations assigned are provided for each of the 4 test sentences, averaged over all 58 subjects. Test sentences differed as to their inherent semantic attachment preferences (bias calculated from textually presented stimuli): while (a) does not display any clear preference, (b) and (c) have a strong preference for low attachment, while (d) is mainly attached high.

The most important result is that a clear disambiguation effect could be found not only for ambiguous sentences without any clear semantic attachment preference, such as (a), but that automatically generated prosody could effectively override even strong preferences for low (b,c) or high attachment (d).

With sentences showing a strong bias for low attachment, we observed that the speech stimuli designed to suggest low attachment do not quite reach the level of the bias. We tentatively attribute this difference to a mismatch between expected and actual prosodic contours in synthetic speech, which can hopefully be overcome on the basis of better prosody planning to be obtained from future experimental studies.

As a measure of the disambiguation effect we take the span between perceived high and low attachment. For H1 and L2 it ranges from 0.23 (=0.83-0.60; utterance d) to 0.47 (=0.69-0.22; utterance c), with an average around 0.37 (=0.76-0.39). The value for H2 (average: 0.63) shows a far lower disambiguation potential than H1, while the value reached by L1 (average: 0.50) proves this contour unsuitable for the task. This latter result confirms for German the findings made in Schafer (1997) for English that insertion of a pre-object boundary enhances perception of low attachment. The results for the high attachment contours (H1 vs. H2), however, suggest that choice of tones is almost as important as break insertion, in order to maximise the disambiguation effect.

2.2.2 Object Fronting

Results confirm previous findings on prosody-induced early effects, as well as our own claim concerning the disambiguation potential of prosody in speech synthesis.

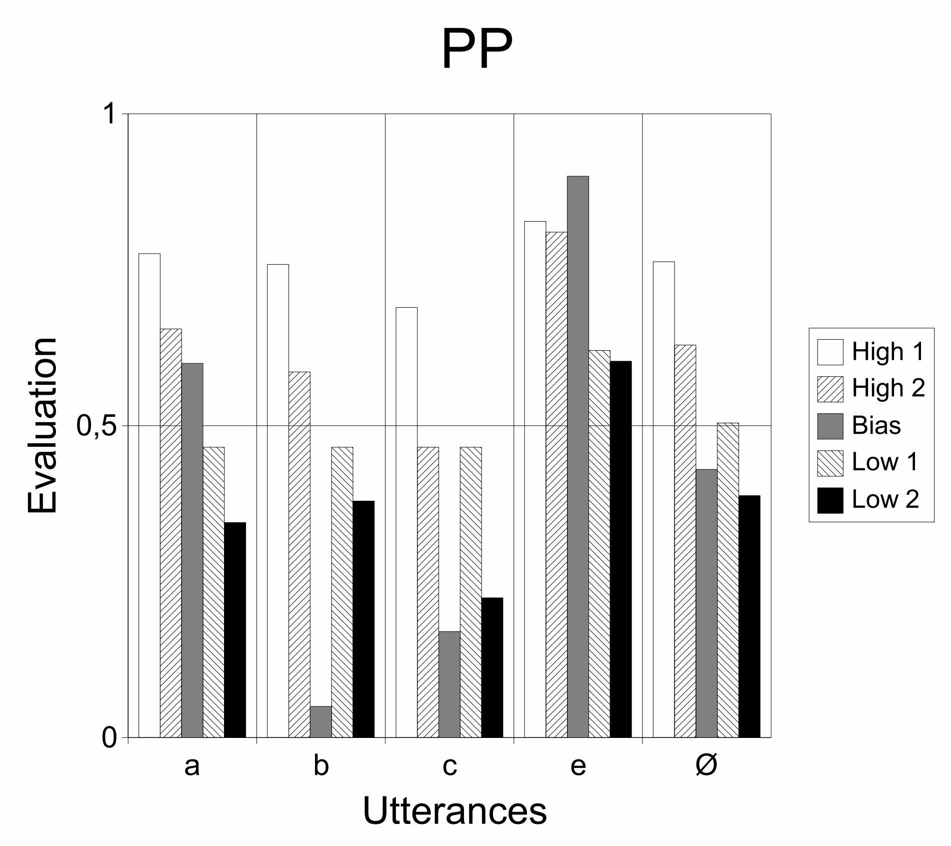

Figure 9: Interpretation of disambiguating contours for modifier attachment: high (H1,H2), textual bias, low (L1,L2), for each 4 test sentences.

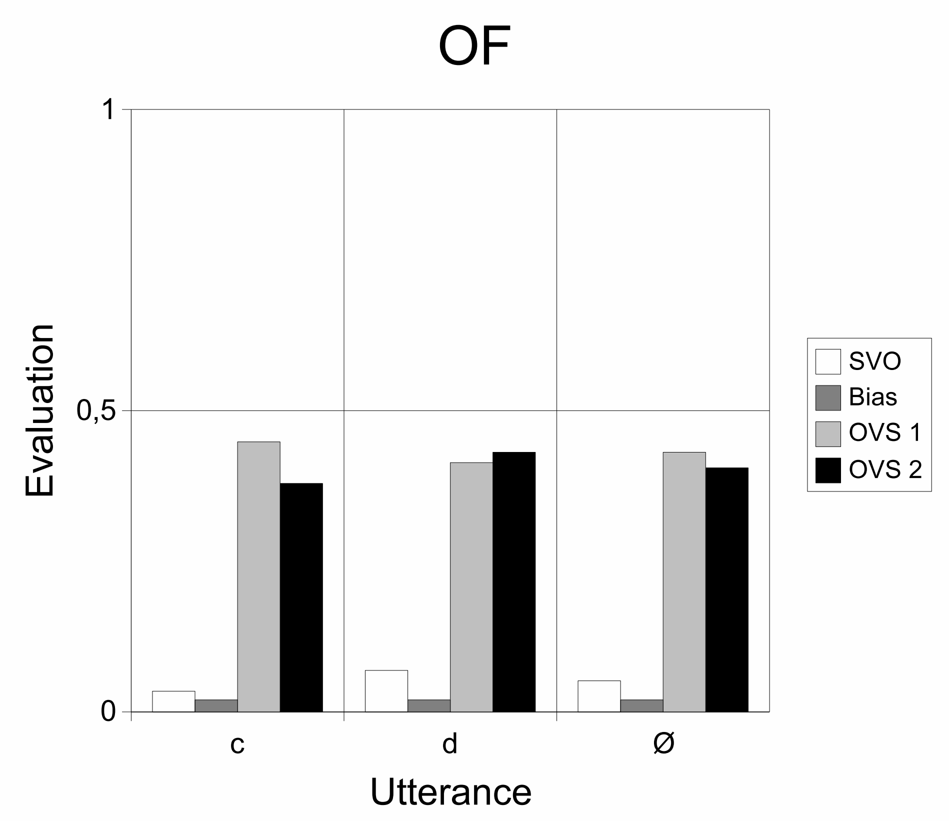

Figure 10: Interpretation of disambiguating contours for object fronting: SVO, textual bias, OVS1

Details are provided in Figure 10, where, again, a value of 1 corresponds to perceived object fronting, and 0 to subject fronting. In contrast to modifier attachment, however, the bias for SVO was extremely high (=0.02 for OVS). Still, by means of carefully designed disambiguating prosody, it was possible, with an average value of 0.43 (OVS1), to make available, for interpretation, a reading that was practically inaccessible with textual stimuli.

Although the values for unmarked SVO (e: 0.03; f: 0.07; average: 0.05) do not fully reach the bias determined with textual stimuli, we believe that these differences are negligible. The strength of the disambiguation effect, that is, how well prosody distinguishes SVO and OVS interpretation averages at 0.38 for OVS1 and at 0.36 for OVS2.

An observation that deserves discussion here, is that the disambiguation effect obtained with OVS1 and OVS2 is almost identical, despite the difference in tonal realisation, namely in the choice of the boundary tone. This is somewhat surprising at first, since with high modifier attachment, we observed a clear impact of the choice of tones. However, difference in tonal realisation is far less salient in the case at hand, compared to the test contours for high attachment: first, tonal difference only involves the choice of boundary tone here, whereas in the case of high attachment, it extends to the nuclear pitch accent. Furthermore, in the case of OVS, realisation of the boundary tone falls on a reduced, and short vowel (schwa). We hypothesise that the combination of these effects makes the tonal differences between these contours hard to perceive.

The contours for subject fronting and for object fronting (OVS1) are given in figures 6, 7, and 8.

3 Conclusion

In this paper we have presented experimental evidence showing how prosody automatically generated from deep syntactic trees can be used successfully to disambiguate structural ambiguities in German. The results we obtain using prosodically enhanced diphone synthesis compare well to disambiguation rates previously achieved for English modifier attachment ambiguities using human speech stimuli: Schafer (1997) reports a value of 0.651 in response to high attachment stimuli similar to our H1, and a value of 0.472 with low attachment stimuli similar to our L2, yielding an overall disambiguation effect of 0.18, compared to our 0.37. The result we obtained with object fronting further suggest that the disambiguating effect (0.38) of our automatically generated prosody is very robust, even against a very strong bias for subject fronting.

The disambiguation effects we obtain with synthesised speech also underline the potential of prosody derived from deep syntactic structures for the improvement of intelligibility in TTS applications. Finally, the fact that automatically generated stimuli can achieve disambiguation rates comparable to human speech makes our system a valuable test bed for studies at the syntax-prosody interface.

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Verb Sequencing Constraints in Ga:
Serial Verb Constructions and the Extended Verb Complex

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Abstract

The paper examines two verb sequencing constructions in Ga: the Serial Verb Construction (SVC) and the Extended Verb Complex (EVC). The former is an instance of a commonly recognized construction, the latter is typically found in the Volta Basin area of West Africa. EVCs are sequences of verbs functioning as single verb units relative to the syntax, but with an internal structure much like syntactic complementation. Both constructions show agreement of aspect and mode marking throughout the sequence, but with differences in exponence: in an SVC all Vs expose such marking, in an EVC only a limited (down to one) number of verbs, depending on the inflectional category. The paper presents the basic facts, based on work by Dakubu (2002, 2004, to appear), and gives an HPSG account of their morphology, syntax and semantics. The analysis is sustained by a grammar of the phenomena implemented with the 'Linguistic Knowledge Builder' (LKB), an engineering platform for natural language processing.

1 Introduction

This paper gives a theoretical examination of verb sequencing constraints in Ga (a language spoken in the Accra area of Ghana), as instantiated in Serial Verb Constructions (SVCs) and Extended Verb Complexes (EVCs), based on the comprehensive description of Dakubu (Dakubu, 2002, 2004a, 2004b, to appear), and using Head-driven Phrase Structure Grammar (HPSG) as framework of analysis.

SVCs in Ga largely resemble constructions classified under this category world-wide: as generally conceived, an SVC is a sequence of verbs or VPs without intervening co- or subordinating particles, and without any subordination or argument-of relation obtaining between the adjacent verbs. A non-initial VP takes as its subject argument a participant which is also an argument of the preceding VP, typically its subject. In some languages, including Ga, the non-initial VP in such a sequence occurs sometimes with, sometimes without a subject agreement marker (pronoun prefix). Cross linguistically, SVCs divide into at least two major types, one where the consecutive VPs denote temporally distinct events (often referred to as 'clause chaining'), and one where the VPs express interleaving aspects of one and the same event, often in a collocational fashion (referred to as 'integrated SVCs'). SVCs consistently display patterns of agreement of tense, mode and aspect between the VPs, either implicit or explicit, and independently of the number of

VPs in the sequence (which is in principle unbounded, although largely restricted to two in the cases of interleaving VPs). [1]

Moreover, in Ga, verb sequencing also obtains *word internally*, in that an item which plays the role of *one verb* relative to the syntactic setting, may be internally composed of many verbs: one *main verb*, and one or more *preverbs*. Such sequences we call *Extended Verb Complexes* (*EVC*s) ("SVC" is a widely used term and concept, but the term "EVC" is original to us.) In the following example, the verb expression is one orthographic word, and can, more essentially, be defined as one word on phonological grounds (see Dakubu (to appear)):[2][3]

(1) a. Tɛte yana.

tɛte	yà	nà
Tettey	AOR.EGR	AOR.*see*
PN	V	

`Tettey went and saw (it).'

b. Kofi kɛba.

kofi	kɛ́	bà
Kofi	MOVE.PERF	*come*
PN	V	

`Kofi has brought (it).'

c. Tɛte akasele yɛ biɛ.

tɛte	á	ká	sèle	yɛ	biɛ
Tettey	SBJV	PROHIB.SBJV	*swim*	*at*	*here*
PN	V			P	ADV

`Tettey is not to swim here'

Generated in TypeCraft.

Ya in (1a), *kɛ* in (1b) and *ka* in (1c) are what are here called preverbs, and are part of a phonological domain also including respectively *-na*, *-ba* or *-sele*, the whole complex functioning as one verb word. In contrast, in an SVC, each verb is phonologically a complete domain—none of the consecutive verbs is part of the same phonological domain as the verb that precedes it or follows it. One

[1] Many scholars including at least one of the present authors would reserve the term SVC to constructions in which the Subject is shared. If it is not, the relations between the VPs are obviously quite different and should be accounted for as different constructions. The same applies to the various phenomena grouped under "clause chaining".

[2] In this paper only the tones of verbs and their affixes are indicated, in the gloss line (the orthography does not mark tones). Tones of other categories are not relevant to the discussion.

[3] A sequence of any or all of these items, together with a subject pronoun prefix if present, is written as a single word in the established orthography (cf. Bureau of Ghana Languages, 1995, and M.E. Kropp Dakubu, 2000), as reflected in the top line of the example. Notice that in the Parts of Speech line of the glossing (exported from and using the standards of TypeCraft (typecraft.org), the whole EVC is designated as one V, aligned with the initial point of the EVC.

assumed contrast between an EVC and an SVC is thus that the former has the status of a word-level complex, while the latter is a phrasal complex.

Yà in (1a) is a possible verb word by itself, but that is not true for *ká* (1c) or *kɛ́* (1b). In each case, omission of the preverb would still give a well-formed expression. What motivates ascribing them verbal status is mainly their capability of taking inflections characteristic of verbs. As will be shown, both EVCs and SVCs display comparable patterns of aspect, mode and polarity agreement, although they manifest them differently. Corroborating the word status of an EVC as a whole, however, are (i) patterns of agreement between the verbs not parallelled by the patterns in an SVC, (ii) a strict fixedness of position of the preverbs relative to each other, which also does not have a parallel in an SVC. In Ga, thus, an SVC may be a sequence of EVCs, since any V head of a VP is potentially expandable to an EVC.

The EVC construction is apparently quite wide-spread in the languages in the Volta Basin area, and its instantiation in Ga is representative of the phenomenon, although by no means the most complex version, nor the simplest.[4] Based on a comprehensive overview of the Ga verb system (Dakubu to appear), the present paper makes an attempt to construe some of the facts involving Ga EVCs and their relationship to SVCs in a formal grammatical setting. The framework employed is Head-driven Phrase Structure Grammar (HPSG), cf. Pollard and Sag (1994), and Sag, Wasow, Bender (2003).[5]

2 Overview of the Data Situation

The *Preverbs* in Ga are the following:

(2) ***kɛ*** 'move' (a transitive verb, must be followed by a V)
Gloss: **MOVE**
ka 'not'/'neg' (must be followed by a V)
Gloss: **PROHIB**
ba 'come' (must be followed by a V, but is also homophonous with a V_{main} of similar meaning)
Gloss: **INGR**
ya 'go' (as for ***ba***)
Gloss: **EGR**

The latter two will be referred to as *deictic preverbs*, where the notion 'deictic' involves specification of the event as taking place towards (*ba*) or away from (*ya*) the deictic centre, normally the speaker, The prohibitive preverb is used only for expressing modal negation, see Dakubu (to appear) for an overview. The gloss given for *kɛ* is here highly approximate. In an initial / stand-alone VP

[4] An example of a more complex system is that found in Dangme, a close relative of Ga (Dakubu 1987). A comparable system of deictic preverbs also exists in Akan (Christaller 1875 [1964]; Dolphyne 1996).
[5] Works on related phenomena in HPSG include Muansuwan 2002, Sahoo 2001.

kɛ always has an object. This object may be overt, so that more than one word is involved, but in this paper we mainly use examples where where it is not overt.[6]

A form displaying a maximal sequence of these items is given in (3):

(3) **Ekɛɛ akɛ okɛkabaha.**

e	kɛɛ	akɛ	ò	kɛ́	ká	bà	hã́
3SG	*AOR.say*	*that*	2SG	MOVE.SBJV	PROHIB.SBJV	INGR	*give*
V		COMP	V				

`He said that you should not come give (it)'

Generated in TypeCraft.

The only word-internal item capable of preceding the verb cluster in an EVC is the pronominal agreement morpheme, exemplified above by the prefixal 2nd person pronoun **ò-** in (3), which precedes *kɛ́* inside the complex verb word. The sequencing here exemplified is strict:

Pron-prefix $V_{k\varepsilon}$ V_{neg} V_{deict} V_{main}

This whole domain of pre-root verb-internal items obeys principles of a phonological nature, which are as follows (cf. Dakubu 2002):

Ga is a tone language, with two tones. Every syllable of a lexical stem has a specified tone, as do all grammatical affixes. However the four pre-verbs and the subject prefix pronouns do not – they get their tone from what follows. If an Aspect-Mode-Polarity prefix to the main verb or another dependent verb follows a dependent verb, the segmental features of that prefix disappear, ie. it has no segmental realization, and its tone is expressed on the dependent verb or the subject pronoun immediately to the left. This kind of contraction / incorporation occurs nowhere else in the language. In particular it does not happen in a sequence of two "normal" verbs where nothing intervenes between them. This is demonstrated in (4), where the independent lexical verb *ya* 'go' with the progressive prefix *mii-* is followed by another verb *na* 'see', which is preceded by *ya*, this time in the capacity of a deictic dependent verb. Deictic *ya* and independent *na* are each preceded by the subjunctive prefix *á-*. The prefix before *na* is manifested by the high tone on deictic *ya*. The prefix to the deictic *ya* however appears in its full form.[7]

[6] In Ga as in most Volta Basin languages, a third person pronoun object with non-human reference is phonetically null, except in certain special cases (see Stewart (1966) and Dakubu (to appear)).

[7] Note that (4) is NOT an example of an SVC; it is indeed a sequence of two EVCs, but the second is in a complement (purpose) relation to the first.

(4) **Kofi miiya ya na lɛ.**

kofi	mìi	yà	á	yá	na	lɛ
Kofi	PROG	*go*	SBJV	EGR.SBJV	*see*	3SG
PN	V		V			PRON

`Kofi is going to see him'

Generated in TypeCraft.

Among the items in (2), only V_{neg} and V_{deict} inflect for tense/aspect; in addition, any full verb stem (V_{main}) undergoes inflection. Inflectional categories can be realized either by *segments* (which may or may not have assigned tone) or by *floating tones*. A segment can occur either as a prefix or as a suffix, and in principle a floating tone can "dock" either to the left or to the right, although in Ga they invariably dock to the left. By a morpheme having a *single marking*, we mean that it is realized by a single affix/tone, and by it having a *double marking* we mean that it is realized by two affixes (or tone plus affix) at the same time. Segmental exponents representing the aspect inflectional types are *perfect* **{ é`- }**, *progressive* **{ mìi- },** *habitual* **{ -ɔ̀ /-à** }. A prefixed floating low tone characterizes both *habitual* and *aorist* and is expressed by downstep, so that habitual thus has double marking. In addition to these aspectual forms, Ga also has a system of modal inflections, which are *future* **{ àá- },** *subjunctive* **{ á- }**, and *imperative*, which in turn has several phonologically unrelated forms: **{ -à** } for all plural imperatives and, for singular imperatives in the absence of any pre-verb, depending on the phonological type of the main verb: **{ -mɔ́ }**, vowel copy with low-high tone pattern, or the bare root. Singular imperatives with pre-verbs are distinguished from subjunctives only by the absence of a subject pronoun. Plural imperative has double marking, with both the subjunctive prefix and the plural imperative suffix.

Constraints work from left to right. When a main verb item is preceded by a preverb, the preverb and the main verb share the inflectional category; however, the possible choices of inflectional category are then only a subset of those that obtain when a main verb occurs in isolation, and different for each preverb. In essence, the choice of inflectional morpheme category in an EVC is dictated by the category of its leftmost daughter. If V_{main} is alone, then the full array of categories is available, whereas when a deictic preverb is leftmost, the category *Progressive* is not available. When the prohibitive verb is initial, in turn, far fewer categories can be used (mainly, only subjunctive). *kɛ* initial imposes no constraints, and the second verb then decides the array.

A further factor concerns exponency in an EVC. If the chosen inflection is *aspectual*, then only one verb in the EVC may expose it. In a sequence V_{deict} - V_{main}, if the category is *perfect*, then its exponent occurs on V_{deict}, and if the category is *future* (here treated as an aspect) or *habitual*, its exponent occurs on V_{main}. If the chosen inflection is *modal*, and there are at least two verbs present in the EVC, mode is marked twice, on the two leftmost verbs other than *kɛ*. That is, no matter which of the modal morphemes (subjunctive, sing-imperative, or plur-imperative) is selected for the leftmost verb other than *kɛ*, the second always carries the subjunctive marker.[8]

The following table is a tentative binary schema of choices (where the rightmost V is the main verb). 'EXP' means 'exposed'. Options rendered in boldface are available when the leftmost licensing V is a deictic verb, those in italics when the leftmost licensing verb is the prohibitive verb:

V

	V **deict/***prohib*	**V**
Perfect	**EXP**	
Aorist		**EXP**
Habitual		**EXP**
Future		**EXP**
Sg-imperative	***EXP***	***EXP***[9]
Subjunctive	***EXP***	***EXP***
Plur-imperative	*EXP*	*EXP*

Table 1

Turning now to SVCs, we define an integrated Serial Verb Construction in the Ga language as a structure of multiple finite verbs (internally possibly structured as EVCs) that nevertheless constitutes a single clause, in having just one Subject and a potential array of Objects not greater than that possible for a clause with just one verb/EVC. It also has just one interpretation in terms of aspect and mode. A "clause-chaining SVC" more freely allows long sequences of verbs, in some types at least allowing some of these verbs to introduce Objects beyond the limits of a single clause, and having an interpretation of temporally consecutive events, which however tend to be aspectually and modally uniform. In this paper we concentrate on the integrated type. Two sets of examples follow:

(5)a.

Mikuu misɛɛ mibaa dɔŋŋ.

mí	!kṹ	ṹ	mi	sɛɛ	mì	bá	á	dɔŋŋ
1SG	*turn*	NEG.IMPERF	1SG.POSS	back	1SG	*come*	NEG.IMPERF	*ever*
V			N		V			ADV

`I am not coming back again'

[8] For a preliminary account of the EVC and a type hierarchy of the features declared, see (Hellan, Dakubu and Beermann *to appear*).

[9] Note that if the first V is Vneg the sequence can only be sg.imper-subjunctive, but if it is deictic it can only be subjunctive-subjunctive, signifying sg.imperative in the absence of a subject pronoun.

b. **Kofi miiwie eetsɔɔ Ama.**

kofi mìi wìé è è tsɔ̀ɔ́ ama
Kofi PROG *speak* 3SG PROG *teach Ama*
PN V V PN
`Kofi is advising Ama'

c. **Tɛte baanyɛ eba wɔ.**

tɛte bàá nyɛ́ é bà wɔ
Tettey INGR.FUT *can* 3SG.SBJV *come tomorrow*
PN V V ADV
`Tettey will be able to come tomorrow'

(6)a **Kofi wɔɔ kɛmɔɔ shwane fɛɛ.**

kofi wɔ̀ ɔ̀ kɛ̀ mɔ́ ɔ̀ shwane fɛɛ
Kofi sleep HAB MOVE hold HAB *afternoon all*
PN V V N Quant
`Kofi sleeps all afternoon'

b. **Hoomɔ nii aha wɔ**

hòó mɔ̃́ nii á hã́ wɔ
cook IMP *thing*.PL SBJV *give us*
V N V PRON
`Cook for us'

c. **Akɛfutu nu wo kpulu mli.**

à kɛ̀ fútù nu wò kpulu mli
IMPERS AOR.MOVE *mix water* AOR.*put cup inside*
V N V N N
`They were mixed with water and put in a cup'

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The three examples in (5) are of the type called “resumptive” SVCs; a pronominal subject agreement element precedes the second verb. No such element appears in the sentences of (6), although semantically the subject is equally shared. The first verb of (5c) and (6c) and the second in (6a) are EVCs and include one preverb each. Aspect, Mode and Polarity marking is identical in both verbs of the SVCs, except in (5c) where the first verb is future and in (6b) where the first verb is singular imperative. In both cases, the second verb is marked subjunctive. In (6c), there is an understood 3. person plural object of 'mix', understood also as object of 'put'.[10]

As these examples indicate, much of what is said above about EVCs is true of integrated Serial Verb Constructions as well: an SVC is interpreted as manifesting a single aspectual-modal verb feature, and rules for the distribution of feature marking work from left to right. However the feature marking obeys slightly different rules:

Within an EVC (as already said), only modal inflection is morphologically marked more than once, namely on the two left-most pre-verbs excluding *kɛ*. In an SVC on the other hand, all participating Vs must be marked, be it as aorist, perfect, habitual, or progressive, or subjunctive or plur-imperative. One constraint still applies, as noted: only V1 in an SVC can be marked future positive or sing-imperative (see Table 1). V2 in such cases is marked subjunctive. This sequencing however reflects exactly what happens in an EVC, where, e.g., the sing-imperative suffix on the prohibitive verb *ka* is followed by the subjunctive prefix to the next verb. From this, two questions arise: how do we account for this parallelism between the two construction types; and how do we account for the distinctness in verb sequencing for exactly the inflectional categories mentioned?

3 Analytic assumptions and challenges

3.1 Syntactic structure

We assume that in an SVC, each verb phrase is *adjoined* to the preceding sequence of VPs headed by Vs/EVCs (which constitutes a constituent already). This is motivated by the circumstance that when a VP*b* follows VP*a* in the pattern of an SVC, the head verb of VP*a* does *not* take VP*b* as a complement; on the contrary, VP*a* is always fully saturated, and capable of occurring by itself. In an EVC, in contrast, the circumstance that the leftmost V generally

---

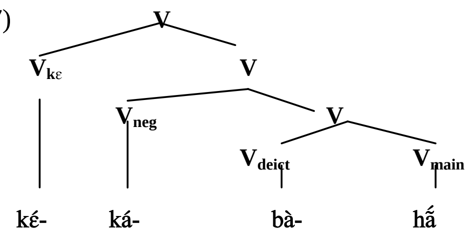
[10] Note that sometimes otherwise identical sentences exist both with and without the resumptive subject marker on the second verb. A resumptive marker never occurs internally in an EVC. Thus both (i) and (ii) are possible, but not (iii) or (iv).

(i)	$\grave{o}_1$-fɔ̃́	tsɛnsi	lɛ	$\grave{o}_1$-kɛ̀- ŋmɛ̀	shi
	2S-throw	pan	DEF	2S-move-put	down
	You threw down the pan				
(ii)	o-fɔ̃́	tsɛnsi	lɛ	kɛ̀-ŋmɛ̀	shi
	2S-throw	pan	DEF	kɛɛ-put	down
	You threw down the pan.				
(iii)	*o-fɔ̃́	tsɛnsi	lɛ	ò-kɛ̀-ò-ŋmɛ̀	shi
	2S-throw	pan	DEF	2S-kɛ-2S-put	down
(iv)	*o-fɔ̃́	tsɛnsi	lɛ	kɛ̀-ò-ŋmɛ̀	shi
	2S-throw	pan	DEF	kɛ-2S-put	down

The ungrammaticality of (iii) and (iv) constitutes a further reason to distinguish EVCs from SVCs, since the pronominal prefix can occur on any verb in an SVC.

decides the array of possible inflectional categories can be captured by analyzing the leftmost V as the *head* of the EVC, so that in complex EVC structures, there will be a right-branching complement-taking pattern as in (7) (reflecting (3)):[11]

(7)



(8) now displays the combination of a simple SVC structure and a simple EVC structure, the latter constituting the head V of the first VP of an SVC:

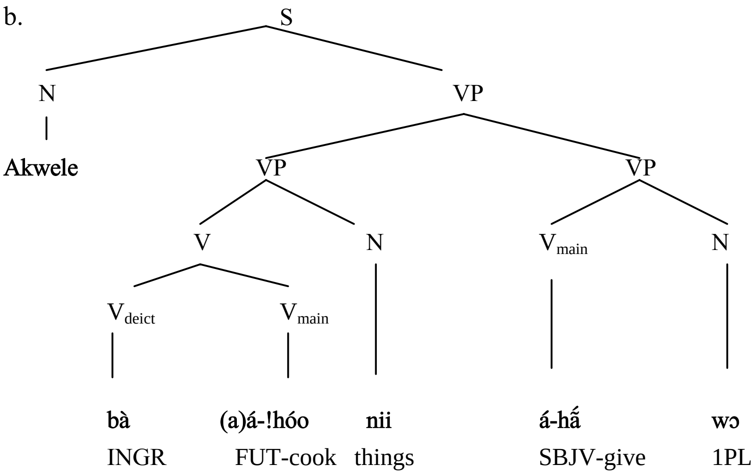
(8) a Akwele baahoo nii aha wɔ.

akwele	bàá	!hóo	nii	á	hã́	wɔ
Akwele	INGR.FUT	*cook*	*thing*.PL	SBJV	*give*	1PL
PN	V		N	V		Pron

`Akwele will cook for us'

Generated in TypeCraft.

b.



' Akwele will cook for us'

[11] An alternative that could be explored is to treat the preverb as a *specifier* of its sister V projection. Examples of an adjunction analysis of SVCs can be found also in Bodomo 1997 and Sahoo 2002 (the latter for rather different phenomena, though).

bàá!hóo is an EVC, with the transitive verb *hòô* 'cook' as main verb; since the verbs are sequenced together as a word unit, the object of *hoo* appears structurally outside the EVC, and thus not in a direct complement position relative to the verb.

3.2 Argument sharing

Technically in (8b), the valency of *hoo* has to be transmitted up to the dominating V, formally along lines well explored e.g., in the analysis of German complex verbs (cf. Müller 2002 for a summary of the literature). The second main verb *ha* 'give' is ditransitive, but in this construction followed only by a single object, the indirect object *wɔ*, instantiating the well known constellation of 'object-sharing' of SVCs: what semantically fills the role of the received of *ha* is *nii*, the object of the first EVC.

At the point where the two verb projections meet in the structure, the COMPS lists of both verbs are saturated. To propagate the information that the theme argument of *ha* 'give' is identical to the direct object of *hoo* 'cook', we need a feature which 'survives' cancellation. In the current setting, we use a feature DOBJECT, exploited in the rule adjoining a serial VP to the preceding VP as follows in (9), in the code of an HPSG Grammar-matrix based LKB grammar (cf. Copestake 2002, Copestake et al. 2005) sustaining the current analysis:

(9)

VP

$$\left[\begin{array}{l}\text{head-v-adjunction-vp-to-vp-objshare}\\ \text{SYNSEM | LOCAL | CAT | QVAL}\left[\begin{array}{l}\text{SUBJECT | ... | INDEX }\boxed{1}\\ \text{DOBJECT | ... | INDEX }\boxed{2}\end{array}\right]\end{array}\right]$$

VP

$$\left[\text{SYNSEM | LOCAL | CAT | QVAL}\left[\begin{array}{l}\text{SUBJECT | ... | INDEX }\boxed{1}\\ \text{DOBJECT | ... | INDEX }\boxed{2}\end{array}\right]\right]$$

VP

$$\left[\text{SYNSEM | LOCAL | CAT | QVAL}\left[\begin{array}{l}\text{SUBJECT | ... | INDEX }\boxed{1}\\ \text{DOBJECT | ... | INDEX }\boxed{2}\end{array}\right]\right]$$

Notice that since the VPs may in principle be saturated also for subject (due to the prefixed pronoun admissible on a 'resumptive' V2), the QVAL identity requirement also comprises SUBJECT.[12] (In a language not allowing for such 'resumptive' SVCs, on the other hand, ensuring shared subject can be done using VAL list information.)[13]

Arguably, object sharing is not necessarily a property of SVCs with transitive verbs, and thus the grammar must contain a counterpart to (9) which does not impose DOBJECT identity (but necessarily SUBJECT identity[14]), to be referred to as *head-v-adjunction-vp-to-vp-nonobjshare*. How to ensure selection of the correct option for each relevant case (when ambiguity does not obtain), is a topic that limitations of space prevent us from going into here.

A preverb is subcategorized for a verbal complement, which may be a main verb or an EVC in turn. The combinatorial rule follows the pattern of head-complement rules. Whatever is the valence of the main verb is propagated to the higher nodes, by a specification in the preverb combinatorial schema as indicated below:

(10)

V
[head-preverb-vcomp-str
SYNSEM | LOCAL | CAT | VAL | COMPS $\boxed{2}$]

V　　　　V
[SYNSEM | LOCAL | CAT | VAL | COMPS $\boxed{2}$]

As noted, *kɛ* is not an independent verb – it must always be followed by another verb. But it also always has an object, even if this is a phonetically null pronoun, or it is only semantically present as in a VP2 in an SVC; in (11a), however, it is present, and the structure of (11a) is interestingly different from (8b), indicated in (11b):

[12] QVAL is a counterpart to VAL supporting non-cancellable valence information, and is an attribute also used in the Norwegian LKB grammar *NorSource* (Beermann and Hellan 2004, Hellan and Beermann 2005): the QVAL specification supplements VAL specification, the latter dealing with valence saturation as in standard HPSG, the former with 'non-local' propagation of valence information. It may be noted that in the LKB grammars based on the 'HPSG Grammar Matrix', a special attribute XARG is used for purposes similar to those of the current QVAL features (earlier HPSG literature also has other attributes with similar function; cf. Ackermann et al).

[13] In the structure illustrated, the second VP is headed by a ditransitive verb, whose valence for a direct object is not satisfied by an actually occurring NP. Whichever mechanism is used to suspend the requirement of a direct object (in the grammar framework referred to it is a unary rule), it has to preserve a referential index for this object, to be equated to the index of the actually occurring NP in the preceding VP.

[14] The constellation type often referred to as 'switched sharing', with object of the first V being identical to the subject of the second V, is not to our knowledge attested in Ga.

(11) a. **ekɛ wolo lɛ ha mi.**

è	kɛ̀	wolo	lɛ	hã́	mi
3SG	MOVE	*book*	DEF	AOR.*give*	1SG
V		N	DET	V	Pron

`He gave me the book'

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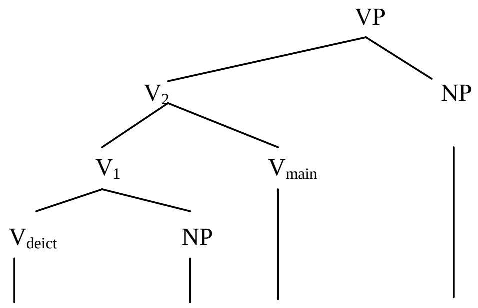
b.

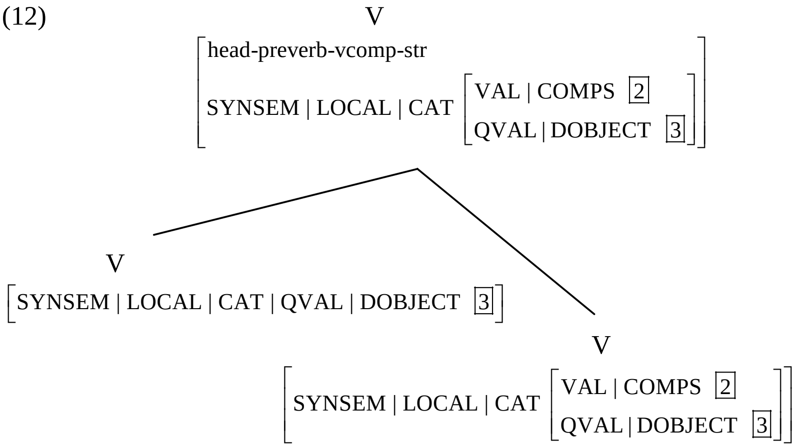


e-kɛ **wolo lɛ** **ha** **mi**

3S-MOVE book the give 1S

'he gave me the book'.

(12)



Like in (8), the understood direct object of *ha* has to come from the preceding verbal projection, but this time, that projection, viz. V_1 in the tree, is itself a preverb of the EVC in which *ha* is the main verb. To deal with this structure, one first needs a variant of the head-complement rule for direct objects which is defined at word level, to accommodate V_1. In the combination of V_1 with V_{main}, which is effected by (10), an identity must in turn be imposed between the `...QVAL|DOBJECT` of the head V_1 and the `...QVAL|DOBJECT` of the V_{main}, an identity of the kind otherwise expressed in the SVC combination rule (9). This, technically, requires one subtype of (10) defined for the case where the left daughter V is a transitive construction (the one here in question), and one for where that V is intransitive (as for the prohibitive verb and the deictic verbs); the version relevant for (11b), thus, is (12) (technically a subtype of (10)).

It will be noted that, given an obvious coindexation between the index of `DOBJECT` and the relevant item on the `COMPS` list, this scheme will ensure that the `DOBJECT` feature propagated to the top V in (12), corresponding to V_2 in (11b), will be identical to the object of *kɛ*. This means that in an SVC with transitive main verbs and with a *kɛ*-EVC constituting the V of the first VP, one will expect object sharing. This, however, is not necessarily the case; for instance, in the 'instrumental' SVC (13), where the string *Aku kɛ kakla e-fo brodo* has the same structure as V_2 in (11b),

(13) **Aku kɛ kakla efo brodo kɛbaha amɛ.**

aku	kɛ̀	kakla	é	fò	brodo	kɛ́	bà	hã́	amɛ
Aku	MOVE	*knife*	PERF	*cut*	*bread*	MOVE.PERF	INGR	*give*	3PL
PN	V	N	V		N	V			Pron

`Aku has cut bread for them with a knife'

Generated in TypeCraft.

'knife' is relevant only to the the preverb of the first VP; *fo* is not ditransitive, and *kakla* (as an instrument) cannot be its object, so that even within the EVC objects need not be shared. (On the other hand, the object of *fo* "cut", ie. "bread", must be available to VP2 as an Object of *ha* "give".) Thus, alongside (12), there has to be assumed another schema for the transitive preverb where its object is not shared with the object of the main verb – thus, a parallelism of schemata like what we observed in connection with (9) above.[15] Exactly how a traditional SVC category like 'instrumental SVC/EVC' can be technically invoked at the point where the parser can in principle apply either (12) or the non-object sharing variant (and for that matter, (9) or *head-v-adjunction-vp-to-vp-nonobjshare* in an SVC), is a question which involves the notion of 'construction' encoding beyond what normally is encoded in a lexical entry, and is a topic we will not pursue here.

[15] It may be noted that when a VP that includes *kɛ* is the V2 in an SVC, its object is not the object of V1 but the entire VP (Dakubu 2004b). An example is given in (i).

(i)

o-fɔ̃́	**tsɛnsi**	**lɛ**	**kɛ̀-ŋmɛ̀**	**shi**
2S-throw	pan	DEF	MOVE-put	down

'You threw down the pan.'

3.3 Aspect sharing

For both EVCs and SVCs, we have stated that *aspect* and *mode* information is generally shared between the sister V constituents at any combination, and that for both SVC and EVC combination, the inflectional category of the head determines that of the sequence; thus, with the binary breakdown of structure assumed, the inflectional category of the head determines the inflectional category of the head of the right daughter. To generalize this kind of constraint over both right-adjunction and right-complementation structures, we need to define a supertype of these two constellation types, one we may call *head-v-initial-binary-structure*, abstracting away from the mode of combination, and from whether the combination is at a phrasal or word-internal level. Thus, the following partial type hierarchy will be assumed (where the non-specified types under *head-v-complement-str* include phrasal combinations):

(14)

head-v-initial-binary-v-structure

head--v-adjunction-str   *head-v-complement-str*

..... *head-v-adjunction-vp-to-vp*   .... *head-preverb-vcomp-str*

The highest of these types is where the common pattern of aspect-mode agreement should be stated; schematically, what we are aiming for is the following reentrancies, where `INDEX` has the value *index* declared, when the expression is verbal, for the feature `ASP-MODE`, with value *asp-mode*, in turn declared for features to be seen shortly:

(15)

$$\begin{bmatrix} \text{head-v-initial-binary-v-structure} \\ \text{SYNSEM | LOCAL | CAT | HEAD verb} \\ \text{SYNSEM | LOCAL | CONT | HOOK | INDEX | ASP-MODE } \boxed{1} \end{bmatrix}$$

V
SYNSEM | LOCAL | CONT | HOOK | INDEX | ASP-MODE $\boxed{1}$

V
SYNSEM | LOCAL | CONT | HOOK | INDEX | ASP-MODE $\boxed{1}$

but in order to state that whenever the left daughter is *sg-imperative* or (non-negated) *future*, then the right daughter is *subjunctive*, we need two subtypes of this schema, one for when the inflection carries the feature `PROSP-`, and one for `PROSP+`, the latter characterizing the cases *imperative* and (non-negated) *future*; `PROSP` is a feature declared by the type *asp-mode* inside the `ASP-MODE` feature:

(16)

a. *head-v-initial-binary-v-structure*

head-v-nonmode-str *head-v-mode-str*

b.

$$\left[\begin{array}{l}\text{head-v-nonmode-structure}\\ \text{SYNSEM | LOCAL | CONT | HOOK | INDEX}\left[\text{ASP-MODE } \boxed{2}\left[\text{PROSP } -\right]\right]\end{array}\right]$$

V
$$\text{SYNSEM | LOCAL | CONT | HOOK | INDEX}\left[\text{ASP-MODE } \boxed{2}\right]$$

V
$$\text{SYNSEM | LOCAL | CONT | HOOK | INDEX}\left[\text{ASP-MODE } \boxed{2}\right]$$

c.

$$\left[\begin{array}{l}\text{head-v-mode-structure}\\ \text{SYNSEM | LOCAL | CONT | HOOK | INDEX}\left[\text{ASP-MODE } \boxed{2}\left[\text{PROSP } +\right]\right]\end{array}\right]$$

V
$$\text{SYNSEM | LOCAL | CONT | HOOK | INDEX}\left[\text{ASP-MODE } \boxed{2}\right]$$

V
$$\text{SYNSEM | LOCAL | CONT | HOOK | INDEX}\left[\text{ASP-MODE } \boxed{2}\text{ subjunctive}\right]$$

The type *subjunctive* we define as follows (introducing `INTENT` as a further feature declared by *asp-mode*):

(17) $$\text{SYNSEM | LOCAL | CONT | HOOK | INDEX}\left[\text{ASP-MODE}\left[\begin{array}{l}\text{INTENT bool}\\ \text{PROSP +}\end{array}\right]\right]$$

as opposed to *imperative* as:

(18) $$\text{SYNSEM | LOCAL | CONT | HOOK | INDEX}\left[\text{ASP-MODE}\left[\begin{array}{l}\text{INTENT} -\\ \text{PROSP +}\end{array}\right]\right]$$

and *future* as:

(19) $$\text{SYNSEM | LOCAL | CONT | HOOK | INDEX}\left[\text{ASP-MODE}\left[\begin{array}{l}\text{INTENT +}\\ \text{PROSP +}\end{array}\right]\right]$$

whereby the occurrence of *subjunctive* in SVCs and EVCs is construed as complying with the general uniformity constraint, albeit still constituting a specified option. (As for further features decomposing the type *asp-mode*, see shortly.)

Relative to the schemata indicated in (9) and (10), these are types that will intersect with the subtypes in (16a), thus having subtypes for both the 'mode' and the 'nonmode' version.

3.4 Inflection exponence in EVCs

A further phenomenon requiring specific constraints is the varying options for *exponence* constraints on inflections inside of an EVC, as described above. To state these in a technically viable fashion, a verb form V will have, for each inflectional category C, a binary feature "I can expose C": when positively specified, the inflectional spelling rule for C will induce the morphology associated with C, and when negatively, not. The environment of V decides whether the specification is positive or negative. For instance, a deictic pre-verb will have the following inherent and subcategorization specification (as was said above, if the inflection chosen in an EVC is *aspectual*, then only one verb in the EVC may expose it; in a sequence V_{deict} - V_{main}, if the category is *perfect*, then its exponent occurs on V_{deict}, and if the category is *future* or *habitual*, its exponent occurs on V_{main}). "I can expose *perfect*" is spelled as 'EXPNT-PERF +' which is to say that the item can *in principle* expose a *perfect*, not necessarily that it has that inflection in a given structure:

(20)

$$\begin{bmatrix} \text{deictic-preverb} & \\ \text{SYNSEM} & \begin{bmatrix} \text{CAT | VAL | COMPS} & \left\langle \begin{bmatrix} \text{EXPNT-PERF -} \\ \text{EXPNT-FUT +} \\ \text{EXPNT-HAB +} \\ \text{EXPNT-AOR +} \end{bmatrix} \right\rangle \\ \text{EXPNT-PERF +} & \\ \text{EXPNT-FUT -} & \\ \text{EXPNT-HAB -} & \\ \text{EXPNT-AOR +} & \end{bmatrix} \end{bmatrix}$$

That is, a deictic preverb by itself can expose perfective, but not future or habitual; and any verb taken as complement of a deictic preverb can expose future, habitual or aorist, but not perfective. A main verb lexeme by itself is underspecified for the EXPNT-features.

With lexical specifications like (20) for preverbs, the combinatorial rules for SVCs and EVCs inheriting from (15) will declare the combining verbs as having identical aspect, whereby the restrictions on exponence are filtered off from the general identity schema.

3.5 Semantic representation

The semantics of SVC and EVC combination needs to take three circumstances into account:

(A) Items combining in these constructions largely bring with them their lexical meaning, so that as a default, the combinatorial semantics should assemble all lexical predicates (with their arguments) in their expressed relationships.

(B) Some combinations are collocational, and need to be marked as such.

(C) Some of the preverbs contribute a global aspectual value to the construction, which ought to be exposed representationally at whatever level aspect is otherwise represented.

In the framework in question, the combinatorial semantics of a construction is standardly exposed in *Minimal Recursion Semantics* (cf. Copestake & al. (2005)). As an example, the representation in this notation for the meaning of (8) (with (8a) repeated) is as follows:

Akwele baahoo nii aha wɔ.

akwele	bàá	hóo	nii	á	hã́	wɔ
Akwele	INGR.FUT	*cook*	*thing*.PL	SBJV	*give*	1PL
PN	V		N	V		Pron

`Akwele will cook for us'

Generated in TypeCraft.

$$\left\langle \begin{bmatrix} \text{ARG0 x4} \\ \text{CARG "Akwele"} \end{bmatrix}, \begin{bmatrix} \text{"\_ba\_pre-v\_rel" ('come')} \\ \text{ARG0 e6} \begin{bmatrix} \text{ASP-MODE} \boxed{1} \begin{bmatrix} \text{INTENT +} \\ \text{PROSP +} \end{bmatrix} \\ \text{DEICT-ASPECT ingress} \end{bmatrix} \\ \text{ARG1 x4} \end{bmatrix}, \begin{bmatrix} \text{"\_hoo\_v\_rel" ('cook')} \\ \text{ARG0 e6} \\ \text{ARG1 x4} \\ \text{ARG2 x9} \end{bmatrix}, \begin{bmatrix} \text{"\_ni\_n\_rel ('thing')} \\ \text{ARG0 x9} \end{bmatrix}, \begin{bmatrix} \text{"\_ha\_v\_rel" ('give')} \\ \text{ARG0 e12} \begin{bmatrix} \text{ASP-MODE} \boxed{1} \end{bmatrix} \\ \text{ARG1 x4} \\ \text{ARG2 x9} \\ \text{ARG3 x13} \end{bmatrix}, \begin{bmatrix} \text{1st-pers\_pron\_rel} \\ \text{ARG0 x13} \end{bmatrix} \right\rangle$$

In this notation, essentially every word in the syntactic string is represented with a so-called elementary predication ('EP'), displaying a predicate value for the word and the arguments of that predicate (ARG0 corresponds to a referential index of the word), in a manner partly reflecting the feature structures assigned by the grammatical types and rules. (A) is thereby here observed, in that each lexical item in (8) constitutes an elementary predication (EP) by itself. (C) is reflected in the circumstance that the preverb *ba* induces the value *ingress* for the feature DEICT-ASPECT, in addition to constituting its own EP. The construction is not a collocation, hence there is no collocativity marking. (The fact that the English translation will use "for" rather than the verb "give" is of course no reason to say that *ha* ('give') in this construction has somehow lost its normal meaning.) Notice that, in accordance with the discussion in 3.2 above, the morphological discrepancy between *future* marking in the first VP and *subjunctive* marking in the second VP has no semantic effect, since the *subjunctive* marking is semantically underspecified relative to *future*.

4 Summary

Two types of multiverb constructions in Ga have been considered, the Extended Verb Complex (EVC) and Serial Verb Constructions (SVC). While SVCs are clearly phrasal constructions, EVCs meet on the one hand criteria of being analyzed as single words, but on the other hand they exhibit internal relations of types that are customarily found in phrasal constructions. Thus, the EVCs have been analyzed as recursive head complement structures, constituting a single word, but with dependent word forms as constituents. The boundedness of the preverbs to the EVC construction is analytically expressed through the obligatoriness of their verbal complement. The head-complement rule used for stating the dependence is formally of the same type as is used at phrasal level, and this hybrid nature of phrasal-like syntax and semantics and word-internal morphology and phonology may be seen as capturing the intermediate status of the EVC as a phenomenon situated between syntax and morphology.

As far as SVCs go, particular to Ga compared to other SVC languages is the 'resumptive subject' option. Otherwise sharing of subjects and objects exhibit patterns similar to what is found in other serializing languages. Not unlike the situation in other such langauges, SVCs have been shown to be expose just one asp-mode value, and so do EVCs, although with different patterns of exponence of the asp-mode values.

A challenge to standard 'locality' assumptions within HPSG is constituted by argument sharing relations between the Vs and VPs partaking in an SVC: at the point where two VPs are adjoined, a record of identity of objects seems necessary for object-sharing SVCs across all languages, and in Ga, this mode of specification is needed also for subjects when V2 has a resumptive subject. The type of specification used here (exemplified in (9)), with phrasally propagated attributes identifying subjects as well as objects, is one way of accommodating the situation.

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Decomposed Phrasal Constructions

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Abstract

In this paper I suggest an interface level of semantic representations, that on the one hand corresponds to morpho-syntactic entities such as phrase structure rules, function words and inflections, and that on the other hand can be mapped to lexical semantic representations that one ultimately needs in order to give good predictions about argument frames of lexical items. This interface level consists of basic constructions that can be decomposed into five sub-constructions (*arg1-role*, *arg2-role* ... *arg5-role*). I argue in favour of phrasal constructions in order to account for altering argument frames and maybe also coercion without having to use lexical rules or multiple lexical entries.

1 Introduction

Every syntactic theory will have to decide on which component of the grammar shoulders the burden of subcategorization, the lexicon or the syntax. While frameworks like HPSG and LFG are mainly lexicalist, Construction Grammar and some versions of Minimalism are more in favour of letting the syntax do most of the labour.

This paper presents an HPSG-like approach which aims at making a clear distinction between morpho-syntactic elements such as phrase structure rules, function words and inflections on the one hand, and open class lexical items on the other. I believe that open class lexical items do not have grammatical content in the sense that they are assigned a particular category and that they require particular argument frames. The fact that they can be coerced is a strong indication that they do not have any fixed grammatical information in the way that function words and inflections do. I also believe that what Borer (2005, 11) refers to as an "intricate web of layers of a complex perceptual structure and emerging world knowledge" is what open class lexical items are representing. And it is in the end this intricate web of layers that the lexical item represents that makes us prefer a particular category and argument frame.

However, writing a grammar based on such a theory is a huge task, considering the enormous amount of factors involved. What I will focus on in this paper are the syntactic rules, the function words and the inflections that make up the grammatical frame that the open class lexical items appear in. I will also sketch an interface to the "web of layers" that can be employed in order to restrict the number of possible argument frames.

The main objective behind such an approach is to be able to account for altering argument frames and maybe also coercion without having to use lexical rules or multiple lexical entries.

I assume five argument roles that are different from the functional argument roles like Subject and Complement used in the HPSG literature. They are also

[†]Thanks to Lars Hellan, Stefan Müller and four anonymous reviewers for helpful comments.

not necessarily linked to functions like Subject, Direct Object and Indirect Object. They are maybe more inspired by the initial stratum in Relational Grammar (see Blake (1990)). The five roles are not directly linked to a particular syntactic realization. That is, a role can be realized either as a phrase structure rule, as an inflection or as a function word. The argument roles are ultimately assumed to be determined by the semantics of the verb, and correspond vaguely to thematic roles:

- **Arg1-role**: The agent or source.
- **Arg2-role**: The patient.
- **Arg3-role**: The benefactive or recipient.
- **Arg4-role**: The goal.
- **Arg5-role**: The antecedent.[1]

The argument roles function as a meeting point between semantics and syntax. I have intentionally been vague in the semantic definitions above, and the role names *arg1-role*, *arg2-role* etc. are chosen not only because similar names are used in Relational Grammar, but also because they are neutral. One role can correspond to several semantic roles in lexical semantics.

This approach can be seen as an attempt to extract the semantics of syntax. So given a syntactic construction, one can infer certain semantic roles even though one does not get the full lexical semantics. I believe that the full semantic representation comes from the semantics of syntax *plus* the meaning that the open class lexical item represents.

2 Construction Grammar

Goldberg (1995) gives a number of phrasal constructions that independent of the lexical meaning of the words can be said to have a meaning. Examples of such constructions are:

i) *The English Ditransitive Construction* (see (1)), which has the following syntactic active structure: [SUBJ [V OBJ OBJ2]],

ii) *The English Caused-Motion Construction* (see (2)), which has the following syntactic active structure: [SUBJ [V OBJ OBL]],

iii) *The English Resultative Construction* (see (3)), which has the following syntactic active structure: [SUBJ [V OBJ OBL]], and

iv) *The Way Construction* (see (4)), which has the following syntactic active structure: [SUBJ$_i$ [V [POSS$_i$ *way*] OBL]]

(1) Sally baked her sister a cake. (Goldberg, 1995, 141)

[1] I use the term *antecedent* (taken from Croft (1991)) as a collection term for roles like instrument, comitative, manner and source.

(2) They laughed the poor guy out of the room. (Goldberg, 1995, 152)

(3) He talked himself blue in the face. (Goldberg, 1995, 189)

(4) Frank dug his way out of the prison. (Goldberg, 1995, 199)

Typical for verbs appearing in these constructions is that their argument frames are not necessarily predictable from the verb's semantics. In Construction Grammar, the argument frames can be contributed by the constructions, and the meaning is composed by the verb's semantics and the construction it appears in. There is no need to assume several verb meanings for the same stem in order to account for a verb with more than one possible argument frame.

Müller (2006) points out a problem with phrasal Construction Grammar as presented in Goldberg (1995), namely that for example 218 constructions are required in order to account for resultatives in connection with permutations of SUBJ, OBJ and OBL, verb initial/verb final position, passive, middle, modal infinitives and free datives in German. And this leaves out the treatment of adjuncts and complex predicates, which could make the number of constructions needed infinite. Müller's criticism presupposes that the phrasal constructions either are flat, or that they necessitate constraints trees of a depth greater than one. For the German subordinate clauses in (5), he assigns the structures in (6):

(5) a. daß so grün selbst Jan die Tür nicht streicht
that that green even Jan the door not paints
'that not even Jan would paint the door that green'

b. daß so grün die Tür selbst Jan nicht streicht
that that green the door even Jan not paints

c. daß Jan so grün selbst die Tür nicht streicht
that Jan that green even the door not paints

d. daß eine solche Tür so grün niemand streicht
that a such door that green nobody paints
'that nobody paints such a door that green'

(6) a. [OBL SUBJ OBJ V]
b. [OBL OBJ SUBJ V]
c. [SUBJ OBL OBJ V]
d. [OBJ OBL SUBJ V]

What is new in the approach that I am going to suggest here, is that constructions are decomposed into sub-constructions. This makes it possible to maintain binary structures without constraints on threes of a depth greater than one, and at the same time have a phrasal approach to constructions. The examples in (5) can be given the (binary) structures in (7):[2]

[2]COMPL stands for *complementizer*

(7) a. [[[[COMPL ARG4] ARG1] ARG2] V]
b. [[[[COMPL ARG4] ARG2] ARG1] V]
c. [[[[COMPL ARG1] ARG4] ARG2] V]
d. [[[[COMPL ARG2] ARG4] ARG1] V]

Before I explain how this can be achieved, I will discuss the argument roles I am assuming.

3 Argument roles

The five argument roles can have different syntactic realizations, as the examples (8)–(12) illustrate. I here exemplify how the argument roles are realized in English.

Arg1-role: The agent or source. The arg1-role can be realized as an NP subject (see (8a)), as the passive auxiliary (see (8b)) or as the infinitival marker (see (8c)). If the arg1-role is realized as the passive morphology, it cannot be a source.

(8) a. **John** smashed the ball.
b. The ball **was** smashed.
c. (John tried) **to** smash the ball.

Arg2-role: The patient. This role is usually realized as the direct object (see (9a)), but if the sentence is unaccusative or passive, it can be realized as subject (see (9b) and (9c), respectively). The role can also be realized as the infinitival marker (see (9d)). When realized as subject or direct object, the argument can be an NP (see (9a) and (9b)), a subordinate clause (see 9e) or an infinitival clause (see (9f)).

(9) a. John smashed **the ball**.
b. **The boat** arrived.
c. **The ball** was smashed.
d. (The car needed) **to** be washed.
e. John said **that Mary smashed the ball**.
f. John promised **to smile**.

Arg3-role: The benefactive or recipient. This role is usually realized as indirect object (see (10a)), but if the sentence is passive, the role can be realized as subject (see (10b)). It can also be realized as the infinitival marker (see (10c)).

(10) a. John gave **Mary** a book.
b. **Mary** was given the book.
c. (Mary wanted) **to** be given a book.

Arg4-role: The goal. This is either a resultative or an end-of-path, and is realized as a PP, AP or NP complement (see (11a)–(11c)).

(11) a. John smashed the ball **out of the room**.
b. John hammered the metal **flat**.
c. He painted the car **a brilliant red**.[3]

Arg5-role: The antecedent. This is a participant which precedes the patient in the chain of events. It can be instrument, comitative, manner or source. It is realized as a PP complement (see (12)).[4]

(12) John punctured the balloon **with a needle**.

4 Argument frames and valence alternations

I assume that argument frames are made up of constellations of the five argument roles above. Some of the argument frames are exemplified in (13). (13a) has one argument role, the arg1-role, which constitutes an arg1-frame. (13b) has two argument roles, the arg1-role and the arg2-role, and the roles together constitute an arg12-frame. (13c) has one argument role, the arg2-role, which constitutes an arg2-frame. (13d) has three argument roles, an arg1-role, an arg2-role and an arg3-role, and these three roles constitute an arg123-frame. (13e) has three argument roles, an arg1-role, an arg2-role and an arg4-role. The three roles constitute an arg124-frame. (13f) has the three roles arg1-role, arg2-role and arg5-role, which constitute an arg125-frame.

(13) a. John smiles. (arg1-frame)
b. John smashed the ball. (arg12-frame)
c. The boat arrived. (arg2-frame)
d. John gave Mary a book. (arg123-frame)
e. John gave a book to Mary. (arg124-frame)
f. John punctured a balloon with a needle. (arg125-frame)

In this account, valence alternations can be explained in terms of verbs entering different syntactic argument frames that are made up of sub-constructions. Examples (14)–(20) are taken from Levin (1993). I have equipped each example with the corresponding argument frame (in parenthesis).

(14) *Causative/Inchoative Alternation*
a. Janet broke the cup. (arg12-frame)
b. The cup broke. (arg2-frame)

(15) *Unexpressed Object Alternation*

[3]This example is taken from Rothstein (1985, 83)

[4]The distinction between participants that precede the object in the causal chain (what here is referred to as the arg5-role) and participants that follow (the arg4-role) is found in (Croft, 1991, 183-240).

a. Mike ate the cake. (arg12-frame)

b. Mike ate. (arg1-frame)

(16) *Conative Alternation*

a. Paula hit the fence. (arg12-frame)

b. Paula hit at the fence. (arg14-frame)

(17) *Preposition Drop Alternation*

a. Martha climbed up the mountain. (arg14-frame)

b. Martha climbed the mountain. (arg12-frame)

(18) *Dative Alternation*

a. Bill sold a car to Tom. (arg124-frame)

b. Bill sold Tom a car. (arg123-frame)

(19) *Locative Alternation*

a. Jack sprayed paint on the wall. (arg124-frame)

b. Jack sprayed the wall with paint. (arg125-frame)

(20) *Instrument Subject Alternation*

a. David broke the window with a hammer. (arg125-frame)

b. The hammer broke the window. (arg12-frame)

I see the argument frames to constitute general construction types that more specific constructions can inherit from. The arg12-frame in (14a) is for example different from the arg12-frame in (20b) in that (20b) is not agentive. The arg124-frame can be seen to have several subtypes, namely the Caused-Motion Construction ((2)), the Resultative Construction ((3)) and the *Way* Construction ((4)).

Some verbs, like *drip*, can enter a great number of argument frames, as illustrated in (21). Here 14 different argument frames are listed. 8 of them have passive counterparts. If one uses a lexical approach, as suggested by Müller, the number of lexical constructions becomes quite large. It is possible to do with only one lexical entry for *drip* here, since the verb is treated more like a modifier of the syntactic argument frame it appears in, rather than as a head with full control of its syntactic environment.

(21) a. *arg1-frame*:
The roof drips.

b. *arg14-frame*:
The doctor drips into the eyes.

c. *arg15-frame*:
The doctor drips with water.

d. *arg145-frame*:
The doctor drips into the eyes with water.

e. *arg12-frame*:
The roof drips water.

f. *arg124-frame*:
The roof drips water into the bucket.

g. *arg125-frame*:
The doctor dripped the eyes with water.

h. *arg145-frame*:
The doctor dripped into the eyes with water.

i. *arg123-frame*:
John dripped himself two drops of water.

j. *arg1234-frame*:
John dripped himself two drops of water into his eyes.

k. *arg12345-frame*:
John dripped himself two drops of water into his eyes with a drop counter.

l. *arg2-frame*:
Water dripped.

m. *arg24-frame*:
Water dripped into the bucket.

n. *arg0-frame*:
It drips.

5 Analysis

The basic argument frame of a clause is arrived at by letting the morpho-syntactic functional elements in the clause (phrase structure rules, function words and inflections) contribute information about which sub-constructions that have applied by means of types. An item that realizes the arg1-role, will contribute the type *arg1+*, an item that realizes the arg2-role contributes the type *arg2+*, and so on. The argument roles that are not realized will be registered with negative types. When a clause is processed, the argument role types are unified. A transitive clause will have the argument role types *arg1+*, *arg2+*, *arg3–* and *arg4–*.[5] As is shown in the type hierarchy in Figure 1, the unification of the types *arg1+*, *arg2+*, *arg3–* and *arg4–* yields the type *arg12*. Similarly, a ditransitive clause will contribute the argument role types *arg1+*, *arg2+*, *arg3+* and *arg4–*, which unifies as the type *arg123*.

The argument role types, that the morpho-syntactic items contribute, together with the hierarchy of argument frames, account for the possible argument frames. The system allows one to constrain a verb to only enter a specific frame. An unergative intransitive verb will for example be constrained to have an arg1-frame. This constraint is only compatible with the following constellation of argument role

[5] I am not including the arg5-role for expository reasons.

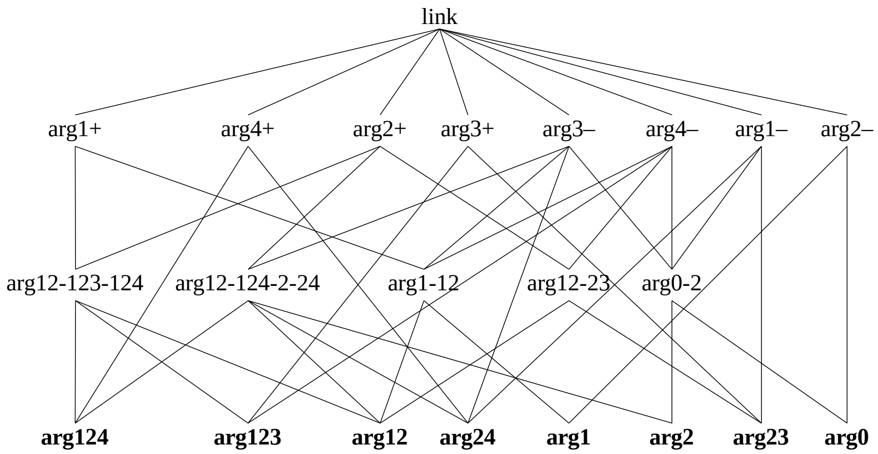

Figure 1: The hierarchy of *argument frame* types

types: *arg1+*, *arg2–*, *arg3–* and *arg4–*. A verb can also be allowed to enter more than one frame. Unexpressed object alternation verbs like *eat* (see (15)) can be constrained to have the argument frame type *arg1-12*. It will then be compatible with two constellations of argument role types, namely *arg1+*, *arg2–*, *arg3–* and *arg4–* and *arg1+*, *arg2+*, *arg3–* and *arg4–* (see Figure 1).[6]

In the approach that I have suggested, permutations and adjunct attachment in German do not pose a problem, since the structures are binary, and there is no need (as Müller claims) to posit constraints on trees of a depth greater than one. The different sub-constructions apply independently, and it is only after the whole clause is processed that it is clear what kind of construction they were a part of.

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[6]Such an analysis is utilized in a broad-coverage HPSG-like grammar that I have developed for Norwegian, Norsyg. Norsyg parses 40.9% of the items of an article on concrete. The article, which has 313 grammatical items, was taken from Norwegian Wikipedia articles marked as excellent, and no changes were made to the grammar in order to adapt it to the data. A manual inspection of all the items that parsed, using the [incr tsdb()] treebanking tool (Oepen and Flickinger, 1998; Oepen, 2001), revealed that 95 out of 128 items (74.2%) had the intended analysis. This means that Norsyg has a coverage of 30.4% of the grammatical items in the article.

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The Syntax of Copular Construction in Mauritian

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Abstract:

This paper[†] examines the syntactic behavior of the Mauritian copula in predicative and extracted sentences. As it is the case in many languages, the Mauritian copula *ete* is absent in certain constructions: It only appears in extraction contexts. Our aim is to show that the postulation of a null copula, which has been proposed in various analyses, is inadequate for the Mauritian data. The phenomenon, as it is argued, rather lends itself to a strictly construction-based analysis within the framework of HPSG and is based on the distribution of weak pronouns and TAM markers.

1 Introduction

Schachter 1985; 1984 defines *copulas* as words that are used to indicate the relation between a subject and a nominal or adjectival predicate. In our analysis, we will extend Schachter's definition to prepositional phrases as well hence accounting for all types of non-verbal predicate. In this sense, it is a lexical verb as opposed to that of being a helping verb when used as an auxiliary. This opposition, which is found in languages like French, English and so on, is not available in Mauritian (henceforth MC) since in this language it is only a main verb appearing in specific contexts. In fact, the copula *ete* in MC fails to appear in declaratives with a predicative complement but is present in extraction contexts. The aim of this paper is to demonstrate that the analyses proposed to account for absent copulas in the many languages where the phenomenon is present namely Creoles- Haitian (Déprez 1997, Gadelii to appear), Mauritian (Syea 1997), German (Müller 2006), African American Vernacular English (Bender 2001) to name but a few, is unmotivated for the data examined in Mauritian- a French-based Creole. These have indeed reached the conclusion that the specific behavior of the copula in these languages could only be accounted for if a null copula is postulated in contexts where it is absent and a corresponding full form where it appears. Syea 1997, within the framework of Government and Binding, for instance, base his analysis on the ECP and assumes that the copula is needed for the trace to be properly governed. The proposition, however, doesn't account for the specific behavior of weak and strong forms of personal pronouns, TAM markers as well as the negation marker. In a constraint-based framework like HPSG, Müller to appear. adopts the null copula analysis in order to preserve the topological fields in German when the copula is omitted in declaratives while Bender (2001) cannot account for long distance dependencies without a phonologically null element in AAVE because in these constructions the copula is still missing. The paper shows that the arguments motivating these analyses do not account for the studied data given that the Mauritian

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copula do not behave like Haitian's or AAVE copula. Furthermore, Müller's account essentially adopts a lexicalist approach over a phrasal one because of the complexity of the former in accounting for the different linearization of a particular phenomena. Both types of analysis have advantages and disadvantages which we will discuss throughout the paper. The latter is organized as follows: Section 2 reviews the historical background pertaining to the emergence of the copula in Mauritian, section 3 presents the relevant data, section 4 reviews briefly the proposed analyses and their problems, section 5 presents an alternative analysis within HPSG and finally section 6 concludes the discussion.

2 (Historical) Background

In his *Etude sur le Patois Creole Mauricien*, Baissac 1880 states that `"(...)Le créole en est resté à cette proposition embryonnaire. Le concept de l'exis -tence sans attribut est trop haute pour lui, il ne s'élève jamais jusqu'à ces abstractions. Le verbe substantif, essentiel, le verbe "être" n'existe pas en créole." P32` [1]. Although it is true that the copula emerged in the late 19th century[2], the author strikingly analyzes it as a variant of the past tense marker *ti*. The confusion, no doubt, results from historical facts. A form *ete/te* can actually be found in old texts where it is clearly a tense marker[3]:

(1) Moy napa ete batte ça blanc la. (1779: Chaudenson 1981)

(2) Quequ'fois cabrit moi te manze. (Chrestien 1831)

In both sentences, *ete/te* is a helping verb and *batte* and *manze* are the main verbs. These ancient forms can indeed be substituted by the past tense marker whose contemporary form is *ti*. This tense marker, which can appear with verbs, can also stand alone in declaratives as will be seen later in this paper as opposed to *ete*, which is a lexical verb (≠ auxiliary).

(3) Kot Zan ti ale?
where John PST go
'Where did John go?'

(4) Kot zan (*ete) ale?

Schachter (1985) and Déprez (2000) distinguishes between **predicators** and **copulas** where the former are used to mark predicate nominals when there is no overt subject. The idea in raising up this point is to see whether other elements

[1](...) Creole has remained at the level of this embryonic proposition. The concept of existence without attribute is way to high for him, he never rises to these abstractions. The substantive verb, which is essential, the verb 'to be' doesn't exist in Creole.)

[2]See Baker & Syea (1991) for more details

[3]The data are taken from Baker & Syea 1991. See also Corne 1980, 1982.

such as *se*, from French *c'est*, can be analyzed as a copula as has been proposed for Haitian Creole (Déprez 2000) or as a proform, i.e. the subject of an expletive type of construction. Considering the following data, it can be argued that compared to HC where *se* is obligatorily present when the predicate is indefinite as in (7), MC never admits *se* as a copula (6b).

(5) (Se) tifi la ki pa'nn vini.
It girl DEF REL NEG.PERF come
'It is the girl who didn't come.'

(6) a. tifi la (*se) profeser.
girl DEF it teacher
'The girl is a teacher.'

b. tifi la enn profeser.
girl DEF DET teacher
'The girl is a teacher.'

c. tifi la, se enn profeser.
girl DEF it DET teacher
'The girl, she is a teacher.'

(7) Jan (*se) yon dokter. HC
Jan SE a doctor
'John is a doctor.'

In (6c), where it seems to behave like a copula, *se* is a presentational pronoun. Compare for instance (6b) to (6c) where the latter is clearly a dislocation as can be seen from the English translation. Moreover there is a difference between the two sentences: when *se* is present there is a pause marking dislocation in the prosody. We thus consider that *se* is a presentational pronoun. In the next section, we consider the data and propose alongside some preliminary analyses of the different constructions.

3 The data

3.1 Verbless copular sentences

MC has an absent copula in non-extracted declaratives whether the predicate is adjectival, prepositional or nominal, whether in the past, present or future and whether the predicate is negated or not as exemplified in (8)-(10).

(8) a. Zan (*ete) (enn) profeser.
John COP a teacher
'John is a teacher.'

b. Zan (*ete) dan lakour.
John COP PREP garden
'John is in the garden.'

c. Zan (*ete) malad.
John COP sick
'John is sick.'

(9) a. Zan pa (*ete) (enn) profeser.
John NEG COP (a) teacher
'John is not a teacher.'

b. Zan pa (*ete) dan lakour.
John NEG COP PREP garden
'John is not in the garden.'

c. Zan pa (*ete) malad.
John NEG COP sick
'John is not sick.'

(10) a. Zan ti (*ete) (enn) profeser.
John PST COP (a) teacher
'John was a teacher.

b. Zan ti/pou (*ete) dan lakour.
John PST/IRR COP PREP garden
'John was/will be in the garden.'

c. Zan ti/pou (*ete) malad.
John PST/IRR COP sick
'John was/will be sick.'

Note that in (10a), we have deliberately excluded the irrealis marker *pou*. With this marker, the verb *vinn* is needed in order to denote process.

(11) Zan pou (*ete) vinn (enn) profeser.
John IRR COP become (a) teacher
Lit. 'John will become a teacher.'

Similar to AAVE (Bender 2001), these verbless sentences behave as finite clauses in the sense that they can be embedded and coordinated with verbal clauses:

(12) a. Mo krwar/panse Zan (*ete) (enn) profeser.
1SG believe/think John COP (a) teacher
'I believe/think that John is a teacher.'

b. Mo krwar/panse Zan (*ete) dan lakour.
1SG believe/think John COP PREP garden
'I believe/think that John is in the garden.'

c. Mo krwar/panse Zan (*ete) malad.
1SG believe/think John COP sick
'I believe/think that John is sick.'

(13) Mo pe ale e Zan (*ete) kontan.
1SG PROG go and John COP happy
'I'm leaving and John is happy.'

The prediction is also true when the embedded clause or second conjunct is negated, or when TAM markers are present as illustrated in (14) and (15).

(14) a. Mo krwar/panse Zan ti (*ete) (enn) profeser.
1SG believe/think John PST COP (a) teacher
'I believe/think that John was a teacher.'

b. Mo krwar/panse Zan pa (*ete) dan lakour.
1SG NEG believe/think John NEG COP PREP garden
'I believe/think that John is not in the garden.'

c. Mo krwar/panse Zan pa ti (*ete) malad.
1SG believe/think John NEG PST COP sick
'I believe/think that John was not sick.'

(15) Mo pe ale e Zan pa (*ete) kontan.
1SG PROG go and John NEG COP happy
'I'm leaving and John is not happy.'

It seems then that in MC there is no element linking the predicate to its subject in declaratives clauses. A lexical form having the properties of a copula somehow surfaces in particular constructions as will be illustrated in the next section.

3.2 Distribution of the copula *ete*

As mentioned earlier, a lexical form *ete* appears in specific constructions, namely in extraction contexts: in direct (16) and indirect interrogatives (17), in topicalisations (18), in relatives clauses (19), clefts (20) and exclamatives[4] (21) (% means that the data is not accepted by all speakers).

(16) Ki tifi la *(ete)?
what girl DEF COP
'What is the girl?'

[4] Syea 1997 discusses such data, but does not include exclamatives.

(17) mo pa kone ki tifi la *(ete)
1SG NEG know what girl DEF COP
'I don't know what this girl is.'

(18) en voler zan *(ete)
A thief John COP
A thief John is.

(19) Sa madam ar ki li *(ete) la
DEM woman with REL 3SG COP
'The woman with whom he is.'

(20) pares ki li *(ete)
lazy COMP 3SG COP
'It is lazy that he is.'

(21) % ala enn bon dokter li *(ete) la!
DEIC a good doctor 3SG COP DEIC
'What a good doctor he is!'

That the predicate is extracted is shown by the fact that we can have a long distance dependency as in (22).

(22) kisannla to panse tifi la *(ete)?
who 2SG think girl DEF COP
'Who do you think this girl is?'

It is thus predicate extraction that triggers the lexical realization of the copula. In interrogatives with an in-situ *wh*-word (23), or with a *wh*-subject, the copula is impossible (24) even if the subject is extracted. It is also impossible if only a complement of the predicate is extracted (26). The same applies in relative clauses where the subject is relativized (27) and in exclamatives with no extraction (28).

(23) a. Zan (*ete) kote?
John COP where
'John is where?'

b. Tifi la (*ete) ki manier?
girl DEF COP how way
'The girl is how?'

(24) kisannla (*ete) malad?
who COP sick
'Who is sick?'

(25) kisannla to panse ki (*ete) malad?
who 2SG think that COP sick
'Who do you think is sick?'

(26) kont kisannla Zan (*ete) ankoler?
against who John COP angry
Lit. 'Against whom John is angry?

(27) Sa madam ki (*ete) malad...
the woman REL COP sick
The woman who is sick...

(28) % Ala Zan (*ete) zoli la!
DEIC John (COP) beautiful DEIC
'How beautiful John is!'

Finally, when a locative or manner predicate is extracted, the lexical copula appears to be optional in interrogatives:

(29) Kot Zan (ete)?
where John COP
'Where is John?'

(30) Ki manier madam la (ete)?
how way woman DEF COP
'How is the woman?'

(31) Komye liv la (ete)?
how book DEF COP
'How much is the book?'

(32) Dan lakour, Zan *(ete)
PREP garden, John COP
'In the garden, John is.'

The data can be summarized in the table below.

(33)

	impossible ete	optional ete	obligatory ete
Declaratives	no extraction	-	topicalisation: loc.pred
Interrogatives	wh-subj/in-situ	wh-loc/manner..	wh-pred.
Relatives	subj.rel.	-	pred.rel loc.rel
Exclamatives	no extraction	-	wh-pred

Notice that *ete* is not necessarily in final position. It can be followed by various PPs or adverbial modifiers as seen from the following examples.

(34) Ki Zan *(ete) dan sa lekol la?
what John COP PREP DEM school DEF
'What is John in this school?'

(35) Kot Zan (ete) zordi?
where John COP today
'Where is John today?'

Given the data, we thus analyze *ete* as a head selecting for a gap predicative complement.

4 Proposed analyses

In HPSG, two main types of analysis have been proposed for verbless clauses: a construction-based approach (as in Sag & Wasow 1999 and Ginzburg et Sag 2000) and a lexicalist approach, based on a phonologically null copula form, as in Bender (2001, 2003) , Borsley (2004) and (Müller 2006). We argue here in favor of the former.

In her analysis, Bender 2001 argues that the only way of accounting for the behavior of the copula in AAVE is to allow that the copula is phonologically null whenever it is deleted. The fact that the verb can be deleted in long distance dependencies poses a serious problem if we are to propose a constructionist approach.

(36) How old you think his baby ∅?

The proposed analysis suggests that the empty copula for AAVE be treated as one of the inflected forms of *be*. A lexical rule applies to the verb verb projecting a null form providing a way to account for sentences such as (36) above. In the case of MC as in (37a) below *ete* is obligatory and hence the proposed analysis cannot be applied to the data.

(37) a. Ki kouler to krwar so sak *(ete)?
how color 2SG believe 3SG.POSS bag COP
'What color you believe his bag is.'

b. Kot to panse so mama *(ete)?
where 2SG think 3SG.POSS mother COP
'Where do you think his/her mother is.'

Borsley 2004, when looking at the comparative-correlative construction in English, suggests that the verb *be* have particular properties since it can be omitted in some CC constructions as in (38).

(38) the more intelligent the students (are), the better the marks (are).

In his analysis, he suggests that a verb *be* can be a phonologically null form only in head-filler phrases. That is, in these constructions where copula omission is possible if and only if its complement is fronted as in (36), the head can be phonologically null with a feature [NULL+]. The lexical description of the null form *be* ensures that its COMPS value is empty in order to avoid in-situ complements while the feature SLASH provides the value of the element to be fronted. The analysis provided by Borsley (2004) does not account for the facts in MC. If a null element can only be accounted for in Head-filler phrases, declaratives without extraction are excluded. And in (34) above, if the complement is fronted, the copula is still obligatory.

(39) Dan sa lekol la, ki Zan *(ete)?
PREP DEM school DEF what Zan COP
In this school, what is John?

In the same kind of constraint-based grammar, Müller to appear. accounts for copula omission in German via a lexical rule as has been proposed for AAVE (Bender 2001[5]). The argument relies on the fact that the clause type determination in German is changed if a constructionist approach is adopted. That is, although the copula doesn't have any semantic contribution to the sentence, there is a need to preserve the order domain because of sentence structure. He furthermore argues that empty elements is to be favored in German when it comes to ellipsis, like for instance ellipsis of NPs, given the fact that without those, the semantics cannot be recovered. A second argument in favor of phonologically null elements versus a construction-based approach concerns the production of multiple phrase-structure rules in the type hierarchy. That is favoring a lexical approach is certainly more economical in terms of rules than a constructionist approach. However, it can be argued that the same problem arises with a lexical-based account, in the sense that we multiply lexical entries. Moreover, in his account no lexical entry is provided[6] for the empty copula and hence, we are not able to see how it could interact with the phrase structure rules for German.

Finally, Syea 1997 in the Government and Binding framework, proposes two forms of the copula for the MC data, a weak form (which is null) and a strong form (which is *ete*). Syea's Generalization says that "the copula has the weak form in the environment of a following overt constituent and the strong form in the environment of a following trace". As already mentioned in the introduction paragraph, his analysis is based on the ECP which says that traces must be properly governed, assuming that the null copula cannot be a proper governor. The proposal is that

[5]See also Ferguson (1968) for a different analysis.

[6]Actually, he send us back in a footnote to Bender's analysis (Bender, 2001).

head-government requirement should apply at PF, while antecedent-government requirement should apply at LF, since the copula, being semantically void, does not exist at LF.

4.1 Against a null copula

Our main argument against a null copula analysis is based on the distribution of weak pronouns *mo* and *to*, the negation marker *pa* and TAM markers *ti*, *pou* and so forth. Weak forms of the 1st and 2nd personal pronouns (*mo* and *to*) can appear in verbless copular sentences but not in case of an extraction, unlike strong forms *mwa* and *twa*:

(40) To dan lakour
2SG PREP garden
'You are in the garden.'

(41) Kot to *(ete)?
where 2SG COP
'Where are you?'

(42) Kot twa?
Where 2SG.OBJ
'Where are you?'

If a null copula is involved in (40), and legitimates the weak form of the pronoun, then it should also be allowed in (41) since the null copula is compatible with an extracted locative with an NP subject as in (29). If we analyze weak pronouns as proclitics (looking for a phonological host to their right), then (41) is bad with an empty copula. The same behavior is witnessed with the negation marker and the TAM markers.

(43) Kot Zan ti *(ete)?
where John PST COP
'Where was John?'

(44) Kot Zan pa *(ete)?
where John NEG COP
'Where wasn't John?'

Since the null pronoun is allowed with these markers in declaratives it should be the case with the extracted locatives, which as seen above are ungrammatical. If we analyze the negator as a modifier seeking a host and TAM markers as raising verbs, then the ungrammaticality of (43) and (44) can be explained by the fact that they are missing their complements. We thus say that they subcategorize for a canonical complement (which can be a finite VP or a predicative XP). Furthermore, as has been argued earlier the proposal made by Bender (2001), Borsley (2004) and Müller (2006) does not apply to the studied data since the optionality of the copula in these languages is based on factors different from those available in MC. in the next section, we provide an alternative analysis in HPSG[7] inspired from Sag & Wasow (1999).

5 A Construction-based HPSG Analysis

In Sag & Wasow 1999, a Zero Copula Rule is proposed whereby [PRED+] expressions (predicative expressions) can combine with a nominative subject to project a fully saturated phrase structure. In other words [PRED+] expressions are able to project finite clauses even if they are missing a verb. This is possible given that the copula is semantically empty. We first provide the necessary lexical entries for TAM markers and the copula and the relevant mechanisms allowing the parsing of the extracted contexts where the copula *ete* is present and copulaless ones where it is missing.

5.1 Lexical entries for *ete, ti* and *pa*

We analyze the copula as a verb which is constrained to take a predicative complement of the type *gap*. A TAM marker like *ti*, on the other hand, is constrained to take a finite VP or predicative complement of the type *canonical*. Finally, the negator *pa* modifies a predicative or verbal head in sentential negation.

(45)
$$\left\langle \text{ete}, \begin{bmatrix} \text{ARG-ST} & \left\langle \boxed{1}, \begin{bmatrix} \textit{gap} & \\ \text{PRED} & + \\ \text{SUBJ} & \left\langle \boxed{1} \right\rangle \end{bmatrix} \right\rangle \end{bmatrix} \right\rangle$$

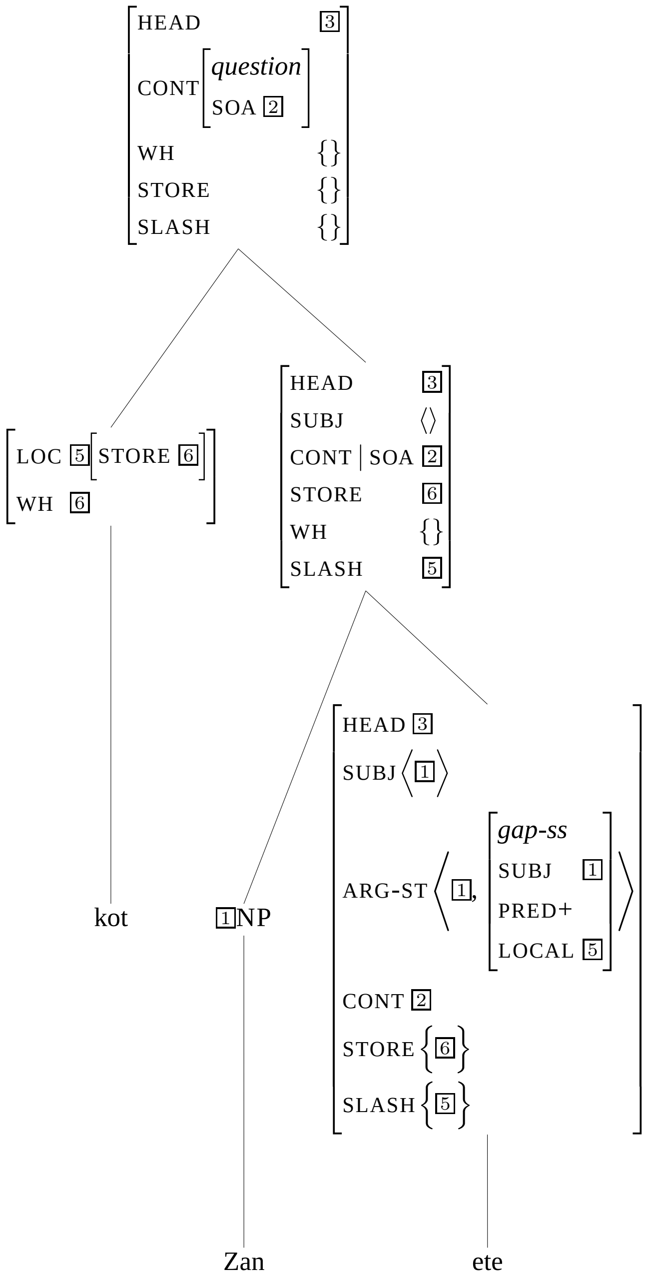
(46)
$$\left\langle \text{ti}, \begin{bmatrix} \text{ARG-ST} & \left\langle \boxed{1}, \begin{bmatrix} \textit{canon} \\ \text{PRED + or } \textit{verb} \\ \text{SUBJ} \left\langle \boxed{1} \right\rangle \end{bmatrix} \right\rangle \end{bmatrix} \right\rangle$$

(47)
$$\left\langle \text{pa}, \begin{bmatrix} \textit{adverb} \\ \text{MOD} \begin{bmatrix} \text{PRED + or } \textit{verb} \\ \text{CONT} \mid \text{NUCLEUS } \boxed{1} \end{bmatrix} \\ \text{STORE} \begin{bmatrix} \textit{neg-quant-rel} \\ \text{ARG } \boxed{1} \end{bmatrix} \end{bmatrix} \right\rangle$$

When the locative (or manner and so forth) complements are analyzed as [PRED +], they can be extracted and the copula thus surfaces. This is illustrated in (48) below.

[7]See also Pollard & Sag 1994.

(48)



5.2 Our analysis of verbless clauses

Following (Sag & Wasow 1999), we handle verbless copular clauses with a specific construction, with a non verbal head, which is a subtype of head-subject phrases, assuming that the Head Feature Principle is a default constraint and that our verbless copular-construction rule here overrides the default constraint as suggested by

Ginzburg & Sag 2000[8].

(49) verbless-cop-cx → head-subj-phrase & $\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{fin} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \textit{message} \\ \text{SOA} \mid \boxed{2} \end{bmatrix} \end{bmatrix} \\ \text{HEAD-DTR} & \begin{bmatrix} \text{HEAD} & \textit{non-verbal} \\ \text{CONT}\mid\text{NUCL} & \boxed{2} \end{bmatrix} \end{bmatrix}$

This construction inherits from the head-subject phrase, which ensures that the subject is appropriate for the head. MC, unlike French, does not generally allow subject inversion. We thus have a precedence rule that forces the subject to precede the (non-verbal) head, accounting thus for the facts in declaratives.

(50) HEAD-SUBJ-PHR → NON-HD-DTR precedes $\left[\begin{bmatrix}\text{PRED} +\end{bmatrix} \vee \begin{bmatrix}\text{VFORM} & \textit{fin}\end{bmatrix}\right]$

Recall that in the types definitions of core clauses we include declarative clauses and interrogatives clauses, among others. The former have a CONTENT value of type *message* while the latter, i.e., declarative clauses and interrogative clauses, which are its subtypes, have a CONTENT of type *proposition* and *question* respectively.

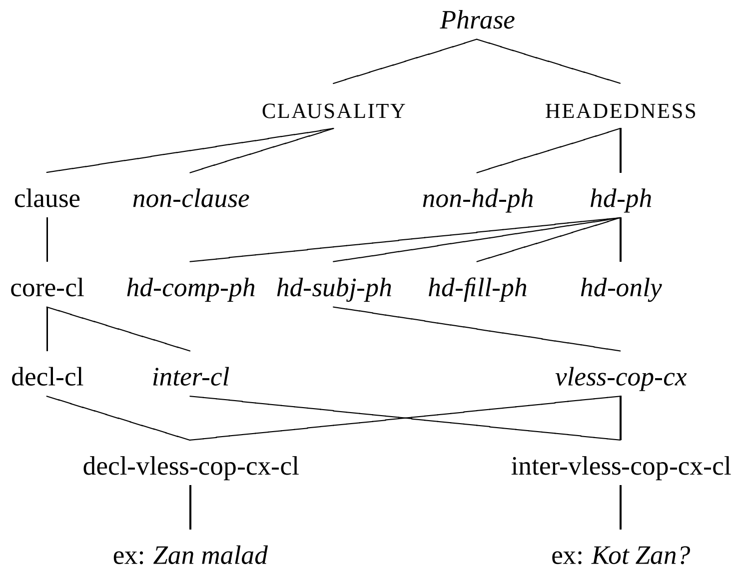
(51) a. *clause* → $\begin{bmatrix} \text{STORE}\,\{\} \\ \text{WH}\,\{\} \\ \text{HEAD PRED+ or } \textit{verb} \\ \text{CONT } \textit{message} \end{bmatrix}$

b. *decl-clause* → *clause* & $\begin{bmatrix}\text{CONT } \textit{proposition}\end{bmatrix}$

c. *inter-clause* → *clause* & $\begin{bmatrix}\text{CONT } \textit{question}\end{bmatrix}$

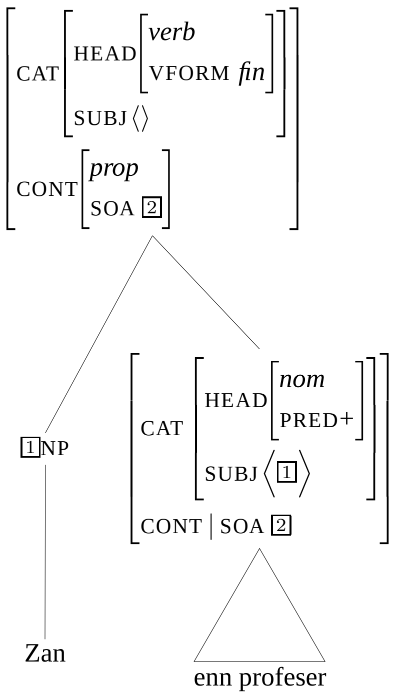
[8]The idea was first suggested by Copestake & Lascarides (1999)

(52)

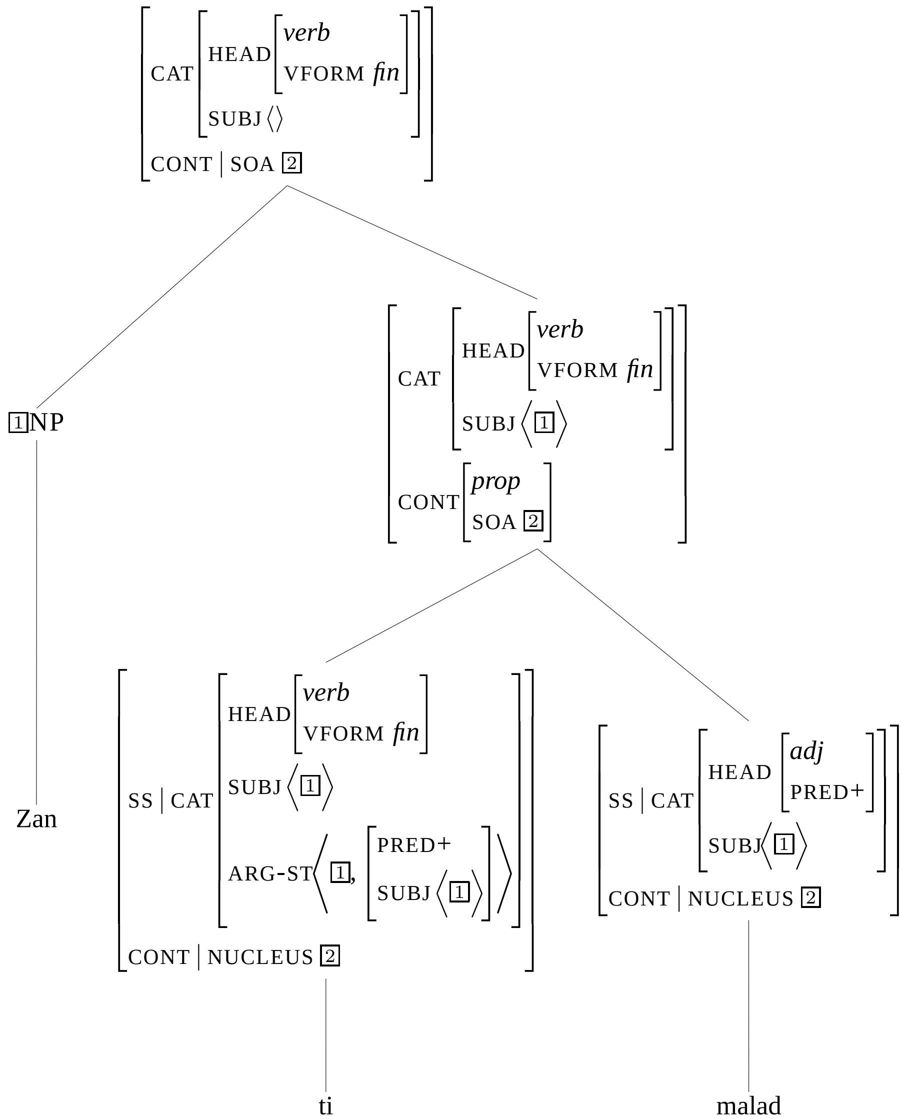


In addition, our constraint only applies to verbal or predicative head daughters. By requiring that verbless constructions or predicative phrases project a [VFORM *fin*], (48) guarantees that these can function as finite clauses in that they can, for instance, be embedded and coordinated. Notice also that our construction has a CONTENT of type *message* meaning that it can account for more specific types like *proposition* for a non-extracted declarative and *question* for verbless interrogatives (29, 30), with both a PRED+ as HEAD feature, as illustrated in the type-hierarchy.

(53)


CAT
HEAD
verb
VFORM fin
SUBJ ⟨⟩
CONT
prop
SOA 2
1 NP
Zan
CAT
HEAD
nom
PRED+
SUBJ ⟨1⟩
CONT | SOA 2
enn profeser

(54)



We analyze locative and manner *wh*-predicates as ambiguous in this respect, in the sense that they are underspecified for the PRED feature. If they are [PRED -], they can be analyzed as heads and can precede the subject, and this is how examples in(29) and (30) above without the copula can be analyzed. That *kot* is not extracted in (29) (i.e. the example without *ete*) is shown by the fact that we don't have a long distance dependency without *ete* as illustrated in (37a) and below. The same applies to manner adverbials.

(55) a. Kot to panse zan *(ete)?
where 2SG think John COP
'Where do you think John is?'

b. Ki manier to panse zan *(ete)?
what manner 2SG think John COP
'How do you think John is?'

c. Komye to krwar lasenn la *(ete)?
How-much 2SG believe necklace DEF COP
'How much do you believe the necklace is?'

However, as has been argued in Müller 2006, a phrasal approach is problematic given that for languages that have free constituent order like German, a large number of constructions are needed to cover all the patterns that can be found for a given phenomena. Although, these results being interesting and absolutely convincing, we need not forget that this stipulation is valid for German and that we are presupposing the existence of a null form if and only if a full form exists in the same slot. For example, in German the copula can be omitted in declaratives. The same applies to the AAVE copula. In the case of MC, the copula is optional only with adverbials (locative, manner and so forth). In declaratives, the copula is not allowed at all (3.1) unless with extraction. Hence, it makes no sense to postulate a null form in a slot where a full form is not allowed. Moreover, Mauritian being a rather strict SVO, will not face the problems encountered by German with a construction-based analysis. Albeit, allowing a phonological null form is still conceivable. Our lexical entries for TAM markers, negation and subject pronouns will have to be modified to allow a canonical complement with feature NULL+[9] as one of the HEAD value; although our lexical entry for the negator, for instance, would be much more complicated. The lexical entry of the phonologically null element would be as such:

(56)
$$\left\langle \emptyset, \begin{bmatrix} \text{VFORM} & \textit{fin} \\ \text{NULL+} & \\ \text{ARG-ST} & \left\langle \boxed{1}, \begin{bmatrix} \textit{canon} \\ \text{PRED +} \\ \text{SUBJ} \left\langle \boxed{1} \right\rangle \end{bmatrix} \right\rangle \end{bmatrix} \right\rangle$$

6 Conclusion

We have, in this paper, argued against a null copula for Mauritian verbless copular clauses, and in favor of a construction-based analysis. The peculiar distribution of the lexical copula *ete* and the TAM markers in copular clauses also provide some support for a lexicalist theory of extraction, as advocated by Bouma & al 2001. A more precise analysis of the semantics of the construction, as well as an extension to comparative clauses, which can also appear with or without the copula, still need to be provided.

[9] The idea is from Borsley 2004.

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Applying Licenser Rules to a Grammar with Continuous Constituents

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Abstract

Licenser rules have originally been introduced in Müller (1999) as a part of a grammar based on discontinuous constituents. We propose licenser rules as a means to avoid underspecified empty elements in grammars with continuous constituents. We applied them to a verb movement analysis of the German main clause with right sentence bracket and to complement extraposition. To reduce the number of unnecessary hypotheses, we extended the licenser rule concept with a licenser binding technique. We compared the licenser rule approach to an approach based on underspecified traces with respect to processing performance. In our experiment, the use of licenser rules reduced the parse time by a factor of 13.5.

1 Introduction

Some linguistic phenomena can be elegantly formalized by assuming phonetically empty elements (traces) which are related to overtly realized antecedents. However, the processing of empty elements is problematic in two ways. First, the parser can hypothesize infinitely many empty elements at any position in the input sentence. Second, empty elements tend to be dramatically underspecified unless information about the antecedent is locally available. This paper addresses the latter problem, but we will touch on the first issue in the context of our actual grammar implementation.

The structure of the paper is as follows. We first illustrate the problem of underspecifed traces by means of German examples. We then discuss related work and state our own contributions. Next, we show how licenser rules can be applied to a verb movement analysis of the German main clause and to complement extraposition. After introducing the licenser binding technique and discussing the problem of spurious ambiguities, we proceed to the experiments.

2 Traces and Underspecification

Sentence (1) is an example of a German main clause:

(1)

gestern	*liess*	*ihn*	*sein*	*Vater*	*ausschlafen*
yesterday	let	him	his	father	sleep-late

'yesterday, his father let him sleep late'

In German main clauses, the predicate complex is split into a left and a right sentence bracket. The left sentence bracket contains the finite verb (*liess* in the above example) and the right sentence bracket contains all other verbal elements (*ausschlafen*). Each verbal element can contribute its own complements to the predicate complex, and these complements can be permuted almost freely between the two sentence brackets. To bridge the gap between the left and the right sentence bracket, it is common to assume a trace (an empty verbal head) which acts as the sentence-final counterpart of the sentence-initial finite verb:

(2) *gestern liess*$_i$ *ihn sein Vater ausschlafen* t_i

Empty verbal heads allow the German predicate complex to be analyzed locally, but they pose a great challenge for bottom-up parsing. In actual implementations such as Carpenter and Penn (2003), empty verbal heads typically are underspecified. In particular, the number and types of their complements are not sufficiently constrained. This leads to a large number of superfluous hypotheses, i.e. VPs which do not meet the requirements of the sentence-initial finite verb.

This problem is not limited to empty heads. In his analysis of partial verb phrase fronting in German, Müller (2005) assumes a trace which represents the fronted partial verb phrase within the right sentence bracket:

(3)	*(seiner*	*Tochter*	*erzählen)*$_i$	*wird*$_j$	*er*	*das*	*wohl*	t_i	*müssen*	t_j
	his	daughter	tell	will	he	this	probably		have-to	

'he will probably have to tell this to his daughter'

The modal verb *müssen* subcategorizes for a verbal complement whose arguments it attracts. If the verbal complement is an underspecified trace t_i, the subcategorization information of the verbal complex t_i *müssen* is underspecified as well.

3 Contributions and Related Work

Approaches for processing traces more efficiently have been proposed in several publications. Johnson and Kay (1994) are mainly concerned with the fact that an infinite number of traces can hypothesized at any position in the input sentence. They suggest to associate each lexical entry with a bounded number of traces. Each parse can consume only those traces which are provided by the lexical items occuring in the sentence. Thus, the number of traces in any single parse is bounded and the parser is guaranteed to terminate (at least if the grammar does not permit infinite recursion). Besides demonstrating how traces can be assigned to lexical items in several GB analyses, they note that lexical items could be used to partially specify their associated traces.

Geißler (1994) and Batliner et al. (1996) adopt a similar idea for the processing of German main clauses. Whenever a lexical item of a sentence-initial finite verb is accessed, the corresponding empty verbal head is made available to the parser. As this approach establishes the relation between the trace and its antecedent, the empty verbal head is fully specified.

However, the antecedent of a verbal trace need not always be lexical. Counterexamples are fronted partial verb phrases (see previous section) and coordinated sentence-initial finite verbs in German:

(4)	*sie*	*(suchte*	*und*	*fand)*$_i$	*die*	*Lösung*	t_i.
	she	looked-for	and	found	the	solution	

'she looked for the solution and found it.'

Müller (1999) introduced the concept of licenser rules to avoid underspecified verbal traces in his analysis of fronted partial verb phrases. In essence, licenser rules make information about a lexical or phrasal antecedent available locally. Licenser rules will be discussed in greater detail in the next section.

Our contributions are the following: we applied licenser rules to a grammar with continuous constituents. This is novel as licenser rules allow for non-adjacent daughters and were originally proposed for a grammar based on discontinuous constituents. In particular, we used licenser rules in an analysis of the German main clause and complement extraposition. Finally, we extended the licenser rule concept with a *licenser binding* mechanism. This technique allows to further reduce the number of superfluous hypotheses arising from the use of traces. The effect of licenser binding was assessed experimentally.

As one reviewer pointed out, the problem of underspecified traces also occurs for natural language generation. In the solution proposed by Shieber et al. (1990), the overtly realized antecedent can be thought of as being generated at the position of the trace. Then, the antecedent is replaced by an empty element. The empty element in turn is specified according to the antecedent. This solution is related to the licenser rule approach in that it generates a trace after its (phrasal or lexical) antecedent has been derived, incorporating all necessary information from the latter.

4 Licenser Rules

A licenser rule is a (typically discontinuous) binary production rule whose right-hand side contains an argument marked as the licenser argument. In HPSG terminology, a licenser argument has the property that it does not contribute to the phonological information of the mother sign. Or, from the parser's point of view, the application of a licenser rule results in a chart edge covering exactly the same words as the edge which instantiates the non-licenser argument. Further, it can be specified whether the licenser is supposed to be positioned before or after the non-licenser. Thus, a licenser schema can be interpreted as a unary rule which uses a licenser for one (or both) of the following purposes:

- Information contained in the licenser can be used to prevent the resulting edge from being underspecified.
- The presence of the licenser triggers the application of the unary rule. This can avoid unnecessary hypotheses if the resulting edge can only be part of a complete parse if there is a matching licenser.

An example for the former case is the trace-based analysis of the German main clause, whereas the latter case applies to complement extraposition. A more detailed account of how licenser rules are applied to those phenomena will be given in the following sections.

4.1 German Main Clauses with Right Sentence Bracket

As has been argued in Section 2, a trace-based analysis of the German main clause poses a particular challenge for bottom-up parsing. In the following we will adopt the HPSG analysis presented in Müller (2005). The right sentence bracket is assumed to contain an empty verbal head representing a sentence-final finite verb, such that the predicate complex can be analyzed locally. The predicate complex can then combine with its complements and adjuncts, eventually constituting a VP. The LOCAL value of the empty verbal head is duplicated in its head feature DSL, which is percolated to the verbal head's maximal projection (the VP). The sentence-inital finite verb finally subcategorizes for a VP with a matching DSL value, thus closing the gap between the left and the right sentence bracket.

To prevent the empty verbal head from being underspecified, we use the licenser schema shown in Figure 1. It basically combines the empty verbal head with its verbal complement. The NON-LICENSER-DTR represents the verbal complement and LICENSER-DTR is a sentence-initial finite verb. The empty verbal head is only implicit in this schema. The licenser daughter provides all information necessary to fully specify the empty verbal head: the DSL value of its complement is identical to the LOCAL value of the empty verbal head. Like this it is ensured that all maximal projections of the empty verbal head will meet the requirements of the licensing sentence-initial verb. This schema is implemented by means of a discontinuous licenser rule stating that the licenser daughter may appear anywhere to the left of the non-licenser daughter. In our grammar, we used licenser rules

$$\begin{bmatrix} \text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \boxed{1}\begin{bmatrix}\text{DSL} & \boxed{2}\begin{bmatrix}\text{CAT} & \begin{bmatrix}\text{HEAD} & \boxed{1}\\ \text{SUBCAT} & \langle \boxed{4}\rangle \oplus \boxed{3}\end{bmatrix}\\ \text{CONT} & \boxed{5}\end{bmatrix}\end{bmatrix}\\ \text{SUBCAT} & \boxed{3}\end{bmatrix}\\ \text{CONT} & \boxed{5}\end{bmatrix}\\ \text{DTRS} & \begin{bmatrix}\text{LIC-DTR} & \begin{bmatrix}\text{SYNSEM}|\text{LOC}|\text{CAT} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{fin}\\ \text{INITIAL} & + \\ \textit{verb} & \end{bmatrix}\\ \text{SUBCAT} & \left\langle\left[\text{LOC}|\text{CAT}|\text{HEAD}|\text{DSL}\ \boxed{2}\right]\right\rangle\end{bmatrix}\end{bmatrix}\\ \text{NON-LIC-DTR} & \left[\text{SYNSEM}\ \boxed{4}\right]\\ \textit{licenser-structure} & \end{bmatrix}\\ \textit{phrasal-sign} & \end{bmatrix}$$

Figure 1: Licenser schema for German main clauses with right sentence bracket.

specifically for analyzing German main clauses with a right sentence bracket. A trace-based analysis of main clauses without right sentence bracket would be very costly, as the empty verbal head would have to be hypothesized at virtually every position in the sentence. If no right sentence bracket is present, we therefore resort to a left-branching structure as proposed in Crysmann (2003a).

4.2 Complement Extraposition

An efficient HPSG solution for the extraposition of adjuncts was proposed by Crysmann (2005). In HPSG with continuous constituents, the extraposition of complements is typically accounted for by means of a non-local dependency mechanism. Keller (1995) uses a lexical rule to move an extraposed complement from the SUBCAT list to an EXTRA set (a unary dominance schema or extraposition traces could be used alternatively). The EXTRA set is percolated by the Nonlocal Feature Principle until its members are eventually bound to matching phrases.

(Müller, 1999, p. 252) notes that this approach unnecessarily inflates the search space: a phrase with an extraposed complement is hypothesized even if no matching phrase is present. In a grammar with discontinuous constituents, this problem does not arise because a phrase and its extraposed complement form a discontinuous constituent. In grammars with continuous constituents, one can use licenser rules to reduce the search space. Our analysis is based on Keller (1995) and on the INERT/ACTIVE percolation approach proposed by Crysmann (2005) to avoid spurious ambiguities. However, as we use a licenser rule instead of a lexical rule, we can ensure that a non-local dependency is introduced only if there is a matching phrase somewhere to the right.

5 Licenser Binding

We have extended the licenser rule concept with a *licenser binding mechanism*. Our basic assumption is the following: in a parse of a complete sentence, each edge serving as a licenser also has to appear as a non-licenser at some point of the derivation. More precisely: if a licenser rule produces an edge e, the licenser edge has to appear as a sibling of some edge e' derived from e.

It is possible to early reject edges which will never satisfy this requirement. Suppose that there are two edges e_1 and e_x such that e_x has been used as a licenser in the derivation of e_1. If e_1 is combined with an edge $e_2 \neq e_x$ and if e_2 and e_x overlap, then no derivation of the resulting edge will be able to combine with e_x. Therefore, two edges e_1 and e_2 may be combined only if the following *licenser binding constraint* holds:

> *For any edge e_x that has instantiated a licenser argument in the derivation of e_1, either e_2 and e_x do not overlap or $e_2 = e_x$.*

Licenser binding can easily be implemented by adding a licenser set to each chart edge. For edges of lexical entries, the licenser set is empty. If two edges e_1 and e_2 with licenser sets L_1 and L_2 are combined by means of a non-licenser rule, the licenser set of the resulting edge is $L_1 \cup L_2$. If a licenser rule is applied and e_2 is the licenser edge, the resulting licenser set is $L_1 \cup \{e_2\}$.

This simple variant of licenser binding has the disadvantage that it interfers with ambiguity packing as proposed by Oepen and Carroll (2000): it may happen that two otherwise identical chart edges cannot be packed because they have different licenser sets. However, the above idea can be straightforwardly generalized to a variant which does not impair ambiguity packing. The basic idea is that a chart edge should bear a disjunction of licenser sets rather than a single licenser set. If two edges e_1 and e_2 with licenser set disjunctions $L_{11} \vee ... \vee L_{1n}$ and $L_{21} \vee ... \vee L_{2m}$ are combined by rule application, the disjunction of the resulting edge is $(L_{11} \cup L_{21}) \vee (L_{11} \cup L_{22}) \vee ... \vee (L_{1n} \cup L_{2m})$. If e_2 is packed onto e_1, the disjunction of the latter is extended to $L_{11} \vee ... \vee L_{2m}$. It now holds that a chart edge can be safely rejected as soon as for each of its licenser sets the licenser binding constraint has been violated at some point of the derivation.

In order to simplify the bookkeeping which is necessary for the above generalization, we actually use a more restricted variant of licenser binding. In general, we do not allow the packing of two edges with different licenser sets. The single exception are edges which were produced by the same licenser rule with the same non-licenser edge. The licenser sets of such edges will only differ with respect to a single element, namely the licenser edge of the preceding licenser rule application. This case is particularly interesting, as the packed edges can actually be ignored in the unpacking phase.

6 Spurious Ambiguities

A general problem arising from licenser rules are spurious ambiguities. The licenser is expected to take on a very specific role with respect to the non-licenser at some later point in the derivation. To a certain degree, this is enforced by the specification of the trace and by the licenser binding constraint. However, it can still happen that the licenser does not take on the appropriate role:

(5)	*sie*	*habe*$_i$	*gesagt*	t_i	*er*	*habe*$_j$	*es*	*gewusst*	t_j
	she	has	said		he	has	it	known	

'she said that he knew it'

The two instances of the auxiliary verb *habe* are syntactically and semantically identical. Therefore, the verbal complex *gewusst* t_j can be licensed by habe$_i$, even though habe$_j$ finally serves as the antecedent. As the "intended" licensing is also possible, we get one spurious ambiguity. Note that the licenser constraint is not violated: each licenser appears as a sibling of some phrase derived from a non-licenser. As mentioned in the previous section, spurious ambiguities of this kind can be reduced as a side-effect of ambiguity packing.

Still, spurious ambiguities are not banned completely. Consider the following scenario. There are two chart edges e_1 and e_2 whose LOCAL values are unifyable, but neither value subsumes the other. Each edge is used as the licenser of the same licenser rule with the same non-licenser edge. As a result, we get two edges $e_1{}'$ and $e_2{}'$ whose feature structures incorporate information (i.e. the LOCAL value) of their respective licenser. Because of this licenser information, neither edge subsumes the other. This in turn implies that ambiguity packing does not apply to $e_1{}'$ and $e_2{}'$.

As the licenser information of ${e_1}'$ and ${e_2}'$ is consistent with both e_1 and e_2, e_1 and e_2 can serve as the antecedent in derivations of both ${e_1}'$ and ${e_2}'$. Consequently, we get two spurious ambiguities in addition to the two proper readings.

The most general way to completely eliminate spurious ambiguities arising from licensing is to filter them out after parsing. This is achieved by "replaying" the unifications for each derivation tree without instantiating the licenser daughters. This operation yields a list of HPSG signs with fully instantiated DAUGHTER features. The spurious ambiguities are filtered out by removing the duplicates from this list.[1] Carrol and Oepen (2005) use such a "replay pass" to reintroduce the semantic features which were removed prior to ambiguity packing. If such a device is already applied for other reasons, the above filtering procedure is relatively cheap.

7 Experiments

7.1 The Parser

The following experiments were performed with our Java HPSG parser. A particularity of this parser is that it can process continuous as well as discontinuous rules. In discontinuous rules, the relative order of the rule arguments may or may not be specified. Regardless of the rule type, one or more (but not all) rule arguments can be specified to be licenser arguments. Different indexing structures are maintained to allow for the efficient processing of both types of rules. Further, the parser allows the specification of *relational constraints*. As in the TRALE system, see Haji-Abdolhosseini and Penn (2003), the evaluation of a relational constraint can be blocked and it can introduce non-determinism.

We use *equivalence-based ambiguity packing* rather than the more general subsumption-based packing proposed in Oepen and Carroll (2000). This enables us to efficiently retrieve a candidate set of potentially identical chart edges by means of hashing. The parser employs a special search strategy in order to facilitate the packing of edges that were produced by licenser rules (see Section 5). This is achieved by means of an agenda which uses two alternating phases. In the first phase, the parser tries to derive as many hypotheses as possible without applying licenser rules. The actual licensing takes place in the second phase, after (hopefully) all potential antecedents have been derived.

The parser applies many of the optimizations that have been proposed in the literature. It implements the *quasi-destructive unification algorithm* by Tomabechi (1992) and the *subgraph sharing* technique proposed in Malouf et al. (2000). It employs a *key-driven rule instantiation strategy* which was found to be beneficial in Oepen and Callmeier (2000). Further, the parser makes use of the *rule filter* and a technique for reducing the number of initial chart edges, both as proposed

[1] One might be tempted to simply remove duplicate derivation trees, again ignoring the licenser subtrees. However, this is not feasible in general. For example, non-deterministic procedural attachments such as the `member` relation may lead to hypotheses with identical derivation trees but non-identical feature structures.

in Kiefer et al. (2000). The parser also removes seperable verb prefixes for which there is no matching prefix verb in the chart. This is relevant for our experiments as many verb prefixes are homographs of frequent prepositions and verb prefixes are particularly expensive for an analysis based on underspecified traces.

7.2 The Base Grammar

The German grammar used in the following experiments is largely based on Müller (1999), Müller (2007), Crysmann (2003a) and Crysmann (2005). For a concise list of the covered phenomena we refer to the grammar test results which can be inspected on http://www.tik.ee.ethz.ch/~kaufmann/grammar/test07.html.

7.3 Licenser Rules vs. Underspecified Traces

To compare the performance of our licensing approach with that of an approach based on underspecified traces, we ran experiments with two slightly different grammars. Both grammars were derived from the base grammar by removing the rule for partial verb phrase fronting and disabling licensing for the complement extraposition rules. The grammars differ only in how the analysis of verb movement is implemented. The first grammar applies a licensing rule as discussed in Section 4.1. The second grammar uses underspecified traces. In both grammars, we assume a left-branching structure if there is no right sentence bracket.

The grammar with underspecified traces employs the optimizations proposed by Crysmann (2003b). In particular, we exploit the fact that the non-finite partial verbal complex in the right sentence bracket has a fully specified subcategorization list. This information can be used when the verbal complex is combined with the empty verbal head. The empty verbal head basically inherits the subcategorization list of the non-finite verbal complex. As is common in German HPSG, we assume that the subject is not part of this list. If the verbal complex is headed by a past participle, a subject may be added or not (omitting the subject is necessary to account for passive constructions). If it is headed by an infinitive, one or two underspecified complements are added, thereby allowing for raising and control. If the verbal complex consists of a verb prefix only, we assume a fully underspecified subcategorization list which is restricted to contain at most 5 elements. Underspecified list elements are restricted such that they do not match implausible complements such as determiners.

To compare the coverage of the two grammars, each of them was applied to our set of about 900 grammar development test sentences. It turned out that the grammar based on underspecified traces is in fact more restrictive. This is due to the fact that the partial specifications described above imply very specific assumptions about the grammar. For instance, it is assumed that the finite verb has at least as many (non-verbal) complements as its infinitive verbal complement. However, this is not correct for modal infinitives (6) and for imperative forms of subject control verbs (7):

(6) *das ist nicht zu verachten*
this is not to condemn
'this should not be condemned'

(7) *versucht zu schlafen!*
try to sleep!
'try to sleep!'

It is further assumed that all complements on the infinitive verb's subcat list are "inherited" by the finite verb. This does not comply with the analysis of dative passive presented in Müller (1999). The mentioned problems could be overcome by increasing the amount of underspecification, at the cost of higher processing complexity. However, we decided to stick to the more restrictive grammar.

To compare the parsing performance of the two approaches, both grammars were used to parse the same set of sentences on the same platform (Linux 2.6.16 on a Sun-Fire-X2200-M2-64 with 2 AMD Opteron 2218 processors and 7 GB of memory, Sun Microsystems Java Runtime environment 1.5.0_01). Licenser binding was enabled for the grammar based on licenser rules. The test data consisted of 458 sentences transcribed from three broadcasts of a German news shows (the "Tagesschau"). The sentence lengths ranged from single words up to 37 words, with a mean of 10.8 words.

approach	#edges	#nodes	time (s)
underspecified traces	4739	429341	2.49
licenser rules	908 (-81%)	66542 (-85%)	0.18 (-93%)

Table 1: For each approach, the number of edges, AVM nodes and the parse time are averaged over the 458 sentences.

As the results in Table 1 show, the parsing time could be reduced by a factor of 13.5 by using licenser rules instead of underspecified traces. Note that parsing was aborted if the representations of the AVMs required more than 8 millions of graph nodes. For the grammar based on underspecified traces, early termination occurred in 6 sentences. The grammar with licenser rules never required more than 1.6 millions of AVM nodes.

We further compared the number of readings of full parses and complete phrases for the results produced by the two grammars. The occasional differences could all be attributed to the fact that the grammar based on underspecified traces is more restrictive. This implies that spurious ambiguities as discussed in Section 6 did not occur at all.

7.4 Licenser binding

To quantify the benefit of the licenser binding mechanism, we processed the same set of 458 sentences with and without licenser binding. In contrast to the previous experiment, we applied the full base grammar which uses licenser rules for partial verb phrase fronting, complement extraposition and German main clauses with right sentence bracket. The experiment was carried out on the same platform as the previous one.

The results are shown in Table 2. It can be seen that the number of edges and the memory consumption (as measured by the number of AVM nodes) are reduced by roughly 25%. The reduction in parse time (-11%) is smaller, but still significant. Note that the base grammar with licenser binding produces even less edges than the more restricted grammar from the previous experiment. This is due to the licensing of complement extraposition, which saves more edges than are produced by the partial verb phrase fronting rule.

approach	#edges	#nodes	time (s)
no licenser binding	1136	93218	0.282
licenser binding	875 (-23%)	67602 (-27%)	0.250 (-11%)

Table 2: For each approach, the number of edges, AVM nodes and the parse time are averaged over all 458 sentences.

8 Conclusions

We propose licenser rules as a technique to very selectively avoid underspecified traces in grammars with continuous constituents, particularly in grammars that are geared towards computational efficiency. We have applied this technique to an analysis of the German main clause with right sentence bracket and have found large performance gains in comparison to an implementation based on underspecified traces. We have further proposed a licenser binding technique to avoid unnecessary hypotheses. Our experiments demonstrate that this technique can yield a significant reduction in the number of chart edges as well as parse time.

Apart from the computational issue, licenser rules may also be advantageous from the grammar developer's point of view. Approaches based on underspecified traces typically need to encode prior knowledge about the formalized language in order to be computationally tractable. Such optimizations introduce redundancy and affect the elegance of the grammar – in fact, they can even reduce its coverage. As licenser rules provide all information about the antecedent, such extra knowledge is not necessary.

Licenser rules are a processing technique rather than a formal device. Thus, it seems to be desirable to hide them from the grammar developer. One possible approach might be to introduce traces with parser-specific annotations. These traces are then compiled into the grammar, which amounts to adding licenser rules and removing some of the original rules.

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Syntax and Semantics of Korean Numeral Classifier Constructions

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Abstract

The so-called floating quantifier constructions in languages like Korean display intriguing properties whose successful processing can prove the robustness of a parsing system. This paper shows that a constraint-based analysis, in particular couched upon the framework of HPSG, can offer us an efficient way of analyzing these constructions together with proper semantic representations. It also shows how the analysis has been successfully implemented in the LKB (Linguistic Knowledge Building) system.

1 Issues

One of the most salient features in languages like Korean is the complex behavior of numeral classifiers (Num-CL) linked to an NP they classify. Among several types of Num-CL constructions, the most complicated type includes the one where the Num-CL floats away from its antecedent:

(1) pemin-i cengmal sey myeng-i/*-ul te iss-ta
criminal-NOM really three CL-NOM/ACC more exist-DECL
'There are three more criminals.'

There also exist constraints on which arguments can 'launch' floating quantifiers (FQ). Literature has proposed that the antecedent of the FQ needs to have the identical case marking as in (1). However, issues become more complicated with raising and causative constructions where the two do not agree in the case value:

(2) a. haksayng-tul-**ul** sey myeng-**i/ul** chencay-i-lako mit-ess-ta.
student-PL-ACC three-CL-NOM/*ACC genius-COP-COMP believed
'(We) believed three students to be genius.'

b. haksayng-tul-**ul** sey-myeng-**i/ul/*eykey** ttena-key hayessta
student-PL-ACC three-CL-NOM/ACC/*DAT leave-COMP did
'(We) made three students to leave.'

As given in the raising (2a) and causative (2b), the Num-CL *sey myeng* 'three CL' can have a different case marking from its antecedent, functioning as the matrix object. In a sense, it is linked to the original grammatical function of the raised object and the causee, respectively.

Central issues in deep-parsing numeral classifier constructions thus concern how to generate such FQ constructions and link the FQ with its remote antecedent together with appropriate semantics (cf. Kang 2002). This paper provides a typed feature structure grammar, HPSG, together with Minimal Recursion Semantics (MRS), is well-suited in providing the syntax and semantics of these constructions for computational implementations.

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2 An Analysis

2.1 Forming a Numeral-Classifier Sequence and its Semantics

The starting point of our analysis is forming well-formed Num-CL expressions.[1] Syntactically, numeral classifiers are a subclass of nouns (for Japanese see Bond and Paik (2000), Bender and Siegel (2004)). However, unlike common nouns, they cannot stand alone and must combine with a numeral or a limited set of determiners as in **(twu) kay* 'two CL' (Numeral) and **(myech) kay* 'how many' (Interrogative).[2] Semantically, there are tight sortal constraints between the classifiers and the nouns (or NPs) they modify. For example, *pen* can classify only events, *tay* machinery, and *kwuen* just books. Such sortal constraints block classifiers like *tay* from modifying thin entities like books as in **chayk twu tay* 'book two-CL'. Reflecting these syntactic and semantic properties, we can assign the following lexical information to numerals (*num-det*) and classifiers (*cl-n*) within the feature structure system of HPSG and MRS (cf. Copestake et al. 2006).

(3) a.
$$\begin{bmatrix} \textit{num-det} \\ \text{ORTH } \langle \text{sey `세'} \rangle \\ \text{SYN} \mid \text{HEAD} \begin{bmatrix} \text{POS } \textit{det} \\ \text{NUM } + \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{HOOK} \begin{bmatrix} \text{INDEX } i \\ \text{LTOP } h2 \end{bmatrix} \\ \text{RELS} \left\langle \begin{bmatrix} \text{PRED } \textit{card\_rel} \\ \text{LBL } h2 \\ \text{ARG0 } i \\ \text{CARG } 3 \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

[1]We have inspected the Sejong Treebank Corpus to figure out the distributional frequency of Korean numeral classifiers in real texts. From the corpus of total 378,689 words (33,953 sentences), we identified 694 occurrences of numeral classifier expressions. Of these 694 examples, we identified 36 FQ examples.

[2]A limited set of common nouns such as *salam* 'person', *kulus* 'vessel', *can* 'cup', *khep* 'cup', and *thong* 'bucket' can also function as classifiers.

b. $$\begin{bmatrix} \textit{cl-n} \\ \text{ORTH } \langle \text{myeng ‘명’} \rangle \\ \text{SYN} \begin{bmatrix} \text{HEAD} \begin{bmatrix} \text{POS } \textit{noun} \\ \text{CLTYPE } + \end{bmatrix} \\ \text{VAL} \mid \text{SPR } \left\langle \begin{bmatrix} \text{NUM } + \\ \text{INDEX } i \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{HOOK} \begin{bmatrix} \text{INDEX } i \\ \text{LTOP } \textit{h1} \end{bmatrix} \\ \text{RELS} \left\langle \begin{bmatrix} \text{PRED } \textit{person\_rel} \\ \text{LBL } \textit{h1} \\ \text{ARG0 } i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

The feature structure in (3a) represents that there exists an individual *x* whose CARG (constant argument) value is "3". The feature NUM is assigned to the numerals as well as to determiners like *yele* 'several' and *myech* 'some' which combine with classifiers. Meanwhile, (3b) indicates that syntactically a classifier selects a NUM element through the SPR, whereas semantically it belongs to the ontological category *person_rel*. The feature CLTYPE differentiates classifiers from common nouns. An independent grammar rule then ensures that only [NUM +] elements can combine with the [CLTYPE +] expression, ruling out unwanted forms such as **ku myeng* 'the CL'.

2.2 Dealing with FQ Constructions

As noted earlier, the Num-CL can float away from the NP it classifies. There exist several supporting phenomena indicating that the FQ modifies the following verbal expression. One phenomenon is the substitution by the proverb *kule-* 'do so'. As noted in (4), unlike the NI type, only in the NC type, an FQ and the following main verb can be together substituted by the proverb *kulay-ss-ta*:

(4) a. namca-ka [sey myeng o-ass-ko], yeca-to kulay-ss-ta
man-NOM three CL come-PST-CONJ woman-also do-PST-DECL.
'As for man, three came, and as for woman, the same number came.'

b. *[namca sey myeng-i] o-ass-ko, yeca-to [kulay-ss-ta]

This means that the FQ in the NC type is a VP modifier, though it is linked to a preceding NP.

Coordination data also support a VP modifier analysis:

(5) [namhaksayng-kwa] kuliko [yehaksayng-i] [sey myeng-i] oassta
boy student-and and girl student-NOM three CL-NOM came
'The total 3 of boys and girls came.'

The FQ ‘three-CL’ cannot refer to only the second conjunct ‘girl students’: its antecedent must be the total number of boys and girls together. This means the FQ refers to the whole NP constituent as its reference. This implies that an analysis in which the FQ forms a constituent with the preceding NP then cannot ensure the reading such that the number of boys and girls is in total three.

Given this VP-modifier treatment, the following question is how to link an FQ with its appropriate antecedent. There exist several constraints in identifying the antecedents. When the floating quantifier is case-marked, it seems to be linked to an argument with the same case marking. However, further complication arises from examples in which either the antecedent NP or the FQ are not marked with a case marker, but a delimiter or topic marker:

(6) a. haksayng-tul-i/un sakwa-lul sey kay-lul mekessta
student-PL-NOM/TOP apple-ACC three CL-ACC eat
‘As for the students, they ate three apples.’

b. sakwa-lul haksayng-tul-i/un sey kay-lul mekessta

The data suggest that a surface case marking cannot be a sole indicator for the linking relation, and that we need to refer to grammatical functions. What we can observe is that, regardless of the location, the NOM-marked FQ is linked to the subject whereas the ACC-marked FQ is linked to the object. This observation is reflected in the following lexical information given to the type *num-cl-mw* (*numeral-classifier-multiword*):[3]

(7) a.
$$\left[\begin{array}{l} \textit{num-cl-mw} \\ \text{ORTH } \langle \text{sey myeng-i} \rangle \\ \text{HEAD} \left[\begin{array}{l} \text{POS } \textit{noun} \\ \text{CASE} \mid \text{GCASE } \textit{nom} \\ \text{MOD} \left\langle \left[\begin{array}{l} \text{POS } \textit{verb} \\ \text{SUBJ} \left\langle \text{NP}_i \right\rangle \end{array}\right] \right\rangle \end{array}\right] \\ \text{SEM} \mid \text{HOOK} \mid \text{INDEX } i \end{array}\right]$$

b.
$$\left[\begin{array}{l} \textit{num-cl-mw} \\ \text{ORTH } \langle \text{sey myeng-ul} \rangle \\ \text{HEAD} \left[\begin{array}{l} \text{POS } \textit{noun} \\ \text{CASE} \mid \text{GCASE } \textit{acc} \\ \text{MOD} \left\langle \left[\begin{array}{l} \text{POS } \textit{verb} \\ \text{COMPS} \left\langle \text{NP}_i\text{,...} \right\rangle \end{array}\right] \right\rangle \end{array}\right] \\ \text{SEM} \mid \text{HOOK} \mid \text{INDEX } i \end{array}\right]$$

[3]When the FQ has a delimiter marker (rather than a case marker) or no marker at all, it will refer to one of the elements in the ARG-ST (argument structure). Its antecedent will be determined in context.

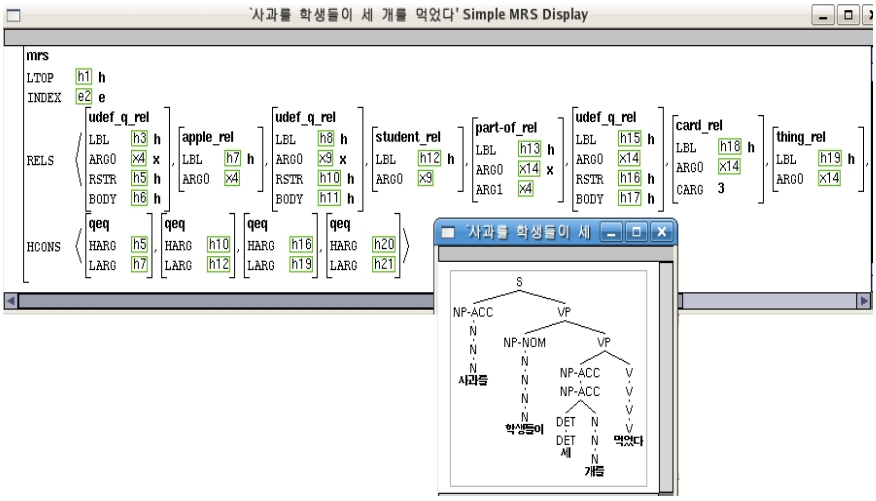

Figure 1: Parsed Tree and MRS for 'As for the students, they ate three apples.'

As given in (7), the NOM-marked *num-cl-mw* modifies a verbal element whose SUBJ has the same index value, whereas the ACC-marked *num-cl-mw* modifies a verbal element which has at least one unsaturated COMPS element whose INDEX value is identical with its own INDEX value. What this means is that the NOM or ACC marked *num-cl-mw* is semantically linked to the SUBJ or COMPS element through the INDEX value.

Figure 1 is the parsing results for (6b) that our system yields. As seen from the parsed syntactic structure in Figure 1, the FQ *sey kay-lul* 'three CL-ACC' (NP-ACC) modifies the verbal expression *mek-ess-ta* 'eat-PST-DECL'. However, as noted from the output MRS, this modifying FQ is linked with its antecedent *sakwa-lul* 'apple-ACC' through the relation *part-of_rel*. Leaving aside the irrelevant semantic relations, let's see *card_rel* and *apple_rel*. As noted, the ARG0 value (x14) of *part-of_rel* is identified with that of *card_rel* whereas its ARG1 value (x4) is identified with the ARG0 value of the *apple_rel*. We thus can have the interpretation that there are three individuals x14s which belongs to the set x4.

3 Case Mismatches

Further complication in parsing FQ constructions comes from raising, causatives, and topicalization where the FQ and its antecedent have different case values. In such examples, the two need not have an identical case value. For example, as given in (8b), the ACC-marked raised object can function as the antecedent of either the NOM-marked or ACC-marked FQ:

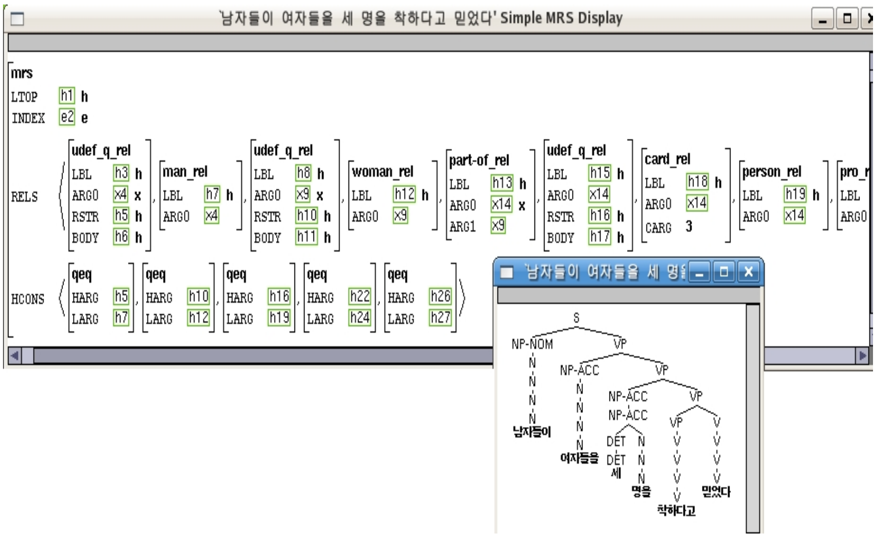

Figure 2: Parsed Tree and MRS for 'As for the students, they ate three apples.

(8) a. namcatul-i [yecatul-**i** sey myeng-**i/*ul** chakhata-ko] mitessta.
men-NOM women-NOM three-CL-NOM/*ACC honest-COMP thought
'Men thought that three women are honest.'

b. namcatul-i yecatul-**ul** sey myeng-**ul** chakhata-ko mitessta.

c. namcatul-i yecatul-**ul** sey myeng-**i** chakhata-ko mitessta.

In the present analysis in which the case-marked FQ is linked to either the SUBJ or a COMPS element, we can expect these variations. Let us consider the lexical entry for the raising verb *mitessta* 'believed':

(9) a. $\begin{bmatrix} \text{HEAD} \mid \text{POS } \textit{verb} \\ \text{SUBJ } \langle \boxed{1}\text{NP} \rangle \\ \text{COMPS } \langle \boxed{2}\text{S} \rangle \\ \text{ARG-ST } \langle \boxed{1}, \boxed{2} \rangle \end{bmatrix}$ b. $\begin{bmatrix} \text{HEAD} \mid \text{POS } \textit{verb} \\ \text{SUBJ } \langle \boxed{1}\text{NP} \rangle \\ \text{COMPS } \langle \boxed{2}\text{NP}_i, \boxed{3}\text{VP[SUBJ } \langle \text{NP}_i \rangle] \rangle \\ \text{ARG-ST } \langle \boxed{1}, \boxed{2}, \boxed{3} \rangle \end{bmatrix}$

(9a) represents the lexical entry for *mitessta* 'believed' in (8a) selecting a sentential complement. Meanwhile, (9b) represents the raising verb 'believed' in (8b, c) in which the subject of the embedded clause is raised as the object. This lexical element allows *yecatul-ul* 'women-ACC' to function as the syntactic object of the verb even though it is the semantic subject of the lower predicate.

Equipped with these, our grammar generates Figure 2 as the parsing results for (8b). Syntactically, as noted from the parsed structure, the ACC-marked FQ *sey myeng-ul* 'three CL-ACC' (NP-ACC) modifies the VP *chakhata-ko mitessta* 'honest-COMP believed'.[4] Meanwhile, semantically, the ACC-marked FQ is linked

[4]Our grammar allows only binary structures for the language. One strong advantage of assuming binary structures comes from scrambling facts. See Kim and Yang (2004).

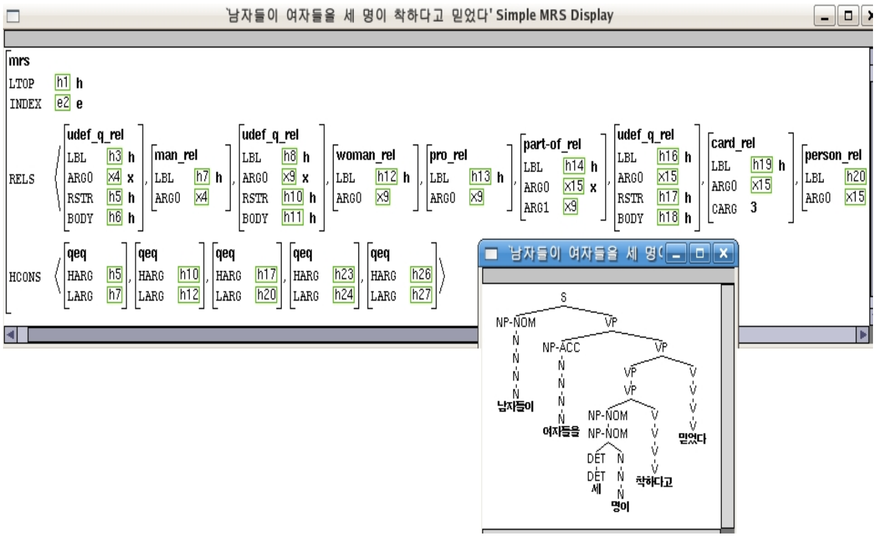

Figure 3: Parsed Tree and MRS for 'Men (NOM) thought three (NOM) women (ACC) are honest.'

to the ACC-marked object *yecatul-ul* 'woman-ACC'. This is because in our grammar the antecedent of the ACC-marked FQ must be an unsaturated complement of the VP it modifies. As noted from the semantic relations *part-of_rel*, *card_rel* and *woman_rel* in the parsed MRS, this linking relation is attested. That is, the ARG0 value (x9) of *woman_rel* is identified with the ARG1 value of *part-of_rel* whereas the ARG0 value of *card_rel* is identical with the ARG0 value of *part-of_rel*. Thus, the semantic output correctly indicates that the individuals denoted by the FQ is a subset of the individuals denoted by the antecedent.

For the mismatch example (8c), our grammar correctly produces two structures. Let's see Figure 3 first. As seen from the parsed syntactic structure here, the FQ *sey myeng-i* 'three CL-NOM' (NP-NOM) modifies the complex VP *chakhata-ko mitessta* 'honest-COMP believed'. However, in terms of semantics, the FQ is linked to the subject of the VP that it modifies.[5]This linking relation is once again attested by the MRS structure here. As noted here, the two semantic arguments of *part-of_rel*, ARG0 and ARG1, have identical values with the ARG0 value of *card_rel* (x14) and *man_rel* (x4), respectively.

Meanwhile, as given in the second parsing result Figure 4, the FQ *sey myeng-i* 'three CL-NOM' modifies the simple VP *chakhata-ko* 'honest-COMP' only. Since the VP that the FQ modifies has only its SUBJ unsaturated, the SUBJ is the only possible antecedent. The output MRS reflects this raising property: The ARG0 value of *part-of_rel* identified with that of *card_rel* whereas its ARG1 value is identified with the ARG0 value of *woman_rel*. Our system thus correctly links the NOM-marked FQ with the ACC-marked antecedent even though they have different case values.

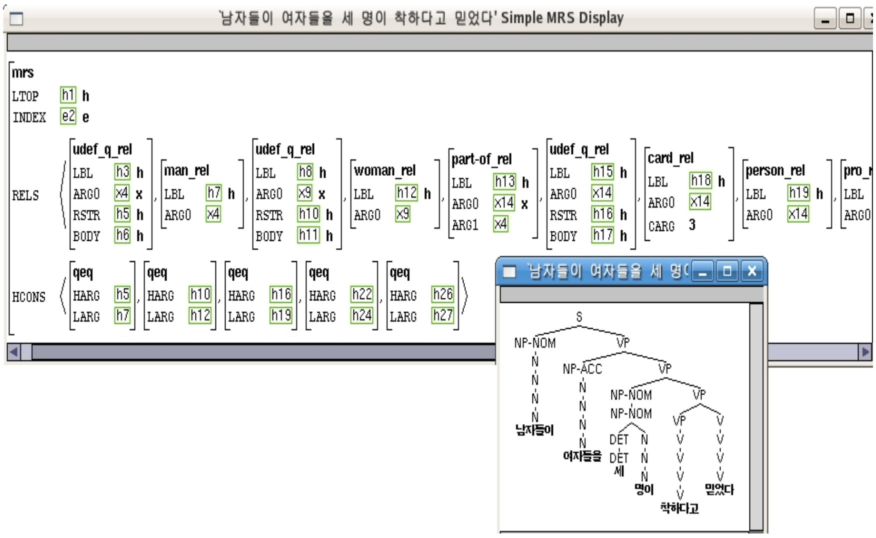

Figure 4: Parsed Tree and MRS for 'Men (NOM) thought there are three (NOM) women (ACC) are honest.'

The grammar we have built within the typed-feature structure system and well-defined constraints, eventually aiming at working with real-world data, has been implemented in the HPSG for Korean (cf. Kim (2004), Kim and Yang (2004)). We have shown that the grammar can parse the appropriate syntactic and semantic aspects of the FQ constructions. The test results provide a promising indication that the grammar, built upon the typed feature structure system, is efficient enough to build semantic representations for the simple as well as complex FQ constructions.

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Extending partial *pro*-drop in Modern Hebrew: A comprehensive analysis

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Abstract

Modern Hebrew is considered to be a 'partial *pro*-drop language'. Traditionally, the distinction between cases where *pro*-drop is licensed and those in which it is prohibited, was based on the person and tense features of the verb: 1st and 2nd person pronominal subjects may be omitted in past and future tense. This generalization, however, was found to be false in a number of papers, each discussing a subset of the data. Thus, contrary to conventional wisdom, dropped 3rd person pronouns subjects do occur in the language in particular contexts.

Identifying these contexts by way of a corpus-based survey is the initial step taken in this study. Subsequently, a careful syntactic analysis of the data reveals broad generalizations which have not been made to date. Thus, what was initially assumed to be a uniform phenomenon of 3rd person *pro*-drop turns out to be manifested in three distinct types of constructions. Finally, the proposed HPSG-based analysis incorporates insights concerning correlations between finite and non-finite control, non-canonical elements, locality, and binding.

1 Introduction

The phenomenon of *pro*-drop whereby pronominal arguments may be omitted in particular contexts is well-known and well-studied. Moreover, the notion of the Null Subject Parameter, which presumably distinguishes between those languages which allow unexpressed pronominal subjects (i.e., *pro*-drop languages) and those which do not, is prevalent in the transformational syntax literature. Modern Hebrew (MH) poses a challenge to this bifurcation since it exhibits what is referred to as 'partial *pro*-drop', where *pro*-drop is only partially licensed in the language.

Traditionally, the distinction between cases where *pro*-drop is licensed in MH, and those in which it is prohibited, was based on the person and tense features of the verb. This generalization, however, was shown to be empirically false in several papers (Borer 1989, Ariel 1990, Vainikka and Levy 1999, and Gutman 2004), each discussing a subset of the data, from one particular aspect.

In this paper I take a broader perspective by first conducting a comprehensive corpus-based survey[1] of cases in which the traditional distinction fails, followed by a careful syntactic analysis of the data. This process, as I show, reveals broad generalizations which have not been made to date, as well as insights concerning the correlation between the control of unexpressed subjects of infinitival complements and the identification of dropped subjects in finite complement clauses.

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[1]The Haaretz Corpus, compiled from a daily newspaper in Hebrew, was provided to me by the Knowledge Center for Processing Hebrew (http://mila.cs.technion.ac.il).

2 *Pro*-drop in Modern Hebrew

The licensing conditions of null pronominal subjects in MH is often attributed to the person and tense features. Thus, 1st and 2nd person pronominal subjects may be omitted in past and future tense (1). Overt pronouns in this context are used for emphasis or contrastively.

(1) (ata) **axalta/toxal** tapuax
(you) ate/will-eat.2SM apple

"You ate/will eat an apple."

Pro-drop is not possible with third person pronominals (2a) and in all cases of present tense, regardless of the agreement properties of the subject (2b).

(2) a. *(hu) **axal** tapuax
(He) ate.3SM apple

"He ate an apple."

b. *(ani) **oxel** tapuax
(I) eat.SM apple

"I eat an apple."

The distinction between the two cases is often ascribed to the "richness" of the morphology. Past and future tense verbs in 1st and 2nd person are morphologically marked for person, number, and gender, while present tense verbs and third person verbs in past and future tense are marked for number and gender, but not for person. Thus, it is the person agreement feature which enables the identification of the dropped subject.

However, despite traditional observations, 3rd person *pro*-drop (3P-PD) is not completely banned from the language.[2] Sentence (3), taken from the Haaretz corpus, illustrates a number of contexts in which 3P-PD can occur.

(3) be-mixtav be-anglit ileget she-**hefits** bekerev kol ha-ovdim
in-letter in-English broken that-distributed.3SM among all the-workers
ha-zarim **hoda** la-hem beit ha-malon al
the-foreigners thanked.3SM to-them house.M.CS the-hotel for
avodat-am ha-kasha ve-**hodi'a** she-**yirkosh**
work-POSS.3PM the-hard and-announced.3SM that-will-buy.3SM
la-hem kartisei tisa le-artsotei-hem mi-kasp-am
to-them tickets.CS flight to-countries-POSS.3PM from-money-POSS.3PM

"In a letter in broken English which it distributed among all the foreign workers, the hotel management thanked them for their hard work and announced that it will buy them plane tickets to their countries at their own expense."

[2]Note that I do not consider impersonal or non-referential uses of verbs in 3rd person as 3P-PD.

First, the verb *hefits* ('distributed') heads a non-subject relative clause in which the unexpressed pronominal subject refers to the matrix subject ('the hotel'). Second, the verb *yirkosh* ('will purchase') heads a subordinate clause which functions as the complement of the verb *hodi'a* ('announced'), which in itself appears to be subjectless.

3 Previous analyses of 3rd person *pro*-drop

The phenomenon of MH *pro*-drop has been discussed in numerous papers. However, as I came to realize, in many papers the existence of 3P-PD is not acknowledged (see, for example, Shlonsky (1997)). In what follows I briefly survey a number of analyses which do address 3P-PD.

Borer (1989), working in the transformational framework, distinguishes between 1st and 2nd *pro*-drop, where she posits that a phonologically empty *pro* occupies the subject position, and 3rd person *pro*-drop, which she claims is realized as an anaphoric AGR. 3P-PD is licensed when the embedded AGR is bound by an NP in a higher clause which assigns reference to the empty subject. Borer supports her claim by drawing parallels between "regular" anaphoric elements and 3P-PD. According to her, both anaphors and anaphoric AGRs cannot be bound by split antecedents. As evidence, she presents the following ungrammatical example, in which the agreement properties marked on the subjectless verb do not match those of either one of the matrix arguments.

(4)

*Rina	amra	le-Ran	she-**hiclixu**	ba-bxina
Rina.F	said.3SF	to-Ran.M	that-succeeded.3P	in-the-test

"Rina told Ran that they succeeded in the test." (Borer (1989) ex. 55a)

Vainikka and Levy (1999) draw on the parallel behavior of Hebrew and Finnish with respect to *pro*-drop and propose a unified analysis for the two languages. They distinguish between the referential nature of 1st and 2nd person, on the one hand, and 3rd person on the other, and claim that the distinction has syntactic reflexes. *Pro*-drop is licensed whenever a referent is available. In 1st and 2nd person the referent is in the immediate conversational context; in embedded clauses with 3rd person *pro*-drop the referent is in the matrix clause. While the technical syntactic details proposed by Vainikka & Levy differ from those of Borer's, as far as I can tell, their empirical coverage is similar. Both analyses predict that 3P-PD is possible in complement clauses, as long as there is a matrix-argument antecedent.

Ariel (1990) takes a different perspective by considering 3P-PD in the context of her Accessibility Theory. Ariel proposes a type of an accessibility hierarchy for each of the factors involved in *pro*-drop. The anaphoric element, which is the verb, may have different degrees of "richenss" of agreement marking. Antecedents have different levels of salience, or prominence. Finally, there are varying degrees of cohesion between units in which anaphor and antecedent may appear.

To illustrate the difference between her approach and that of Borer (1989), she provides a counter-example to Borer's claim regarding the unavailability of split antecedents.

(5) Noga$_i$ bikra et Shimon$_j$ al ma'amaro ha-shovinisti
Noga.F criticized.3SF ACC Shimon.M on his-article the-chauvinistic
kshe-**nas'u**$_{i+j}$ li-yrushalayim
when-went.3P to-Jerusalem

"Noga criticized Shimon on his chauvinistic article when they went to Jerusalem." (Ariel (1990), chapter 6, ex. 5a)

Ariel attributes the difference in grammaticality to the type of verb used. Complements of *amar* ('said'), she claims, do not share the same degree of cohesion to the matrix verb than other sentential complements. Ariel, however, overlooks the fact that while sentence (5) does show a grammatical occurrence of split antecedents, its syntactic structure is not identical to (4), since the dropped subject in this case is the subject of an adverbial clause, not a complement clause. This, as I will subsequently show, makes a difference.

Gutman (2004) continues Ariel's line of inquiry by comparing the distribution of null subjects in Hebrew, Finnish, and Rumanian, a typical *pro*-drop language, and testing various salience and cohesion factors. She considers the effect of saliency in terms of grammatical functions, agents vs. non-agents, and animates vs. inanimates, and concludes that MH is less restrictive in the distribution of 3P-PD than Finnish, in that it allows non-subjects, non-agents, and inanimates to act as antecedents to dropped 3rd person subjects. In terms of cohesion, she claims that when the meaning is kept constant there is not observable contrast in MH between subordination and conjunction.

In conclusion, the different studies reviewed here suffer from a number of shortcomings. First, each of the studies addresses only some of the constructions and is based on a limited data set. Furthermore, I have shown cases where the authors do not make a clear distinction between the different constructions. This, as I will presently demonstrate, obscures the data and weakens the analysis. For these reasons the goals of the following sections are (i) to conduct a pre-theoretic corpus-based survey of 3P-PD, and (ii) to provide a comprehensive account of the data.

4 A closer look at the data

The starting point of the current analysis is identifying the syntactic constructions which license 3P-PD. A survey of examples cited in the literature as well as "naturalistic" corpus examples reveals four syntactic environments where 3P-PD is licensed: (i) adverbial clauses, (ii) non-subject relative clauses, (iii) complement clauses, and (iv) coordinated constructions. In what follows I will discuss each one in turn.

4.1 Adverbial clauses

Judging from the corpus data, *pro*-drop is the unmarked choice for 3rd person pronominal subjects of adverbial clauses in past or future tense. No 3P-PD was found in present tense. In the majority of the cases the antecedent is the matrix subject, yet antecedents with other grammatical functions were found as well. Consider, for example, sentence (6), where the antecedent is oblique, and sentence (5) above, where the antecedent is split between the subject and direct object.

(6)

hu	haya	yoshev	leyad-am$_i$	kol	ha-layla
he	was.3SM	sit.present.SM	next-to-them.3PM	all	the-night

kshe-**naflu**$_i$	le-mishkav...
when-fell.3PM	to-bed

"He would sit next to them all night when they were ill..." (Ha'aretz Corpus)

The fact that adverbial clauses, which are adjoined to the main clause, constitute an appropriate context for 3P-PD is not surprising in light of Ariel's (1990) prediction regarding the level of cohesion that is required between the unit which hosts the dropped pronoun and that in which the antecedent occurs.[3]

4.2 Relative clauses

Non-subject relative clauses, too, are able to host 3P-PD. While this construction is not explicitly mentioned in the literature on MH *pro*-drop, a number of examples of it were found in the corpus. One such example is given in (3) and is repeated in abbreviated form in (7).

(7)

be-mixtav	she-**hefits**$_i$	bekerev	ha-ovdim	hoda	la-hem
in-letter	that-distributed.3SM	among	the-workers	thanked.3SM	to-them

beit	ha-malon$_i$...
house.M.CS	the-hotel...

"In a letter which it distributed among the workers, the hotel management thanked them..."

Relative clauses, too, function as adjuncts, and thus form cohesive units with the matrix clause. This cohesion is the enabling condition for the antecedent-dropped subject relationship.

[3]Note a parallel construction in English: *When asked to Join the party, Bill declined*.

4.3 Complement clauses

The case of complement clauses is not as straightforward as the previous ones. This was already hinted at in the discussion of Ariel's analysis, where she singles out a particular lexical item, *amar* ('said'), whose complement clauses form less cohesive units with their matrix clauses. It appears that not all complement clauses are created equal in terms of 3P-PD. In what follows I distinguish between three distinct cases.

Many MH verbs which take infinitival VP complements can also take finite clauses as complements. This class of verbs is further divided into two classes. The first class, to which I refer here as 'full control verbs', exhibits the same control pattern with both infinite and finite complements. Thus, when the subject of the finite clause is unexpressed, its referent is identified with the same matrix argument as in the infinitival case. An example is given in (8a), where the controller of the unexpressed subject is the indirect object *ha-ma'askikm* ('the employers').

The subject of the embedded clause, however, is not restricted to 3P-PD. Rather, it can be a pronominal, coindexed or not with the controller, or any lexical NP (8b). Furthermore, similarly to English control phenomena, this relationship carries over to denominal verbs as well (8c). Examples of subject control verbs in this category are *hivtiax* ('promise'), *kiva* ('hope'), and *hitsi'a* ('offer').

(8) a. ha-va'ad darash me-ha-ma'asikim$_i$
the-union demanded from-the-employers.PM
lashalem/she-**yeshalmu**$_i$ maskorot
to-pay.INF/that-will-pay.3PM salaries
"The union demanded from the employers to pay salaries."

b. ha-va'ad darash me-ha-ma'asikim$_i$
the-union demanded from-the-employers.PM
she-hem$_{i/j}$/ha-menahalim **yeshalmu** maskorot
that-they/the-managers will-pay.3PM salaries
"The union demanded from the employers that they/the managers pay salaries."

c. drishat ha-va'ad me-ha-ma'asikim$_i$
demand.CS the-union from-the-employers.PM
lashalem/she-**yeshalmu**$_i$ maskorot
to-pay.INF/that-will-pay.3PM salaries
"The union's demand from the employers to pay salaries"

Note that since finite verbs in Hebrew are morphologically marked in agreement with their subjects, the form of the verb indicates explicitly which is its antecedent (and can be manipulated to check alternatives). It should be added that present tense in this case is ungrammatical.

The second class of verbs is referred to here as 'semi-control verbs'. For this class, control is limited only to the infinitival case. Thus, while the controller of the unexpressed subject of the infinitival VP is the matrix subject (9a), the subject of the embedded finite clause **cannot** be coindexed with the matrix subject, whether it is expressed or unexpressed (9b). Lexical NPs or unbound pronominals are acceptable (9c).

(9) a. ha-maxlaka ratsta **livnot** et ha-batim...
the-department.SF wanted.3SF to-build ACC the-houses
"The department wanted to build the houses..." (attested example)

b. *ha-maxlaka$_i$ ratsta she-hi$_i$/she-$\emptyset$ **tivne**$_i$ et
the-department.SF wanted.3SF that-she/that-$\emptyset$ will-build.3SF ACC
ha-batim...
the-houses

c. ha-maxlaka$_i$ ratsta she-ha-irya$_j$/she-hi$_j$
the-department.SF wanted.3SF that-the-municipality.SF/that-she
tivne$_j$ et ha-batim...
will-build.3SF ACC the-houses
"The department wanted the municipality to build the houses..."

Other members of this class are *tixnen* 'plan', *hiskim* 'agree', and *serev* 'refuse'.

The third class of verbs, referred to as 'finite control verbs', are verbs which only take finite clauses as complements. A 3P-PD embedded subject is obligatorily controlled by the matrix subject (10a). Split antecedents are impossible (cf. (4)). Moreover, present tense is ungrammatical. When not a 3P-PD, the embedded subject can be a pronominal or any lexical NP, on a par with full control verbs (10b).

(10) a. ha-xevra$_i$ hodi'a ki **hixlita**$_i$ al hafsakat
the-company.SF announced.3SF that decided.3SF on stopping
yitsur ha-memisim...
production the-solvents
"The company announced that it has decided to stop producing the solvents." (Ha'aretz Corpus)

b. ha-xevra$_i$ hodi'a ki hi$_{i/j}$/ha-va'ada **hixlita**
the-company.SF announced.3SF that she/the-committee decided.3SF
al hafsakat yitsur ha-memisim...
on stopping production the-solvents
"The company announced that it/the committee has decided to stop producing the solvents."

This class includes verbs of statement, such as *hitshir* ('claim'), *siper* ('tell'), and *hodi'a* ('announced'), which are widespread in the newspaper corpus I checked. Furthermore, it appears from the corpus that 3P-PD is the preferred option with this type of verbs in this register. Closely associated with the newspaper register is the use of the complementizer *ki* (‘that’), which is seldom used as an embedding complementizer in spoken language.[4]

To summarize, the licensing of 3P-PD in complement clauses depends on the verb type. The following table lists the different types of verbs discussed, along with information regarding their complementation patterns and the availability of 3P-PD.

Verb Type	VP*inf*	S*fin*	3P-PD
Finite Control Verbs	*	√	√
Full Control Verbs	√	√	√
Semi-Control Verbs	√	√	*
Infinitival VP only	√	*	*

Note that the “Infinitival VP only” category is included in the table for completeness. Verbs in this category, for example *nisa* (‘try’), are not compatible with a finite complement clause, and are therefor not candidates for 3P-PD.

We can then conclude that 3P-PD is licensed in the finite complement clauses of two types of verbs: verbs which only take finite clauses as complements (i.e., finite control verbs) and a subset of verbs which take both infinitival VPs and finite clauses as complements (i.e., full control verbs).

4.4 Coordinated constructions

Many corpus examples of 3P-PD, as well as constructed examples in the literature, are instances of coordination, where a subjectless verb appears in the second conjunct. Alongside straightforward VP-CONJ-VP strings, there are many cases in which the second conjunct is preceded by an adverbial. Sentences such as (11) are considered by Ariel (1990) and Gutman (2004) as “conjoined sentences” with 3P-PD in the second conjunct.

(11) hayom noga$_i$ hitxila im shimon u-le-da’ati maxar
today Noga.F started.3SF with Shimon.M and-to-my-mind tomorrow
tatxil$_i$ im david
will-start.3SF with David.M

“Today Noga made a pass at Shimon and in my opinion tomorrow she will make a pass at David.” (Ariel (1990), chapter 6, ex. 6a)

Note that this construction is not amenable to a simple VP-coordination analysis. The clause-initial adverbial *hayom* (‘today’) has scope only over the first conjunct, as it is contrasted with the adverbial *maxar* (‘tomorrow’) in the second conjunct.

[4] The complementizer *ki* is frequently used in a different sense, meaning ‘because’.

A purely syntactic VP-coordination analysis, then, would have to assume a discontinuous VP constituent.

An additional example is the matrix clause of sentence (3), repeated here in abbreviated and slightly modified form as (12). The first conjunct in sentence (12) is an instance of "triggered inversion", where a non-subject dependent (a PP, in this case) appears clause-initially and triggers subject-verb inversion. The result is a VSO word order, where the subject comes between the verb and its complement, thus splitting the VP constituent.

(12) ba-mixtav [hoda la-hem beit ha-malon$_i$ al
in-the-letter thanked.3SM to-them house.M.CS the-hotel on
avodat-am] [ve-**hodi'a**$_i$ she-yirkosh la-hem
work-POSS.3PM and-announced.3SM that-will-buy.3SM to-them
kartisei tisa]
tickets.CS flight

"In the letter the hotel management thanked them for their work and announced that it will buy them plane tickets..."

One important characteristic which sets this construction from the previous ones is that the coordinate construction allows 3P-PD with a present tense verb in the second conjunct. This is illustrated in (13).

(13) asrot anashim$_i$ magi'im mi-tailand le-israel kshe-hem$_i$
tens.CS people arrive.PM from-Thailand to-Israel while-they
nirshamim ke-mitnadvim ax le-ma'ase **meshamshim**$_i$ ovdim
register.PM as-volunteers but actually serve.PM workers.PM
sxirim zolim
paid.PM cheap.PM

"Tens of people arrive from Thailand to Israel registered as volunteers while they actually work as low paid workers." (Ha'aretz Corpus)

The construction illustrated by (12) is similar to the Subject Gap in Finite clauses (SGF) coordination construction which is found virtually in all Germanic languages and marginally in English (Wunderlich 1988, Kathol and Levine 1993, Kathol 1999).[5]

(14) In den Wald ging der Jager und fin einen Hasen
into the forest went the hunter and caught a rabbit

"The hunter went into the forest and caught a rabbit."

The similarity between the MH construction and the SGF coordination construction, which is found in non-*pro*-drop languages, as well as the construction's

[5] I thank an anonymous reviewer for this suggestion.

compatibility with present tense suggest that the unexpressed subject in the second conjunct is an instance of some type of construction-specific gapping, and not *pro*-drop.

A different case of interaction between 3P-PD and coordination is discussed by Ariel (1990). This is illustrated by the example sentence in (15).

(15)	noga	dibra	im	shimon$_i$	yafe,	ve-*(laxen)	**ya'azor**$_i$	la	li-sxov
	Noga.F	spoke	to	Shimon.M	nicely	and-so	will-help.3SM	her	to-carry
	et	ha-mizvada							
	ACC	the-suitcase							

"Noga spoke nicely to Shimon, and (so) he will help her carry the suitcase."
(Ariel (1990), exx. 6c & 6eii)

Unlike the previously mentioned coordinated construction, the dropped subject of the verb in the second conjunct is not identified with the subject of the first conjunct. Rather, it is the indirect object which antecedes the missing subject. Consequently, a VP-coordination analysis is irrelevant. Moreover, as Ariel notes, the adverbial preceding the second conjunct is obligatory.

The role of the adverbial in licensing the 3P-PD in this case is creating cohesion between the two coordinated units by explicitly marking that the second clause is a consequence of the first. This is the type of construction referred to by Foley and Van Valin (1984) as 'cosubordination'.

To summarize, I propose that of all the coordinated constructions only those in which the dropped subject in the second conjunct is identified with an argument other than the subject are true cases of 3P-PD. Moreover, those are the cases where the obligatory occurrence of an adverbial subordinates the second conjunct to the main clause. In contrast, coordinated constructions where the subject of the first conjunct antecedes the empty subject in the second conjunct are instances of gapping.

4.5 Summary

At this point it has been established that contrary to conventional wisdom, 3rd person pronouns may be omitted in Modern Hebrew. Moreover, it has been shown that 3P-PD is licensed in a number of distinct constructions. One question remains, however, which is whether what we referred to here as 3P-PD is in fact "real" *pro*-drop.

In all the constructions in which they are licensed, dropped 3rd person pronominal subjects require linguistic antecedents. This characteristics sets them apart from "standard" *pro*-drop, which does not impose such a constraint. In Ariel's (1990) terms, the impoverished accessibility of 3rd person referents as identifiers of unexpressed subjects (in comparison with highly accessible 1st and 2nd person referents) requires there to be a linguistic antecedent in the matrix clause to identify the dropped 3rd person pronominal subject.

The tense restriction, which prohibits 1st and 2nd person *pro*-drop from occurring in present tense, applies to 3P-PD in adjunct clauses and complement clauses. Nevertheless, dropped 3rd person subjects in present tense coordinated constructions are grammatical. This, I claims, rules out the possibility of associating 3P-PD in coordinate constructions with *pro*-drop. This type of construction is similar to the SGF coordination constructions, which is also found in non-*pro*-drop languages (e.g,. German and English).

As to 3P-PD in adjunct and complement clauses, the main distinction between this type of subject drop and that of 1st and 2nd person is the nature of the licensing conditions. 1st and 2nd person *pro*-drop is licensed regardless of the syntactic construction in which it appears. In contrast, the distribution of 3P-PD is constrained by the type of syntactic construction. 3P-PD in adjunct clauses can be anteceded by a single or a split matrix antecedent. 3P-PD in complement clauses is licensed lexically by the embedding verb, and not by the verb whose pronominal subject is dropped. Moreover, the identification of the referent (or controller) of the unexpressed subject is lexically specified at the matrix verb level.

Consequently, I conclude that while there indeed are similarities between "standard" *pro*-drop and 3P-PD, the two phenomena cannot be conflated. Moreover, what was at first assumed to be a uniform phenomenon of 3P-PD has turned out to be manifested in three distinct types of constructions.

5 The proposed analysis

5.1 Overview

The main challenges which 3P-PD in Modern Hebrew poses are threefold: accommodating non-local constraints, accounting for the two types of dropped subjects, and providing an analysis of the different control patterns in complement clauses. In what follows I will undertake each of the challenges in the process of presenting an account of the phenomenon.

5.1.1 Non-local constraints

The 3P-PD constructions presented here raise issues regarding the locality of selection, in that they require that information regarding the subject of a finite clause be visible at the CP level. Thus, in all relevant constructions the licensing of 3P-PD does not occur at the lexical level, where the verb combines with its dependents, but rather, at the clausal level. This, of course, is problematic in a framework such as HPSG where valence requirements are canceled off as they are realized in the construction of phrasal signs. Once the SUBJ requirement is fulfilled it is assumed to be non longer on the VALENCE lists.

In this issue, Sag (2007) mentions similar cases of controlled pronominal subjects in finite clauses in the context of his discussion of locality. The solution which he proposes for such cases, as well as other related phenomena, is the category feature EXTERNAL ARGUMENT (XARG). Unlike VALENCE requirements, which are cancelled off from the list as they are realized, the XARG feature percolates information "beyond" the phrasal level. As such, this feature provides a handle to information inside the clause, and thus overcomes the locality issue.

The visibility of the XARG feature at the clausal level enables us to define clausal constraints which target properties of the clausal subject. More specifically, this requires that the XARG feature percolate from the lexical level to the CP level. This, I propose, is achieved by the coindexation of the complementizers' XARG feature with the XARG of the clause which they select.

(16)
$$\left[\text{SS}\,|\,\text{LOC}\,|\,\text{CAT} \left[\begin{array}{ll} \text{HEAD } \textit{c} & \\ \text{XARG } \boxed{1} & \\ \text{VAL}\,|\,\text{COMPS} & \left\langle \left[\begin{array}{l} \textit{fin-clause} \\ \text{HEAD} \left[\begin{array}{l} \textit{verb} \\ \text{VFORM } \textit{fin} \end{array}\right] \\ \text{XARG } \boxed{1} \end{array}\right] \right\rangle \end{array}\right]\right]$$

Overcoming the locality barrier is the first step in providing an analysis of 3P-PD in its various manifestations. The second step is to determine the exact nature of the unexpressed 3rd person pronominal subject, and to distinguish it from "standard" 1st and 2nd person *pro*-drop.

5.1.2 *Pro*-drop

The analysis of *pro*-drop in HPSG builds on the disassociation between ARG-ST and VALENCE proposed by Manning and Sag (1998). Thus, *pro*-drop is viewed as a variation on the Argument Realization Principle (ARP), where the least oblique argument in ARG-ST is not mapped to a VALENCE slot, yet remains in ARG-ST (Ginzburg and Sag, 2000). A preliminary version of the MH *pro*-drop ARP, which incorporates the language-specific tense & person restrictions and reflects the traditional description of *pro*-drop, is given in (17).

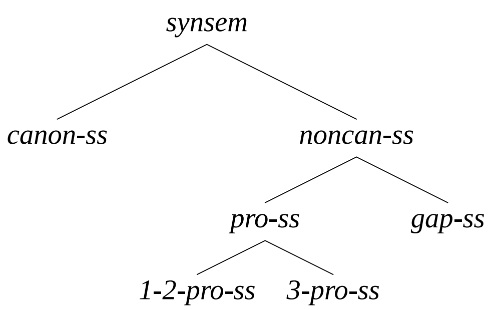
(17) *Pro*-drop ARP (preliminary version)
$$\left[\begin{array}{l} \text{HEAD} \left[\begin{array}{l} \textit{v} \\ \text{VFORM } \textit{past} \vee \textit{future} \end{array}\right] \\ \text{VAL} \left[\begin{array}{l} \text{SUBJ} \langle\rangle \\ \text{COMPS } \boxed{1} \end{array}\right] \\ \text{ARG-ST} \left\langle \text{NP:}\left[\begin{array}{l} \textit{ppro} \\ \text{PER } \textit{1st} \vee \textit{2nd} \end{array}\right] \right\rangle \oplus \boxed{1}\ \textit{list} \end{array}\right]$$

This type of constraint could suffice for the purpose of accounting for "standard" *pro*-drop in the language, since overt 1st and 2nd person pronoun subjects can be freely omitted (modulo pragmatic considerations), regardless of the syntactic context, and consequently the status of a *pro*-dropped clause is identical to that of its overt-pronoun counterpart. 3P-PD, however, as was previously shown, has a much more restricted distribution. Moreover, the licensing conditions of 3P-PD target "higher" clauses, where the subject requirements of the lower verb are not visible. In other words, the fact that a 3rd person pronominal was dropped needs to be projected at the clausal level. For this reason the XARG feature should be incorporated into the *pro*-drop constraint. Moreover, the value of XARG should reflect the fact that the subject is "dropped" or unexpressed.

The HPSG type inventory provides a way to account for arguments which are not realized locally by overt linguistic expressions. These arguments are licensed by non-canonical synsems (*noncan-ss*), in distinction from canonical sysems (*canon-ss*), which license overt expressions. The type hierarchy given in (18), is an extension of the hierarchy posited by Ginzburg and Sag (2000). Ginzburg and Sag's hierarchy defines two subtypes of *noncan-ss*: *gap-ss*, which refers to 'gap' arguments in extraction constructions, and *pro-ss*, which accounts for unexpressed controlled subjects of nonfinite phrases.

For the purpose of this account I propose a slight extension. Under this analysis the use of *pro-ss* is extended to the domain of finite phrases, and, in addition, is further expanded by the introduction of two immediate subtypes: *1-2-pro-ss* and *3-pro-ss*. As will be shown, this architecture provides a way of both distinguishing and consolidating the two types of dropped subjects.

(18)



Consequently, the proposed *Pro*-drop Argument Realization Principle is given in (19). Note that the relationship between the unexpressed pronominal subject in ARG-ST and the non-canonical pronominal in XARG is maintained by the coindexation of the CONTENT value of the two features. Thus, once constructed, the phrase projects the INDEX feature of its unexpressed subject, as well as the information that it contains a non-canonical subject.

(19) *Pro*-drop ARP (final version)

$$\begin{bmatrix} \text{HEAD} \begin{bmatrix} v \\ \text{VFORM } \textit{past} \ \vee \textit{future} \end{bmatrix} \\ \text{VAL} \begin{bmatrix} \text{SUBJ} \langle\rangle \\ \text{COMPS } \boxed{1} \end{bmatrix} \\ \text{ARG-ST} \left\langle \text{NP: } \boxed{2}\textit{ppro} \right\rangle \oplus \boxed{1} \textit{ list} \\ \text{XARG } \textit{pro-ss}\text{: } \boxed{2} \end{bmatrix}$$

It should be added, for completeness, that in the "standard" ARP the XARG value is identified with that of (the first and only element of) SUBJ.

5.1.3 Adjunct clauses

The licensing of 3P-PD in adjunct clauses is defined in contrast to its prohibition in root clauses. Both constraints apply to clausal types. Following Sag (1997) and Ginzburg and Sag (2000), relative clauses are licensed by subtypes of the clausal type *rel-cl*. The distinguishing characteristics of all relative clauses are: (i) they cannot serve as independent clauses, (ii) they cannot be inverted, and (iii) the modify nominals. These characteristics are expressed by way of type constraints on the supertype *rel-cl*.

The aforementioned studies do not consider adverbial clauses. However, I assume that in addition to the *rel-cl* type an analogous type, *adv-cl*, is needed in order to account for adverbial clauses, which, similarly to relative clauses, (i) cannot serve as independent clauses, (ii) cannot be inverted, and (iii) have a non-empty MOD feature. Naturally, the MOD value of adverbials is not *noun*, but *v*. The question of whether *rel-cl* and *adv-cl* are subtypes of a more general type (*mod-cl*) is immaterial to the present analysis. The crucial issue is that both types of clauses allow their XARG value to be of type *3-pro-ss*. In contrast, clauses which function as root clauses are incompatible with a *3-pro-ss* XARG. This generalization can be captured either by a default constraint on all clauses, or explicitly on the most general clause types which function as root clauses. An illustration of an analysis of 3P-PD in an adverbial clause (extracted from (5)) is given in figure 1.

Recall that the identification of the referent of the unexpressed embedded subject depends on linguistic antecedents in the matrix clause. This, however, is a pragmatic process, which is not syntactically determined, and, thus permits both single or split antecedents.

5.1.4 Complement clauses

As was previously discussed, the control patterns involved with 3P-PD are quite complex. An account of these patterns is required to distinguish between three different verb categories: *full control verbs*, *semi-control verbs*, and *finite control verbs*. In what follows I address each one in turn.

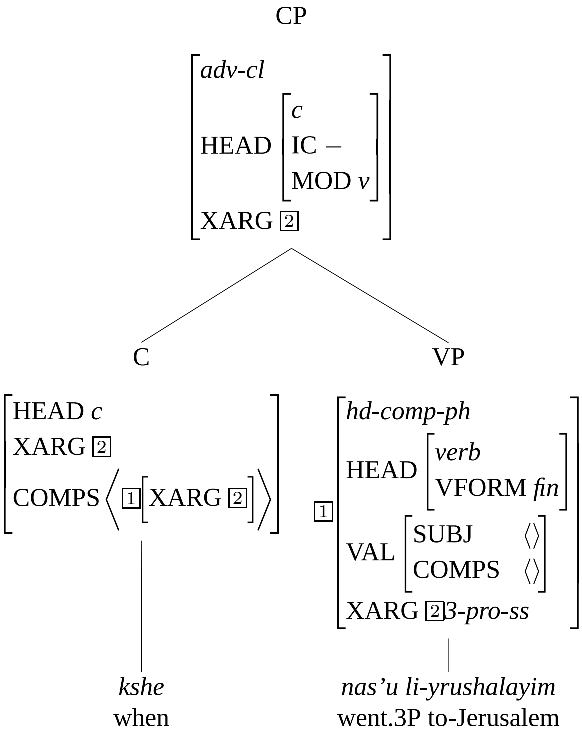


Figure 1: Adverbial Clause

Full control verbs

The class of *full control verbs* is the least restrictive one. Verbs which belong to this class alternate between taking infinitival and finite clauses as complements. The infinitival case is remarkably similar to that of English, and, therefore compatible with the analysis proposed by Pollard and Sag (1994). Verbs fall into two categories — subject control and object control — according to the grammatical function of the matrix argument which controls the unexpressed subject of the VP complement. Control in this case is obligatory.

Finite control is more involved. The subject of the finite complement clause may not necessarily be controlled by a matrix argument. Thus, as was illustrated in (8) above, the embedded subject can be a controlled *3-pro-ss*, a controlled or free personal pronoun (*ppro*), or an unbound lexical NP (*npro*). An additional complication, not mentioned earlier, is the possibility of the occurrence of an uncontrolled *1-2-pro-ss*. An example is given in (20).

(20) ha-va'ad darash me-ha-ma'asikim$_i$ she-**neshalem**$_i$ maskorot
the-union demanded from-the-employers.PM that-will-pay.1P salaries

"The union demanded from the employers that we pay salaries."

In order to capture the different patterns, I propose to differentiate between those cases in which control is obligatory and those in which it is not. Consequently, a lexical rule will account for the control pattern correspondence between the infinitival and the finite cases. The Infinite to Finite Subject Control Lexical Rule for subject control verbs such as *hivtiax* ('promise') is given in (21).

(21) Infinite to Finite Subject Control Lexical Rule

$$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{inf-subj-full-ctrl}} \\ \text{CAT} \mid \text{VAL} & \left[\begin{array}{l} \text{SUBJ} \left\langle \text{NP}_{\boxed{1}} \right\rangle \\ \text{COMPS} \left\langle \text{VP} \left[\begin{array}{l} \text{VFORM } \textit{inf} \\ \text{SUBJ} \left\langle \text{NP}_{\boxed{1}} \right\rangle \end{array}\right] : \boxed{3} \right\rangle \end{array}\right] \\ \text{CONTENT} & \left[\begin{array}{l} \text{RELATION } \textit{rel} \\ \text{ARG1 } \boxed{1} \\ \text{SOA-ARG } \boxed{3} \end{array}\right] \end{array}\right] \Rightarrow \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{fin-subj-ctrl}} \\ \text{CAT} \mid \text{VAL} & \left[\begin{array}{l} \text{SUBJ} \left\langle \text{NP}_{\boxed{1}} \right\rangle \\ \text{COMPS} \left\langle \left[\begin{array}{l} \textit{fin-clause} \\ \text{HEAD } \textit{c} \\ \text{XARG } \textit{pro-ss}_{\boxed{1}} \end{array}\right] : \boxed{3} \right\rangle \end{array}\right] \\ \text{CONTENT} & \left[\begin{array}{l} \text{RELATION } \textit{rel} \\ \text{ARG1 } \boxed{1} \\ \text{SOA-ARG } \boxed{3} \end{array}\right] \end{array}\right]$$

It should be emphasized that the ability to "look inside" the finite complement is achieved by way of the XARG feature which exposes the type of subject and its CONTENT value. The structure-sharing of index features, indicated by $\boxed{1}$, renders the control obligatory. A similar rule is required for object control verbs.

A partial analysis of the finite object control example in (8a) is given in figure 2.

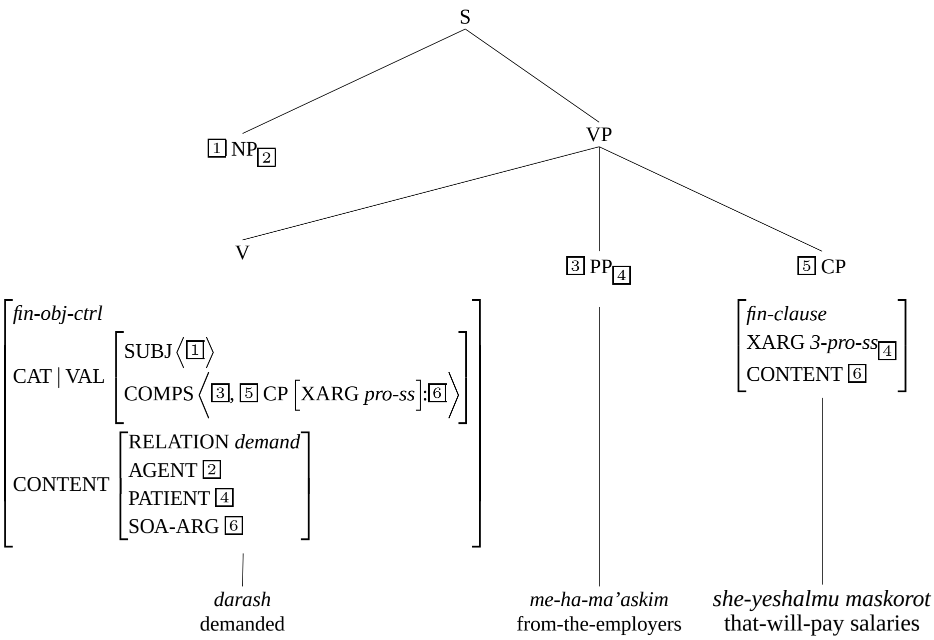


Figure 2: Finite Object Control

The remaining cases are those in which the embedded subject is not necessarily coindexable with the matrix subject. A description of the associated lexical type is given in (22).

(22)
$$\begin{bmatrix} \textit{finite-comp} & \\ \text{CAT} \mid \text{VAL} & \begin{bmatrix} \text{SUBJ} & \left\langle \text{NP}_{\boxed{1}} \right\rangle \\ \text{COMPS} & \left\langle \begin{bmatrix} \textit{fin-clause} \\ \text{HEAD } \textit{c} \\ \text{XARG } \begin{bmatrix} \textit{canon-ss} \\ \text{HEAD } \textit{noun} \end{bmatrix} \vee \textit{1-2-pro-ss} \end{bmatrix} : \boxed{3} \right\rangle \end{bmatrix} \\ \text{CONTENT} & \begin{bmatrix} \text{RELATION } \textit{rel} \\ \text{ARG1 } \boxed{1} \\ \text{SOA-ARG } \boxed{3} \end{bmatrix} \end{bmatrix}$$

As was previously mentioned, different types of nominal subjects can serve as embedded subjects in this construction. This is expressed in the XARG value of the finite clause in the COMPS list. Nominal external arguments of type *cannon-ss* account for lexical NPs as well as pronominal ones. It should be noted that while the constraints do not impose a coindexation relation between the XARG and the SUBJ, they do not prevent it. Consequently, embedded pronominal subjects are either bound or free. The second disjunct in the XARG value is necessary in order to allow cases of 1st or 2nd person *pro*-drop in the complement clause, such as (20) above.

The use of disjunction in this constraint is not trivial with respect to the formalism of HPSG. However, the proposed type hierarchy of *synsems* does not allow for a natural grouping of these NPs (i.e., lexical NPs, personal pronouns, and 1st and 2nd person *pro*-drop). For the purpose of descriptive adequacy I choose to use the disjunction operator. An alternative solution is to posit different lexical entries for each of the XARG possibilities.

Semi-control verbs

The Infinite to Finite Subject Control Lexical Rule given in (21) does not apply to the class of semi-control verbs, since control in this case is restricted to the nonfinite domain, similarly to English control verbs. Thus, while as infinitival control verbs the two types of verbs are indistinguishable, the types which license them must be distinct. For this reason I posit two separate types, *inf-subj-full-ctrl* and *inf-subj-semi-ctrl*, which are both subtypes of more general type *inf-subj-ctrl*.

In addition to infinitival VPs, finite clauses too can serve as complements to semi-control verbs, provided that the embedded subject is not controlled by the matrix subject (see (9b) & (9c)). This completely rules out any type of NP, canonical or non-canonical, which is coindexed with the subject.

One way to build this type of a constraint into the grammar is by using inequation, and stating that the indices of the two entities cannot be coindexed. This, of course, raises the issue of the status of inequation in the formalism of HPSG, a debate which is not the focus of this paper. An alternative option is to associate this constraint with Binding Theory. More specifically, according to Principle B, a personal pronoun must be a-free, where ‘a-free’ refers to the locus of the HPSG Binding Theory, namely ARG-ST (Manning and Sag, 1998). Since both overt pronouns and *pro*-sss are pronouns, the binding of XARG by the matrix subject can be avoided by adding it to the ARG-ST of the embedding clause.[6]. In such a configuration, XARG is in the binding domain of the subject, and thus cannot be coindexed with it.

(23)
$$\begin{bmatrix} \textit{finite-comp-no-bind} \\ \text{CAT} \begin{bmatrix} \text{VAL} \begin{bmatrix} \text{SUBJ} \left\langle \boxed{1}\ \text{NP}_{\boxed{4}} \right\rangle \\ \text{COMPS} \left\langle \boxed{2} \begin{bmatrix} \textit{fin-clause} \\ \text{HEAD } c \\ \text{XARG } \boxed{3}\text{NP} \end{bmatrix} : \boxed{5} \right\rangle \end{bmatrix} \\ \text{ARG-ST} \left\langle \boxed{1}, \boxed{2}, \boxed{3} \right\rangle \end{bmatrix} \\ \text{CONTENT} \begin{bmatrix} \text{RELATION } \textit{rel} \\ \text{ARG1 } \boxed{4} \\ \text{SOA-ARG } \boxed{5} \end{bmatrix} \end{bmatrix}$$

At this point I consider the two alternatives as engineering solutions. I leave the question of the theoretical and empirical ramifications of each option to further research.

Finite control verbs

Finally, finite control verbs can only take finite clauses as complements. In fact, the type of constructions in which these verbs are licensed is a subset of those which license full subject control verbs, namely the finite ones. Consequently, the two lexical types which describe the realization possibilities of these verbs are *fin-subj-ctrl* (21) and *finite-comp* (22).

5.1.5 Coordinated constructions

The discussion of the coordinate constructions involved with 3P-PD distinguished between two types of constructions: an SGF-like construction, in which the unexpressed subject of the second conjunct is considered to be a gap, and cosubordination, where the unexpressed subject of the cosubordinated clause is identified with a non-subject in the first clause. An analysis of these constructions is outside the scope of this paper and is left for future work. Nevertheless, an HPSG-based analysis of the SGF coordination construction is proposed by Kathol (1999) in

[6]Note that this move is possible due to the disassociation between ARG-ST and VALENCE proposed by Manning and Sag (1998)

a linearization framework, where linear order is considered conceptually distinct from constituent relations. In addition, a discourse functional analysis of SGF coordination in LFG is proposed by Frank (2002).

6 Conclusion

Contrary to the traditional description of *pro*-drop in MH, *pro*-drop of 3rd person pronouns does occur. Its distribution, however, is more restricted than that of 1st and 2nd person pronouns. The observation presented here is that 3P-PD occurs freely in adjunct subordinate clauses (i.e., adverbial clauses, relative clauses, and 'cosubordinated' clauses) when it is anteceded by a matrix argument antecedent (single or split). Cases which were previously viewed as 3P-PD in conjoined sentences were analyzed here as cases of gapping and not *pro*-drop. Consequently, it was proposed that the licensing of this kind of 3P-PD is associated with types of *clausal constructions*. Furthermore, the clausal association confirms Ariel's prediction regarding the necessity of cohesion between the units of the antecedent and dropped subject.

More restrictive licensing conditions were found to apply to embedded complement clauses, where the licensing of 3P-PD depends on lexical properties of the embedding verb. Three types of verbs were identified, each with its particular complementation and control patterns. For one type of verbs referred to as 'full control verbs' the identification of the antecedent of the empty subject was found to correlate with the identification of the controller of parallel constructions with an infinitival complement. More generally, the licensing of 3P-PD in complement clauses was found to be determined at the lexical level.

In conclusion, this study provided a comprehensive data-driven account of the phenomenon of 3P-PD, a phenomenon that has not received an adequate analysis up until now. The proposed HPSG-based analysis incorporated insights concerning locality, clausal vs. lexical constraints, correlations between finite and non-finite control, non-canonical elements, and binding.

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Constructing Spanish Complex Predicates

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Abstract

Abeillé and Godard (2007) describe a variety of Spanish whose complex predicates differ structurally from the more familiar flat VP type of complex predicate common to other varieties of Spanish and Romance. I present a verb cluster analysis of this variety which both captures these structural differences, and at the same time preserves those features that are common across both construction types. Coupled with a simple morphological treatment of affixation, this analysis predicts the range of 'clitic climbing' facts. The parsimony of the affixation analysis is afforded by an alternative approach to the constraints on reflexive affix distribution in Spanish complex predicates. I depart radically from previous morpho-lexical approaches to the phenomenon, instead showing how the constraints follow from independently motivated binding principles. This approach not only handles more of the Spanish data, but also has the potential to provide a unified account of the phenomenon across Romance.

1 Introduction

It is generally agreed that periphrastic causatives and perception verbs with infinitival complements fall into two basic construction types in Romance languages (Abeillé et al., 1997; Abeillé et al., 1998; Miller and Lowrey, 2003). The first is the double complement construction (1), where the causative/perception verb selects for both an NP controller and an infinitival VP complement, as shown in the following examples from Spanish:

(1)	*Yo*	*hice*	*a*	*Pedro*	*comer*	*la*	*manzana*
	I	made.1sg	to	Pedro	eat	the	apple
	'I made Pedro eat the apple'						

The second is a structure in which the finite causative/perception verb and the infinitive together form a complex predicate (2), as evidenced by various telltale properties. The first is the word ordering: in cases where the subject of the infinitive is realised as an NP, it must not intervene between the two verbs (2):

(2)	*Yo*	***hice***	***comer***	*la*	*manzana*	*a*	*Pedro*
	I	made.1sg	eat	the	apple	to	Pedro
	'I made Pedro eat the apple'						

A second is the placement of pronominal affixes[1], which appear on the finite verb, even where they are semantic arguments of the infinitive (so-called 'clitic-climbing'[2]):

[†]Particular thanks to Inbal Arnon, John Beavers, Danièle Godard, Philip Hofmeister, Beth Levin, Ivan Sag, Harry Tily, and the audience of the HPSG07 conference for their valuable input.

[1]There is a good deal of evidence supporting an affixal, as opposed to a clitic analysis of these elements, see Miller (1991) for overview and discussion.

[2]I will henceforth use the traditional term 'clitic climbing' as a shorthand for this behaviour, even though (unsurprisingly) I present here neither a clitic, nor a movement analysis of the phenomenon.

(3)

Yo	***la***	*hice*	*comer*	*a*	*Pedro*
I	it.acc	made.1sg	eat	to	Pedro

‘I made Pedro eat it’

Further properties, which space prevents me from illustrating here,[3] include middle-passive SE and periphrastic passive formation, and occurrence in bounded dependencies, all of which may target the object of the infinitive as though it were an argument of the complex predicate head.

Together, these properties attest to the monoclausality of Romance complex predicates. In the HPSG literature they are analysed in terms of argument structure sharing: the head of the complex predicate inherits all of the arguments of the unsaturated V argument on its own argument structure list (so-called ‘argument composition’, Hinrichs and Nakazawa (1990)):

(4)
$$\begin{bmatrix} \textit{composition-verb-lxm} \\ \text{ARG-STR} \quad \langle \text{NP} \rangle \oplus \boxed{A} \oplus \left\langle \boxed{1}, \text{V}\begin{bmatrix} \textit{word} \\ \text{ARG STR} \quad \langle \boxed{1} \rangle \oplus \boxed{A} \end{bmatrix} \right\rangle \end{bmatrix}$$

Abeillé and Godard (2007) have convincingly demonstrated that these monoclausal properties are common to complex predicate structures across the Romance family, which argues for a common argument composition analysis for these languages. At the level of constituent structure however, they show that Romance complex predicates do not form a homogenous class. On the basis of a number of tests, the existence of two basic structures are motivated. The first is a flat VP (figure 1). The second is a ‘verb cluster’, where the two verbs form a constituent (figure 2).

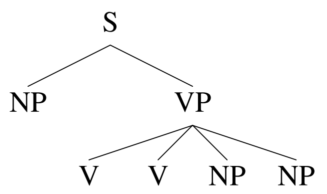


Figure 1: Flat VP

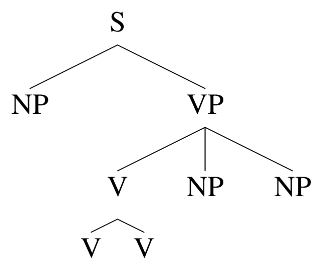


Figure 2: Verb cluster

The flat VP structure characterises the French, Portuguese, Italian complex predicates, as well as one variety of Iberian Spanish (henceforth S1).[4] The verb cluster characterises complex predicates in a second variety of Iberian Spanish (S2).[5] The structural differences reveal themselves in the placement of adverbials,

[3]See Abeillé and Godard (2007) for a detailed description.

[4]Romanian shows mixed behaviour depending on the specific verb.

[5]Non-Iberian varieties of Spanish are not discussed.

and in coordination and subject-verb inversion facts. By contrast with members from the former group, in S2, adverbials may not intervene between the head and the infinitival V, coordination of sequences of non-finite verbs with their complements are not allowed, and the subject may not invert with the head of the complex predicate in interrogative constructions.[6]

In the HPSG literature on Romance complex predication, the French and Italian structures have received more attention than their Spanish counterparts. It can be observed that the basic argument composition analysis proposed to capture the monoclausal properties of complex predicates straightforwardly produces the flat VP structure appropriate for these languages, when the composition verb combines with its arguments in the syntax, via the head-complement construction. It will however, produce the wrong structure for the verb-cluster variety of Spanish.

The first part of this paper is devoted to an analysis of the verb-cluster variety of Spanish, with the aim of capturing both the structural difference between this type and the flat VP type, and also the properties common to both constructions, which derive from the shared argument structure. To this end, I adopt a head-cluster analysis of the type proposed for verb clusters in various non-Romance languages.[7] Coupled with a simple morphological analysis of Spanish affixation, this analysis predicts the range of pronominal affixation phenomena exhibited by Spanish causative and perception verb complex predicate constructions. I restrict here the discussion to causative verbs, though the analysis should extend straightforwardly to perception verbs also.

For readers familiar with HPSG analyses of Romance complex predicate affixation (e.g. Miller and Sag, 1997; Tily and Sag, 2006), it will be apparent that the present analysis does away with many of the 'book-keeping' features and types that characterise previous analyses. The type- and feature-heavy nature of these analyses has been primarily due to the problematic facts pertaining to reflexive affix realisation. Because, in the second part of this paper, I show (for Spanish, at least) that the locus of explanation for these constraints can be shifted to an entirely different domain of the grammar, that of the binding theory, the affixation analysis I present is consequently far more abstemious in its reliance on ad hoc types and features than its predecessors.

Across Romance languages, reflexive affixes[8] constitute a striking apparent exception to the generalisation that all affix arguments in complex predicate constructions climb: when the affix is reflexive, it is constrained to remain attached to the infinitival verb:

[6]See Abeillé and Godard (2007), for a detailed description, and language specific differences among the flat VP languages.

[7]See, *inter alia*, Müller (2000) for German, Rentier (1994) for Dutch and Chung (1993) for Korean.

[8]In French there is a further series of 'intrinsic' affixes, idiosyncratically associated with specific verbs, which also fail to climb. Because Spanish does not possess this set of clitics, I do not touch on the behaviour of these elements here.

(5)

Yo	*lo*	*hice*	*lavar-**se***
I	him.acc	made.1sg	wash-refl

‘I made him wash himself

Previous analyses have approached these facts from a morpho-lexical perspective, positing distinct verb types for verbs that realise reflexive affixes and for those that realise non-reflexive affixes (Abeillé et al., 1998; Tily and Sag, 2006). Specific constraints on complex predicate forming verbs then ensure that the verb selects for a certain type of infinitive only.

The second part of this paper provides a more parsimonious alternative to this morpho-lexical approach to the constraints on reflexive affix realisation in complex predicate constructions. I show that the constraints follow from independently motivated binding principles, in conjunction with the particular argument structural properties of complex predicates. As such, there is no need to complicate the type hierarchy and the lexical entries of complex predicate forming verbs in order to handle the reflexive facts. Crucially, this analysis does not depend on particular selectional or type constraints which might be predicted to vary across languages, but rather capitalises on the common property shared by complex predicates across the Romance family: their composed argument structure.

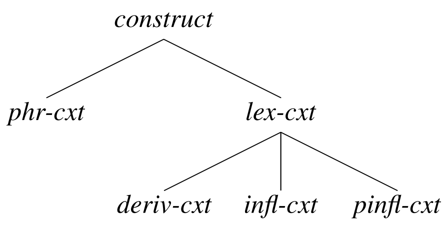
2 The Analysis

The framework adopted in this paper is that of sign based construction grammar (Sag, 2007a,b), which treats lexical items and phrases alike as *constructs*, which are modeled as feature structures (6), with a MOTHER (MTR) feature and a DAUGHTERS (DTRS) feature. The value of the MTR feature is a sign, and the value of the DTRS is a (possibly empty) list of signs.

(6)
$$construct \Rightarrow \begin{bmatrix} \text{MTR } \textit{sign} \\ \text{DTRS } \textit{list(sign)} \end{bmatrix}$$

The immediate subtypes of *construct* are *phrasal-construct* and *lexical-construct*, under which the rest of the type hierarchy of *constructs* is classified:

(7)



We can think of constructs as local trees which are licensed by some *construction* of the grammar. A construction is a type constraint which licenses a distinctive class of constructs. Lexical entries are constructions (of type *lexical class*) which license a class of lexical items. From lexical items, lexical and phrasal constructions (*combinatoric* constructions) serve to build larger signs.

2.1 Affixation

It has been widely recognised for some time that Romance 'clitics' exhibit all the behaviour of pronominal affixes (see Miller 1991 for an extensive discussion), and thus that verb forms bearing these affixes should be formed in the lexicon, rather than in the syntax. A recent analysis in this spirit, for pronominal affixation in French, is found in Tily and Sag (2006) (henceforth TS06), which builds on the comprehensive earlier analysis of Miller and Sag (1997) (henceforth MS97). TS06 take the presence of an affix to correspond to the presence of a *pro* (a definite null instantiated argument)[9] on a verb's argument structure list. They implement this by means of a derivational construction which removes an affixal element from the verb's ARG-ST and replaces it with a *pro* argument.

For Spanish affixation,[10] I will follow TS06 in taking affix realisation to correspond to a replacement element on the ARG-ST list, but will simply allow this to be an element of type *nominal object*, which is constrained to be a non-affix (to avoid repeated application of the rule to its own output). It is also constrained to share the same SEM value as the affixal element on the DTRS list (indicated by the colon preceding the tag).[11] This will ensure that the relevant referential properties of the affixal argument such as person, gender and number information, together with the nominal object type (*ppro*/*ana*) (and thus the binding constraints on these types) will be inherited. The retention of these referential properties is crucial, and will be directly relevant in the analysis of reflexive affixes in §2.3.1.

I capture the same effect as the *pro* analysis by enforcing an argument structure/ valency discrepancy:[12] the affixed argument is 'canceled' off the valency list, such that the MTR's ARG-ST list is longer than the VAL list by one.[13] This reflects the intuition that affix realisation, although a morphological rather than a syntactic process, nevertheless serves to saturate an argument. The choice of an argument structure/valency mismatch as opposed to a phonologically null *pro* analysis will allow us more easily to define certain constraints on the types of infinitives that complex predicate forming verbs must select for in order to enforce affix climbing (see §2.2.1), and is more amenable to a straight forward account of reflexive binding facts (see §2.3.1).

Because affixes always attach to already inflected verb forms (*words*), and because in Spanish the location of the affixation depends on the type of inflected verb form (left edge for finite verb forms, right edge for non-finite forms), I take affix realisation to be derived in the lexicon via a type of post-inflectional construction (an *aff-cxt*),[14] which takes as both its DTRS and its MTR a value of type *word*.

[9] *pro* on this analysis is a phonologically null subtype of sign.

[10] The analysis of Spanish affixation presented here is not intended to be restricted to the verb cluster variety of Spanish, but rather should hold generally for both varieties.

[11] cf. the mechanism of 'content-sharing' in HPSG, e.g. Davis (2001).

[12] See Abeillé et al. (1998) for a similar argument structure/valency discrepancy analysis for French.

[13] I side-step the complicated issues surrounding the phenomenon of Spanish 'clitic doubling' here.

[14] As opposed to a derivational construction as assumed by TS06 for French.

The function F*aff* (essentially the same as F*praf* introduced by MS97), determines the FORM value of a given affixed word. It takes as input the inflected form of the host, the syntactic category of the host, and the affixal element to be affixed, returning the affixed form.

For finite verb forms, the constraints on the ARG-ST list of the DTRS guarantees that the first affixal element on the list is realised as a pronominal argument on the MTR's ARG-ST:

(8)

$$
\textit{aff-wd-cxt} \Longrightarrow \left[\begin{array}{ll}
\text{MTR} & \left[\begin{array}{l} \textit{word} \\ \text{FORM } \langle\, \text{F}_{aff}(\boxed{3},\boxed{4},\boxed{1}\,)\,\rangle \\ \text{ARG-ST } \boxed{\mathit{A}} \oplus \langle \text{NP}_{\textit{nonaff}}{:}\boxed{2}\rangle \oplus \boxed{\mathit{B}} \\ \text{SYN } \left[\begin{array}{l} \text{CAT } \boxed{3} \\ \text{VAL } \left[\boxed{\mathit{A}} \oplus \boxed{\mathit{B}}\right] \end{array}\right] \\ \text{SEM } \boxed{5} \end{array}\right] \\
\text{DTRS} & \left\langle \left[\begin{array}{l} \textit{word} \\ \text{FORM } \boxed{4} \\ \text{ARG-ST } \boxed{\mathit{A}}\textit{list(nonaff)} \oplus \langle\, \boxed{1}\textit{aff}{:}\boxed{2}\rangle \oplus \boxed{\mathit{B}} \\ \text{SYN } \left[\text{CAT } \boxed{3}\left[\text{VFORM } \textit{finite}\right]\right] \\ \text{SEM } \boxed{5} \end{array}\right] \right\rangle
\end{array}\right]
$$

Because both MTR and DTRs are of type *word*, an affixed word may occur as the DTR of an *aff-wd* construct, for as long as there are still affixes on the list.[15] This is relevant in the case of ditransitives, for example, where there may be multiple object affixes that need to be realised. The ordering constraint (that affixation always targets the *first* affixal element on the ARG-ST list) further guarantees that the process of multiple affixation will follow the obliqueness hierarchy which corresponds to the relative proximity of affixes to the finite inflected verb stem in Spanish (where there are accusative and dative clitics attached to the verb stem, the accusative is closer to the verb stem):[16]

(9) a. *Roberto dió el libro a Miguel*
Roberto gave the book to Miguel
'Roberto gave the book to Miguel'

[15]This avoids the division of *clitic word* and *plain word* introduced by Miller and Sag (1997), which as pointed out by Monachesi (1999), and TS06, is syntactically unmotivated.

[16]For non-finite forms, multiple affixes have the inverse relative proximity with respect to the verb: the accusative is farther away from the verb stem than the dative. Non-finite verb forms are therefore constrained to always realise the *last* affixal element on the ARG-ST list of the DTRS as a pronominal argument on the MTR's ARG-ST.

b. *Roberto se lo dió*
Roberto dat acc gave
'Roberto gave it to him'

The post-inflectional affix realisation construction interacts with the lexical entries for complex predicate forming verbs, and with the head-cluster construction to predict the affix climbing facts. I turn to these two components of the analysis in the next section.

2.2 Constructing complex predicates

We saw above that S2 complex predicate constructions are structurally distinct from the French, Italian and S1 complex predicate types. While the latter show the characteristics of a flat VP structure, the infinitival V in the S2 constructions forms a constituent with the matrix verb. Clitic climbing, passive formation and occurrence in bounded dependencies all indicate, however, that, independent of their variable constituency, complex predicates across the family are characterised by a shared argument structure, to which these monoclausal properties are attributable.

A simple way of capturing the structural difference between S2 on the one hand, and French, Italian and S1 on the other is to take bare V arguments in the verb cluster variety of Spanish as not being privileged to participate in the same combinatoric constructions as phrase level complements. This can be enforced by specifying that the unsaturated verbal complement be listed as the value of a special valence feature, VCOMP (Chung, 1993; Rentier, 1994; Müller, 2000), the value for which for all other verb types is specified as the empty list. Because the bare V does not occur on the ARG-ST list, the valence principle does not apply to it, and so, unlike other complements, it does not appear on VAL list. By this means, it cannot be realised via the Head-Complement construction.

In order to guarantee that cluster forming verbs combine first with their bare verbal complement before combining with any phrasal nominal complements (thus producing the correct constituency structure), the head in the Head-Complement construction is required to have an empty VCOMP value (see (15) below). Verbs which have a non-empty VCOMP value are thus licensed not by the Head- Complement construction, but by the Head-Cluster Construction, some form of which has been proposed already for various non-Romance verb cluster constructions.[17] Before I present the Head-Cluster Construction, we shall first look at the nature of the lexical entry of the Spanish causative and perception verbs that are licensed to participate in this construction type.

[17] See, e.g. Chung (1993), Rentier (1994) and Müller (2000).

(10)
$$
\left[\begin{array}{l}
\textit{cluster-vb-lxm} \\
\text{SYN}\,|\,\text{VCOMP} \left\langle \left[\begin{array}{l} \textit{verb} \\ \text{ARG ST } \langle\boxed{1}\rangle \oplus \boxed{B} \\ \text{SYN} \left[\begin{array}{l} \text{CAT} \left[\text{VFORM } \textit{inf}\right] \\ \text{VAL } \langle\boxed{1}\rangle \oplus \boxed{B} \\ \text{VCOMP } \langle\ \rangle \end{array}\right] \\ \text{SEM } \boxed{2} \end{array}\right] \right\rangle \\
\text{ARG-STR } \langle \text{NP}_i \rangle \oplus \boxed{B} \oplus \langle \boxed{1}\text{NP}\rangle \\
\text{SEM } \textit{cause}(i,\boxed{2})
\end{array}\right]
$$

(10) gives the (simplified) lexical entry for the verb cluster forming verb, a subtype of transitive verb. The verb semantically selects for an NP subject, and an infinitival V, denoting an event. The VCOMP value of the verb is the infinitival V.

The ARG-ST list of the causative lexeme includes the arguments inherited from the infinitival V, in keeping with the standard argument composition approach to argument sharing. I stress here that this argument composition component of the lexical entry is not particular to the verb-cluster variety of Spanish, but is common to complex predicate forming verbs in both varieties of Spanish. The composed ARG-ST is the locus of the monoclausal properties common to the complex predicates of both varieties of Spanish (and in Romance generally), and thus is a feature of both construction types. Furthermore, it is the properties of the composed ARG-ST which, I show in §2.3.1, are relevant for accounting for the reflexive affix constraints. These constraints are present in both varieties of Spanish and thus it is expected that they should derive from properties shared across both construction types.

I will now briefly discuss these composed ARG-ST properties. First, note that VAL and the ARG-ST lists of the infinitival V are required to be identical. This is crucial for the analysis of clitic climbing, to be presented in the following section.

Second, note the order of elements on the composed ARG-ST list of the finite verb: the first element (subject) on the infinitive's ARG-ST list is 'demoted' to occur after the infinitive's object argument. This ordering of elements is adopted in recent composition analyses such as TS06, in order to capture the case distribution facts (the final (infinitival subject) element on the combined ARG-ST receives dative rather than accusative case). Significantly, this ordering will also play a crucial role in the binding account of reflexive affix realisation presented in §2.3.1, which provides independent motivation for this ordering of obliqueness.

Finally, observe that on this analysis, Spanish verb cluster lexemes are semantically dyadic. The literature is somewhat divided as to the semantic arity of complex predicate forming causative and perception verbs cross linguistically. Like the present analysis, TS06 assume semantic dyadicity for their French composition causative constructions, as does Rentier (1994) for causative and perception cluster forming verbs in Dutch. Abeillé et al. (1998), by contrast, propose that the French causative *faire* take three semantic arguments when it combines with a transitive infinitive, while adopting a raising analysis of *faire* with intransitive infinitives. While it is not made explicit in their analysis, the consequence of Abeillé et al's approach is that both double complement constructions and composition constructions with transitive infinitives are taken to involve semantically selected controllers (causees), and thus have the same semantic arity. While this may be an appropriate characterisation of the French data, it does not appear to be for Spanish.

Moore (1996) observes that the double complement construction (11a) has an interpretation of direct causation, where the agent directly acts on the causee, to bring about the caused event. By contrast, the complex predicate construction (11b) has an indirect causation reading:[18]

(11) a. *Los hizo quemar las casas*
them.acc made.3sg burn the houses
'He made them burn down the houses'

b. *Les hizo quemar las casas*
them.dat made.3sg burn the houses
'He had them burn down the houses'

The semantic generalisation is that in the double complement construction, the accusative marked participant is a semantic argument of the causative verb, while the complex predicate forming verb is semantically dyadic (causer, caused event).[19]

The semantic dyadicity of the complex predicate construction is made particularly evident by the fact that while *hacer* imposes selectional restrictions on causees in the double complement construction, it never does on the equivalent participant in the complex predicate construction. Thus, (12a) (from Moore (1996)) is unacceptable in the double complement construction, because *hacer* requires animate causees. By contrast, the complex predicate example in (12b) is well formed, because here *hacer* selects only for an event, and thus imposes no restriction on the animacy of the agent of that event.

(12) a. *?El ingeniero la hizo (a la pared) resistir el temblor.*
The engineer it-acc made to the wall resist the tremor.
'The engineer made the wall resist the tremor'

b. *El ingeniero le hizo resistir el temblor (a la pared).*
The engineer it-dat made resist the tremor to the wall
'The engineer made the wall resist the tremor'

[18] Because there is no independent NP in these two examples, word order does not distinguish the two structures. However, the accusative affix in (11a) shows this to be a double complement construction; the dative affix in (11b) signals that it is a complex predicate.

[19] In the literature on the semantics of perception verbs, it is generally agreed that a perception verb selecting an infinitival complement is semantically dyadic (Felser, 1999; Higginbotham, 1983), so for this verb class at least, this is not a particularly controversial claim.

In addition to the semantic evidence presented above, treating these verbs as dyadic will end up being pivotal for the reflexive binding facts.

I turn now to the head-cluster construction, which licenses verb cluster forming verbs:

(13)

$$\textit{head-cluster-cxt} \Longrightarrow \begin{bmatrix} \text{MTR} & \begin{bmatrix} \textit{phrase} \\ \text{SYN} \begin{bmatrix} \text{VAL } \boxed{A} \\ \text{VCOMP } \langle\ \rangle \end{bmatrix} \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \textit{word} \\ \text{SYN} \begin{bmatrix} \text{VAL } \boxed{A} \\ \text{VCOMP } \langle \boxed{1} \rangle \end{bmatrix} \end{bmatrix}, \boxed{1}\text{V} \right\rangle \end{bmatrix}$$

The DTRS of this construction consist of the head verb of type *word*, and a second complement, also a verb of type word, which is the VCOMP value of the first daughter. The MTR of this construction is of type *phrase*.

It is important to note that verb-cluster formation must be treated as a syntactic process, rather than a morphological one. Evidence ruling out a morphological derivation includes, *inter alia*, the fact that certain prosodically 'light' adverbs can occur between the two verbs, and that the lexical coordination of two non-finite verbs is permitted (See Abeillé and Godard (2007) for details). Thus, the MTR of a head cluster construction cannot be of type *word*.[20]

This creates a problem when we consider the fact that the Head-Complement construction as it is standardly formulated does not license phrasal heads. In order to ensure that in spite of being phrasal, the head cluster can still participate the Head Complement construction and thus have the noun phrase complements on its VAL list realised in the standard way,[21] I leave the type of the head daughter of the Head Complement construction underspecified, simply allowing it to be of type *expression*, rather than *word*. Although the head type remains underspecified, the head complement construction will nevertheless not ordinarily allow a phrasal head, by virtue of the specification that it have a non-empty VAL list (i.e, it cannot have saturated complements). The only exception to this will be verb clusters, which, despite being of type phrase, have no (non-affixal) arguments saturated. In this manner we can faithfully capture the mixed properties of verb clusters: the fact that they are produced combinatorically in the syntax like phrases, yet participate as complex heads with respect to immediate dominance schemata.

Finally, note that the empty VCOMP value on the DTRS will ensure that verb cluster forming verbs that have not already combined with their infinitival V complement are not licensed to participate in the Head-Complement construction, thus ensuring the correct constituency in verb cluster constructions.

[20]Thanks to Danièle Godard, who alerted me to the relevant data points.

[21]Rentier (1994) captures this via the feature LEX.

(14) **Spanish Head-complement construction**

$$
\textit{head-cmp-cxt} \Longrightarrow \begin{bmatrix} \text{MTR} & \begin{bmatrix} \textit{phrase} \\ \text{SYN} \begin{bmatrix} \text{VAL } \langle \boxed{1} \rangle \end{bmatrix} \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \textit{expression} \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{XARG } \boxed{1} \end{bmatrix} \\ \text{VAL } \langle \boxed{1} \rangle \oplus \boxed{B} \\ \text{VCOMP } \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle \oplus \boxed{B}\textit{nonempty} \end{bmatrix}
$$

2.2.1 The interaction with (non-reflexive) affix realisation

Let us now consider how the morphological analysis of affix realisation interacts with the head cluster construction. First, clitic climbing is enforced by the lexical specification that the finite cluster-forming verb selects for an infinitive that has no ARG-ST-VAL mismatch. Recall that any affixed verb form features a valency reduction (cf. 28). This constraint will therefore disallow the matrix verb to select an infinitive that has had its affixes already realised. If a complex predicate forming verb selects for an infinitive that bears any affixal arguments, then these will be inherited on the combined ARG-ST list. When inflected, this complex predicate forming verb can function as the input to a post-inflectional affix realisation construction:

(15)
$$
\begin{bmatrix} \begin{bmatrix} \textit{aff-cxt} & \\ \text{MTR} & \begin{bmatrix} \textit{word} \\ \text{FORM } \langle \textit{le, hice} \rangle \\ \text{ARG-ST } \langle \boxed{1} \rangle \oplus \boxed{B} \oplus \langle \text{NP:}\boxed{3} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{VFORM } \textit{fin} \end{bmatrix} \\ \text{VAL } \langle \boxed{1} \rangle \oplus \boxed{B} \\ \text{VCOMP } \left\langle \text{V} \begin{bmatrix} \text{ARG ST } \langle \text{NP:}\boxed{3} \rangle \oplus \boxed{B} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \textit{word} \\ \text{FORM } \langle \textit{hice} \rangle \\ \text{ARG-ST } \langle \boxed{1} \rangle \oplus \boxed{B} \oplus \langle \boxed{2}\textit{aff}\text{:}\boxed{3} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{VFORM } \textit{fin} \end{bmatrix} \\ \text{VAL } \langle \boxed{1}\text{NP} \rangle \oplus \boxed{B} \oplus \langle \boxed{2}\textit{aff}\text{:}\boxed{3} \rangle \\ \text{VCOMP } \left\langle \text{V} \begin{bmatrix} \text{ARG ST } \langle \boxed{2}\textit{aff}\text{:}\boxed{3} \rangle \oplus \boxed{B} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}
$$

The resulting affixed verb form, having a non-empty VCOMP value, is licensed by the verb-cluster construction (but not the head complement construction), and in this way can combine with its infinitival V complement.

2.3 Reflexives

In the present analysis, the lexical specification that the causative/perception verb combine with an infinitive V whose VAL list is identical to its ARG-ST list enforces any affixal argument specified on the V's ARG-ST list to be realised on the matrix verb. That is to say, clitic climbing is enforced absolutely given this lexical requirement.

At first glance, this would appear to make entirely the wrong predictions for reflexive affix realisation. Recall the constraints on reflexive affix climbing: the reflexive *se* does not attach to the finite verb in complex predicate constructions such as (16). This is the case regardless of whether the intended co-indexation is with the causer, or the causee:[22]

(16)	**Curro*$_i$	*se*$_{i/j}$	*hizo*	*afeitar*	*a*	*Jose*$_j$
	Curro	refl	made.3sg	shave	to	Jose
	'Curro made Jose shave himself'					

As discussed above, previous HPSG analyses for French, which exhibits similar constraints, have dealt with these facts by positing distinct verb types for verbs that realise reflexive clitics and for those that realise non-reflexive clitics. Specific constraints on complex predicate forming verbs then ensure that the verb selects for a certain type of infinitive only (Abeillé et al., 1998; Tily and Sag, 2006).

Abeillé et al. (1998), for example, distinguish between two types of verb: *basic* and *reduced*. Basic verbs are either those that have been realised without clitics or else intrinsic clitic verbs, one of whose arguments is realised as a reflexive or intrinsic clitic. Because the composition causative is constrained to select for a basic infinitive, reflexive clitics will never surface on the finite verb in composition constructions, because the infinitive selected for already must have had its affixes realised. By virtue of the same constraint, non-reflexive clitics will always surface on the finite verb, but they are never realised on the infinitive type selected for the composition verb.

There are problematic aspects to this type of analysis. First is the general question of why it should be the case that reflexive affixed verbs pattern differently from non-reflexive affixed verbs to begin with. Simply positing a distinction between verb types is perhaps descriptively adequate, but has no particular explanatory force. Of course, it may be that this is simply an arbitrary morphological phenomenon, but if a less stipulative account can be arrived at, it is certainly preferable.

[22]The reflexive examples in this section are taken from Moore (1996).

Moreover, if it is simply an arbitrary phenomenon, we might expect to see some variation across the family in this regard. It is telling that these constraints on reflexive affix realisation are shared across the family, which suggest that they derive from some property common across complex predicate constructions in these languages.

A more immediate problem for Spanish is that there is prima facie evidence that there can be no general constraint barring the possibility of reflexive affixes attaching to the finite causative verb, because there is one context where precisely this can happen, namely where the infinitive is an impersonal form (that is, when it has an uninstantiated subject with a generic interpretation):

(17)	*Curro$_i$*	*se$_i$*	*hace*	*castigar*
	Curro	refl	make.3sg	punish
	'Curro makes people punish him'			

Requiring the causative verb to select for an infinitive verb that has realised its reflexive affix locally would therefore erroneously rule out cases like (17), at least, without further stipulation.

I pursue in the next section an alternative approach to reflexivisation which relies on the independently motivated binding theory, and the argument structural properties of complex predicates we have already reviewed above. This analysis thus extends to both varieties of Spanish, because it hinges in no way on the specific structural type of complex predicate (flat VP vs. verb cluster).

2.3.1 A binding account of the reflexive affix constraints

Reflexive clitics *must* be bound within the clause in Spanish (Aissen, 1979), i.e., they must be locally O-bound.

(18)	*Pablo$_i$*	*se*	*lavó*
	Pablo	refl	washed.3sg
	'Pablo washed himself'		

Thus, the following binding relation is ruled out, because there is no local ARG-ST list on which the subject of the control verb can bind the reflexive:

(19)	**María$_i$*	*me*	*permitió*	*besarse$_i$*
	Maria	me	let.3sg	kiss.refl
	'Maria let me kiss her'			

In control constructions the *object* of the matrix verb may bind the downstairs reflexive, because this argument occurs on the local argument structure of the infinitive, and is therefore an available local antecedent for the reflexive:

(20)	*Le*$_i$	*permití*	*lavarse*$_i$
	3sg.dat	let.1sg	wash.refl
	'I let him wash himself'		

Given the grammaticality of (20) above, it is at first blush counter-intuitive that in a complex predicate construction, the following binding relation, where the object Jose binds the reflexive, should be ruled out:

(21)	**Curro*$_i$	*se*$_j$	*hizo*	*afeitar*	*a*	*Jose*$_j$
	Curro	refl	made.3sg	shave	to	Jose
	'Curro made Jose shave himself'					

However, this illicit binding relation has a straightforward account given the analysis of these complex predicates presented above. Recall that in the combined argument structure list in the complex predicate construction, the causee *is more oblique* than the object of the infinitive (in this case, the anaphoric element), which is motivated independently by the case assignment facts (cf. TS06). Assuming that the reflexive affix is of type *anaphor*, and is thus subject to the same constraints as anaphoric pronouns (cf. MS97), and §2.1 above), this will result in an O-command violation, and the structure will not be licensed. Note that this account relies crucially on the posited semantic dyadicity of the cluster forming verb: if such verbs selected semantically for a causee, then this causee would occur on the ARG-ST of the matrix causative, which would provide an appropriate antecedent for the anaphor. The semantic facts presented in §2.2, which argue against such a triadic semantic argument structure therefore dovetail with the binding constraints described here.

(22) A-command violation, where $l = k$

$$\begin{bmatrix} \textit{cluster-vb-lxm} \\ \textsc{arg-str}\ \langle \text{NP}_i,\ \textit{ref-aff}_k,\ \text{NP}_l,\ \rangle \\ \textsc{syn}\,|\,\textsc{vcomp}\ \langle \text{V}\Big[\textsc{arg st}\ \langle \text{NP}_l,\ \textit{ref-aff}_k \rangle\Big]\rangle \end{bmatrix}$$

The only way to express this binding relation is with the double complement construction, in which there is no conflicting combined ARG-ST ordering, and in which, as in (20) above, the antecedent outranks the reflexive on the local argument structure of the infinitive:

(23)	*Curro*$_i$	*hizo*	*a*	*Jose*$_j$	*afeitarse*$_j$
	Curro	made.3sg	to	Jose	shave.refl
	'Curro made Jose shave himself'				

The relative ordering of the infinitive's arguments on the combined ARG-ST does not, however, account for why the *causer* should also not be able to bind into a reflexive element, as in:

(24) **Curro*$_i$ *se*$_i$ *hizo* *afeitar* *a* *Jose*$_j$
Curro refl made.3sg shave to Jose
'Curro made Jose shave himself'

If these are monoclausal constructions, then we would expect the subject to be a suitable antecedent for the reflexive. What then rules out this binding relation? An answer is also provided by the Binding Theory. In order to satisfy Principle A (*A locally O-commanded anaphor must be locally O-bound* (Pollard and Sag, 1994)), if the causative selects for an infinitive with a reflexive object, and if on that infinitive's ARG-ST there is an O-commanding antecedent, it must be bound by it (in the example below, l must be identified with k). If it doesn't, it will produce a Principle A violation. However, if the two arguments on the infinitive's ARG-ST are co-indexed, this will rule out any possible co-indexation with the causer on the combined ARG-ST: although the anaphor will now have a suitable binder (the causer), the co-indexation on the lower ARG-ST required by Principle A will force the causer to also be co-indexed with the non-anaphoric argument. This will produce a Principle B/C violation. Thus, whatever the co-indexing relation, some violation will result.

(25) Principle A violation where $l \neq k$; Principle B/C violation where $i = l$

$$\begin{bmatrix} \textit{cluster-vb-lxm} \\ \textsc{arg-str}\ \langle \mathrm{NP}_i,\ \textit{ref-aff}_k,\ \mathrm{NP}_l \rangle \\ \textsc{syn} \mid \textsc{vcomp}\ \langle \mathrm{V}\begin{bmatrix}\textsc{arg st}\ \langle \mathrm{NP}_l,\ \textit{ref-aff}_k \rangle\end{bmatrix} \rangle \end{bmatrix}$$

The binding theory can thus account in a simple way for the constraints on reflexive affixes. Instead of stipulating an *ad hoc* division between verb types on the basis of affix type and equally *ad hoc* verb selectional restrictions on composition verbs, the reflexive affix constraints simply follow from well motivated binding principles, given the independently motivated obliqueness ordering of composed arguments in complex predicate constructions.

Let us now turn to the data from impersonal constructions. As we saw above, in such contexts, the reflexive affix attaches to the finite verb:

(26) *Curro*$_i$ *se*$_i$ *hace* *castigar*
Curro refl make.3sg punish
'Curro makes people punish him'

Such examples are highly problematic for an analysis such as Abeillé et al. (1998) where realisation of reflexives is enforced via a verbal type division together with the lexical specification that complex predicate forming verbs select for an infinitive of a certain type only. This will exceptionlessly require complex predicate forming verbs to combine with infinitives that have a reflexive argument realised locally, and without further stipulation, (26) is predicted not to be possible.

On the present binding account, however, the location of the reflexive affix in these constructions is straightforwardly predicted, when we consider the properties of impersonal uninstantiated subjects.

English null instantiation has been studied comprehensively by Fillmore (1986); following Fillmore, Lambrecht and Lemoine (2005) have more recently developed a typology for French. In these studies a basic division is drawn between Indefinite Null Instantiated Objects (INIs) and Definite Null Instantiated Objects (DNIs). In the case of INIs, no inference is possible as to the identity of the missing object, and the subject receives a generic interpretation. DNIs, by contrast, share properties with anaphora, involving a specific referent who is identifiable from the context. TS06 have argued for French that, on the basis of these distinct properties, and also certain case assignment facts in complex predicate constructions, that DNIs are present as *pros* on the ARG-ST list of the predicate that subcategorises for them, while, by contrast, INIs are truly absent.

I will follow this treatment of INI objects for Spanish impersonal (unexpressed) subjects, which similarly receive a generic interpretation, taking these to be absent on the ARG-ST list of the subcategorising verb. This has the result that in the complex predicate constructions in (26), there is no subject on the ARG-ST structure list of the infinitival word which would enforce the binding of the reflexive affix, and thus rule out a binding relation with the causer, as in (25) above. Because the reflexive is nevertheless bound locally on the combined ARG-ST list of the complex predicate by a local antecedent, it satisfies Principle A, and thus the binding relation is licensed.

(27) $$\begin{bmatrix} \textit{cluster-vb-lxm} \\ \text{ARG-STR } \langle \text{NP}_k,\ \textit{ref-aff}_k \rangle \\ \text{SYN} \mid \text{VCOMP } \langle \text{V}\begin{bmatrix}\text{ARG ST } \langle \textit{ref-aff}_k \rangle\end{bmatrix} \rangle \end{bmatrix}$$

Note now that a reflexive element affixed to the right edge of the infinitive is ruled out, where the construction is impersonal:

(28) **Curro$_i$* *hace* *castigarse$_i$*
Curro make.3sg punish.refl
'Curro makes people punish him'

If we take seriously the consequences of the argument composition analysis presented above, namely that causatives and perception verbs require their infinitival V argument to have no mismatch between their VAL and ARG-ST lists, and as such that affixes (reflexive or otherwise) in complex predicate constructions must always climb, then affix realisation on the infinitive in examples such as (28) is a diagnostic for a double complement construction.[23] And thus the ungrammat-

[23]There is some cross-dialectal variation in this regard. Moore (1996) reports that for some speakers a reflexive on the downstairs infinitive is possible with a dative causee. It is unclear how much of this is due to the independent influence of *leísmo*, whereby the dative *le* is used in place of accusative masculine *lo* (or, exceptionally, accusative feminine *la*) as a pronoun for the direct object.

icality of (28) provides further evidence that INI elements are not present on the ARG-ST list: if there is no subject on the ARG-ST list of the infinitival complement (and no combined ARG-ST where a local antecedent could save the relation), then there exists no local antecedent which can bind the reflexive in (28). Because Spanish reflexives *must* have a local binder, (28) is thus not a permissable sentence. It should be noted that examples such as these do not create a Principle A violation, as it is formulated in HPSG, because Principle A says nothing about cases where there is no local antecedent. But the Spanish specific requirement that reflexive affixes must be bound locally renders them ungrammatical.

Space prevents any detailed analysis of the French facts here, or consideration of intrinsic affixes (which Spanish does not possess). I simply note that it is probably significant that reflexive affixes climb in French complex predicate constructions involving tense auxiliaries. Notably, just as in the case of impersonal constructions, in the French tense auxiliary complex predicate construction, because the auxiliary is a subject to subject raising verb, there is no clash between local binding requirements on the infinitive's and on the combined ARG-ST: the only available local binder of a reflexive is the subject of the combined ARG-ST. The binding analysis of reflexive affix realisation constraints thus may well prove elucidating for the French facts also, in explaining the contrast between the presence of reflexive affix climbing in tense auxiliary constructions and the lack of it in causative/perception verb constructions.

3 Conclusion

I have presented an analysis of the verb cluster variety of Spanish complex predication which (1) captures the structural differences between this construction and the flat VP construction common to French, Italian, and other dialects of Spanish, and (2) faithfully preserves those features that are common across both construction types. (1) is achieved by the introduction of a separate construction type, the Head-Cluster Construction, and the additional feature VCOMP, both of which have in some form been successfully used in analyses of various non-Romance verb cluster constructions. (2) is achieved by retaining the basic argument composition analysis standardly assumed for Romance complex predicates. Coupled with a simple morphological treatment of affixation, intended for both varieties of Spanish, this analysis predicts the range of clitic climbing facts.

The parsimony of the affixation analysis, which dispenses with many of the types and book-keeping features of previous analyses, is afforded by the analysis of reflexive affix constraints I have presented in the second part of this paper. Departing from the standard morpho-lexical approach to reflexive affixation, with its reliance on stipulative type divisions and selectional restrictions, I have shown how the constraints follow from independently motivated binding principles. Reflexive affix constraints thus reveal a further property of Romance complex predicates that can profitably be analysed as deriving from their composed argument structure.

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NPI Licensing, Intervention and Discourse Representation Structures in HPSG

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Abstract

Negative Polarity Items (NPI) are expressions such as English *ever* and *lift a finger* that only occur in sentences that are somehow "negative". NPIs have puzzled linguists working in syntax, semantics and pragmatics, but no final conclusion as to which module of the grammar should be responsible for the licensing has been reached. Within HPSG interest in NPI has developed only relatively recently and is mainly inspired by the entailment-based approach of Ladusaw (1980) and Zwarts (1997). Since HPSG's CONTENT value is a semantic representation, the integration of such a denotational theory cannot be done directly. Adopting *Discourse Representation Theory* (DRT, Kamp and Reyle (1993); von Genabith et al. (2004)) I show that it is possible to formulate a theory of NPI licensing that uses purely representational notions. In contrast to most other frameworks in semantics, DRT attributes theoretical significance to the representation of meaning, i.e. to a "logical form", and not only to the denotation itself. This makes DRT particularly well-suited to my purpose.

1 Introduction

Negative Polarity Items (NPI) are expressions that only occur in sentences that are somehow "negative" (or "affective", Klima (1964)). The typical examples for NPIs are English *any* and *ever*. NPIs have puzzled linguists working in syntax, semantics and pragmatics, but no final conclusion as to which module of the grammar should be responsible for the licensing has been reached. Within HPSG interest in NPI has developed only relatively recently with Tonhauser (2001) and Richter and Soehn (2006). While superficially very different, the two papers agree in many respects. In particular they both attempt to rebuild notions that stem from entailment-based theories of NPI licensing such as Ladusaw (1980) and Zwarts (1997). This theory is based on the denotation of the licensing contexts. Since HPSG's CONTENT value is a semantic representation, the integration of such a denotational theory cannot be done directly. In the present paper I build on the earlier HPSG studies, but I show that it is possible to formulate a theory of NPI licensing that uses purely representational notions. For this enterprise, I adopt the framework of *Discourse Representation Theory* (DRT, Kamp and Reyle (1993); von Genabith et al. (2004)). In contrast to most other frameworks in semantics, DRT attributes theoretical significance to the representation of meaning, i.e. to a "logical form", and not only to the denotation itself. This makes DRT particularly well-suited to my purpose.

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2 Data

I only consider two basic facts about NPIs that are commonly acknowledged in the literature, leaving many other aspects aside: the distinction between weak and strong NPIs and so-called intervention effects in NPI licensing. I also limit myself to NPIs in declarative clauses.

There are at least two types of NPIs, *strong* and *weak* NPIs (Zwarts, 1997). Within the considered contexts, strong NPIs can only occur in the scope of a clause-mate negation, as expressed in English with a negated auxiliary or an n-word (such as *nobody*), and in the restrictor of a universal quantifier.[1] Weak NPIs are furthermore possible in the scope of expressions such as *few N*. If no such licenser is present in a sentence, both weak and strong NPIs are ungrammatical. Prototypical data are shown in (1) and (2).

(1) Distribution of a strong NPI:
   a. Pat won't lift a finger to help me.
   b. Nobody will lift a finger to help me.
   c. Every student who lifts a finger will pass the exam.
   d. *Few students lifted a finger to help me.
   e. *Pat will lift a finger to help me.

(2) Distribution of a weak NPI:
   a. Pat didn't budge during the experiment.
   b. Nobody budged during the experiment.
   c. Every student who budged during the experiment was excluded from further participation.
   d. Few students budged during the experiment.
   e. *Pat budged during the experiment.

The second observation that I discuss are so-called *intervention effects*: Consider the minimal pair in (3) for illustration. In a sentence with a negation, an NPI and a universal quantifier the universal quantifier may not take scope between the negation and the NPI. In (4) I sketch the three potential readings of the sentences in (3). The second formula expresses the unavailable 'intervention' reading. Given the word order in (3-b) this would be the most natural scope reading for this sentence. Since this reading is unavailable in some papers, for example Jackson (1995), sentences such as (3-b) are claimed to be ungrammatical.

(3) a. Kim didn't give any apple to every teacher.
   b. ??Kim didn't give every teacher any apple.

[1] There are more contexts that allow for strong NPIs, such as the complement clause of adversative predicates or rhetorical questions, to mention just two of these contexts.

(i) a. I doubt that he will lift a finger to help me.
   b. Who will lift a finger to help clean up after the party?

(4) a. $\neg\exists x[\textbf{apple}(x) \wedge \forall y[\textbf{teacher}(y) \rightarrow \textbf{give}(\textbf{kim}, x, y)]]$
b. $\#\neg\forall y[\textbf{teacher}(y) \rightarrow \exists x[\textbf{apple}(y) \wedge \textbf{give}(\textbf{kim}, x, y)]]$
c. $\forall y[\textbf{teacher}(y) \rightarrow \neg\exists x[\textbf{apple}(x) \wedge \textbf{give}(\textbf{kim}, x, y)]]$

3 Previous Approaches

In this section I limit myself to a discussion of the entailment-based approach to NPI licensing and to three proposals that have been made within HPSG. I leave aside purely syntactic approaches such as Klima (1964) and Progovac (1994) as well as pragmatic approaches such as Krifka (1994) or Chierchia (2004) and the mixed approach of Linebarger (1980).

3.1 The Entailment-based Approach

The most influential theory in NPI research, Ladusaw (1980) and Zwarts (1997), states that NPIs must occur in a *downward-entailing* context, i.e. a context that allows inference from supersets to subsets. For strong NPIs this context must even be *anti-additive*, i.e. display an entailment behavior that is even closer to that of negation than simple downward-monotonicity. This theory captures the basic data in (1) and (2) correctly: Affirmative sentences are not downward entailing, thus (1-e) and (2-e) are predicted to be excluded. In all other sentences in (1) and (2) the NPI is in a downward-entailing context. The different types of downward-entailingness are needed to differentiate between strong and weak NPIs. The scope of *few N* is downward entailing, but not anti-additive. Consequently, only weak NPIs are allowed here. It is the particular attractiveness of this account that it allows one to group the restrictor of the universal quantifier together with negation.

However, over the years the entailment-based account has faced a number of problems.[2] One problem is that trivially downward-entailing contexts such as the one constituted by *zero or more N* do not license NPIs. A problem that will be central to our discussion is that the theory does not account for the intervention effect illustrated in (3). Even in the unavailable reading (4-b) the context of the NPI is downward-entailing, notwithstanding the intervening universal quantifier (Jackson, 1995). In this case the entailment-based theory lacks the means to limit the domain of the licensing.

3.2 Scope Constraints: Tonhauser (2001)

Tonhauser (2001) attempts to encode an entailment-based theory of NPI licensing using a version of *Minimal Recursion Semantics* (MRS) in which potential licensers indicate the licensing strength of their scopal arguments.[3] Thus, *every* has a specification in its semantics that its restrictor is a licenser of strength

[2] Krifka (1994) is a nice summary of many of the problematic points.

[3] Tonhauser's theory depends on properties of the MRS version of Copestake et al. (1997) which are not part of the published version (Copestake et al., 2005).

anti-additive. The lexical specification of an NPI includes a scoping constraint in its HANDLE-CONSTRAINTS-list that there must be some operator of the right strength that has scope over the NPI. Tonhauser's theory shows the paradox of an HPSG rendering of entailment-based notions: When we look at the denotation of an expression, it is natural to talk about the entailments of that expression. In a representational framework such as HPSG, however, the entailment behavior has to be explicitly encoded in the structure. In the case of Tonhauser, this is done with otherwise unmotivated diacritic marking.

3.3 Collocations: Richter and Soehn (2006)

There are a number of collocational approaches within HPSG. The most recent and explicit one among them is Richter and Soehn (2006). I will focus on this approach in the present discussion and briefly address a second one, Sailer and Richter (2002) in the next subsection.

Richter and Soehn (2006) use *Lexical Resource Semantics* (LRS, Richter and Sailer (2004)) as their theory of semantic combinatorics. Just like MRS, LRS stands in the tradition of formalisms of underspecified semantics. In contrast to Tonhauser, however, Richter and Soehn do not include the NPI requirement in the constraints on semantic combinatorics but they treat them as collocational requirements, assuming a theory of collocation as employed in Soehn (2004) for idioms. This collocational treatment of NPIs has been put forward for example in van der Wouden (1997). Richter and Soehn use a feature COLL whose value indicates the lexically specified collocational restrictions of a sign. The COLL-list contains objects of sort *barrier*, which specify the syntactic domain within which the requirement must be fulfilled, such as the sentence or the utterance that contains the NPI. To give a concrete example, their lexical entry for the German NPI *scheren* (*care*) is given in (5). This NPI is licensed by any kind of licenser, as long as the licensing occurs in the same clause.

(5) Lexical entry of the German NPI *scheren* (*care*), adapted from Richter and Soehn (2006):

$$\begin{bmatrix} \text{PHON} & \langle \textit{scheren} \rangle \\ \text{SYNS} & \begin{bmatrix} \text{LOCAL} & \begin{bmatrix} \text{CAT HEAD} & \textit{verb} \\ \text{CONT MAIN} & \boxed{1}\ \textbf{scheren} \end{bmatrix} \end{bmatrix} \\ \text{COLL} & \left\langle \begin{bmatrix} \textit{complete-clause} & \\ \text{LF-LIC} & \begin{bmatrix} \text{EX-CONT} & \boxed{2} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix} \ \&\ \texttt{imp-op}(\boxed{2},\boxed{1})$$

This lexical entry has a COLL specification that contains a *complete-clause* object. A general constraint in the grammar insures that the LF-LIC value of this object is identical to the logical form (i.e. the LF value) of the smallest complete clause that dominates the word.[4]

[4] In LRS a difference is made between the CONTENT value and the LF value. The former includes only the index and the main semantic constant contributed by a word, i.e. the information needed for

The lexical entry imposes a constraint on the logical form of this syntactic domain. It requires that its logical form contain the semantics of the NPI (the constant **scheren**) in the scope of a licensing operator. This is achieved by a number of relations for different types of semantic licensing domains. For illustration I give the definition of the relation `downward-entailing-strength-operator` in (6). Since downward-entailing contexts are a subgroup of anti-additive contexts, the relation `de-str-op` also holds if the stronger relation `aa-str-op` (`anti-additive-strength-operator`) holds.

(6) The definition of the relation `de-str-op` from Richter and Soehn (2006):

$$\texttt{de-str-op}(\boxed{\text{lf}},\boxed{1}) \Leftrightarrow \exists \boxed{2} \exists \boxed{3} \left(\begin{array}{l} \boxed{1} \triangleleft \boxed{3} \textbf{ and } \boxed{2} \triangleleft \boxed{\text{lf}} \textbf{ and} \\ \left(\begin{array}{l} \boxed{2}\ \textbf{FEW}(\_,\_,\boxed{3}) \triangleleft \boxed{\text{lf}} \textbf{ or} \\ \boxed{2}\ \textbf{AT-MOST-}n(\_,\_,\boxed{3}) \triangleleft \boxed{\text{lf}} \textbf{ or} \\ \boxed{2}\ \textbf{HARDLY}(\boxed{3}) \triangleleft \boxed{\text{lf}} \textbf{ or} \\ \ldots \end{array} \right) \end{array} \right)$$
$$\textbf{or } \texttt{aa-str-op}(\boxed{\text{lf}},\boxed{1})$$

For the NPI *scheren* the semantic requirements are even weaker since this NPI may also occur in imperatives and in interrogative clauses. The example of the definition in (6) shows that while Richter and Soehn (2006) capture the mutual inclusion of the licensing contexts, every licensing operator is mentioned explicitly in the relation. The authors state that this explicit listing is made only for the sake of concreteness in the current absence of a better semantic generalization. In this sense the present paper can be seen as a step towards such a generalization for a core class of licensing contexts.

The strength of the approach in Richter and Soehn (2006) is its formal explicitness and the fact that it discusses a wide range different types of NPIs. On the other hand it fails to capture the unifying property of NPIs in an intuitive way: the fact that they are licensed under negation.

3.4 Decomposition: Sailer and Richter (2002)

The main concern of Sailer and Richter (2002) is to show that NPI-hood goes hand in hand with other collocational properties. In the paper we assume a collocational module similar to the one in Richter and Soehn (2006). It is only towards the end of the paper that we address the question of what kinds of semantic representations license NPIs. We speculate that all NPI-licensing contexts can be decomposed into logical forms that contain a negation. In the case of strong NPIs the NPI's semantics must be in the immediate scope of the negation, in the case of weak NPIs, semantic operators may intervene. The discussion does not go beyond the sketchy representational reformulation of the entailment-properties of prototypical NPI-licensing contexts given in (7).

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selection. The LF value, which is not part of *synsem*, contains all the semantics including quantifiers and operators. The EX(TERNAL)-CONT(ENT) value of a clause can be considered as the semantic representation associated with this clause.

(7) Representation of NPI-licensing contexts (Sailer and Richter, 2002):

entailment classification	example	lf representation
antimorphic	*nicht* (*not*)	$\neg[\ldots\phi\ldots]$
anti-additive	*niemand* (*nobody*)	$\neg\exists[\ldots\phi\ldots]$
downward entailing	*wenige* (*few*)	$\neg\mathsf{many}'[\ldots\phi\ldots]$

This approach is certainly very close to the ideas developed in the present paper. However, due to the choice of Ty2 (Gallin, 1975) as the underlying semantic representation language, the contexts did not cluster naturally. In the following section I will show that using DRT the intuitions behind the approach in Sailer and Richter (2002) can be expressed in a transparent way.

4 Discourse Representation Structures in HPSG

I assume that the CONTENT value of a sign is a *Discourse Representation Structure* (DRS, Kamp and Reyle (1993); von Genabith et al. (2004)). The use of DRT semantics within HPSG is not wide-spread, but has a number of predecessors, such as Frank and Reyle (1995), Eberle (1997), Holler (2003), Arnold (2004), Marshall and Sáfár (2004) to name just a few. My analysis does not depend on a particular choice of how to encode DRSs in HPSG. It is also independent of which combinatorial mechanism is used to arrive at the logical form of a complex sign.[5]

I use the standard definitions for DRT, as they can be found in Kamp and Reyle (1993) or von Genabith et al. (2004). In this paper, space restrictions force me to use the so-called *linear notation* instead of the more traditional box notation. To give an example, the semantic representation that I assume for the sentence in (8-a) is given in box notation in (8-b) and in linear notation in (8-c).

(8) a. Kim gave an apple to a student.

b. Box notation:
$$\begin{array}{|c|}\hline e,x,y \\ \hline \textbf{apple}(x) \\ \textbf{student}(y) \\ \textbf{give}(e,\textbf{kim},x,y) \\ \hline \end{array}$$

c. Linear notation: $[e,x,y|\textbf{apple}(x),\textbf{student}(y),\textbf{give}(e,\textbf{kim},x,y)]$

A DRS consists of two parts: a set of variables, written at the top of the DRS, and a set of conditions. A variable that is introduced in a universe is interpreted as being existentially bound.The example illustrates that I use eventuality variables (e) in addition to the variables for individuals.

In addition to simple DRSs, DRT allows for DRSs as part of conditions, i.e. in-

[5] However, I have argued elsewhere that a combinatorial semantics that uses techniques of underspecification as used in LRS can lead to an elegant account of NPI licensing in negative raising constructions (Sailer, 2006). At the end of Section 7 I mention another potential advantage of LRS.

side the body of a DRS. Those are used for negation ($\neg K$), implication ($K \Rightarrow K'$) and disjunction (K **or** K'). It should be noted that DRT treats negation, implication and universal quantification alike: A condition of the form $\neg K$ is equivalent to a condition of the form $K \Rightarrow$ **false**. Expressions of the form *every N VP* are translated into $[x|\phi] \Rightarrow \psi$, where ϕ and ψ correspond to the translation of N and VP respectively. In this paper, I will assume that the notation $\neg K$ is in fact just an abbreviation of $K \Rightarrow$ **false**.

The basic DRT-language naturally extends to generalized quantifiers, using conditions of the form $\mathcal{Q}x\ K_1K_2$, for some determiner $\mathcal{Q}$, some variable x and DRSs K_1 and K_2 (von Genabith et al., 2004). This kind of representation is called a *duplex condition*, i.e. there are two DRSs, a restrictor and a scope, that are part of the condition. It has been emphasized in Partee (1988) that duplex conditions should be used for the representation of proportional determiners, whereas cardinal determiners will be treated as indefinites, introducing just a single DRS.[6] From this point of view, conditions of the form $K \Rightarrow K'$ should also be considered duplex conditions. This is in line with Partee's approach since the universal determiner is also proportional.

DRT uses a traditional notion of *subexpression* or *component*. In addition there is a notion of *accessibility*: A DRS K is accessible from an expression ϕ iff (i) ϕ is a subexpression of K, or (ii) K is the first DRS in a duplex condition and ϕ is the second DRS in this condition (i.e. there is a condition of the form $K \Rightarrow \phi$ or $\mathcal{Q}xK\phi$), (iii) or ϕ and K are in the transitive closure of (i) and (ii). Accessibility is a central concept in DRT. To account for so-called *donkey sentences* as in (9), the interpretation of a variable occurrence is determined by the closest accessible DRS that contains this variable in its universe. In (9) the occurrence of the variable x in the consequent of the implication is determined by the antecedent, since the DRS is accessible from the consequent and contains the variable in its universe.

(9) a. If a man called, he left a message.
b. $[x|\textbf{man}(x)] \Rightarrow [e|\textbf{leave-message}(e, x)$

As is common practice in DRT, I assume lexical decomposition. In particular, I decompose downward-entailing operators into a combination of a negation and an upward-entailing operator which is in the scope of the negation. This was proposed for example in Krahmer and Muskens (1995) for negative verbs such as *lack* and *forget*. Applying this to determiners, the negative indefinite determiner *no* is represented as a negation and an indefinite ($\neg[x| \ldots]$). Downward-entailing proportional quantifiers such as *few* are represented as $\neg[\emptyset|\textbf{many}xK_1K_2]$.[7]

[6] For a cardinal determiner Det the truth of $Det(A)(B)$ only depends on the size of the set $A \cap B$. For a proportional determiner, it also depends on the size of the set A. *Some* is cardinal, since *some*$(A)(B)$ is true iff $|A \cap B| \neq 0$. *Every* is proportional, since *every*$(A)(B)$ is true iff $|A \cap B| = |A|$.

[7] The determiners *many* and *few* have both a proportional and a cardinal reading. In the cardinal reading of the intersection of the restrictor and the scope must be above (resp. below) a contextually specified minimal value. In the proportional reading it must be above (below) a contextually specified

5 A DRT-based Account of NPI Licensing

In (10) I sketch the DRSs for the sentences in (2). I use eventuality variables e and e', and I only mention the relevant conditions.

(10) Simplified DRSs for the sentences in (2):

a. $[\emptyset|\neg[e|\mathbf{budge}(e,\mathbf{pat})]]$
b. $[\emptyset|\neg[x,e|\mathbf{budge}(e,x)]]$
c. $[\emptyset|[x,e|\mathbf{budge}(e,x)] \Rightarrow [e' : \mathbf{be\text{-}excluded}(e',x)]]$
d. $[\emptyset|\neg[\emptyset|\mathbf{many}x[x|\mathbf{student}(x)][e : \mathbf{budge}(e,x)]]]$
e. *$[e|\mathbf{budge}(e,\mathbf{pat})]$

In (a) and (b) the semantics of the NPI is a condition in a sub-DRS of the negation. In (c) it occurs in the antecedent of a conditional DRS. I assume that these contexts are *NPI-licensing DRSs.* This notion is defined in (12).

(11) NPI-licensing DRS (first attempt):
A DRS K is an *NPI-licensing DRS* in a larger DRS K' iff K occurs in K' as part of a condition of the form $\neg K$ or $K \Rightarrow K''$.

As mentioned above, negation in DRT is nothing but an implication with a contradiction in the consequent ($K \Rightarrow$**false**). This allows us to simplify the definition of an NPI-licensing DRS.

(12) NPI-licensing DRS (final version):
A DRS K is an *NPI-licensing DRS* in a larger DRS K' iff K occurs in K' as part of a condition of the form $K \Rightarrow K''$.

I use this notion to express a necessary condition for the occurrence of NPIs: An NPI must always occur inside an NPI-licensing DRS. This condition is expressed in (13).

(13) General structural constraint on NPI licensing:
The logical form of an NPI must be a subexpression of an NPI-licensing DRS.

The sentences in (1-e) and (2-e) violate this constraint. The semantic representation of (2-e) is sketched in (10-e) above. Since it does not contain an NPI-licensing DRS, the NPI cannot be a subexpression of an NPI-licensing DRS.

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percentage of the restrictor set. In this paper I focus on the proportional reading. These two readings of *few* lead to distinct entailment behavior in the restrictor. For both readings the scope is downward entailing, it is, however, only in the cardinal reading that the restrictor position is also downward entailing. Thus, the following entailment is not valid:

(i) Few (= a small percentage) people know Latin.
$\not\models$ Few (= a small percentage) classicists know Latin.

Similarly, the NPI is not licensed in the scope of a universal quantifier, as shown in (14). While the DRS $[x|\textbf{student}(x)]$ is an NPI-licensing DRS in this sentence, the DRS that contains the NPI is not a sub-DRS of this DRS.

(14) a. *Every student gives a damn about syntax.
b. $[\emptyset|\ [x|\textbf{student}(x)] \Rightarrow [e|\textbf{give-a-damn}(e, x)]]$

In addition to this general structural constraint we also need special constraints for the different kinds of NPIs. If we compare the semantic representation of a sentence that contains an n-word, (10-b), with that of a sentence that contains a downward-entailing quantifier such as *few*, (10-d), the latter contains an additional DRS with a non-empty universe that is accessible from the NPI. I will refer to accessible DRSs with a non-empty universe that intervene between an NPI and its licensing DRS as *potential interveners*. This notion plays a central role in characterizing the difference between strong and weak NPIs. It is defined in (15).

(15) A DRS K is *a potential intervener* for an NPI ϕ in a DRS K' iff[8]

1. $K \neq \phi$,
2. K' is an NPI licensing DRS that contains ϕ and K,
3. K is accessible from ϕ, and
4. K has a non-empty universe

I use this notion to express the different occurrence requirements of strong and weak NPIs.

(16) Special constraints:
a. Strong NPI: There is **no** potential intervener for the NPI in its NPI-licensing DRS.
b. Weak NPI: There is **at most one** potential intervener for the NPI in its NPI-licensing DRS.

To see the effect of these two special constraints we have to look at a context in which a weak NPI can occur but a strong NPI is excluded. The scope of *few* was shown to be such a context. The DRSs for (1-d) and (2-d) are given in (17).

(17) a. *Few students lifted a finger to help me.
$[\emptyset|\neg[\emptyset|\textbf{many}x[x|\textbf{student}(x)]\ [e|\textbf{lift-a-finger}(e, x)]]]$
b. Few students budged during the experiment.
$[\emptyset|\neg[\emptyset|\textbf{many}x[x|\textbf{student}(x)]\ [e|\textbf{budge}(e, x)]]]$ (= (10-d))

In both cases the structural constraint in (13) is met. The DRSs contain an NPI-licensing DRS: the scope of the negation ($\neg[\emptyset|\textbf{many}x\ldots]$). Inside this NPI-licensing DRS we find the DRS that contains the NPI ($[e|\textbf{lift-a-finger}(e, x)]$ in

[8] To be precise: ϕ is the smallest DRS that contains the semantic contribution of the NPI.

(17-a) and $[e|\mathbf{budge}(e, x)]$ in (17-b)). In both cases, the DRS that that contains the NPI is the second DRS in the duplex condition introduced by the determiner **many**.

The restrictor of the quantifier, the DRS $[x|\mathbf{student}(x)]$, is a potential intervener. We can check the conditions in (15) to prove this. Condition 1: the restrictor and the scope of **many** are not the same DRS. Condition 2: the NPI-licensing DRS contains both the restrictor and the scope of **many**. Condition 3: the restrictor is accessible from the scope by the definition of accessibility. Condition 4: the restrictor has a non-empty universe since it contains the variable bound by the quantifier.

The special constraint on strong NPIs in (16-a) forbids the occurrence of a potential intervener. Consequently the semantic representation in (17-a) is not compatible with this restriction on strong NPIs. For weak NPIs, one potential intervener is allowed. Since the restrictor of **many** is the only potential intervener, the DRS does not violate the occurrence constraint on weak NPIs in (16-b).

While only weak NPIs are licensed in the scope of *few*, both weak and strong NPIs are licensed in negated sentences, in the scope of n-words and in the restrictor of *every*. DRSs of these types of sentences are given in (10-a), (10-b) and (10-c) respectively. In the first two cases the DRS that contains the NPI is the scope of the negation. Consequently, the DRS that contains the NPI is itself an NPI-licensing DRS. For this reason there cannot be an intervener between the DRS that contains the NPI and its licenser. This explains why both weak and strong NPIs can occur in these constructions.

We should also consider the case of an NPI in the restrictor of a universal quantifier as in (10-c). Structurally this case is identical to the one with a negation or an n-word. The DRS that contains the NPI is the antecedent of a conditional. Therefore it is itself an NPI-licensing DRS according to the definition in (12). This, again, explains why both weak and strong NPIs are possible in this position.

In this section I outlined the basics of a representational theory of NPI licensing. It was always considered one of the major achievements of the entailment-based theory that it accounted for the occurrence of NPIs under negation and in the restrictor of universal quantifiers by uniform means. The approach developed here shows that these contexts also form a natural class from a DRT perspective: the antecedent of an implication. In the next section I show how my account can capture intervention effects — which are problematic for entailment-based approaches.

6 Intervention Effects

Intervention effects seem to be the strongest argument for a structural, i.e. representational, theory of NPI licensing. For this reason they are also a test case of the present approach. First I illustrate that intervention effects with two quantifiers are immediately accounted for by the theory. Second I look at the case of an intervention effect with verbal negation and a quantifier such as in example (3). This latter case will require us to reconsider the DRSs for negated sentences.

The present approach elegantly captures intervention effects with two quantifiers. Sentence (18-a) cannot have a reading in which *few* takes scope over *most* which, in turn, scopes over *any*. I sketch the DRS of this unavailable reading in (18-b). I provide the box notation for better readability. I abbreviate the semantic contribution of the nouns and the verb with the corresponding upper case letters.

(18) a. ??Few students gave every teacher any apple.
b. Hypothetical DRS of the unavailable reading:

$$\begin{array}{|l|}\hline \\ \hline \neg\ \begin{array}{|l|}\hline \\ \hline \mathbf{many}x \begin{array}{|c|}\hline x \\ \hline \mathbf{S}(x) \\ \hline \end{array} \begin{array}{|l|}\hline \\ \hline \begin{array}{|c|}\hline y \\ \hline \mathbf{T}(y) \\ \hline \end{array} \Rightarrow \begin{array}{|c|}\hline z,e \\ \hline \mathbf{A}(z) \\ \mathbf{G}(e,x,z,y) \\ \hline \end{array} \\ \hline \end{array} \\ \hline \end{array} \\ \hline \end{array}$$

The DRS $[z, e|\mathbf{A}(z), \mathbf{G}(e, x, z, y)]$ is the DRS that contains the NPI in this semantic representation. The NPI-licensing DRS is the scope of the negation. The NPI is contained in the scope of the universal which, in turn, is part of the scope of **many**. Since both the universal determiner and **many** contribute a restrictor with a non-empty universe, their restrictors are potential interveners for the NPI in the sense of (15). Consequently there are two potential interveners and the occurrence restriction of the weak NPI is violated. Strong NPIs are of course also excluded since they wouldn't even allow for a single potential intervener.

This example shows that the DRT-based approach directly accounts for the intervention effects induced by the presence of two proportional determiners. Let us now turn to a more subtle type of intervention effect, induced by a verbal negation and a quantifier such as example (3). If we look at this example naively, it seems that the theory fails to prevent the weak NPI from occurring. In (19) I restate the unavailable reading of sentence (3-b) in DRT terms.

(19) Naive DRS for the excluded reading of (3-b):
?? Kim didn't give every teacher any apple.
$[\emptyset|\neg[\emptyset|[y|\mathbf{teacher}(y)] \Rightarrow [x, e|\mathbf{apple}(x), \mathbf{give}(e, \mathbf{kim}, x, y)]\ ]]]$

The NPI contributes the variable x and the DRS that contains the NPI is the scope of the universal quantifier ($[x, e|\mathbf{apple}(x), \mathbf{give}(e, \mathbf{kim}, x, y)]$). The NPI-licensing DRS is the scope of the negation ($\neg[\emptyset| \ldots]$). There is exactly one potential intervener between these two DRSs: the restrictor of the universal quantifier ($[y|\mathbf{teacher}(y)]$). In fact this constellation is analogous to the one of licensing in the scope of *few* (see (17-a)). For this reason we would expect that the weak NPI is licensed in this reading and, consequently, fail to predict the intervention effect.

I will show that there is independent evidence that the DRS in (19) is not correct. I demonstrate that sentences of this form do in fact contain a second potential intervener. This additional potential intervener will be the NPI-licensing DRS itself. I will show that it contains a non-empty universe in cases of verbal negation. I concentrate on the following pair of sentences for my argument.

(20) a. Not every visitor got a/any present.
b. Every visitor didn't get a/?any present.

In their most natural readings both sentences in (20) are interpreted with the universal in the scope of the negation. For (20-a) this is the only possible reading, and the weak NPI is licensed. Matters are different, however, for sentence (20-b). While the reading with a wide scope of the negation, the so-called *inverse scope reading* is the preferred reading of this sentence if there is no NPI, this reading is unavailable if the NPI is in the sentence. In the presence of *any*, sentence (20-b) can only have the surface-scope reading, i.e. wide scope of the universal quantifier with respect to the negation.

The data in (20) illustrate that there is an intervention effect for the inverse scope reading of (20-b), but no intervention effect for (20-a). If the representational theory outlined in the previous section is on the right track, we should find evidence for an additional potential intervener for the inverse scope reading of (20-b). Such evidence comes from reference to abstract objects. I will show that there is an abstract discourse referent which is introduced between the negation and the universal quantifier.

Discourse referents introduced in the scope of negation are normally not accessible as antecedents for pronouns outside the scope of this negation (Kamp and Reyle, 1993), see (21-a). Such a pronominal reference is possible if there is a continuation with a modal or hypothetical context, as in (21-b). This modal subordination allows us to "skip" the outermost negation and gives access to discourse referents in its scope.

(21) a. Pedro doesn't own [a donkey]$_i$. He calls it$_{*i}$ Emma.
b. Pedro doesn't own [a donkey]$_i$. He would call it$_i$ Emma.

To apply the same test to the data with universally quantified subjects, I use appositive *which* relative clauses.[9] There, the relative pronoun typically refers to abstract entities from the main clause. With a continuation in the indicative, (22), there is no difference between the two antecedent clauses: *which* refers to the situation in which some visitors did not get presents.

(22) Every visitor didn't get a present/ Not every visitor got a present,
a. #which was very expensive. (*which* = every visitor got a present)
b. which was a bit unfair. (*which* = some visitors didn't get a present)

[9]See Holler (2003) for a discussion of the corresponding type of sentences in German.

An irrealis continuation allows for modal subordination as in (21-b). For the sentence with a universally quantified subject and a verbal negation as (20-b), the best continuation refers to a situation in which every visitor actually received a present, i.e. (23-a). This continuation is unavailable for the sentence which has a subject of the form *not every N* as shown in (24).

(23) Every visitor didn't get a present, ...

a. which would have been very expensive.
(*which* = every visitor got a present)

b. ??which would have been a bit unfair.
(*which* = some visitors didn't get a present)

(24) Not every visitor got a present, ...

a. #which would have been very expensive.
(*which* = every visitor got a present.

b. ??which would have been a bit unfair.
(*which* = some visitors didn't get a present)

This contrast follows if we assume the presence of an abstract discourse referent, written as p, which can serve as the antecedent in (23). I refrain from committing myself to the concrete nature of p. It would be a state in classical DRT, a proposition in SDRT, or a situation in other variants. This referent is not present in (24). The resulting DRSs are shown in (25), where I abbreviate the semantic contribution of the nouns and verbs with capital letters.

(25) a. DRS for (23): $[\neg[p|p : [\emptyset|[x|\mathbf{V}(x)]\Rightarrow[y,e|\mathbf{P}(y),\mathbf{G}(e,x,y)]]]$

b. DRS for (24): $[\neg[\emptyset|[x|\mathbf{V}(x)]\Rightarrow[y,e|\mathbf{P}(y),\mathbf{G}(e,x,y)]]$

If modal subordination allows us to ignore the highest negation, the DRS in (25-a) provides an antecedent for *which*, but the DRS in (25-b) does not.

After this discussion we can come back to the original problem that sentence (20-b) cannot have an inverse-scope reading if the NPI is present. The DRS for the hypothetical inverse scope reading of sentence (20-b) is identical to the one in (25-a). In this DRS there are, now, two potential interveners for the NPI. First, the restrictor of the universal quantifier is an intervener, as we have seen above. In addition, the NPI-licensing DRS itself is a second intervener. To verify that this DRS is a potential intervener we have to go through the four conditions in the definition in (15). First, it is a DRS that is distinct from the DRS that contains the NPI. Second, it is also contained in the NPI-licensing DRS, since every DRS is contained within itself. Third, it is accessible from the DRS that contains the NPI, because the NPI is contained in a sub-DRS of the intervener. Fourth, the DRS has a non-empty universe: its universe contains the abstract discourse referent p.

This shows that our original theory from Section 5 accounts for the contrast in (20) under the independently motivated DRSs for negated sentences. We can now adapt the hypothetical DRS for the intervention reading from (19) accordingly.

This results in the following semantic structure.

(26) DRS for the excluded reading of (3-b):
?? Kim didn't give every teacher any apple.
$[\emptyset|\neg[p|p : [\emptyset|[y|\textbf{teacher}(y)] \Rightarrow [\overline{x, e|}\textbf{apple}(x), \textbf{give}(e, \textbf{kim}, x, y)]\ ]]]]$

This DRS is analogous to the one in (25-a), i.e. the NPI is contained in a DRS for which there are two potential interveners in the overall semantic representation of the sentence: the restrictor of the universal and the scope of the negation.

In Section 5 I provided the basic definitions of a DRT-based theory of NPI licensing. This was enough to account for the basic data. In the present section I demonstrated that this theory is able to capture intervention effects directly.

7 HPSG Encoding of the Analysis

To integrate my analysis into HPSG, I follow Richter and Soehn (2006) in adopting a collocational approach to NPI licensing. I will focus exclusively on the NPI properties of the lexical items, leaving aside other collocational requirements they may have. My improvement over Richter and Soehn's account lies in the uniform characterization of the licensers and in the fact that the intervention effects follow directly from the licensing conditions of the different types of NPIs.

I adopt the COLL feature from Richter and Soehn (2006) as sketched in Section 3.3. If I ignore for the moment the syntactic domain within which particular NPIs need to be licensed (such as within the same clause as in (5)), there is a general principle of the grammar — the *Licensing Principle* in Richter and Soehn (2006) — which guarantees that the LF-LIC values on a word's COLL list are identical to the logical form of some sign that dominates the word.

(27) Licensing Principle:
In every unembedded sign s, and for each lexical sign w in s:

> every object on w's COLL value has an LF-LIC value that is identical to the CONT value of some sign s' that dominates w in s.

We need relations that correspond to the notions *NPI-licensing DRS* and *potential intervener* as defined in (12) and (15) above. I assume RSRL (*Relational Speciate Re-Entrant Language*, Richter et al. (1999) and Richter (2004)) as the underlying formalism of HPSG grammars. RSRL provides the use of relations and quantification over subcomponents of feature structures. This very expressive language allows us to define the necessary relations and to formulate the collocational constraints. The concrete definition of the relations depend on details of the HPSG encoding of DRSs. For this reason I will not provide these definitions here but give formal specification of the relations instead.

The HPSG encoding of DRSs comes along with a specification of the relations `component` (written as "$\leq$"), which holds of a pair $\langle k, k' \rangle$ iff k is contained in the DRS k'. The notion of accessibility used in DRT must also be translated into the HPSG encoding. Here I assume a three-place relation `accessible` which holds of a triple $\langle k, k', k'' \rangle$ iff k is accessible from k' within a larger DRS k''.

After these general relations that are needed for any integration of DRT into HPSG I turn to the relations that are specific to the present theory. I start with the relation `npi-lic`. It holds of a pair $\langle k, k' \rangle$ iff k is an NPI-licensing DRS in k'.

(28) Specification of the relation `npi-lic`:

The relation `npi-lic` holds of a pair $\langle k, k' \rangle$
iff there is some k'' such that $k' = k \Rightarrow k''$.

The second relation that is fundamental to my approach is a relation that identifies potential interveners. The relation `pot(ential)-inter(vener)` holds of a triple $\langle k, p, k' \rangle$ iff k is a potential intervener for the logical form of an NPI p in a larger structure k'. The definition follows the conditions in (15).

(29) Specification of the relation `pot(ential)-inter(vener)`:

The relation `pot-inter` holds of a triple $\langle k, p, k' \rangle$ iff there is a DRS k_p ($k_p \leq k'$) which is the smallest DRS that contains p and

1. $k \neq k_p$,
2. $k \leq k'$ and $k_p \leq k'$,
3. $\langle k, k_p, k' \rangle \in$ `accessible`, and
4. k has a non-empty universe.

Note that all these notions are defined purely in terms of the semantic representation and do not refer the denotation.

With the help of these relations, we can formalize the lexical specifications of a weak and a strong NPI schematically in (30) and (31). In both cases, $\boxed{1}$ is the semantics of the NPI and $\boxed{2}$ is the semantics of a larger sign that contains the NPI-licensing DRS $\boxed{3}$ for the NPI. The general structural constraint is expressed by the line "`npi-lic`($\boxed{3}$,$\boxed{2}$) & $\boxed{1} \leq \boxed{3}$". The condition below this line expresses the special constraint for weak NPIs in (30). Correspondingly, in (31) the line below the general structural constraint is a direct rendering of the interpretive constraint of strong NPIs.

(30) Schematic lexical specification of a weak NPI:

$$\begin{bmatrix} \text{SYNS LOC} \begin{bmatrix}\text{CONT } \boxed{1}\end{bmatrix} \\ \text{COLL} \left\langle \begin{bmatrix} \text{LF-LIC } \boxed{2}\ \textit{drs}\end{bmatrix}\right\rangle \end{bmatrix} \mathbin{\&} \exists \boxed{3} \left(\begin{array}{l} \texttt{npi-lic}(\boxed{3},\boxed{2}) \mathbin{\&} \boxed{1} \leq \boxed{3} \\ \mathbin{\&} \neg\exists \boxed{4} \exists \boxed{5} \left(\begin{array}{l} \boxed{4} \neq \boxed{5} \\ \mathbin{\&} \texttt{pot-inter}(\boxed{4},\boxed{1},\boxed{3}) \\ \mathbin{\&} \texttt{pot-inter}(\boxed{5},\boxed{1},\boxed{3})\end{array}\right)\end{array}\right)$$

(31) Schematic lexical specification of a strong NPI:

$$\begin{bmatrix}\text{SYNS LOC}\left[\text{CONT } \boxed{1}\right]\\ \text{COLL}\left\langle\left[\text{LF-LIC } \boxed{2}\ \textit{drs}\right]\right\rangle\end{bmatrix} \& \ \exists \boxed{3} \begin{pmatrix}\texttt{npi-lic}(\boxed{3},\boxed{2}) \ \& \ \boxed{1} \leq \boxed{3}\\ \& \ \neg\exists \boxed{4}\left(\texttt{pot-inter}(\boxed{4},\boxed{1},\boxed{3})\right)\end{pmatrix}$$

The specifications in (30) and (31) are necessarily very schematic. It is known that NPIs show variation with respect to their licensing contexts. Since the theory developed in this paper encodes the licensing requirement as a lexical property of an NPI, it allows further restrictions on individual NPIs or a loosening of the restrictions for more permissive NPIs. At the same time, the schematic specifications exemplify the distinctions that are generally acknowledged to play a role in NPI licensing beyond finer idiosyncratic variation.

Let me address the issue of the syntactic domain of the NPI licensing. So far, I followed Richter and Soehn (2006) in this respect. A simpler theory would assume that it is enough to state that the collocational conditions must be met by the semantic representation of some sign that dominates the NPI. This simplification would still account for almost all the data reported by Richter and Soehn. The only exception are NPI verbs such as *scheren* (*care*) (see (5)). This verb is a weak NPI that requires a clausemate licenser. Here, the simplified theory would overgenerate.

Depending on how the syntax-semantics interface is handled, the simplification might be possible nonetheless. Klooster (1993) argues that weak clausebounded NPIs are typically verbs — he calls them *Negative Polar Heads*. In LRS, which is also the semantic framework assumed in Richter and Soehn (2006), verbs have a semantic specification that is identical to the logical form of the clause in which they occur. This is the EXTERNAL-CONTENT value. To account for the clause-boundedness effect of verbs it is enough to require that the LF-LIC value must be identical to their EX-CONT. This ensures that the NPI is licensed within its own clause. A schematic lexical entry of a Negative Polar Head is shown in (32).

(32) Schematic lexical specification of a weak clausebounded NPI:

$$\begin{bmatrix}\text{SYNS LOC}\left[\text{CONT } \boxed{1}\right]\\ \text{LF}\left[\text{EX-CONT } \boxed{2}\right]\\ \text{COLL}\left\langle\left[\text{LF-LIC } \boxed{2}\ \textit{drs}\right]\right\rangle\end{bmatrix} \& \ \exists \boxed{3} \begin{pmatrix}\texttt{npi-lic}(\boxed{3},\boxed{2}) \ \& \ \boxed{1} \leq \boxed{3}\\ \& \ \neg\exists \boxed{4}\ \exists \boxed{5} \begin{pmatrix}\boxed{4} \neq \boxed{5}\\ \& \ \texttt{pot-inter}(\boxed{4},\boxed{1},\boxed{3})\\ \& \ \texttt{pot-inter}(\boxed{5},\boxed{1},\boxed{3})\end{pmatrix}\end{pmatrix}$$

It seems that the syntactic component from Richter and Soehn (2006) can be removed if we combine the DRT-based theory with an LRS combinatorics. This also leads to a more restrictive theory: It predicts that verbal NPIs, but not nominal NPIs, can be weak and yet clause-bounded — because in LRS verbs, but not nouns, are assumed to have the same EX-CONT value as the clause in which they occur.

I showed how the DRT-based theory of NPI licensing can be formalized in HPSG using the COLL module. I pointed to some differences between my proposal and the one in Richter and Soehn (2006). It should be noted that the elimination of the syntactic domains relies on a particular framework of semantic combinatorics.

Consequently, it is only a side-remark in the present paper.

8 Conclusion

The integration of a theory of NPI licensing has to face two problems: first, how to characterize the licensing domain and second, how to encode the context requirement of an NPI inside its lexical entry. This paper attempts to make an original contribution to the first of these two questions, while building on an earlier HPSG analysis within a collocational framework for the second question.

DRT allows for a purely representational formulation of the contexts in which NPIs can occur. Instead of listing all NPI licensers individually or marking them explicitly as licensers, the decomposed semantic representation of the licensers is sufficient. Since licensers such as *few* introduce a negation and a quantifier, the occurrence constraints of NPIs immediately account for the fact that only weak NPIs are possible in such constellations. The constraints also capture the attested intervention effects. Future work has to show whether reasonable logical forms can be given for non-declarative sentences which allow for a natural extension of the present theory to NPI-licensing contexts such as interrogatives and imperatives.

Another extension would be to generalize the notion of an NPI-licensing DRS from the antecedent of an implicational condition ($K \Rightarrow K'$) to all first DRSs in a duplex condition. This would still capture the NPI licensing in the discussed contexts, but it would at the same time generalize to contexts which have been identified as highly problematic for entailment-based theories of NPI licensing. Israel (1995, 2004) shows that an NPI is licensed in the restrictor of a proportional determiner independent of its monotonicity properties if a rule-like interpretation of the sentence is possible. The following variation of an example with a universal quantifier from Heim (1984) can be used for illustration.

(33) [Most restaurants that charge <u>as much as</u> a dime for iceberg lettuce]
  a. should be shut down.
  b. *happen to have four stars in the handbook.

In this example the strong NPI *as much as* is licensed in the restrictor of *most*, even though this position is not downward-entailing. In a DRT-based approach this context patterns naturally with the other NPI-licensing contexts: It is the first DRS in a duplex condition. While this certainly is a straightforward and promising extension of the present analysis, further research is needed to capture the contrast between the two different continuations in (33), i.e. the question of why the strong NPI is only felicitous in a rule-like statement but not in a more episodical statement.

The combination of DRT and HPSG has proven fruitful in a number of other papers quoted at the beginning of Section 4. The present discussion has shown that the independently motivated semantic representations assumed in DRT provide exactly the right structures and distinctions for a representational theory of

NPI licensing. Since HPSG's linguistic objects contain semantic representations, DRT is a natural choice as a semantic formalism. Finally, the research on collocations carried out within HPSG can be put to use for an explicit encoding of NPI properties as distributional idiosyncrasies of individual lexical items.

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A lexical account of Sorani Kurdish prepositions

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Abstract

In Sorani Kurdish dialects, the complement of a preposition can generally be realized either as a syntactic item (NP, independent pronoun or PP) or a bound personal morpheme (clitic/affix). However, the affixal realization of the complement gives rise to a range of specific phenomena. First, some prepositions display two different phonological forms depending on the realization of their complement: the variant combining with a syntactic item is referred to as 'simple', while the variant combining with an affixal complement is called 'absolute'. Furthermore, unlike syntactic complements, which are always realized locally, the affixal complement of an absolute preposition can have a non-local realization, attaching to a host with which it has no morphosyntactic relations. In order to deal with these facts, this paper proposes a classification of Sorani prepositions along two lines: the affixal versus non-affixal realization of the complement on the one hand and its local versus non-local realization on the other hand. All cases of non-local realization receive a lexical account, either in terms of argument composition or in terms of linearization constraints on domain objects.

1 Introduction

Sorani Kurdish dialects[1] have a rich class of prepositions and prepositional collocations with a complex syntactic behavior. This situation results from two factors. The first one involves the historical constitution of this class: the initial set of prepositions has progressively been enriched with elements borrowed from other classes, such as substantives, which generally combine with primary prepositions to form compound prepositions. Some of them, however, have undergone a grammaticalization process and can function as prepositions by themselves. These 'new' prepositions have nevertheless preserved a part of their nominal properties and differ with respect to their morpho-syntactic properties from primary prepositions.

The second factor concerns the realization of the complement: some prepositions allow for a clitic (affixal) realization of their complement, while others do not. Furthermore, the alternation of the form of the complement can give rise to an allomorphic variation of the preposition itself. Finally, depending on the preposition, the clitic complement does not necessarily attach to the preposition and can be realized at distance.

In order to account for these properties, this paper suggests a classification of Sorani Kurdish prepositions along two dimensions: the affixal versus non-affixal

[†]I am especially indebted to Amr Ahmed, my principal informant for the Kurdish data, for his patient and enthusiastic contribution to this study. I am also grateful to Olivier Bonami, for his valuable comments and suggestions.

[1]Sorani is one of the two principal branches of Kurdish, the other one being Kurmanji. Sorani dialects are spoken in Iraq and Iran, by about five million speakers. The dialect under study in this paper is the one spoken in the region of Suleymaniye, in Irak.

realization of the complement on the one hand and its local versus non-local realization on the other hand. The clitic realization of the complement is argued to be an instance of affixation and a lexicalist account is outlined for all cases of non-local realization of the clitic, either in terms of argument composition or in terms of constraints on the linearization of domain objects.

2 Preposition classes in Sorani

Within Sorani prepositions, a first distinction can be established between primary prepositions and non-primary prepositions (i.e. prepositions resulting from: i) the combination of a primary preposition and another lexical unit, a substantive or adverb for instance; ii) grammaticalization of other lexical units, such as substantives for instance). Primary prepositions are in turn divided into two subclasses, simple prepositions and absolute prepositions (Mackenzie, 1961).

2.1 Primary prepositions: Simple versus absolute distinction

The members of this class (Table (1)) constitute the original set of Kurdish prepositions descending from Proto-Iranian prepositions.

Primary prepositions		
Simple	Absolute	
ba	*pê*	'to', 'with', 'at'
bê	–	'without'
bo	(*bo*)	'for'
-a	*-ê*	'to'
la	*lê*	'of', 'in'
tâ	–	'until'
da	*tê*	'to', 'with', 'at'
lagal	(*lagal*)	'with'

Table (1)

As one may notice, some of these prepositions display two phonological variants referred to as 'simple' and 'absolute' by Mackenzie (1961). The simple variant does not bear lexical stress and undergoes proclisis, while the absolute variant is accentuated. The relation between the two variants can be viewed as an allomorphic variation triggered by clitic versus non-clitic (non-affixal) realization of the complement:[2]

[2]The term 'clitic' is used here in a pre-theoretical sense to designate one of the two sets of bound personal morphemes in Sorani and does not entail a syntactic view of these items. These forms resemble 'special clitics' (see Zwicky (1977) and Anderson (1992), among others) with respect to their placement properties: they do not occur in the canonical syntactic position they would be expected to occur and can attach to a variety of hosts. As it has been argued in detail by Samvelian (2006),

‘Corresponding to the simple *ba*, *wa*, *la*, *da*, *-a*, there are the following ‘absolute’ forms, employed when the form governed is other than an independent noun or pronoun: *pê*, *wê*, *lê*, *tê*, *-ê* (Mackenzie, 1961, p. 123).’

‘These forms [i.e. absolute prepositions] must be used when the preposition governs a pronoun expressed as an affix (Edmonds, 1955, p. 496).’

Simple prepositions combine with syntactic items (NP or independent pronoun), but never with a clitic:[3]

(1) (a) min ba Narmîn/to da-lê-m
(I) to Narmin/you IPFV-tell.PRS-1.SG
‘I am telling to Narmin.’
(b) Âzâd la jêr mêz da-xaw-ê
Azad to under table IPFV-sleep.PRS-3.SG
‘Azad is sleeping under the table.’
(c) *ba=t da-lê-m
à-2.SG IPFV-say.PRS-1.SG
(putatively) ‘I am telling you.’

By contrast, absolute prepositions take a clitic complement:

(2) pê=t da-lê-m
to=2.SG IPFV-say.PRS-1.SG
‘I am telling you.’

(3) *pê Narmîn/to da-lê-m
to Narmin/*you IPFV-say.PRS-1.SG
(putatively)‘I am telling Narmin/you.’

Furthermore, as will be discussed in detail in section (4), unlike simple prepositions whose complement is always realized locally (i.e. within the PP), absolute prepositions allow for a non-local realization of their clitic complement.

Table (1) requires some further comments. Two prepositions, *bê* ‘without’ and *tâ* ‘until’, do not display an absolute variant. The prepositions *bo* ‘for, to, towards’ and *lagal* ‘with’, which are generally considered as simple prepositions, can nevertheless combine with a clitic complement without displaying phonological variation. This is the reason why, in this study, they also occur in the column of absolute

despite some degree of syntactic transparency, these forms are best regarded as affixes, on a par with the other paradigm of bound personal forms in Sorani, verbal personal endings, which always attach to the verb. In this paper, the label ‘clitic’ is nevertheless maintained for convenience sake in order to distinguish the members of the two sets of bound personal forms.

[3] Abbreviations: COP = copula, DEF = definite, EZ = ezafe, INDEF = indefinite, IPFV = imperfective, OBL = oblique, PST = past, PERF = perfect, PL = plural, PRS = present, SG = singular.

prepositions. Finally, *-a* 'to', and its absolute variant *-e*, both enclitics, have an extremely limited distribution and always occur after a verb:

(4) Sîrwân kitêb-aka da-dat=a Narmîn
Sirwân book-DEF.SG IPFV-give.PRS=to Narmin
'Sirwan is giving the book to Narmin.'

Primary prepositions have more or less a weak semantic content. They generally introduce subcategorized complements of verbs (ex. (1-a), (2) and (4)), but also some temporal and locative circumstances (ex. (5)). In order to express a more specific semantic content, Sorani uses either compound prepositions (i.e. a combination of a simple preposition and a nominal or adverbial item) or circumpositions (i.e. combination of a preposition and a postposition).

(5) (a) la Pârîs dost-akân dît
at Paris friend-DEF.PL see.PST
'She/he met her/his friends in Paris.'
(b) ba šaw Sîrwân da-xaw-ê u ba roj îš
at night Sirwan IPFV-sleep.PRS-3.SG and at day work
da-k-â(t)
IPFV-do.PRS-3.SG
'Sirwan sleeps during the night and works during the day.'

2.2 Non-primary prepositions (compound and nominal prepositions)

The combination of the simple prepositions *la*, *ba* and *a* with nominal and adverbial elements such as *sar* 'head', *pišt* 'back', *bar* 'side', *paš* 'ahead', etc. gives rise to 'compound prepositions' (Mackenzie, 1961):

(6) (a) kitêb-aka la sar mêz-a
book-DEF.SG to head table-COP.3.SG
'the book is on the table.'
(b) Sîrwân xo=y la pišt Alî šârd-awa
Sirwan self-3.SG to behind Ali hide.PST-PERF
'Sirwan has hiden himself behind Ali.'
(c) čû-m=a sar čom-î Ancîna
go-1.SG-to head river-EZ Ancina
'I went to the river Ancina.' (Bassols-Codina, 1992)

Kurdish grammars generally consider combinations such as *la sar* to be single items and provide their inventory. Nevertheless, it is not always clear whether these combinations are definitely lexicalized as single lexical units, in which case the whole sequence is opaque for the purposes of syntax and behaves like a single preposition, or whether each item functions as an independent word, i.e. a preposition, in itself. In this case, the simple preposition combines with the PP headed by *sar* or *pišt*.

The first alternative is supported by the fact that, in many cases, the simple preposition cannot be dropped:

(7) (a) *kitêb-aka sar mêz-a
book-DEF.SG on table-COP.3.SG
'The book is on the table.'
(b) *Sîrwân xoy pišt Alî šârd-awa
Sirwan self behind Ali hide.PAS-PERF
(putatively) 'Sirwan has hidden himself behind Ali.'

This tends to prove that *sar* and *pisšt* do not function as prepositions by themselves. However, in some other cases, the simple preposition is either optional or excluded:

(8) (a) (la) pâš awa
(at) after this
'after this'
(b) kišt-u-kâl=yân jêr âw bû
culture=3.PL under water is.PST
'The cultures were inundated.' (Lit. The cultures were under water) (Edmonds, 1955, p. 500)

I will not take a definite stand on this issue here, which requires further invesigation. For the purpose of classification, I will consider that sequences like *la sar*, *la pâš*, and *-a sar* in (6) form a single syntactic unit, a compound preposition, while in (8), *pišt* and *jer* are prepositions by themselves. They will be referred to as nominal prepositions.

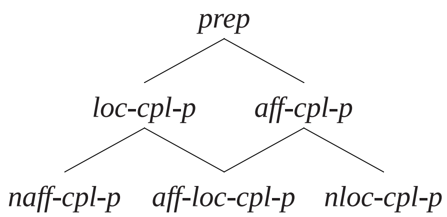
Like absolute prepositions, compound and nominal prepositions can combine with a clitic complement. However, unlike the former, they do not allow for a non-local realization of their clitic complement.

(9) (a) Sirwân xoy la pišt=im sârd-awa
Sirwan himself at behind=1.SG hide.PST-PERF
'Sirwan has hidden himself behind me.'
(b) (la) pâš=im
(à) après=1.SG
'after me'

3 Preposition types and hierarchy

On the basis of the facts just examined, the type hierarchy in (10) is proposed for Sorani prepositions. This hierarchy gives rise to three maximal types. The supertype *prep* has two subtypes, *loc-cpl-p*, a preposition whose complement is realized locally, and *aff-cpl-p*, a preposition whose complement is realized as an affix.

(10) Preposition types and hierarchy



Each type has in turn two subtypes. The type *loc-cpl-p* allows for its complement to have an affixal or a non-affixal realization, which gives respectively *aff-loc-cpl-p* and *naff-cpl-p* maximal types. The prepositions of type *aff-cpl-p* have either their complement realized locally, *aff-loc-cpl-p*, or non-locally, *nloc-cpl-p*. Note that unlike the *aff-loc-cpl-p* type, which inherits from both *loc-cpl-p* and *aff-cpl-p* supertypes, *naff-cpl-p* and *nloc-cpl-p* types inherit from only one supertype, respectively *loc-cpl-p* and *aff-cpl-p*. This type hierarchy has two consequences: first the non-affixal complement of a preposition has always a local realization, and second the non-local realization for the complement of a preposition is necessarily affixal. Here are some examples of each maximal type:

(11) *naff-cpl-p*: *ba Narmîn* ‘to Narmin’, *la sar mêz* ‘on the table’

(12) *aff-loc-cpl-p*: *pê=t* ‘to you’, *la pišt=it-awa* ‘behind you’

(13) *nloc-cpl-p*: *pê* ‘to’

Simple prepositions are always of type *naff-cpl-p*. Compound and nominal prepositions are either *naff-cpl-p* or *aff-loc-cpl-p*, depending on whether their complement is realized as a syntactic item or as an affix. Finally, absolute prepositions are of type *aff-loc-cpl-p*, in case their complement is realized locally, or of type *nloc-cpl-p*, if their complement is realized at distance.

Constraint (14) applies to all prepositions by default and requires that the members of the ARG-ST list occur also on the COMPS list:

(14) Default argument realization for prepositions

$$prep \rightarrow \left[\text{ARG-ST} / \boxed{1}, \text{COMPS} / \boxed{1}\ \right]$$

The following constraints are associated to specific types:

(15) *aff-cpl-p* → [ARG-ST <*aff*>]

(16) *naff-cpl* → [ARG-ST < *canon* >]

(17) *aff-loc-cpl* → [COMPS < >]

Constraint (15) and (16) state respectively that, if a preposition is of type *aff-cpl-p*, then the members of its ARG-ST are of type *aff* (*affixal*) and, if a preposition is of type *naff-cpl-p*, then the members of its ARG-ST list are of type *canon* (*canonical*). Finally, constraint (17) requires that the COMPS list of an *aff-loc-cpl-p* be empty.

4 The non-local realization of the clitic complement

As mentioned previously, the clitic complement of an absolute preposition can have a non-local realization. However, this realization is subject to strict constraints and is limited to two cases: the complement either occurs with the verb or attaches to the right edge of the constituent immediately preceding the preposition.

These two possibilities are in complementary distribution:

1. The first only occurs with transitive verbs in the past tenses.

2. The second occurs either with transitive verb in the present tenses or with intransitive verbs (regardless of the tense).

The two cases of non-local attachment will receive two different lexical treatments. Attachment to the verb will be considered as an instance of argument (Abeillé et al. (1998), Hinrichs and Nakazawa (1994), Miller and Sag (1997), Tseng (2004), among others), while attachment to a constituent preceding the preposition will be accounted for in terms of linearization constraints on DOMAIN objects (Crysmann (2002), Crysmann (2003) and Kathol (2000)).

4.1 Attachment to the verb

When an absolute preposition occurs in a past transitive construction and introduces an argument of the verb, the complement of the preposition occurs on the verb and not on the preposition. The significant fact is that, contrary to what would be expected, the complement is not realized as a 'clitic' in this case, but as a 'verbal personal ending'. The latter constitutes, along with the clitics, the two paradigms of bound personal forms in Sorani. Before going through the description of this case of attachment, a brief presentation of these two paradigms would be useful.

Apart from independent pronouns, Sorani displays two other paradigms of personal morphemes, which are bound forms:

Independent Pronouns		
	Sg	Pl
1	*min*	(*h*)*êma*
2	*to*	*êwa*
3	*awa*	*awân*

Table 2

Clitics		
	Sg	Pl
1	*-(i)m*	*-mân*
2	*-(i)t*	*-tân*
3	*-î/-y*	*-yân*

Table 3

Verbal endings		
	Sg	Pl
1	*-(i)m*	*-în*
2	*-î*	*-(i)n*
3	*-ê(t)/Ø*	*-(i)n*

Table 4

When used in relation with a verb, these bound forms assume the same functions and are in complementary distribution in the following way:

1. With transitive and intransitive verbs in the present tenses and only intransitive verbs in the past tenses, personal endings realize subject agreement and are compulsory. Clitics, if present, are generally interpreted as the direct object of the verb.

2. With transitive verbs in the past tenses, a reversed pattern is observed. Clitics realize subject-verb agreement and are compulsory. Personal verbal endings, if present, are interpreted as a direct object.

The two paradigms differ with respect to their placement properties:

a. Personal endings always attach to a verb and follow the verbal stem. These are word-level affixes.

b. Clitics, roughly speaking, attach to the right edge of the 'verbal phrase' (i.e. an instance of the so-called 'second position' clitics). When the verb is the first member of the VP, the clitic interrupts the verb (i.e. endoclitic) and is placed after the first morpheme of the verb.

The examples in (18) illustrate the situation described in (1) above. The personal ending is placed after the verbal stem and realizes subject-verb agreement. Note that the subject is realized independently, either as a pronoun or an NP. A clitic occurs in (18-c), a present transitive construction, which refers to the direct object of the verb. Note that, in this case, the clitic alternates (i.e. is in complementary distribution) with an NP or and independent pronoun, in other words, clitic doubling is excluded.

(18) (a) bê to na-ro-**m**
without you NEG-go.PST-1.SG
'I won't go without you.'
(b) Azad u Narmîn lagal Ali hat-**in**
Azad and Narmin with Ali come.PST-3.PL
'Azad and Narmin came with Ali.'
(c) min ba Narmîn=**î** (ba kurdî) da-lê-**m**
I to Narmin=3.SG (in Kurdish) IPFV-tell.PRS-1.SG
'I am telling it to Narmin (in Kurdish).'

The examples in (19) illustrate the situation described in (2) above. In both examples, the clitic is attached to the right edge of the NP which realizes the direct object. Note that in (19-a) no personal verbal ending is present. In (19-b), by contrast, the NP realizing the direct object is doubled by a personal verbal ending. Thus, although doubling is possible in this case, it is by no means obligatory.

(19)	(a)	(min)	kitêb-êk**=im**	bo	Narmîn	kirî
		(I)	book-INDEF.SG=1.SG	for	Narmin	buy.PST
		'I bought a book for Narmin.'				
	(b)	bâzirgân-akân	asp-akân**=yân**	da-kirî(**-in**)		
		tradesman-DEF.PL	horse-DEF.PL=3.PL	IPFV-buy.PST-(3.PL)		
		'The tradesmen were buying the horses.' (Blau, 1980, p. 71)				

It should be mentioned at this point that the facts just discussed can receive a totally different account such that personal endings would regularly be considered as agreement-markers while clitics would be regarded as bound pronouns realizing one of the arguments of the verb (Patient or Agent). This analysis, which is reminiscent of split ergativity, is the one suggested by Mackenzie (1961), who considers that the NP referring to the Agent argument of the verb in the past transitive construction 'is in no way equivalent to a Subject, in concord with the verbal form'(p. 107). The clitic in this case is an 'agential affix' and the verbal construction is referred to as an 'agential construction' by Mackenzie.

Mackenzie's view is supported by historical facts. Indeed, like Kurmanjî, Sorani has gone through a stage of morphological ergativity with oblique case-marking of the Agent and object-agreement in the past transitive construction, even though almost all Sorani dialects have lost the oblique case-marking. Furthermore, this view has the advantage of providing a unified account for each set of personal bound morphemes. The forms in Table (4) are always regarded as inflectional verbal affixes and function as agreement-markers, while the forms in Table (3), i.e. clitics, regularly realize a verbal argument and are thus bound pronominals.

However, as argued by Samvelian (2006), despite its advantages, Mackenzie's analysis faces problems, the main one being that it does not account for the fact that the clitic is obligatory in the past transitive construction, regardless of the presence of a noun phrase or an independent pronoun referring also to the Agent. Consequently, I will assume that the clitic in the past transitive construction is an agreement marker, and not a bound pronominal.

Let us return now to absolute prepositions in the past transitive construction. As mentioned previously, the complement of the preposition can be realized non-locally, but in this case, it necessarily occurs on the verb and is realized as a verbal personal ending (i.e. forms in Table (4)) and not as a clitic (i.e. forms in table (3)).

(20)	(a)	rojbâš=yân	**lê**	kird-**în**
		good-morning=3.PL	to	do.PST-1.PL
		'They wished us good morning.'		

(b) *rozjbâš=yân **lê** kird=**mân**
good-morning-3.PL to do.PST=1.PL
(putatively)‘They wished us good morning.’

(21) (a) pâra-yêk-î zor-î **lê** wargirt-**im**
money-INDEF.SG-EZ much-3.SG from take.PST-2.PL/3.PL
’He received a great amount of money from you/them.’
(b) *pâra-yêk-î zor-î **lê** wargirt=**tân/yân**
money-INDEF.SG-EZ much-3.SG from take.PST=2.PL/3.PL
(putatively) ’He received a great amount of money from you/them.’

When the direct object is also realized as a bound morpheme, the verbal stem bears two personal endings. The order in which the two affixes are placed seems to be subject to variation in different dialects and even within the same dialect. Edmonds (1955), for instance, claims that the affix corresponding to the complement of the absolute preposition precedes the affix corresponding to the direct object:

(22) Xwâ **bo**=y nard-**im**-î(t)
God to=3.SG send.PAST-1.SG-2.SG
‘God sent you to me.’ (Edmonds, 1955)

While Mackenzie (1961) gives the reverse order:

(23) **lê**=y sand-in-**în**
for=3.SG take.PAST-3.PL-1.PL
‘He took them for us.’ (Mackenzie, 1961, p.116)

(24) xwâ dâ=m-î-**n=ê**
God give.PAST=1.SG-3.SG-2.PL=to
‘God gave me to you.’

To sum up, in the past transitive construction, the complement of the preposition behaves very much like a direct complement of the verb. The metamorphosis of the clitic into a personal ending constitutes a problem for a syntactic view of the clitic, and rather calls for a morphological account, where both the clitic and the personal ending are considered as affixes realizing the same exponent in two different forms, according to the head to which the affix is adjoined.

The realization of the argument of the preposition on the verb can then be viewed as an instance of argument composition. The subcategorization requirements of the absolute preposition are inherited by the verb, and the affixal argument of the absolute preposition is realized as an affixal argument of the verb. The lexical rule in (25) applies to verbs that subcatgorize for a PP complement. A verb that subcategorizes for a PP complement can instead subcategorize for two complements: the preposition itself and the element corresponding to the unsaturated complement of the preposition.

(25) Argument composition lexical rule

$$\begin{bmatrix} \textit{verb} \\ \text{COMPS } \langle \ldots \begin{bmatrix}\text{HEAD } \textit{prep}, \text{ COMPS } \langle\,\rangle\end{bmatrix} \ldots \rangle \end{bmatrix}$$
$$\Longrightarrow \begin{bmatrix} \text{COMPS } \langle \ldots \begin{bmatrix} \text{HEAD } \textit{prep} \\ \text{COMPS } \langle \boxed{1} \rangle \end{bmatrix} \ldots \rangle \bigcirc \langle \boxed{1} \rangle \end{bmatrix}$$

Recall that clitics are assumed to be affixes, on a par with personal verbal endings, and are thus handled morphologically. This implies that personal affixes (*pers-aff*) have two subtypes in Sorani Kurdish, *cl-pers-aff* (clitic personal affixes) and *v-pers-aff* (verbal personal affixes). The information transmitted to the verb is that one of the members in its COMPS list is an affix (i.e. *affixal synsem*). The concrete form of the affix is not transmitted, since it is calculated by morphological realizational schemata involving the verbal conjugation (see Crysmann (2002)).

4.2 The clitic precedes the preposition

With intransitive verbs or with transitive verbs in the present tenses, the clitic complement of the preposition can attach to the right edge of the constituent that immediately precedes the preposition. Thus, although the clitic is not phonologically attached to the preposition, it must nevertheless be noted that it always occurs adjacent to it.[4]

(26) (a) rojbâš=**yân** **lê** a-kâ
good-morning=3.PL to IPFV-say.PRS
'He wishes them 'Good Morning'.'
(b) êma=**y** **tê** nâ-ç-în
we=3.SG to NEG-go.PRS-3.PL
'We do not go there.' (Edmonds, 1955, p. 498)

Consequently, unlike the previous case, this placement does not involve a real non-local realization, but rather two different possibilities in the linearization of the preposition and its affixal argument.

In order to handle this case, I will adopt a linearization-based account worked out by Crysmann (2003) on the basis of Kathol (2000). The main idea behind this approach is that the relationship between word-level signs and the word order domain object they contribute need not to be isomorphic and that word-level signs can contribute more than one domain object into syntax. The clitic is introduced in the lexical entry of the absolute preposition, even though the two items are not strictly ordered. Linearization constraints provide then different order possibilities. The clitic can thus be placed before or after the preposition, but being an enclitic it always attaches to the left. Consequently, when preceding the preposition, it forms

[4]Thackston (2006) claims that the clitic and the preposition can be separated by one or more items, but he gives no convincing example illustrating this possibility.

a prosodic unit with the word it follows, and not with the preposition, with which it has a morphotactic relation.

It is first assumed that prepositions of type *aff-loc-cpl-p* contribute two domain objects in their DOM list. Prepositions of type *naff-loc-p* and *nloc-cpl-p*, like ordinary lexical items contribute one domain object by default.[5]

(27) Constraint on *aff-loc-cpl-p*

$$\begin{bmatrix} \textit{aff-loc-cpl-p} \\ \text{DOM} \left\langle \begin{bmatrix}\text{PHON } \boxed{1}\end{bmatrix} \right\rangle \bigcirc \left\langle \begin{bmatrix}\text{PHON } \boxed{2}\end{bmatrix}\right\rangle \\ \text{M} \left\langle \begin{bmatrix} \textit{prep} \\ \text{PHON } \boxed{1}\end{bmatrix}\right\rangle \oplus \left\langle \begin{bmatrix}\textit{p-cl-aff}\\ \text{PHON } \boxed{2}\end{bmatrix}\right\rangle \end{bmatrix}$$

In line with Crysmann (2002), I use the feature M(ORPH) to represent the internal morphological structure of words. This feature, which takes a list of elements of type *morphe* as its value, is valid only for lexical items (i.e. not for *phrases*). Like *lexemes*, *affixes* are considered as *morphes*. In other words, *affixes* and *lexemes* are the two subtypes of *morphe*. However, unlike *lexemes*, *affixes* are not signs. Objects of type *morphe* have minimally the feature PH(ONETIC), but only *lexemes* are specified for the feature M(ORPH).

The morphological schema in (28) introduces the clitic in the lexical entry of the absolute preposition and thus produces an ‘affixed preposition’. It further registers the consequence of this affixation on the COMPS list of the preposition. The clitic is identified as the argument of the absolute preposition and is discharged from the COMPS list of the preposition, which is now empty. Note that the preposition and the clitic are not strictly ordered, and thus the clitic can either precede or follow the preposition. Since the clitic corresponds to a distinct DOM object, discontinuous realization of the clitic and the preposition is rendered possible.

(28) Clitic affixation morphological schema

$$\begin{bmatrix} \textit{aff-loc-cpl-p} \\ \text{DOM} \left\langle \begin{bmatrix} \text{PHON } \boxed{1} \\ \boxed{3}\ \text{SS}|\text{LOC} \begin{bmatrix} \text{CAT}|\text{HEAD } \textit{n} \\ \text{CONT } \textit{ppro} \end{bmatrix} \end{bmatrix} \right\rangle \bigcirc \left\langle \begin{bmatrix}\text{HEAD } \boxed{2}\end{bmatrix} \right\rangle \\ \text{M} \left\langle \begin{bmatrix} \textit{p-cl-aff} \\ \text{PHON } \boxed{1} \end{bmatrix} \right\rangle \bigcirc \text{ LIST} \\ \text{SS}|\text{LOC} \begin{bmatrix} \text{HEAD } \boxed{2} \begin{bmatrix}\textit{aff-loc-cpl-p}\end{bmatrix} \\ \text{VAL}|\text{COMPS } \langle\ \rangle \\ \text{ARG-ST} \left\langle \boxed{3} \right\rangle \end{bmatrix} \end{bmatrix}$$

[5] As one may have noticed, absolute prepositions are not the only lexical items displaying such a property in Sorani Kurdish. Verbs also can contribute more than one domain object, given the fact that clitics can have a non-local realization when used in relation with a verb, either as agreement or argument markers.

Constraints in (29) and (30) provide the two linearization possibilities for the clitic and the preposition:

(29) Adjacency constraint

$$\begin{bmatrix} \textsc{dom}\left\langle \boxed{1}\left[\textsc{head}\ \textit{aff-loc-cpl-p},\ \textsc{comps}\left\langle \boxed{2}\right\rangle\right]\right\rangle \\ \bigcirc \left\langle \boxed{2}\ \textit{p-cl-aff} \right\rangle \bigcirc\ \textit{list} \end{bmatrix} \rightarrow$$

$$\left[\textsc{dom}\left\langle \boxed{1}, \boxed{2}\right\rangle \bigcirc\ \textit{list}\right] \vee \left[\textsc{dom}\left\langle \boxed{2}, \boxed{1}\right\rangle \bigcirc\ \textit{list}\right]$$

This constraint requires that the preposition and the clitic be adjacent, when the clitic follows the preposition.

The following constraint restricts the realization of the clitic before the preposition to either intransitive verbs or to the present tense:

(30) Constraint on the verbal tense and construction

$$\begin{bmatrix} \textit{clause},\ \textsc{dom}\left\langle \boxed{1}\left[\textsc{head}\ \textit{aff-loc-cpl-p},\ \textsc{comps}\left\langle \boxed{2}\right\rangle\right]\right\rangle, \\ \left\langle \boxed{2}\ \textit{p-cl-aff} \right\rangle \bigcirc\ \textit{list} \end{bmatrix} \rightarrow$$

$$\left[\textsc{head}\ \textit{verb}\ \textsc{vform}\ \textit{present}\right] \vee \left[\textsc{head}\ \textit{verb}\ \textsc{vform}\ \textit{intransitive}\right]$$

5 Conclusion

In this paper, I have proposed a classification of Sorani prepositions along two lines, the affixal versus non-affixal realization of the complement, on the one hand, and its local versus non-local realization on the other. I have then outlined a lexical analysis of all cases of non-local realization, either in terms of argument composition or in terms of linearization constraints on DOMAIN objects.

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Type Hierarchies for Passive Forms in Korean

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Abstract

This paper aims to provide type hierarchies for Korean passive constructions on the basis of their forms within the HPSG framework. The type hierarchies proposed in this paper are based on the classification of Korean passives; suffixal passives, auxiliary passives, inherent passives, and passive light verb constructions. Verbs are divided into five subtypes in accordance with the possibility of passivization. We also provide type hierarchies for verbal nouns and passive light verbs.

1 Introduction

The passive is one of the most frequently analyzed constructions in the tradition of modern linguistics. Within the HPSG framework, the passive construction has been interpreted as a relationship between two verb forms (Sag and Wasow 1999:233), and lexical-rule based approaches have been employed in the analysis of the passive (Müller 2000). Korean passive constructions have also been a hot topic since the early days of Korean generative grammar. However, the constraint-based perspective on Korean passive constructions was introduced only recently, and there is few literature of the Korean passive in HPSG. Chang (1995) might be the first to have provided an analysis of Korean passive within the constraint-based framework. In recent years, Kim (2005) recast the Korean passive within the HPSG analysis and tried to find a solution to computational implementation for it. These previous studies offer an overall picture of Korean passives constructions, but they dealt with passives rather on an illustrative basis, showing that some samples can be handled in HPSG. The goal of this paper is to propose more fine-grained type hierarchies for the Korean passive constructions within the constraint-based grammar.

1.1 The Passive Forms

Haspelmath (1990:27) claims 'passive constructions without passive morphology do not exist.' Yeon (2005:587), likewise, says that morphological aspects have been disregarded in comparison with syntactic or semantic view in the study of Korean passives. Since passive expressions generally contain passive markers, the forms play an important role in the characterization of passives. We also regard the forms, in particular, the forms of VPs, as a significant criterion for Korean passive types. Keenan (1985:246) argues that linguists who want to study passives should take a serious view of 'ways of forming verb phrases,' because passives belong to

† We would like to thank Prof. Kiyong Lee, Prof. Jong-Bok Kim and Prof. Suk-Jin Chang for their help throughout this research. We appreciate the comments on an earlier version of this paper from anonymous readers, and also are thankful for the comments from some members of the audience during the HPSG conference held at Stanford, July 20-22, 2007. Of course, all remaining errors are our own responsibility.

the process of verbal formations. In this study, we observe the verbal formation of passive constructions in Korean, and seek to find out the constraints based on their forms.

1.2 The Scope of Korean Passives

Since there seems to be no clear consensus as to the scope of the passive constructions in Korean, we adopt the following assumption from a cross-linguistic perspective. Hereafter, all analyses to Korean passives will be grounded on (1).

(1) The Scope of Korean Passives
  a. In principle, only transitive verbs can be transformed into passives. The passive sentence, therefore, must have both agent and theme roles, though the agent role may not be realized overtly.
  b. There should be a corresponding active form for each passive form. Besides, passives must be morphologically distinct from their corresponding actives.

1.3 The Data Compilation

We have attempted to consider the range of relevant data for our studies in a systematic and comprehensive way, because we believe that the data-oriented approach works for describing the characteristics of language much better. In order to collect relevant data, we took advantage of four linguistic resources as follows: the *Sejong POS-tagged Corpora*[1], the *Sejong Electronic Dictionary*, the *Standard Korean Dictionary*, and the *Yonsei Korean Dictionary*. In the following, especially in Sections 3.1 and 4.1, we will give a full detail of the process of data collection for our study.

2 Basic Data

Passive constructions in Korean are divided into three subgroups; suffixal passives, auxiliary passives, and passive light verb constructions. Suffixal passives are expressed by suffixes whose occurrence is conditioned largely by the stem-final sounds. There are four variants in the suffix; *-i*, *-hi*, *-li*, and *-ki*. For example, *ccic-* ‘tear’ takes the suffix *-ki* to form a passive verb like *ccic-ki-* ‘be torn.’ Auxiliary passives are phrasal passives which consist of a verbal stem followed by the complementizer *-e* or *-a* and the auxiliary *-ci* as in *ccic-e ci-* ‘be torn.’ Passive Light Verb Constructions (henceforth pLVCs, named after Chae 2003) are the ones that consist of verbal nouns (hereafter VNs) and passive light verbs (hereafter pLVs), such as *toy-*, *pat-*, and *tangha-*. For instance, the active light verb construction, such as *chepel ha-* ‘punish’ which is made up of a verbal noun *chepel* ‘punishment’ and a

[1] These morpheme-tagged corpora include approximately ten-million “words,” or graphic words which are called *eojeol* in Korean.

light verb *ha-*, can be transformed into the passives, as in *chepel toy-/pat-/tangha-* 'be punished.'

The issue which we would like to raise is that there are some restrictions on which type of passive construction is possible for a given active sentence. The main purpose of this study is to propose a solution for the puzzle of constraints regarding their passive forms.

2.1 Suffixal Passives vs. Auxiliary Passives

Typical passive forms of verb in Korean contain suffixes like *-i*, *-hi*, *-li* and *-ki*, and therefore the active-passive correspondence has been treated either as part of a syntactic process or as a lexical redundancy rule. However there are a large number of exceptions to this generalization, and this should be taken into account. For example, there is no passive counterpart **mandul-li-* of an active verb *mandul-* 'make', as shown in (2).[2]

(2) a. *Mia-ka* *ku* *sangca-lul* *mandul-ess-ta.*
   Mia-NOM DET box-ACC make-PAST-DC
   'Mia made the box.'
  b. **ku* *sangca-ka* *mandul-**li**-ess-ta.*
   DET box-NOM make-**PASS**-PAST-DC
   'The box was made.'
  c. *ku* *sangca-ka* *mandul-**e*** ***ci**-ess-ta.*
   DET box-NOM make-**COMP** **AUX**-PAST-DC
   'The box was made.'

There is no such expression like (2b), because some verbs like *mandul-* cannot be used as passives with suffix. Whereas verbs like *mandul-* cannot combine with any kind of passive suffix, verbs like *tat-* 'close'[3] are the opposite with reference to passivization. Though the auxiliary passive construction is a more productive operation than the suffixal passive construction, yet certain verbs sound odd when passivized in this way.[4]

(3) a. *Mia-ka* *ku* *sangca-lul* *tat-ass-ta.*
   Mia-NOM DET box-ACC close-PAST-DC
   'Mia closed the box.'
  b. *ku* *sangca-ka* *tat-**hi**-ess-ta.*
   DET box-NOM close-**PASS**-PAST-DC
   'The box was closed.'

---

[2] The glosses used in this paper are as follows.
ACC: accusative, AUX: auxiliary, COMP: complementizer suffix, DAT: dative, DC: Declarative sentence-type suffix, DET: determiner, LV: light verb, NOM: nominative, PASS: passive suffix, PAST: past tense suffix, PLV: passive light verb

[3] In Korean, *tat-* 'close' is used only as a transitive verb, unlike English.

[4] It could be somewhat controversial to make a comparison between the less productive one and the more productive one. But the primary goal of this paper is to draw an outline of the Korean passive system. Therefore it is necessary to discuss about the difference in form concerning passivization, which is one of the main properties of Korean passives.

c. ??*ku* *sangca-ka* *tat-**a*** ***ci**-ess-ta.*
DET box-NOM close-**COMP** **AUX**-PAST-DC
'The box was closed.'

(3c) sounds awkward, while the suffixal passive predicate in (3b) which corresponds to (3a) sounds perfect. However, as given below, some verbs like *ccic-* 'tear' can be passivized with an auxiliary verb as well as with a suffix.

(4) a. *Mia-ka* *ku* *os-lul* *ccic-ess-ta.*
Mia-NOM DET dress-ACC tear-PAST-DC
'Mia tore the dress.'
b. *ku* *os-i* *ccic-**ki**-ess-ta.*
DET dress-NOM tear-**PASS**-PAST-DC
'The dress was torn.'
c. *ku* *os-i* *ccic-**e*** ***ci**-ess-ta.*
DET dress-NOM tear-**COMP** **AUX**-PAST-DC
'The dress was torn.'

2.2 Passive Light Verb Constructions

There are co-occurrence restrictions between VNs and pLVs. For example, pLV *toy-* can attach to *cheypho* 'arrest' to form the passive verb *cheypho-toy-* 'be arrested,' but the same VN *cheypho* with another pLV *pat-*, such as **cheypho-pat-ta*, is not a legitimate form in Korean as shown below.

(5) a. *kyengchal-i* *Mia-lul* *cheypho-**ha**-yess-ta.*
policeman-NOM Mia-ACC arrest-**LV**-PAST-DC
'A policeman arrested Mia.'
b. *Mia-ka* *kyengchal-eykey* *cheypho-**toy**-ess-ta.*
Mia-ka* *kyengchal-eykey* *cheypho-pat**-ass-ta.*
Mia-ka *kyengchal-eykey* *cheypho-**tangha**-yess-ta.*
Mia-NOM policeman-DAT arrest-**PLV**-PAST-DC
'Mia was arrested by a policeman.'

Which nominal can be taken as the complement of pLVs also falls under the constraint on pLVCs. Korean light verb constructions have the case frame like 'VN(*-ul/lul*[ACC]) + *ha*.' The passive forms for the frame can be divided into two forms; 'VN(*-i/ka*[NOM]) + PLV' or 'VN(*-ul/lul*[ACC]) + PLV.' (6) shows the difference between them clearly.

(6) a. *kyengchal-i* *Mia-lul* *cheypho*(*-lul*) *ha-yess-ta.*
policeman-NOM Mia-ACC arrest-ACC LV-PAST-DC
'A policeman arrested Mia.'
b. *Mia-ka* *kyengchal-eykey* *cheypho*(*-ka*) *toy-ess-ta.*
**Mia-ka* *kyengchal-eykey* *cheypho*(*-ka*) *tangha-yess-ta.*
Mia-NOM policeman-DAT arrest-NOM **PLV**-PAST-DC
'Mia was arrested by a policeman.

c. **Mia-ka* *kyengchal-eykey* *cheypho*(*-lul*) *toy-ess-ta.*
Mia-ka *kyengchal-eykey* *cheypho*(*-lul*) *tangha-yess-ta.*
Mia-NOM policeman-DAT arrest-ACC **PLV**-PAST-DC
'Mia was arrested by a policeman.

There are three forms of passivization for VNs, and the pLVs are distinct from each other with respect to the choice of VNs. The meanings of the three pLVs are different from each other as well. Basically, *toy-* means 'become,' *pat-* may convey a sense of 'reception,' and *tangha-* can be translated into English as 'suffer.' Sentences in (7) are the cases that *toy-*, *pat-*, and *tangha-* are made use of as main verbs with their regular verbal meanings.

(7) a. *Mia-ka* *kyoswu-ka* *toy-ess-ta.*
Mia-NOM professor-NOM **become**-PAST-DC
'Mia became a professor.'
b. *Mia-ka* *pyenci-lul* *pat-ass-ta.*
Mia-NOM letter-ACC **receive**-PAST-DC
'Mia received a letter.'
c. *Mia-ka* *sako-lul* *tangha-yess-ta.*
Mia-NOM accident-ACC **suffer**-PAST-DC
'Mia suffered an accident. (Mia met with an accident.)'

Keenan (1985:257) says that there are four types in respect of periphrastic passives. According to his analysis, periphrastic passives may fall into natural subclasses depending on the choice of the auxiliary verb: 'being' or 'becoming,' 'reception,' 'motion,' or 'experience.'

(8) a. *Hans* *wurde* *von* *seinem* *Vater* *besttaft.*
Hans **became** 'by' his father punished
'Hans was punished by his father.' (German, Keenan 1985:257)
b. *Mia-ka* *chepel-i* *toy-ess-ta.*
Mia-NOM punishment-NOM **become**-PAST-DC
'Mia was punished.'
(9) a. *Cafodd* *Wyn* *ei* *rybuddio* *gan* *Ifor.*
get Wyn his warnings by Ifor
'Wyn was warned by Ifor.' (Welsh, Keenan 1985:259)
b. *Mia-ka* *chepel-ul* *pat-ass-ta.*
Mia-NOM punishment-NOM **receive**-PAST-DC
'Mia was punished.
(10) a. *Quang bi* (*Bao*) *ghet.*
Quang **suffer** (Bao) detest
'Quang is detested (by Bao).' (Vietnamese, Keenan 1985:260)
b. *Mia-ka* *chepel-ul* *tangha-yess-ta.*
Mia-NOM punishment-NOM **suffer**-PAST-DC
'Mia was punished.

From this cross-linguistic viewpoint, it is not surprising that there are three elements in Korean pLVs. And our main concern regarding the difference is on the co-occurrence restrictions on the relationship between the VN and the pLVs, which will be discussed in 4.2.

2.3 Inherent Passives

There are some cases which do not include any passive morpheme on the surface, but yet show passive-active correspondence semantically. For example, verbs like *mac-* 'be hit' and *ttayli-* 'hit' behave like a passive-active pair in terms of their argument structure.

(11) a.	*Inho-ka*	*Mia-lul*	*ttayli-ess-ta.*
	Inho-NOM	Mia-ACC	hit-PAST-DC
	'Inho hit Mia.'		
b.	*Mia-ka*	*Inho-eykey*	*mac-ass-ta.*
	Mia-NOM	Inho-DAT	be hit-PAST-DC
	'Mia was hit by Inho.'		

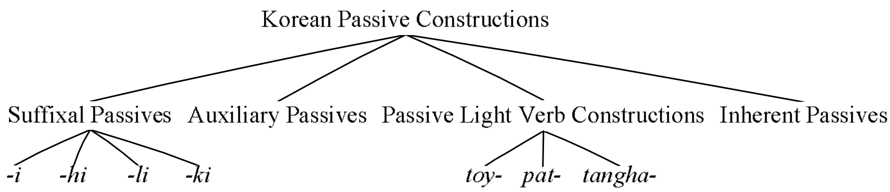
According to Sohn (1999), *mac-* in (11b) may be analyzed as passives in a broad sense, in terms of its passive-like meanings and syntactic behavior.[5] It is noticeable that verbs in (11) cannot be passivized with auxiliary verbs, nor with suffixes (e.g. **ttayli-i-*, **ttayli-e ci-*, **mac-hi-*, and **mac-a ci-*). We call this type 'Inherent Passives'.

2.4 Types of Korean Passives

As was mentioned before, there are some restrictions on the passivization process. It is possible to specify passivization possibility for each verb, but a more efficient way to encode the same information would be to make use of type hierarchy. It would also allow a more natural and systematic grouping of verbs in terms of passivization.

Building on some previous studies (Chang 1995, Sohn 1999, and Kim 2005) and the data given above, we classify Korean passive expressions into four subclasses, including the inherent case. The taxonomy of passives in Korean is sketched out below.

(12)



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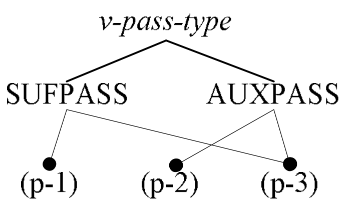
[5] According to the criterion on Korean passives that we assumed previously, this type also belongs to passives.

3 Suffixal, Auxiliary, and Inherent Passives

We propose that verbs in Korean are initially classified into four subtypes with respect to passivization, excluding the ones that don't allow any kind of passivization like *talm-* 'resemble.' The subtypes are primarily differentiated from each other according to whether it allows only one of the suffixal or auxiliary passivization, or both.

(13)



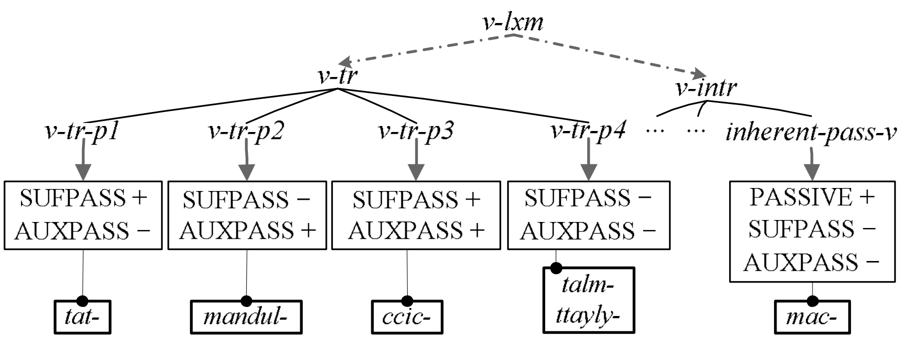
Verbs which allow only suffixal passives belong to (p-1) type. (p-2) type involves the verbs that can be transformed into passives only by auxiliary verbs. Verbs of (p-3) type allow both types of passives. Then there is the other possibility where a verb allows neither suffixal nor auxiliary passives. It can be called type (p-4). Examples for the four types are given in the following table, where the bold faced verbs indicate the blocked forms.

Table (1)

		SUFPASS	AUXPASS
(p-1)	*tat-ta* 'close'	*tat-hi-ta*	***??tat-a ci-ta***
(p-2)	*mandul-ta* 'make'	****mandul-li-ta***	*mandul-e ci-ta*
(p-3)	*ccic-ta* 'tear'	*ccic-ki-ta*	*ccic-e ci-ta*
(p-4)	*talm-ta* 'resemble'	****talm-ki-ta***	***??talm-a ci-ta***

The last line in the table should be distinguished from the cases of the inherent passive verbs like *mac-* 'be hit'. It allows neither passivization processes, but it still has its passive counterpart, albeit inherent, so we suggest that the inherent passive forms its own type. The overall picture of verb types are sketched out in (14)

(14)



The feature specification in (14) shows clearly which kind of passivization is allowed for each type. It also shows if a given type is inherently passive.

3.1 Classification of Verbs

We started from *The Sejong POS-tagged Corpora* to get the list of verbs which have a frequency over nine. There were 1,459 verbs on our initial list. Let us call it List A. Next, we extracted the suffixal passive forms from each of *The Sejong Electronic Dictionary*, *The Standard Korean Dictionary*, and *The Yonsei Korean Dictionary*. Avoiding marginal or controversial cases, we included only the forms which are admitted to be passives in all of the dictionaries as suffixal passives. Finally, we excluded from our suffixal passives list the items whose corresponding active forms are not on List A. As a result, there were 152 Suffixal Passive forms collected in this way.

As for auxiliary passives, we searched the *Sejong POS-tagged Corpora* to find out the phrasal form like 'V-*e/a ci*-.' There were 397 types of verbs which appeared in this context. From this list we excluded some cases through the following four processes. First, the list of verbs were checked against the *Standard Korean Dictionary* to find out the ones that have the suffixal passive forms (e.g. *po-i-ta*, 'be seen') or causatives (e.g. *pes-ki-ta*, 'take off other's clothes') listed in the dictionary. In this way non-active forms were excluded from the 397 types. Second, the verbs which have adjective usage (e.g. *palk-ta*, 'be bright') were also discarded, because an adjective combined with '-*e/a ci*-' has an inchoative meaning as in *palk-a ci-ta* 'brighten.' Third, we also got rid of the verbs which have a locative case-mark alternation, such as NP[loc]-*ey/lul hyangha-ta* 'go towards NP[loc].' Finally, we excluded the items which are not on List A. Consequently, we got 214 verbs that can be passivized by an auxiliary. In accordance with taxonomy mentioned before, we rearranged verbs entries and classified them into three subcategories. Some examples are shown below.

(15) (p-1) *kkakk-ta* 'cut', *mek-ta* 'eat', *ssu-ta* 'use', *cap-ta* 'catch' (110 verbs)
(p-2) *nukki-ta* 'feel', *kus-ta* 'draw', *cis-ta* 'build', *chac-ta* 'find' (172 verbs)
(p-3) *sek-ta* 'mix', *ssu-ta* 'write', *ssis-ta* 'wash', *phwul-ta* 'solve' (42 verbs)

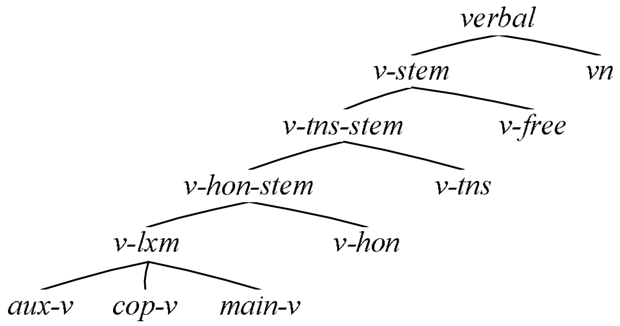
3.2 Suffixal Passives

(16a) shows the typical structure of a verb with its suffixes, and (17) is a type hierarchy for the sequence like (16a) proposed by Kim & Yang (2006). However, notice that passives and causatives are not properly represented in the hierarchy.[6]

(16) a. V-base + (PASS/CAUS) + (HON) + (TNS) + MOOD + (COMP)
b. *cap-hi-si-ess-ta* 'catch-PASS-HON-PAST-DC'

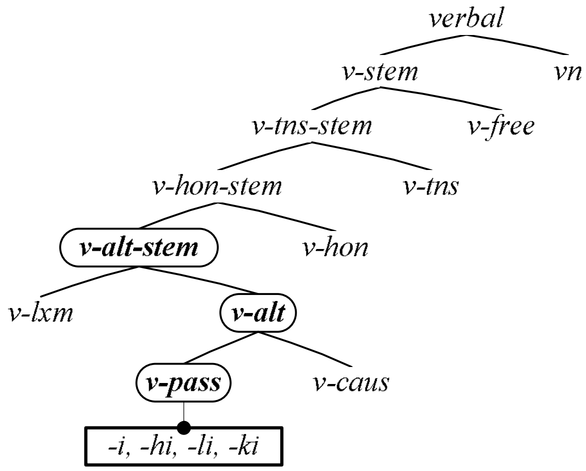
[6] The sequence MOOD + (COMP) in (16a) is treated as forming a *v-free* node in (17).

(17)



(18) is our revised verbal hierarchy which can treat a suffixal passive verb properly within the verbal system.

(18)



Whether passive suffixes are derivational or inflectional has been a hot issue for a long time, reflecting the difficulty of drawing a strict line between a derivational suffix and an inflectional suffix because of the morph-syntactic peculiarity of Korean verbal system.[7] Crucially though, since passive suffixes lead to argument alternations, we name the super-class of passive suffix *v-alt-stem*. The node *v-alt-stem* is inserted between *v-hon-stem* and *v-lxm* in the type hierarchy.

(19) presents a lexical rule that shows the actual derivation of passive forms. If the stem has the features [PASSIVE –] and [PASS-TYPE.SUFPASS +], it can turn into a *v-pass* type with an appropriate suffix. The process of the argument alternation will take place, as shown in the crossed linking relations of the arguments, represented as *i* and *j*, between the values of the two ARG-ST features in (19). (20) shows how (p-1) type like

[7] Kim (1992), for example, classified Korean verbal suffix into three subgroups; Inflection, Derivation, and Inflectional derivation. Sohn (1999) also said that passive or causative suffixes in Korean are somewhat on the border between inflection and derivation. See Cho and Sells (1995) as well for further discussion.

tat-hi- 'be closed' is derived.

(19) $v\text{-}pass \Rightarrow$

$$\begin{bmatrix} \text{PASSIVE } + \\ \text{STEM} \begin{bmatrix} v\text{-}tr \\ \text{PASSIVE } - \\ \text{PASS-TYPE.SUFPASS } + \\ \text{ARG-ST} \left\langle \text{NP}_i, \text{NP}_j \right\rangle \end{bmatrix} \\ \text{ARG-ST} \left\langle \text{NP}_j, (\text{NP}[dat]_i) \right\rangle \end{bmatrix}$$

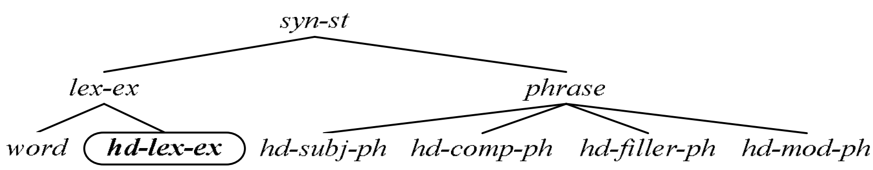
(20)

$$\begin{bmatrix} v\text{-}tr\text{-}p1 \\ \text{PHON} \left\langle ① tat\text{-} \right\rangle \\ \text{PASSIVE } - \\ \text{PASS-TYPE} \begin{bmatrix} \text{SUFPASS} & + \\ \text{AUXPASS} & - \end{bmatrix} \\ \text{ARG-ST} \left\langle \text{NP}_i, \text{NP}_j \right\rangle \\ \text{SEM } ② \begin{bmatrix} \text{INDEX} & s \\ \text{ARG1} & i \\ \text{ARG2} & j \end{bmatrix} \end{bmatrix} \rightarrow \begin{bmatrix} v\text{-}pass \\ \text{PHON} \left\langle ① tat\text{-}hi \right\rangle \\ \text{PASSIVE } + \\ \text{ARG-ST} \left\langle \text{NP}_j, (\text{NP}[dat]_i) \right\rangle \\ \text{SEM } ② \end{bmatrix}$$

3.3 Auxiliary Passives

The hierarchy of syntactic structure below is from Kim (2004:76), who proposes that auxiliary passives can be handled as *hd-lex-ex*, as shown in (22).

(21)



(22)

$$\begin{bmatrix} hd\text{-}lex\text{-}ex \\ \text{COMPS L} \end{bmatrix} \rightarrow ① \begin{bmatrix} \text{LEX } + \\ \text{COMPS L} \end{bmatrix}, \text{H} \begin{bmatrix} \text{AUX} + \\ \text{COMPS} \left\langle ① \right\rangle \end{bmatrix}$$

We agree that auxiliary passives should fall under *hd-lex-ex*. However, we would say that it is necessary for *hd-lex-ex* to branch out. We suggest *hd-lex-pass-ex* as one of subtypes of *hd-lex-ex*. There are two reasons for this.

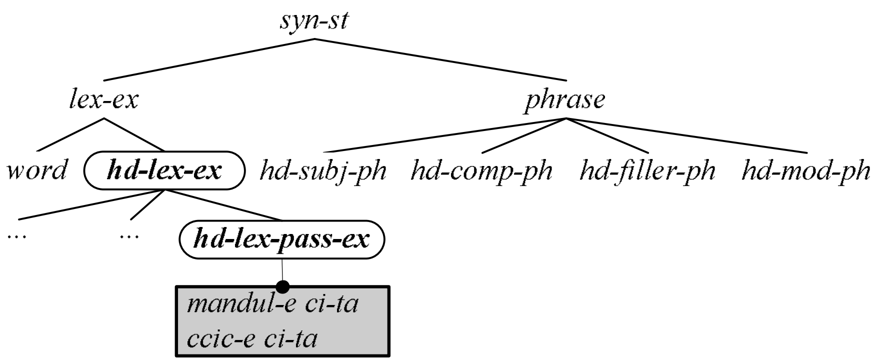
First, let us consider which conveys the sense of passives. Is it the main verb or the passive auxiliary *ci-*? Kim (2005) proposed that main verbs cannot combine with an auxiliary such as *ci-* or passive light verbs such as *toy-*, *pat-*, and *tangha-* until they are transformed into passives. Our claim is that *hd-lex-pass-ex* should be introduced as a subtype of *hd-lex-ex*, because what is responsible for passive meaning is not the verb but auxiliary *ci-* (cf. Lee 2005). Our approach has an added benefit of getting rid of, to our view, an extra process of vacuous case alternation for every verb. In our analysis, this process is triggered only when the verb combines with *ci-*, thus making the system more controlled.

Secondly, there are several other uses of Korean *-e/a ci-* construction other than passive constructions. If *-e/a ci-* phrase combines with adjectives, it represents an inchoative meaning like (23a). On the other hand, if *-e/a ci-* phrase combines with forms already passivized as in (23b), we suggest it conveys some resultative meaning. These phenomena raise the necessity to classify *-e/a ci-* phrases into several subtypes.

(23) a. *Mia-ka* *yeypp-**e*** ***ci**-ess-ta.*
Mia-NOM pretty-**COMP** **AUX**-PAST-DC
'Mia became pretty.'
b. *Mia-ka* *ic-**hi**-**e*** ***ci**-ess-ta.*[8]
Mia-NOM forget-**PASS**-**COMP** **AUX**-PAST-DC
'Mia has been forgotten.'

Then, (24) is a revised syntactic hierarchy that we would like to suggest for the auxiliary passive constructions.

(24)



(25) is the constraint for *hd-lex-ex*, replacing (22) in the above, and (26) is the rule that we propose for the auxiliary passive construction.

(25) $$[\textit{hd-lex-ex}] \rightarrow \textcircled{1}[\text{LEX } +],\ \text{H}\begin{bmatrix}\text{AUX} + \\ \text{COMPS}\langle \textcircled{1} \rangle\end{bmatrix}$$

8 In the traditional prescriptive grammar, this kind of 'double passive' form is considered to be wrong, but this form is used far more frequently than the more "correct" form *ice-hi-ess-ta*.

(26)
$$\begin{bmatrix} \textit{hd-lex-pass-ex} \\ \text{SUBJ}\ \langle \textcircled{2} \rangle \\ \text{COMPS}\ \langle (\textcircled{1}) \rangle \end{bmatrix} \rightarrow \textcircled{3}\begin{bmatrix} \textit{v-comp} \\ \text{PASSIVE}\ - \\ \text{PASS-TYPE.AUXPASS}\ + \\ \text{ARG-ST}\ \langle \textcircled{1}, \textcircled{2} \rangle \end{bmatrix}, \begin{bmatrix} \textit{V} \\ \text{PASSIVE}\ + \\ \text{SUBJ}\ \langle \textcircled{2} \rangle \\ \text{COMPS}\ \langle \textcircled{3} \rangle \end{bmatrix}$$

Now we can show how the appropriate passive forms for (p-2) type like *mandul-* 'make' are derived. Since (p-2) type has a [PASS-TYPE.SUFPASS –] feature, the suffixal passivization process will be blocked.

(27)
$$\begin{bmatrix} \textit{V'} \\ \text{PHON}\ \langle \textit{maldul-e ci-ess-ta} \rangle \\ \text{HEAD}\ \textcircled{4} \\ \text{PASSIVE}\ + \\ \text{SUBJ}\ \langle \textcircled{2} \rangle \\ \text{COMPS}\ \langle (\textcircled{1}) \rangle \end{bmatrix}$$

$$\textcircled{3}\begin{bmatrix} \textit{v-comp} \\ \text{PHON}\ \langle \textit{maldul-e} \rangle \\ \text{STEM}\ \langle \textit{v-tr-p}2 \rangle \\ \text{PASSIVE}\ - \\ \text{PASS-TYPE}\begin{bmatrix} \text{SUFPASS} & - \\ \text{AUXPASS} & + \end{bmatrix} \\ \text{ARG-ST}\ \langle \textcircled{1}, \textcircled{2} \rangle \end{bmatrix} \qquad \textcircled{4}\begin{bmatrix} \textit{V} \\ \text{PHON}\ \langle \textit{ci-ess-ta} \rangle \\ \text{PASSIVE}\ + \\ \text{AUX} + \\ \text{SUBJ}\ \langle \textcircled{2} \rangle \\ \text{COMPS}\ \langle \textcircled{3} \rangle \end{bmatrix}$$

(28) and (29) illustrates how (p-3) type like *ccic-* 'tear' is derived. Since both PASS-TYPE features of *ccic-* are plus, *ccic-* can be transformed into either *ccic-ki-* or *ccic-e ci-*.

(28)
$$\begin{bmatrix} \textit{v-tr-p}3 \\ \text{PHON}\ \langle \textcircled{1}\textit{ccic-} \rangle \\ \text{PASS-TYPE.SUFPASS}\ + \end{bmatrix} \rightarrow \begin{bmatrix} \textit{v-pass} \\ \text{PHON}\ \langle \textcircled{1}\textit{ccic-ki} \rangle \\ \text{PASSIVE}\ + \end{bmatrix}$$

(29)

$$\begin{bmatrix} \textit{V'} \\ \text{PHON}\ \langle \textit{ccic-e ci-ess-ta} \rangle \\ \text{PASSIVE}\ + \end{bmatrix}$$

$$\begin{bmatrix} \textit{v-comp} \\ \text{PHON}\ \langle \textit{ccic-e} \rangle \\ \text{STEM}\ \langle \textit{v-tr-p}3 \rangle \\ \text{PASS-TYPE.AUXPASS}\quad + \end{bmatrix} \qquad \begin{bmatrix} \textit{V} \\ \text{PHON}\ \langle \textit{ci-ess-ta} \rangle \\ \text{PASSIVE}\ + \\ \text{AUX}\ + \end{bmatrix}$$

3.4 Inherent Passives

Inherent passive verbs need to have passive information from the start. Further information need to be specified to block the passive rules from applying to them. AVM (30) is lexical representation for the inherent passive verb *mac-* 'be hit', while (31) is for the corresponding active verb *ttayli-* 'hit' which can be passivized neither suffixally nor with auxiliary verbs. Some verbs which cannot be transformed into passives like *talm-* 'resemble' also belong to *v-tr-p4*.

(30) *mac-*

$$\begin{bmatrix} \textit{inherent-pass-v} \\ \text{PASSIVE}\ + \\ \text{PASS-TYPE} \begin{bmatrix} \text{SUFPASS} & - \\ \text{AUXPASS} & - \end{bmatrix} \\ \text{ARG-ST}\ \langle \text{NP}[\textit{nom}]_j, \text{NP}[\textit{dat}]_i \rangle \end{bmatrix}$$

(31) *ttayli-*

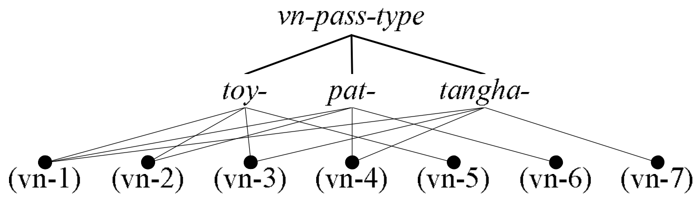
$$\begin{bmatrix} \textit{v-tr-p}4 \\ \text{PASSIVE}\ - \\ \text{PASS-TYPE} \begin{bmatrix} \text{SUFPASS} & - \\ \text{AUXPASS} & - \end{bmatrix} \\ \text{ARG-ST}\ \langle \text{NP}[\textit{nom}]_i, \text{NP}[\textit{acc}]_j \rangle \end{bmatrix}$$

4 VNs and PLVs

VNs also constitute a type hierarchy of their own with respect to their combination with the light verbs. Therefore, we also propose a type hierarchy of VNs in relation to pLVs.

Since there are three pLVs available for combination with VNs, there are eight types of VNs with respect to passivization, including a case such as *swuhak* 'study' where a VN cannot take any pLVs.

(32)



It is rather surprising that actual verbal nouns for each of the logically possible seven types are attested in Korean. Asterisks in Table (2) show the unacceptable forms.

Table (2)

		+ *toy-*	**+ *pat-***	**+ *tangha-***
(vn-1)	*chepel* 'punishment'	O	O	O
(vn-2)	*yongse* 'forgiveness'	O	O	*
(vn-3)	*cheypho* 'arrestment'	O	*	O
(vn-4)	*kisup* 'raid'	*	O	O
(vn-5)	*yenkwu* 'research'	O	*	*
(vn-6)	*conkyeng* 'respect'	*	O	*
(vn-7)	*kangkan* 'rape'	*	*	O
(vn-8)	*swuhak* 'study'	*	*	*

4.1 Classification of VNs

The major diagnostic criterion for VNs is whether a given noun can be combined with the light verb *ha-*. Therefore, we first extracted from the *Sejong Electronic Dictionary* (2002-3) a list of nouns whose lexical entries specify that it can be combined with *ha-*. Among the VN items on the list, we further consulted with their entries and narrowed the list to those items whose entry specifies that they have the case frame of 'NP-*ul/lul* VN-*ul/lul ha.*' This restriction was introduced to ensure that the nontransitive VNs be excluded because they cannot have a passive counterpart in principle. We also excluded the cases where the VN consists of one syllable or over three syllables which tend to involve some semantic peculiarity. The resulting number of VNs was 2,707. The next step in our data collection and classification was to find positive evidence for possible combination of VNs and pLVs by searching the *Sejong POS-tagged Corpora*. For instance, given a VN *yenkwu* and a pLV *toy-*, we searched the corpus to see whether there is a form similar to *yenkwu-toy* in the corpus. Likewise, we also checked for sequences such as VN-*pat-,* VN-*lul pat-*, VN-*tangha-,* VN-*lul tangha-* in the corpus. Altogether 1,713 (or 1,595 if more strict criteria are adopted) VNs out of the 2,707 were found to be combinable with one or more of the three pLVs.

(33) (vn-1) *kangyo* 'forcible demand', *ekap* 'suppression', *chepel* 'punishment', *chwukwung* 'pressing hard', *chimhay* 'infringement' (54 VNs / 30 VNs)
(vn-2) *taychwul* 'loan', *poko* 'briefing', *sangsok* 'inheritance', *sentayk* 'selection', *yangto* 'transfer' (264 VNs / 189 VNs)
(vn-3) *kamkum* 'imprisonment', *kecel* 'refusal', *salhay* 'murder', *apswu* 'confiscation', *hayko* 'dismissal' (120 VNs / 122VNs)
(vn-4) *myelsi* 'contempt', *chimlyak* 'invasion' (29 VNs / 6 VN)
(vn-5) *kangjo* 'emphasis', *naptuk* 'assent', *tunglok* 'registration', *pannap* 'return', *punsil* 'loss', *sayong* 'use', *yenkwu* 'inquiry', *yoyak* 'summation', *insang* 'raising', *cunpi* 'preliminary', *hoypok* 'recovery' (1,030 VNs / 1,127 VNs)
(vn-6) *daywu* 'respect', *senmang* 'envy', *conkyeng* 'respect', *chingchan* 'praise', *hoanyeng* 'welcome' (160 VNs / 74 VNs)
(vn-7) *kangkan* 'rape', *sahyeng* 'punishment of death', *hoksa* 'abuse' *paysin* 'betrayal', *kwutha* 'blow', (56 VNs / 47 VNs)

The numbers following the slash at the end of each type are the resulting number of cases where VN+*ul/lul* -pLV (e.g. *chepel-ul pat-*, *chepel-ul tangha-*) are excluded when searching the corpus.[9] Incidentally, there were 994/1,112 VNs for which there was no case of pLV passivization found in the corpus, including *kikwuen* 'abstention', *paywung* 'send-off', *poksup* 'review', *swulyo* 'completion', *yehayng* 'travel', *cwuce* 'hesitation,' etc.

4.2 Types of VNs and PLVs

In the case of pLVCs, when we observed the above data in an inductive way, we came to conclusion that there are three semantic features which seem to be relevant to their restrictions.

First, the 'animacy' of subject seems to be relevant. The constructions with *pat-* or *tangha-* are inclined to have an animate subject. Secondly, grammatical cases of VNs are also relevant. *toy-* takes a nominative case noun as its complement, whereas *pat-* or *tangha-* take an accusative. For this purpose we can make use of the feature AGT, introduced by Kim (2004). Finally, adversity feature of VNs seems to play a role. Almost invariably, *tangha-* combines with the nouns which convey a sense of adversity. Table (3) shows the overall picture of these phenomena.

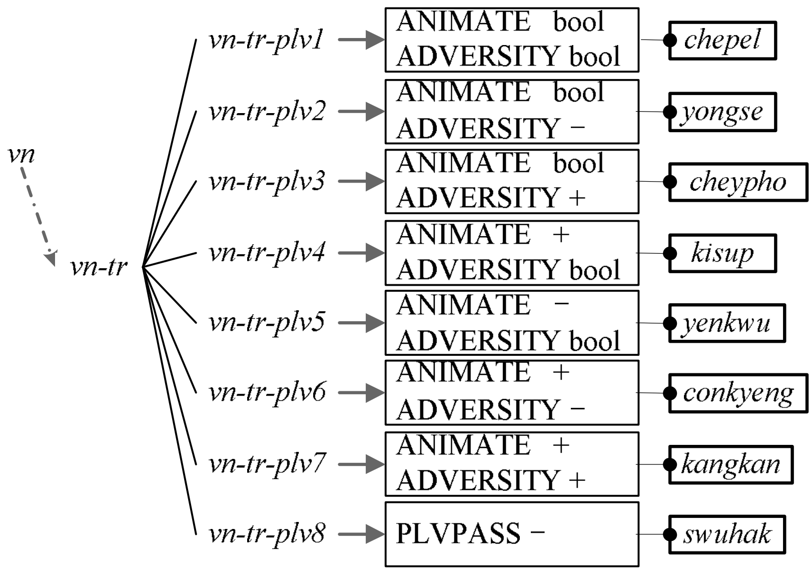
Table (3)

	toy-	***pat-***	***tangha-***
ANIMATE	bool	+	+
AGT	–	+	+
ADVERSITY	–	–	+

[9] Type (vn-4) has the fewest number of examples; apparently, if a VN can be combined with a pLV, but cannot be combined with *-toy*, then *-pat* and *-tangha* are in complementary distribution.

After considering all these factors, we have built up a type hierarchy for VNs as in (34).

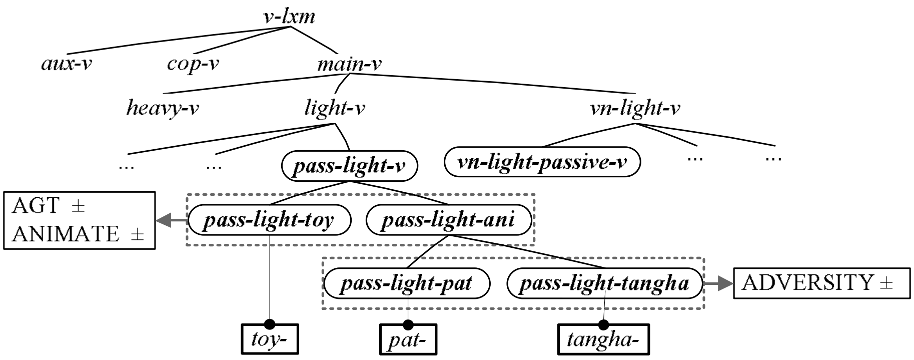
(34)



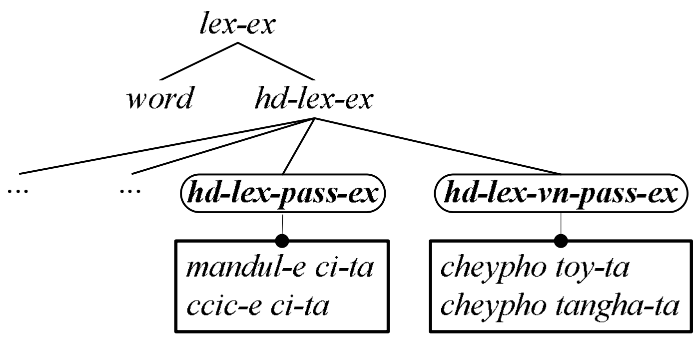
cheypho 'arrest' has an unspecified ANIMATE feature as well as [ADVERSITY +], for instance. According to the constraint, *cheypho* can combine with *toy-* or *tangha-*.

(35) shows a type hierarchy for PLVs. The upper dotted box represents a difference in the ANIMATE feature value and grammatical cases. The lower one stands for the difference in the ADVERSITY feature value. We provide *hd-lex-vn-pass-ex* as a subtype of *hd-lex-ex*, which is sketched out in (36).

(35)



(36)



With constraints and rules in (37), (38), and (39), pLVCs can now be dealt with properly. These AVMs reflect the key features that we have discussed so far; Animate, Adversity, and Grammatical cases.

(37)

$$\begin{bmatrix} \textit{hd-lex-vn-pass-ex} \\ \text{PASSIVE } + \end{bmatrix} \rightarrow \begin{bmatrix} \text{POS } \textit{noun} \\ \text{NOMINAL } + \\ \text{VERBAL } + \\ \text{ANIMATE } \textcircled{1} \\ \text{ADVERSITY } \textcircled{2} \\ \text{PLVPASS } + \end{bmatrix}, \begin{bmatrix} \text{PASSIVE } + \\ \text{ANIMATE } \textcircled{1} \\ \text{ADVERSITY } \textcircled{2} \end{bmatrix}$$

(38) head-lex-vn-pass-rule-1

$$[\textit{hd-lex-vn-pass-ex}] \rightarrow \textcircled{1}[\text{GCASE } \textit{nom}], \begin{bmatrix} \text{AGT } - \\ \text{COMPS} \langle \textcircled{1} \rangle \end{bmatrix}$$

(39) head-lex-vn-pass-rule-2

$$\begin{bmatrix} \textit{hd-lex-vn-pass-ex} \\ \text{SUBJ} \langle [\text{ANIMATE } +] \rangle \end{bmatrix} \rightarrow \textcircled{1}[\text{GCASE } \textit{acc}], \begin{bmatrix} \text{AGT } + \\ \text{COMPS} \langle \textcircled{1} \rangle \end{bmatrix}$$

A sample derivation for pLVCs is given below. The category VN is represented by the features [POS *noun*, NOMINAL +, VERBAL +].

(40) *cheypho*

$$\begin{bmatrix} \textit{vn-tr-plv}3 \\ \text{POS } \textit{noun} \\ \text{NOMINAL } + \\ \text{VERBAL } + \\ \text{ANIMATE bool} \\ \text{ADVERSITY } + \\ \text{PASS-TYPE.PLVPASS } + \\ \text{ARG-ST } \langle \text{NP}_i, \text{NP}_j \rangle \\ \text{SEM} \begin{bmatrix} \text{INDEX } s \\ \text{RESTR} \left\langle \begin{bmatrix} \text{RELN} & \textit{arrest} \\ \text{ARG1} & i \\ \text{ARG2} & j \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

(41)

$$\begin{bmatrix} \textit{V'} \\ \text{PHON} \langle \textit{cheypho-lul tangha-ass-ta} \rangle \\ \text{PASSIVE} + \\ \text{SUBJ} \langle ② \rangle \\ \text{COMPS} \langle ① \rangle \end{bmatrix}$$

$$③\begin{bmatrix} \textit{VNP} \\ \text{PHON} \langle \textit{cheypho-lul} \rangle \\ \text{ANIMATE bool} \\ \text{ADVERSITY } + \\ \text{CASE.GCASE } \textit{acc} \\ \text{ARG-ST} \langle ①, ② \rangle \end{bmatrix} \qquad \begin{bmatrix} \textit{V} \\ \text{PHON} \langle \textit{tangha-ass-ta} \rangle \\ \text{ANIMATE } + \\ \text{ADVERSITY } + \\ \text{AGT} + \\ \text{ARG-ST} \langle ②, ③ \rangle \end{bmatrix}$$

cheypho 'arrest' has an unspecified ANIMATE feature value, [ADVERSITY +], and [PASS-TYPE.PLVPASS +]. Therefore, it can combine with pLV *tangha-* which has an [ANIMATE +] as well as an [ADVERSITY +]. Even if an accusative case is allocated to *cheypho*, pLVCs will be constructed without any problem thanks to an [AGT +] of *tangha-*.

5 Conclusion

In this study, we considered various subtypes of passives and proposed comprehensive type hierarchies for verbs or verbal nouns with respect to passivization. The main points of this paper are as follows: First, we modified the verbal morphology of Kim & Yang (2006) in order to treat suffixal passives in an appropriate way. In particular, the *v-alt-stem* was introduced into verbal morphological hierarchy. Secondly, we classified verbs into five subtypes with reference to passivization. For auxiliary passives, we introduced *hd-lex-pass-ex* into the syntactic structure as a subclass of *hd-lex-ex*. Turning to verbal nouns, we proposed a classification of verbal nouns regarding which passive light verbs they can combine with. A type hierarchy for passive light verbs was also proposed in this study.

We implemented and tested our type hierarchies for passives using the *Linguistic Knowledge Building* (*LKB*) system to check the computational feasibility. All sample sentences in this study were tested in *LKB*.

5.1 Implications and Further Study

An interesting aspect of suffixal passivization in Korean is that the passive suffixes are also used for causatives almost invariably. For example, *cap-hi-* with the suffix *hi* can be interpreted as a passive verb meaning 'be caught' or a causative verb meaning 'have someone/something caught.' Taking this fact into consideration, we can extend the suggested type hierarchy to include suffixal causatives.

(42)

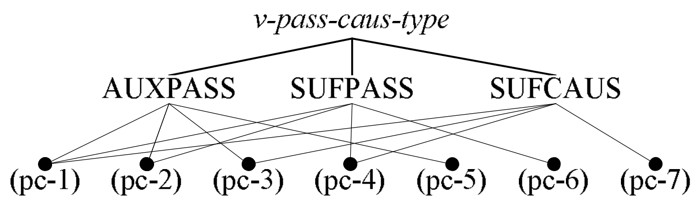


Table (4)

		AUXPASS	SUFPASS	SUFCAUS
(pc-1)	*ccic-ta* 'tear'	*ccic-e ci-ta*	*ccic-ki-ta*	*ccic-ki-ta*
(pc-2)	*mit-ta* 'believe'	*mit-e ci-ta*	*mit-ki-ta*	***mit-ki-ta***
(pc-3)	*pec-ta* 'take off'	*pec-e ci-ta*	***pec-ki-ta***	*pec-ki-ta*
(pc-4)	*cap-ta* 'catch'	**??*cap-a ci-ta***	*cap-hi-ta*	*cap-hi-ta*
(pc-5)	*chac-ta* 'find'	*chac-a ci-ta*	***chac-ki-ta***	***chac-ki-ta***
(pc-6)	*pel-ta* 'earn'	**??*pel-e ci-ta***	*pel-li-ta*	***pel-li-ta***
(pc-7)	*ip-ta* 'wear'	**??*ip-e ci-ta***	***ip-hi-ta***	*ip-hi-ta*

Furthermore, we could extend the type hierarchy to include the cases of auxiliary causatives like *-key ha-ta* and others.

Finally, we would like to point out the methodology taken in this study, that is, to make use of language resources available in an extensive and comprehensive way. We believe this kind of descriptive and inductive approach complements the more theoretically oriented approaches. We also believe that it is an efficient way to figure out the nature of language.

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English prepositional passive constructions

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Abstract

An empirical overview of the properties of English prepositional passives is presented, followed by a discussion of formal approaches to the analysis of the various types of prepositional passives in HPSG. While a lexical treatment is available, the significant number of technical and conceptual difficulties encountered point to an alternative approach relying on constructional constraints. The constructional approach is argued to be the best option for prepositional passives involving adjunct PPs, and this analysis can be extended to create a hierarchy of constructions accommodating all types of prepositional passives in English, and the ordinary NP passive.

1 Syntactic and non-syntactic constraints

In addition to the ordinary passive alternation involving transitive verbs (1a), English allows "prepositional passives" (also referred to as "pseudopassives"), where the subject in the passive structure corresponds to the object of a preposition in the related active structure (1b–c).

(1) a. Kim planted the tree. $\rightsquigarrow$ The tree was planted by Kim.
b. Kim looked after the tree. $\rightsquigarrow$ The tree was looked after by Kim.
c. Kim sat under the tree. $\rightsquigarrow$ The tree was sat under by Kim.

As noted by Huddleston and Pullum (2002, p. 1433), prepositional passives can be divided into two classes, depending on the syntactic function of the PP. In Type I prepositional passives, the PP is a complement whose prepositional head is idiomatically selected by the verb, as in (1b); in Type II prepositional passives as in (1c), the preposition is not part of a verbal idiom. Huddleston and Pullum, suggest that the availability of Type I prepositional passives is ultimately an idiosyncratic lexical property that must be indicated in the dictionary entries of verbal idioms (although, as far as I know, no dictionary explicitly provides this information). Type II passives, on the other hand, are subject to primarily pragmatic constraints.

The linguistic literature on prepositional passives confirms this basic description, while offering a more complex picture of the kinds of constraints involved. It is clear that the prepositional passive is much more restricted than the ordinary passive, which applies quite systematically to all transitive verbs, with a handful of lexical exceptions (e.g., **Two weeks were lasted by the strike*, **Quintuplets were had by an exhausted mother in Des Moines*). Whether a given verb + PP combination will give rise to an acceptable prepositional passive depends on various, poorly understood syntactic, semantic, and pragmatic factors. Context, usage and frequency effects,

[†] I thank Patrick Blackburn and the research group TALARIS at Loria (UMR 7503, Nancy, France) for their support of this research.

and lexical idiosyncrasies also play a crucial role. Previous accounts of the phenomenon rely on notions like "affectedness" or "role prominence" of the passive subject (Riddle and Sheintuch, 1983; Bolinger, 1977, 1978). These proposals are intuitively appealing, but it remains unclear how they can be satisfactorily formalized.

Many authors argue that a high degree of "cohesion" between the verb and the "stranded" preposition is a necessary condition for the well-formedness of the prepositional passive. One version of this approach suggests that V and P are in fact reanalyzed as a complex predicate (e.g., Hornstein and Weinberg, 1981). The fact that V and P typically appear immediately adjacent to one another is taken as evidence for reanalysis. The well-known exception that certain idiomatic direct objects can intervene between V and P in the prepositional passive (2) is not necessarily problematic, nor are the examples of phrasal verbs in (3).

(2) Kim made a fool of / kept tabs on Sandy. $\rightsquigarrow$ Sandy was made a fool of / kept tabs on.

(3) Kim put up with / looked down on / got rid of Sandy. $\rightsquigarrow$ Sandy was put up with / looked down on / gotten rid of.

Such examples can be dealt with by assuming that reanalysis can apply to multiword lexical items or otherwise "listed" combinations. Depending on the details of the analysis, cases involving coordinated structures may or may not be problematic:

(4) a. The delivery was signed and paid for by my assistant.
b. The obstacle will have to be crawled over or under.

The possibility of other kinds of intervening elements, however, does call the reanalysis hypothesis into question. Some marginally acceptable examples of non-idiomatic direct objects can be found in the literature (5), and modifiers and specifiers can also appear between V and P with varying degrees of acceptability (6):[1]

(5) a. ?To be whispered such dirty innuendoes about was enough to break any girl's heart.
b. ?This fork has been eaten spaghetti with.
c. ?I have never been knit a sweater for in my life.

(6) The bridge was sailed right under / walked completely across.

The contrasts illustrated in (7) also shed some light on the nature of the relevant constraint:

[1] Example (5a) is from Bolinger (1977). Example (5b) is from Davison (1980), who considers it ungrammatical, while acknowledging that "at least one" informant accepts it (p. 49).

(7) a. This bed was once napped in by Charlemagne. / ??This bed was once taken a nap in by Charlemagne.
b. This sofa was once sat on by Hadrian. / *This sofa was once had a seat on by Hadrian.

The highly cohesive light verb constructions *take a nap* and *have a seat* might be expected to allow reanalysis in the same way as (2) above, but the passive is in fact quite bad, compared to the versions with single verb synonyms. It is not clear how the notion of cohesion can be defined in order to account for this contrast. Instead, these examples point to a purely structural constraint, although again, an adequate formulation remains elusive.

Examples like (2) and (5) suggest that there is no strict syntactic constraint against the appearance of an arbitrary direct object in the prepositional passive, and that V and P are not required to be adjacent. In fact, if a direct object is involved, then it *must* intervene between V and P. Any attempt to extract or extrapose this NP results in total ungrammaticality:

(8) a. *How much of a fool was Sandy made — of?
b. *I have never been knit — for in my life such an amazing technicolor dream-sweater.

See Tseng (2006) for a more complete discussion of this "anti-adjacency" condition on prepositional passives.

2 Lexical approaches to passivization

Early generative analyses treated the ordinary passive formally as a transformation applying to the complete syntactic structure of an active sentence. In non-transformational approaches, with richer lexical representations, the passive can be analyzed as a lexical process involving only the verb, and no actual syntactic structure. A verb whose basic (active) subcategorization frame is transitive can systematically give rise to a passive verb with the appropriate "demotion" and "promotion" of the (as yet unrealized) subject and object. In HPSG, there are several ways of implementing this idea, the most familiar being the lexical rule approach.[2]

(9) **Ordinary Passive LR**

$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{base}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \text{NP}_i, \text{NP}_j[\textit{acc}] \right\rangle \oplus \boxed{1} \end{bmatrix} \mapsto \begin{bmatrix} \text{PHON} & \left\langle \boxed{2} \right\rangle \\ \text{MORPH} & \begin{bmatrix}\text{PSP} & \boxed{2}\end{bmatrix} \\ \text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{passive}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \text{NP}_j \right\rangle \oplus \boxed{1} \oplus \left\langle (\text{PP}_i[\textit{by}]) \right\rangle \end{bmatrix}$$

[2]For an underspecification-based account of the passive alternation, see Davis and Koenig (2000).

This (simplified) rule constructs a passive lexical entry, given a base verb that selects a direct object (i.e. an accusative NP as the second element of the ARGUMENT-STRUCTURE list). The output lexical entry has the appropriate morphophonological form (past participle)[3], it is identified as *passive* (for external selection, e.g. by the passive auxiliaries *be* and *get*), and it has a new ARG-ST list with the original elements permuted just as required.

The rule in (9) does not mention the semantic content of the verb, which is therefore assumed to remain unchanged. The verbal relation in both *Kim likes Sandy* and *Sandy is liked by Kim* is $\mathsf{like}(k, s)$. Only the syntactic configuration of the two arguments is different. I leave aside the information structural aspects of passivation in this paper, but these effects would also be represented in the output of the lexical rule.

2.1 Extension to Type I prepositional passives

This kind of lexical rule analysis presented above has been standard in HPSG since Pollard and Sag (1987). The approach can be adapted to Type I prepositional passives, in which the preposition is lexically selected by the verb (via PFORM selection).

(10)
$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{base}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \text{NP}_i, \boxed{1}\,(\text{NP}[\textit{canon}]), \text{PP}_j[\boxed{2}\,\textit{pform}] \right\rangle \oplus \boxed{3} \end{bmatrix}$$
$$\mapsto \begin{bmatrix} \text{PHON} & \left\langle \boxed{4} \right\rangle \\ \text{MORPH} & \begin{bmatrix}\text{PSP} & \boxed{4}\end{bmatrix} \\ \text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{passive}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \text{NP}_j, \boxed{1}, \text{P}\begin{bmatrix}\text{PFORM} & \boxed{2} \\ \text{COMPS} & \left\langle \text{NP}_j \right\rangle\end{bmatrix} \right\rangle \oplus \boxed{3} \oplus \left\langle (\text{PP}_i[\textit{by}]) \right\rangle \end{bmatrix}$$

The construction of the passive ARG-ST list is more complicated in this case, because of the stranded preposition. Whereas the active verb selects a saturated PP argument, the passive verb selects a COMPS-unsaturated prepositional argument. The rule allows an intervening direct object, specified as *canonical* to account for the data in (2), (5), and (8).[4]

Like the original passive lexical rule (9), this rule assumes that the semantics of the verb remains unchanged. It should be noted that this analysis requires a further assumption that the preposition in Type I prepositional passives is semantically empty, cf. the treatment of "case-marking"

[3]I am assuming a paradigm-based approach to morphology, in which the MORPH value of a verb encodes all of its inflected forms as the values of the attributes BASE, 3SG, PAST, PSP, etc.

[4]The phrasal verb examples in (3) are not accommodated in this simplified formulation.

prepositions in Pollard and Sag (1994). This makes the index of the prepositional object j visible on the verb's ARG-ST list and available for semantic role assignment in the verbal relation. For example, *Kim looks after Sandy* (and its passive version *Sandy is looked after by Kim*) expresses a single semantic relation look-after(k, s), rather than the conjunction (or some other combination) of a look relation and an after relation. This analysis seems correct for this example, although in general the possibility of a preposition being both syntactically selected via PFORM and contributing its own semantics cannot be excluded (Tseng, 2001), and such cases are present additional complications (see the following section).

A side issue to be addressed here is the proper representation of semantically empty prepositions, such as *after* in this example. According to the analysis of Pollard and Sag (1994), such prepositions share the CONTENT value of their complement. In the analysis of Tseng (2001), on the other hand, empty prepositions are represented with empty content, and the complement's semantics is propagated to the PP by semantic composition constraints applying to the head-complement phrase. The result at the PP level is identical: in *Kim looks after Sandy*, the PP ends up with the semantics of the NP *Sandy*. In the passive, however, the head-driven CONTENT-copying analysis of Pollard and Sag (1994) runs into problems. The stranded preposition in the output of rule (10) would still have nominal semantics, shared with its unrealized complement. This means that it would be subject to binding principles. Given the coindexation indicated in (10), we would have to conclude that the preposition is reflexive, by Principle A. Alternatively, the stranded preposition (and its unrealized complement) could be assigned an *expletive* index instead (no longer coreferent with the passive subject). Neither of these options has any empirical motivation.[5] An analysis in which *after* simply has an empty content value avoids all of these difficulties.

2.2 Type II passives with complement PPs

Turning now to Type II prepositional passives, where the preposition is not selected idiomatically by the verb, the lexical approach runs into problems. There are two cases to consider, depending on the syntactic function of the PP (complement or adjunct). The first case is discussed here. The adjunct case will be discussed afterwards in section 3.

If the PP is a complement—e.g. the directional complement of a verb of motion, as in (6) above—then the prepositional passive involves a reconfiguration of the ARG-ST list along the same lines as (10), but this move is complicated by the fact that the preposition is semantically contentful. In

[5] A third possibility would be to treat the preposition as *intransitive*, like a phrasal verb particle, but this is difficult to motivate for forms like *of* and *for* that appear frequently in prepositional passives, but never as phrasal verb particles.

the semantic representation of *Kim drove past the monument*, for example, there must be a drive relation and a past relation. The precise definitions of these two relations are open to debate (in particular the identities of the internal argument of drive and the external argument of past), but it seems clear that the NP *the monument* does not receive a semantic role directly from the verb. Assuming the same semantics for the passive sentence *The monument was driven past by Kim*, we have a problem because the verb *driven* selects a referential subject, but assigns it no semantic role.

In GB terms, this constitutes a violation of the theta criterion. While this principle has no direct counterpart in HPSG, the idea that all arguments must be assigned a semantic role is captured in the Raising Principle. This is a part of HPSG theory that has received relatively little attention[6] and needs updating in light of developments since Pollard and Sag (1994), but the basic generalization encoded in the Raising Principle remains valid. According to this principle, formulated as a constraint on lexical entries, a verb must normally assign a semantic role to all of its referential (non-expletive) arguments. The only exception is when an argument is inherited (raised) from another element on the verb's ARG-ST (originally SUBCAT) list. In other words, the argument is a syntactic dependent of the verb, but in fact orginates in a "downstairs" constituent (where it is left unrealized).

In our Type II prepositional passive example *The monument was driven past*, in order to avoid a Raising Principle violation, the passive subject NP must be analyzed as a raised argument.[7] In other words, the lexical rule deriving the passive participle *driven* must be defined as follows:

(11)
$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{base}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \text{NP}_i, \boxed{1}\ (\text{NP}[\textit{canon}]), \text{PP} \right\rangle \oplus \boxed{2} \end{bmatrix}$$
$$\mapsto \begin{bmatrix} \text{PHON} & \left\langle \boxed{3} \right\rangle \\ \text{MORPH} & \begin{bmatrix}\text{PSP} & \boxed{3}\end{bmatrix} \\ \text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{passive}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{4}\ \text{NP}_j, \boxed{1}, \text{P}\begin{bmatrix}\text{COMPS} & \left\langle \boxed{4}\ \text{NP}_j \right\rangle\end{bmatrix} \right\rangle \oplus \boxed{2} \oplus \left\langle (\text{PP}_i[\textit{by}]) \right\rangle \end{bmatrix}$$

The main difference with respect to the rule in (10) is that the right-hand side of this rule requires *synsem*-sharing between the passive subject and the unrealized prepositional object, rather than just coindexation.

[6]But see Przepiórkowski and Rosen (2005), for example.

[7]The description of the downstairs constituent in the original formulation of the Raising Principle will also need to be updated to refer not to the SUBCAT list, but to VALENCE attributes. In ordinary raising constructions, the raised argument corresponds to the downstairs subject. For prepositional passives, it is an unrealized downstairs complement that is raised.

One apparent problem faced by this raising analysis is the nominative vs. accusative case mismatch between the two NPs in the output of (11). I follow Przepiórkowski (1999) in assuming that when an argument appears on more than one ARG-ST list, case assignment principles apply only to the "highest" occurrence. For example, in *The monument was driven past*, the *synsem* corresponding to the NP *the monument* appears on three different ARG-ST lists: that of the preposition, the participle, and the finite auxiliary. But the CASE value of this *synsem* object is only instantiated once, with the value *nominative*, by case assignment principles applying to the ARG-ST list of *was*.

2.3 A unified rule

The rules in (10) and (11) were defined to apply to different classes of verbs (Type I verbs with a PP complement headed by an idiomatically selected preposition vs. Type II verbs with a PP complement headed by a freely selected preposition), but there is no clear boundary between these two classes. As they stand, the left-hand side descriptions of the two rules overlap, and it is doubtful that they could be enriched to restrict their application appropriately. Besides, the two rules have very similar effects, so the distinction may be unnecessary after all.

We could simply collapse the two rules by analyzing Type I prepositional passives like *Sandy was looked after* as instances of raising as well. At first sight, this would present a different sort of violation of the Raising Principle, because raised arguments are not supposed to be assigned a semantic role in the "upstairs" argument structure. It was assumed above in section 2.1, that *Sandy* receives a semantic role from the verb (since the preposition is semantically empty). The original Raising Principle was not formulated with such examples in mind, and an updated version of the constraint should allow this configuration, since the raised argument does end up with a unique semantic role.

We can therefore propose the following general rule for prepositional passives involving complement PPs:

(12) **Prepositional passive LR (complement PP)**

$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{base}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \text{NP}_i, \boxed{1}\,(\text{NP}[\textit{canon}]), \text{PP}[\boxed{2}\,\textit{pform}] \right\rangle \oplus \boxed{3} \end{bmatrix}$$

$$\mapsto \begin{bmatrix} \text{PHON} & \left\langle \boxed{4} \right\rangle \\ \text{MORPH} & \begin{bmatrix}\text{PSP} & \boxed{4}\end{bmatrix} \\ \text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{passive}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{5}\,\text{NP}_j, \boxed{1}, \text{P}\begin{bmatrix}\text{PFORM} & \boxed{2} \\ \text{COMPS} & \left\langle \boxed{5}\,\text{NP}_j\right\rangle\end{bmatrix}\right\rangle \oplus \boxed{3} \oplus \left\langle (\text{PP}_i[\textit{by}])\right\rangle \end{bmatrix}$$

This rule is identical to (11), with the addition of the sharing of PFORM values between the input and output specified in (10). This ensures that if the lexical form of the preposition is idiomatically selected by the active verb, the passive verb will select the same preposition. Semantically contentful prepositions that are not idiomatically selected are assumed to bear the feature [PFORM *other*] (Tseng, 2001). The rule therefore prevents a semantically empty preposition in the input from becoming semantically contentful in the output, and vice versa.[8]

3 Adjunct prepositional passives

Thus far, the kinds of prepositional passives we have seen discussed can be analyzed in HPSG by adapting the familiar lexical rule approach (and with some adjustments to existing constraints such as the Raising Principle). Type II prepositional passives involving PP adjuncts, such as *The tree was sat under (by Kim)*, on the other hand, present serious difficulties for lexical accounts. In principle, adjuncts are not selected by the verb and are not accessible in the lexical description of the verb. It would seem impossible, at first sight, to derive a lexical entry for the passive verb *sat* starting from the intransitive verb *sit*, since the subject of passive *sat* originates in an inaccessible PP modifier.

A technical solution is available, in the form of the DEPENDENTS list, or "extended argument structure", of Bouma et al. (2001). This attribute was introduced to allow lexical heads to impose constraints on their adjuncts, by treating these adjuncts effectively as syntactically (but not semantically) selected complements. This move has been controversial within HPSG (see

[8]The rule in (12) does not indicate the linking of the stranded P argument in the argument structure of the output verb. The complete formulation would require a disjunction between contentful Ps (which are assigned a semantic role by the verb), and empty Ps (which are not).

Levine 2003, and the response by Sag 2005), and could be challenged from a conceptual point of view for abandoning conventional notions of selection and argument structure, making too much information accessible at the lexical level.

If we accept the adjuncts-as-complements analysis, the lexical rule approach sketched in the previous section can be easily extended to all (Type I and Type II) prepositional passives. We would simply need to modify rule (12) to refer to the DEPS list instead of ARG-ST. Moreover, the Raising Principle would need to be modified (again), to apply to DEPS, since the passive subject does not receive a semantic role from the verb or from any of the verb's lexical arguments. This is an apparently minor change, but in fact it would result in an undesirable broadening of the contexts where unassigned arguments are allowed. This modified constraint would incorrectly allow examples like the the following:[9]

(13) a. *Kim sneezed it while raining.
(= 'Kim sneezed while it was raining.')
b. *Sandy fainted so much beer after drinking.
(= 'Sandy fainted after drinking so much beer.')

There does not appear to be independent motivation for this move.

The technical difficulties for the lexical account outlined here are probably not insurmountable, and the conceptual objections to the DEPS approach can perhaps be argued away. It does seem worthwhile, nevertheless, to explore alternative analyses of prepositional passives involving adjunct PPs.

3.1 A constructional approach

The remainder of this section is therefore devoted to a proposed analysis of adjunct-based prepositional passives as instances of a special construction, *adjunct-prep-passive-cx*. The relevant constraint is responsible for licensing the VP consisting of the participle, the stranded preposition, and any intervening elements (certain direct objects, phrasal verb particles, specifiers of P).

[9]More accurately, the DEPS version of the Raising Principle would predict the existence of verbs of this type (since **sneeze it* and **faint so much beer* can of course be excluded on other grounds).

(14) **Prepositional passive VP construction (adjunct PP)**

$$\begin{bmatrix} \textit{adj-prep-pass-cx} & \\ \textsc{vform} & \textit{passive} \\ \textsc{subj} & \left\langle \mathrm{NP}_{\boxed{1}} \right\rangle \\ \textsc{comps} & \left\langle (\mathrm{PP}_{\boxed{2}}[\textit{par}]) \right\rangle \end{bmatrix}$$

$$\boxed{3}\ \mathrm{V}\begin{bmatrix} \textsc{vform} & \textit{psp} \\ \textsc{subj} & \left\langle \mathrm{NP}_{\boxed{2}} \right\rangle \\ \textsc{comps} & \langle\ \rangle \\ \textsc{slash} & \{\ \} \end{bmatrix} \quad \mathrm{P}\begin{bmatrix} \textsc{mod} & \boxed{3} \\ \textsc{comps} & \left\langle \mathrm{NP}_{\boxed{1}} \right\rangle \end{bmatrix}$$

The first thing to notice is that the verb is actually an *active* past participle ([VFORM *psp*]), not a passive verb form ([VFORM *passive*], as in the output of the lexical rules in the previous section). Morphologically, English past participles and and passive participles are identical in form, and they have the same semantic content (linked in different ways to the syntactic arguments). Type II prepositional passives can involve intransitive verbs like *go* that never participate in the ordinary passive; on the other hand, all verbs have a past participle form.[10]

Using the active participle also sidesteps the problem, discussed above, of constructing a passive participle that would violate the theta criterion (or HPSG Raising Principle): in the lexical entry of the verb, all arguments are assigned a semantic role. The COMPS and SLASH values of this V daughter in (14) are empty, ensuring that the direct object (if any) is realized canonically.[11]

The other daughter of the construction is specified to be a COMPS-unsaturated prepositional projection (possibly including modifiers or a specifier) that modifies the verb. At the constructional level, the semantic indices of the verb's unrealized subject and of the preposition's unrealized complement are used to construct the valence requirements of the entire construction (note the value of VFORM). The resulting phrase is a passive VP that can appear in all passive contexts and be coordinated with other passive VPs (here, a Type I passive and an ordinary passive):

(15) The birthday cake was [<u>sat on</u>, set fire to, and thrown away] by Kim.

[10]Defective verbs, like modals, with no past participle, also fail to participate in the prepositional passive. Moreover, some verbs may be idiosyncratically blocked from appearing in the adunct prepositional passive construction, just as some transitive verbs (e.g. *cost* or *last*, mentioned at the beginning of section 1) are excluded from the ordinary passive.

[11]Additional constraints need to be incorporated to block the realization of other kinds of complements, like PPs, but more empirical work needs to be done to reveal the nature of these constraints.

Given the redefinition of the VFORM and VALENCE values of the mother, the construction must be considered non-headed, and the full definition would have to specify all of the features of the mother (in particular, its CONTENT value). It would also be possible to adopt the Generalized Head Feature Principle (the default principle of Ginzburg and Sag 2001) and identify the participial projection as the head daughter. This would allow general propagation mechanisms (e.g. the Semantics Principle) to fill in some of the information at the constructional level. The choice is essentially notational and has no consequences for the proposed analysis.

3.2 Extending the analysis to complement PPs

The constructional approach can be adapted to prepositional passives involving complement PPs. The lexical rule analysis presented for these cases in section (2.3) is not wholly unproblematic, (nor particularly elegant). The relevant constructional constraint is shown below:

(16) **Prepositional passive VP construction (complement PP)**

$$\left[\begin{array}{ll} \textit{comp-prep-pass-cx} & \\ \text{VFORM} & \textit{passive} \\ \text{SUBJ} & \left\langle \text{NP}_{\boxed{1}} \right\rangle \\ \text{COMPS} & \left\langle (\text{PP}_{\boxed{2}}[\textit{par}]) \right\rangle \end{array}\right]$$

$$\text{V}\left[\begin{array}{ll} \text{VFORM} & \textit{psp} \\ \text{SUBJ} & \left\langle \text{NP}_{\boxed{2}} \right\rangle \\ \text{COMPS} & \left\langle \text{PP}\left[\text{PFORM} \quad \boxed{3}\right] \right\rangle \\ \text{SLASH} & \left\{ \ \right\} \end{array}\right] \quad \text{P}\left[\begin{array}{ll} \text{PFORM} & \boxed{3} \\ \text{COMPS} & \left\langle \text{NP}_{\boxed{1}} \right\rangle \end{array}\right]$$

In this construction, the past participle projection is specified to be COMPS-unsaturated, and the unrealized PP complement “controls” the P daughter of the construction via the shared PFORM value.[12]

The similarities between the constructions in (14) and (16) can be captured in the definition of a common supertype, resulting in a small constructional hierarchy of English prepositional passives. It seems appropriate to incorporate the non-syntactic factors that determine the well-formedness of the prepositional passive (context, modality, pragmatic and stylistic effects) at the level of this constructional supertype.

[12]Some form of CONTENT sharing is also necessary, in order to ensure the correct assignment of semantic roles by the verb. The revelant disjunctive constraint (for semantically contentful vs. empty prepositions) is not included here (see also fn. 8).

3.3 Extending the analysis to ordinary passives

A natural next step is to consider applying the constructional analysis of prepositional passives to ordinary NP passives. The relevant definition, taking an active past participle and building a passive VP construction is given here:

(17) **Ordinary NP passive VP construction**

$$
\begin{array}{c}
\begin{bmatrix}
\textit{np-passive-cx} & \\
\textsc{vform} & \textit{passive} \\
\textsc{subj} & \left\langle \mathrm{NP}_{\boxed{1}} \right\rangle \\
\textsc{comps} & \left\langle (\mathrm{PP}_{\boxed{2}}[\textit{par}]) \right\rangle
\end{bmatrix} \\
| \\
\mathrm{V}\begin{bmatrix}
\textsc{vform} & \textit{psp} \\
\textsc{subj} & \left\langle \mathrm{NP}_{\boxed{2}} \right\rangle \\
\textsc{comps} & \left\langle \mathrm{NP}_{\boxed{1}} \right\rangle
\end{bmatrix}
\end{array}
$$

At first sight, this looks like a variant of the familiar passive lexical rule expressed using tree notation. However, the daughter in this unary construction ("head-only" in the terms of Ginzburg and Sag 2001) is not necessarily lexical. As in the constructions defined above, the V daughter represents a participial projection that can include modifiers and other dependents (e.g. *stolen secretly from Kim*, *elected president for the third time*). Note that the empty SLASH requirement of (14) and (16) is absent here. The construction then permutes the unexpressed subject and direct object of the VP as expected and instantiates the feature [VFORM *passive*] on the mother.

The main advantage of this analysis over the lexical rule approach is that a single participial lexical entry can be used in both active and passive sentences. This is consistent with English verbal morphology, as mentioned already, although the fact that some verbs are used in compound past tenses but not in the passive (see fn. 10) still needs to be encoded lexically. Another advantage is the possibility of organizing all types of passive structures into a hierarchy of constructions, with shared constraints expressed just once at the appropriate point in the hierarchy.[13]

The analysis presented here is reminiscent of the object-to-subject raising analyses of the passive in German surveyed (and argued against) in Müller (2001). Those proposals (e.g. Pollard, 1994; Kathol, 1994; Müller, 1999) are also motivated in part by the economy of using a single participial entry in active and passive structures. These are all lexical analyses, however, and they rely on a specially defined object-to-subject raising passive

[13]It should be noted that some implementations of lexical rules in HPSG (e.g. Meurers, 2000) also allow generalizations over lexical rule types to be expressed.

auxiliary to build the correct surface structure. As Müller (2001) points out, this is undesirable because there are many contexts where the participle has a passive interpretation in the absence of any auxiliary.

The constructional approach proposed here for English passives avoids this problem, because the constructions apply at the VP level, before combination with the passive auxiliary (which can be a simple subject-to-subject raising verb, as in standard analyses).

4 Concluding remarks

I have argued that the properties of English prepositional passives, particularly those involving adjunct PPs, motivate a treatment in terms of constructions, although a fully lexical approach (e.g. relying on lexical rules) is technically available. The constructional analysis avoids undesirable interactions with the HPSG Raising Principle, and allows the same lexical entry to be used for the particple in both active and passive structures.

The construction-based approach for adjunct PP prepositional passives can be extended to prepositional passives involving complement PPs, and then to ordinary NP passives, resulting in a hierarchy of passive constructions in English.

For the moment, the arguments in favor of lexical vs. constructional approaches are mostly conceptual and theory-internal: How much information about the context should be encoded and accessible in the lexical entry of the head verb? If constraints like the Subcategorization Principle and the Head Feature Principle are no longer applied strictly to all (headed) phrases, what are the restrictions on possible constructions? These questions and other concerns about the descriptive power of HPSG need to be addressed. At the same time, the empirical consequences of the choice between lexical and constructional approaches to the passive must be explored more fully.

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A Description of Chinese NPs using Head-Driven Phrase Structure Grammar

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Abstract

In Chinese, as well as in Japanese and Korean, nouns and classifiers share the co-occurrence restrictions, which are known as the noun-classifier matching. (Levy and Oshima, 2003) And this kind of agreement is the most salient feature of noun phrases, which presents a challenge for linguistic description and formalization.

In this paper, we propose an analysis of Chinese NPs in the framework of HPSG, especially focusing on the noun-classifier matching. Also, with the implementation in the LKB system, we could figure out the pros and cons of the analysis.

1. Introduction

Concerning the noun-classifier matching, we give the examples as follows:[1]

（1）a. yì bĕn shū
one CL_bound book
'a book'

b. *yì taí shū
one CL_machine book

c. yì taí diànnăo
one CL_machine computer
'a computer'

In (1a), the noun *shū* could be modified by the classifier *bĕn*, but not *taí* (as example (1b) shows). In contrast, the classifier *taí* could modify another noun *diànnăo* instead. (See (1c)) Thus, these facts of match and mismatch show the co-occurrence restrictions of nouns and classifiers.

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[1] CL is the abbreviation of classifiers.

The paper is organized as follows: in section 2, we provide a general description of Chinese NPs and introduce the statistic results based on real data. Section 3 compares the three main articles concerning the Chinese NPs in the framework of HPSG. In Section 4, a deep analysis on classifiers is given. Section 5 proposes our analysis of Chinese NPs, which consists of the syntactic structures, the type hierarchies and the semantic features of Chinese NPs. Section 5 shows the results of the implementation in the LKB system. The conclusion remarks are several new ideas and the unsolved problems.

2. A General Description of Chinese NPs

Noun phrase refers to a group of words with a noun or pronoun as the main part (the HEAD) (Jack C. Richards, 2000:315). In the same way, Chinese NPs are generally constructed with nouns and other constituents. And they could also be formed by bare nouns without any functional elements such as determiners, classifiers, or number morphemes. (Rullmann and You, 2003) But, when nouns in Chinese are quantified, the numeral necessarily co-occurs with an appropriate noun-specific classifier. (Ng, 1997)

Further, we need to note that most of the attributes precede the head noun in Chinese NPs. Zhu (1982:151) has concluded that the linear sequence of Chinese NPs is like the following: possessives, demonstratives, quantities (numerals and classifiers), adjectives and nouns. This is only the basic structure of NPs without the particle *de*. In this section, we will describe the basic and complex structures of Chinese NPs, as well as the statistical data.

2.1 The basic structures of Chinese NPs

（2）a. zhè bĕn shū
this CL book
'this book'

b. yì bĕn shū
one CL book
'a book'

c. zhè liăng bĕn shū
this two CL book
'these two books'

As the example (2a), (2b) and (2c) shown above, we find out that they all include classifiers and nouns, but the numerals and the determiners are selected to construct different structures. Obviously, we formalize these structures as follows: “Dem + CL + N”, “Num + CL + N” and “Dem +Num+ CL + N”.[2]

2.2 The complex structures of Chinese NPs

In other cases, NPs are more complex due to the particle *de* that functions as a marker of attributes. (Bloomfield, 1980)

（3）a. tā sònggěi wǒ de nà běn shū
he give me particle that CL book
‘that book which he gives it to me’
b. nà běn tā sònggěi wǒ de shū
that CL he give me particle book
‘that book which he gives it to me’

The examples above show the complex structures of Chinese NPs. In this case, nouns are modified with possessives or relative clauses. The particle *de* is used after the adjuncts and before the nouns. Then we formalize the complex structures as follows: “PossP/RC * (*de*) + Dem + (Num) + CL + N” and “Dem + (Num) + CL + PossP/RC* (*de*) + N”.[3]

Moreover, there are certain adjectives that can modify classifiers, such as dà (big), xiǎo (small), hòu (thick), báo (thin) etc. (Ding, 1961) Just as the example (4) illustrates:

（4） yì dà běn shū
one big CL book
‘a big book’

2.3 Data

We have used the CCRL to collect the data from *People’s Daily* (2000). From the selected data of 292,352 words, we identified the four basic structures of Chinese NPs.[4]

---

2 Dem, Num and N separately refer to demonstratives, numerals and nouns.
3 PossP and RC refer to possessive phrase and relative clause. Also, * means the constituents could be repetitive.
4 CCRL is the abbreviation of the Chinese Corpus Retriever for Linguistic Attributes. And the results are analyzed by Antconc 3.0.

Types of NPs	Frequency	Examples
Dem + CL + N	158	zhè běn shū 'this book'
Num + CL + N	93	yì běn shū 'a book'
Dem +Num+ CL + N	19	zhè liǎng běn shū 'these two books'
Num/Dem + CL + A+ N	18	shí běn xiǎo shū 'ten small books'

Table 1 The basic types of NPs

As it is shown in the Table 1, the structure of "Dem + CL + N" is most frequently used, and then the sequence of "Num + CL + N" follows, while the other three structures are not used so frequently. With these statistical results, we could point out that the "Dem + CL + N" and "Num + CL + N" are two of the most important structures of Chinese NPs. Therefore we take these two types as the object of our study. In the next section, we will review the three articles on Chinese NPs.

3. Previous Studies

Gao (1994), Xue and McFetridge (1995) and Ng (1997) have analyzed Chinese NPs in the framework of HPSG. To compare the ideas in the articles, three main issues have been discussed. The first one is the head of the noun phrase, and the second issue is about the role of demonstratives in the "Dem-CLP-N" structure. Then the last one goes to the co-occurrence between nouns and classifiers. Therefore, in this section, we will focus on these three issues.

3.1 Gao's analysis

Gao assumes the Demonstratives and the CLP together constitute the DemP. And the DemP functions as the Specifier of the head noun.[5] (Just as the figure below shows)

[5] CLP refers to classifier phrases and DemP refers to demonstrative phrase.

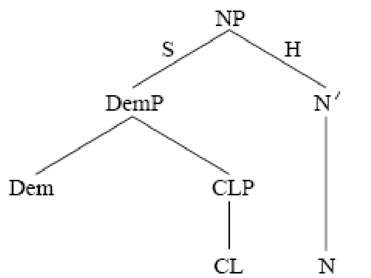


Figure 1 The syntactic structure of NP (Gao, 1994)

Following the analysis of Xue and McFetridge (1995), as well as Ng (1997), we could firstly figure that the construction of DemP is not convincing. Xue and McFetridge (1995) have presented a simple example as the following shows.

（5）	nà	sān	wǎn	fàn	hé	yì	wǎn	tāng
	That	three	CL	rice	and	one	CL	soup

‘that three bowl of rice and one bowl of soup’

The phrase in (5) is ambiguous, because the demonstrative *nà* could refer to “the three bowls of rice” or “three bowls of rice and one bowl of soup”. But according to Gao’s analysis, *nà* only denotes “three bowls of rice” (As the Figure 2 shows). Actually, *nà* could also refer to “three bowls of rice and one bowl of soup”.

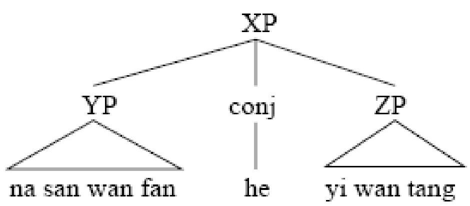


Figure 2 The analysis of *nà sān wǎn fàn hé yì wǎn tāng*

Next, as Ng (1997) has suggested, to specify that the SPEC value of the specifier is an N' with the value sing (see Figure 3) is fundamentally flawed, since nouns in Chinese are indistinguishable with respect to number.

PHON <yi tiao>
SYNSEM | LOC | CAT | HEAD[SPEC N′ [NUM sing, SHAPE tiao]]

Figure 3 The feature structure of the classifier *yì tiáo*

3.2 Xue and McFetridge's analysis

First of all, their ideas are based on the DP hypothesis, so Xue and McFetridge assume that Dem is the head of DP and selects NP as its complement. And this NP consists of CLP and nouns. (As the Figure 4 shows)

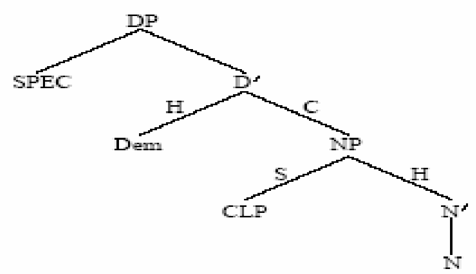


Figure 4 The syntactic structure of NP (Xue and McFetridge, 1995)

However, if we analyze the noun phrase in a broader scope, such as the sentence, we suggest that it is nouns that have relation to the other constituents. Take the sentence below as example, it is the noun *shū* that behaves as the object of the verb *mǎi*.

（6）	tā	mǎi	le	yì	běn	shū
	He	buy	particle	one	CL	book

‘He bought a book’

Moreover, as Ng points out, if the demonstrative is not filled, this will lead to empty categories which current HPSG attempts to avoid. And since NP is as the sub structure of DP, this makes the analysis more complex.

Finally, in dealing with the noun-classifier matching, they only add one feature SHAPE to entail a list of words that could match. (As the figure 5 shows) This seems easy to present the matching facts, but the set of classifiers is an open one, we can not list all the words.

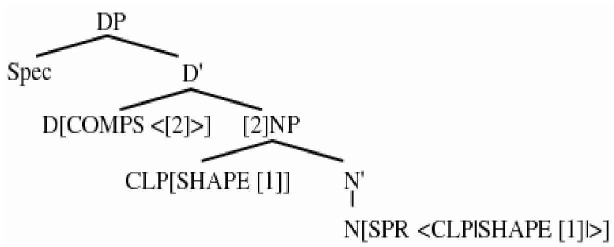


Figure 5 The noun-classifier matching (Xue and McFetridge, 1995)

3.3 Ng's analysis

Using the framework of X-bar theory, Ng suggests a double-specifier analysis of the structure 'Dem-CLP-N'. That is to say, both the Dem and the CLP are analyzed as specifiers of the head noun within an NP. (As the figure 6 shows)

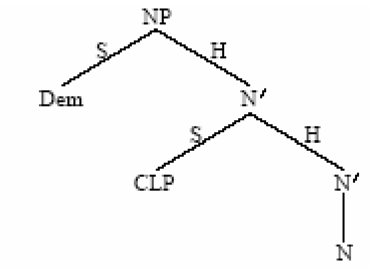


Figure 6 The syntactic structure of NP (Ng, 1997)

In detail, several reasons might account for this conclusion. The most crucial one lies in the argument of head. In contrast to Xue and McFetridge (1995), Ng (1997) claims that even with demonstratives, the head of Chinese NPs should also be noun. Further, Comparing with the analysis of Gao (1994), Ng also make a change in explaining the syntactic role of demonstratives, that is both demonstrative and classifier phrases are specifiers of the head noun.

Moreover, giving a deeper analysis to the internal structure of CLP, Ng finds out that certain adjectives could intervene into the "Num-CL" sequence, in the condition that nouns should own a feature of group. Thus, Ng suggests that there is number agreement between classifiers and nouns.

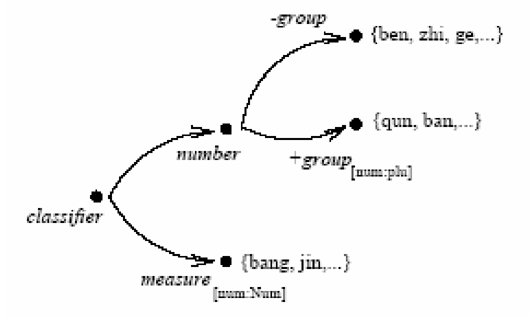


Figure 7 Number agreement between classifiers and nouns (Ng, 1997)

From the figure 7 above, we can see that nouns are classified into group nouns or non-group nouns, which can have different classifiers to be modified. To realize this constraint, Ng assigns a specifier-head relation between numerals and classifiers. We think this makes sense, because the sequence of "CL-N" is not allowed. There must be other constitutes proceed CL. Finally, all analyze above have been tested computationally through an implementation in ALE.[6]

To conclude, we prefer nouns as the head of noun and then considering the role of demonstratives in the "Dem-CLP-N" structure, we prefer a double-specifier account of Chinese NPs. While for the noun-classifier matching problem, their ideas are not sufficient to solve it. Then, in the next section, we need a deeper analysis on the co-occurrence restrictions between classifiers and nouns.

4. Classifiers

Noun classifiers characterize the noun and co-occur with it in a noun phrase. In Mandarin, this kind of agreement is determined by lexical selection, rather than matching any inflectional properties. (Aikhenvald, 2000) Then, to describe this lexical selection, we need to analyze the common features of nouns and classifiers. In the section, we thus concentrate on two aspects, one is the general classification of nouns and classifiers and the other is the semantic feature.

[6] ALE is short for the Attribute Logic Engine. See Penn and Carpenter (1999) for more information.

4.1 The classification

Wang (2004) has classified classifiers and nouns as the table below:[7]

	Indivi-diual	Subs-tance	Group	Abs-tract	Proper	Event	None
Individual	+	-	-	-	+	-	-
Measure	+	+	+	+	-	-	-
Container	+	+	+	-	-	-	-
Group	+	+	+	-	-	-	-
Kind	+	+	+	+	-	-	-
Shape	+	+	-	+	-	-	-
Indefinite	+	+	+	+	-	-	-
Time	-	-	-	-	-	+	-
Verbal	-	-	-	-	-	+	-

Table 2 The classification of classifiers and nouns

From the table above, we know that one classifier may match with different kinds of nouns. Like the group classifier *tào*, may modify individual nouns *shū* (book), group nouns *yīfú* (cloths), or even abstract nouns *zǔzhī* (organization).

Also, we notice that time and verbal classifiers are different from noun classifiers. They could only modify the event nouns. Moreover, we need to point out that their syntactic functions vary dramatically. For noun classifiers as we mentioned in Section 2, they function as modifiers of nouns. While for verbal classifiers, they play as complements of the verbs. Nevertheless, we focus on the function of noun classifiers, so the time and verbal classifiers are not discussed in this paper.

4.2 Individual classifiers

Further, the matching between individual classifiers and individual nouns are more complex. Zhu (1982:49) has pointed out that this kind of coercion is idiosyncratic, and thus need to be noted in the dictionary. And Chao

[7] The words in the vertical column are classifiers and the ones in the horizontal column are nouns.

(1979:234) holds the same idea. It is easy to make a list of the classifiers, but nouns are more productive, which makes it difficult to make a complete list.

Further, in a historical point of view, some classifiers come from nouns. To take *zhī* for example, which originally means a kind of bird, while now is used as a classifier to modify certain kind of animals and other things (Wang, 1980:236). Such analysis presents a clue of the inherent semantic relations between nouns and classifiers.

4.3 Semantic features

Huang (2003) has pointed out that it is the classifier that selects the relevant properties of the noun and coerces the appropriate meaning. Also, Tai (1990: 312) points out: "A classifier categorizes a class of nouns by picking out some salient perceptual properties, whether physically or functionally based, which are permanently associated with the entities named by the class of nouns."

What's more, many nouns have several meanings, and different meaning may need different classifiers. Levy and Oshima (2003) suggest that each class should be a set of semantic properties. And in order to make a selection between nouns and classifiers, we need to judge whether there is an intersection between them. Inevitably, it is not easy to make a unified criterion to define these semantic features. And a list of these features would be endless.

In sum, the noun-classifier matching is based on the classification and the shared features. Then in the next section, we will propose an analysis in the framework of HPSG.

5. Proposed Analysis of Chinese NPs

We suggest three ways to describe Chinese NPs: (1) to propose a model of the syntactic trees of Chinese NPs, including the basic and complex structures; (2) to construct the type hierarchy of Chinese nouns and classifiers; (3) to define new features describing the semantic properties of nouns and classifiers. And at the end of this section, we propose an overall account of the syntactic and semantic analysis of Chinese NPs.

5.1 Syntactic structure

Based on the language facts in section 2, we infer that Chinese NPs could be simply divided into two groups: one is the group which consists of bare nouns and noun phrases without classifiers, and the other with classifiers. Further, this group can be distributed as basic structure and complex structure. In basic ones, NPs are constituted by "CL-N" which proceeded by either "Dem", or "Num", or even "Dem and Num". And the complex ones include more attributives, such as possessives or relative clauses, which might be followed by a particle *de*.

5.1.1 The basic and complex structures

In section 3, we have discussed three crucial issues on the relations of these constituents. The first issue is about the head of NP, we prefer nouns as the head rather than demonstratives. The second one is a debate on the role of demonstratives, we agree with Xue and McFetridge (1995) that demonstratives should not be combined with CLP, and then following the analysis of Ng (1997), we prefer a double-specifier account, that is to say, demonstratives also play a specifier role. The final one is the noun-classifier matching, we propose a specifier relation between them. Then following Ng (1997), we present a specifier-head relation between numerals and classifiers. And the head of CLP is classifiers. Other relations are obvious, for instance, the possessives and relative clauses are modifiers of nouns. Hence, we can display these analyses as the following two figures.

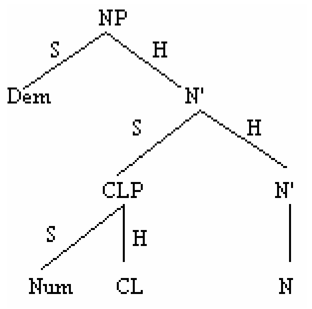


Figure 8: basic structure

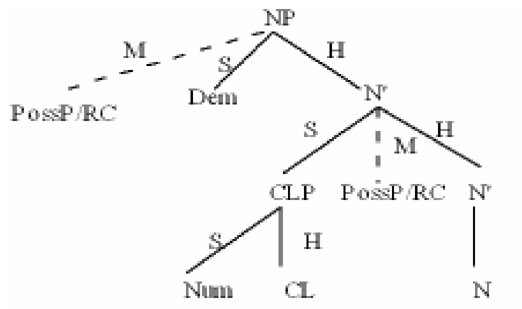


Figure 9: complex structure

5.1.2 Double-Specifier Rule

Since we refer the double specifier account (Ng, 1997) to analyze the structure of NPs with demonstratives and classifiers, we need to modify the head-specifier rule as follows.

$$X\begin{bmatrix}\text{SPR} & \boxed{1}\end{bmatrix} \rightarrow \boxed{2}\begin{bmatrix}\text{SPEC} & \boxed{3}\end{bmatrix},\ \boxed{3}\,X\begin{bmatrix}\text{SPR}\ \boxed{1} + \left\langle \boxed{2} \right\rangle\end{bmatrix}$$

Figure 10: Double-Specifier Rule

5.2 Type hierarchy of Nouns and Classifiers

In HPSG, the lexicon itself can be treated of a type hierarchy. (Sag and Wasow, 2003) Therefore, concerning the classification in Section 4, we construct the type hierarchy of Chinese nouns and classifiers.

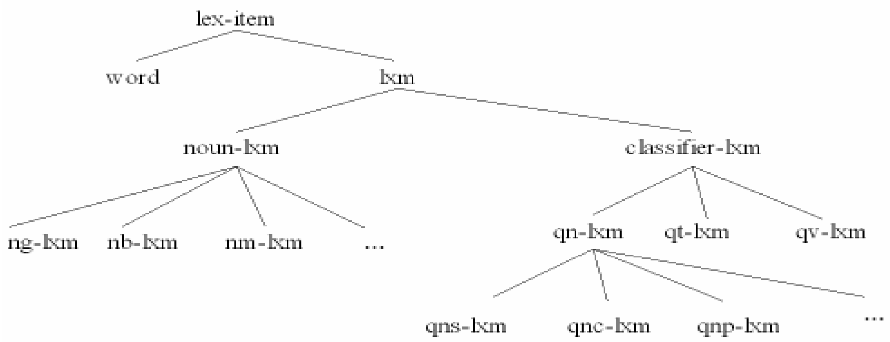


Figure 11 Type Hierarchy of Nouns and Classifiers

As the figure 11 shows, the classifiers are first divided into noun, time and verbal classifiers, and then it is noun classifiers that have sub-types of classifiers, such as individual classifiers which are represented as “qns-lxm”.

5.3 Semantic features

Following the analysis in section 4, we will focus on the coercion between nouns and classifiers. While dealing with this problem, we need to settle two basic questions first. One is that classifiers do not simply agree with noun word, but instead coerce a particular meaning from it. (Huang, 2003) The other one is to determine the basic meanings of nouns and classifiers.

Following Pustejovsky (1995), a book, for example, is constituted by “content”, its formal appearance is “bound”, and it is used to be “read”. As the nouns are constituted by multiple meanings, thus we could make a list of these meanings as [+content, +bound, +read]. Considering the classifiers, the semantic properties of individual classifiers varies, for example, *běn* modifies things which are bound as a common feature. Hence, we could predict that *běn* and *shū* could match because of the common feature [+bound]. Then, we introduce another feature CLS to represent the semantic properties just as the figure 12 shows.

$$\left\langle \text{shu}, \begin{bmatrix} ng-lxm & \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \text{i} \\ \text{RESTR} & \begin{bmatrix} \text{RELN} & \text{book} \\ \text{CLS} & \text{bound} \\ \text{INSTANCE} & \text{i} \end{bmatrix} \end{bmatrix} \end{bmatrix} \right\rangle$$

Figure 12: The lexical entry of *shū* (book)

5.4 The analysis of NPs

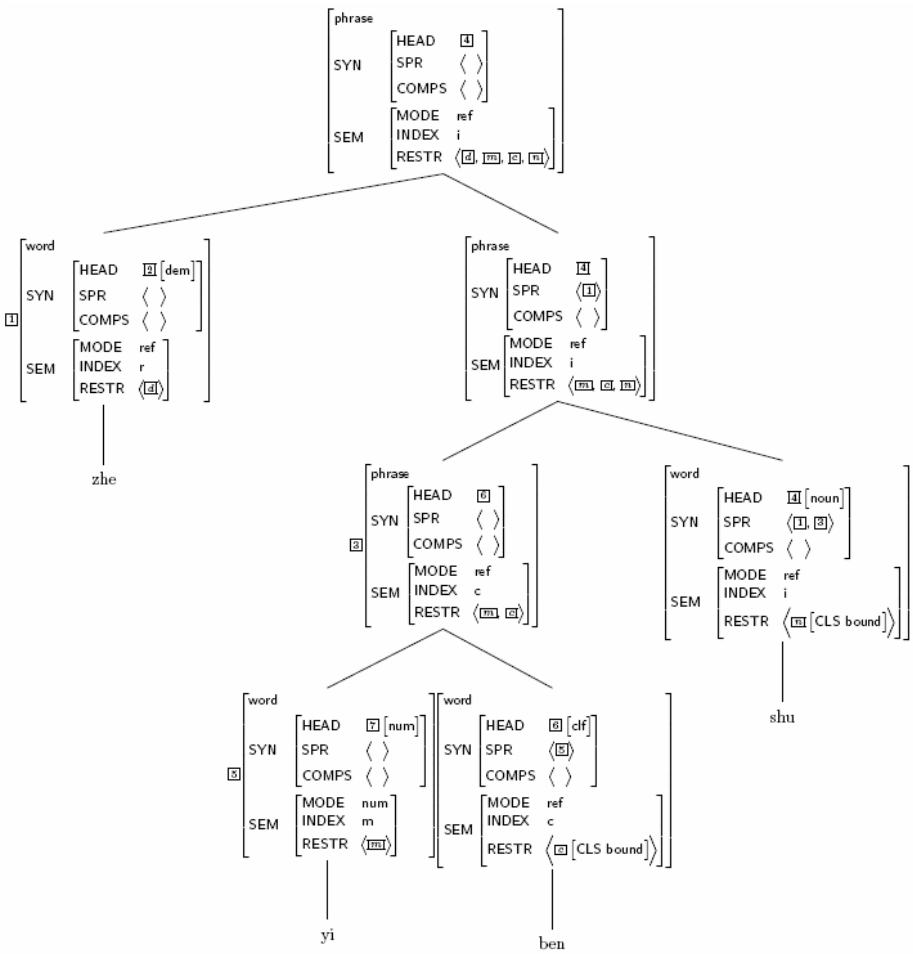


Figure 13: Complete analysis of “*zhè yì běn shū*” (this book)

As the figure above shows, the noun phrase "*zhè yì běn shū*", which is constructed as "Dem+Num+CL+N", obeys Double-Specifier Rule. We begin with the lexical SD of the head noun *shū*.[8] Note that, just as the tag $\boxed{4}$ shows, the HEAD value of the word *shū* and that of the noun phrase are identified via the Head Feature Principle. And in the list of the SPR value of the head noun, there are nodes labeled $\boxed{1}$ and $\boxed{3}$, which separately refers to the demonstrative *zhè* and the classifier *běn*. Then, we could see that, the head noun selects the demonstrative and the classifier as specifiers by the Double-Specifier Rule.

Next, concerning the noun-classifier matching, the head noun and the classifier share the same RESTR value as "bound", which is constrained by the feature CLS. Further, with the Semantic Compositionality Principle, we could see that the RESTR value of the mother is the sum of the four daughters' RESTR lists.[9]

6. Implementing in the LKB system

The LKB system (the Linguistic Knowledge Building system) is a grammar and lexicon development environment for typed feature structures (Copestake, 2002: 6). Since it has been most extensively tested with grammars based on Head-Driven Phrase Structure Grammar (Pollard and Sag, 1987, 1994), we, in this section, implement our analyses in LKB system, and try to figure out the pros and cons of the ideas proposed above.

6.1 Proposed grammar rules, types and lexicon

In Section 5, we modify the Specifier-Head Rule and present a double specifier rule, thus in the grammar file, we need to add this rule as follows:

```
specifier-head-rule-1 := binary-head-final &
   [   SPR #rest,
       COMPS #comps,
       ARGS < #1,    [ SPR [FIRST #1, REST #rest] , COMPS #comps ] > ].
```

Figure 14: Modified Head-Specifier Rule

8 SD is the abbreviation of structural description. See Sag and Wasow (2003).
9 The rules and principles mentioned in this section are based on Sag and Wasow (2003).

Then, concerning the noun-classifier matching in Section 4, we also add a feature CLS in the semantic representations. In Section 5, we add this feature in the RESTR, while in the LKB system, the feature is constrained in INDEX. This seems a contradiction. So we present the problem here that is not solved when implementing in the LKB system. Below are the types of nouns preceded by classifiers:

```
noun-lxm-clf := noun-lxm &
[     SPR < phrase &
                [ HEAD clf,
                  SPR <>,
                  SEM.INDEX #1 ] >,
      SEM.INDEX object & #1 ].
```

Figure 15: Nouns preceded by classifiers

Moreover, concerning the lexicon related to nouns and classifiers, we add the CLS feature at this level. For example,

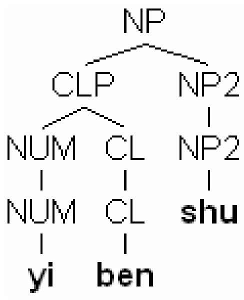
```
shu := noun-lxm-clf &
[     ORTH <! “shu” !>,
      SEM.KEY.PRED “shu_rel”,
      SEM.INDEX.CLS “bound” ].
```

Figure 16: The lexical description of *shū* (book)

6.2 The results

With the grammar we built in the LKB system, we could parse the basic types of Chinese NPs, such as “Num + CL + N”, “Dem + CL + N” and “Dem +Num+ CL + N”. Take *yì běn shū* as example, we enter “yi ben shu” to parse. After the grammar has been loaded, we get the tree diagram as figure 17 shows.[10]

[10] In this figure, there are two NUM and two CL nodes. This is due to the inull-rull and the rule from the lexicon to the tree that we used in our grammar.



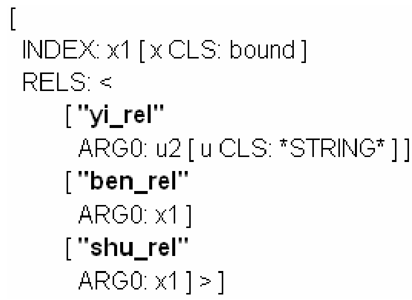


Figure 17: The tree diagram Figure 18: the MRS

In the LKB system, the tree diagram clearly shows the syntactic structure of this noun phrase. However, the syntactic relations between these constituents will be shown in the chart below.[11]

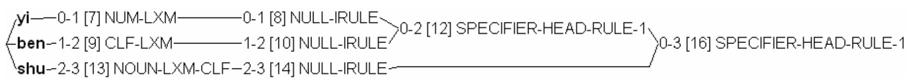


Figure 19: Parsing chart for 'yi ben shu'

Also, if we check the MRS option in the LKB system, Figure 18 just presents the MRS representation for "yi ben shu".[12] In this figure, we could find out that the semantic features for *běn* and *shū* are labeled for the same node "x1", because they are given the same feature as "bound". While concerning the numeral *yī*, the feature for CLS is an empty string, which is not well formed, since numerals do not need this CLS feature.

Finally, if we input "yi tai shu", there will be "No parses found", because tai does not match with *shū* in Chinese, we could see the grammar well solve the noun-classifier matching phenomena.

So far, we built a small grammar of Chinese NPs in the LKB system and successfully test the matching problem between nouns and classifiers. Still, some problems are not solved and new problems arise. For instance, concerning the MRS value, it remains a question that if we need to add the feature CLS in INDEX or RESTR.

[11] The inull-rull here represents the non-morphology changes in Chinese.
[12] MRS refers to the Minimal Recursive Semantics. See more information at Copestake, Ann, Pollard, Carl J. and Sag, Ivan A. (2001) and Flikinger, Dan, Bender, Emily M. and Oepen, Stephan (2003).

7. Concluding remarks

In summary, we analyze the syntactic structures and semantic constrains of Chinese NPs in the frame work of HPSG. Focusing on the noun-classifier matching problem, we suggest a new feature to solve it. For proving our proposal, we implement our ideas in the LKB system and find out the questions of MRS representation.

We also find two questions: (1) For Chinese HPSG processing, we need a further study of the multiple matching and the semantic constraints between nouns and classifiers of classifiers; (2) The problem when implementing the MRS representation in the LKB system should be studied completely. Further researchers include the multiple matching problems and implementations in other systems, like TRALE and the Matrix.[13]

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[13] TRALE is a grammar implementation platform specifically for the implementation of theoretical HPSG grammars. (Nurit Melnik, 2005) And the Matrix is a framework for the development of broad-coverage, precision, implemented HPSG grammars for diverse languages. (http://www.delph-in.net/matrix/)

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Complex Topic-Comment Structures in HPSG

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Abstract

Based on Krifka (1992) and de Kuthy (2000), this paper develops an architecture for complex topic-comment structures in HPSG and applies it to predicate fronting in English with the goal of capturing the insights of Ward (1988) on this construction. We argue that predicate fronting is a distributed constructional form consisting of an auxiliary occurring in a predicate preposing phrase. The use of predicate preposing is a function of a combination of simultaneous constraints on its theme structure, its background-focus distribution, and its presuppositional structure. It is shown that these constraints can be made explicit within the HPSG architecture developed here.

1 Non-canonical Syntactic Constructions

Höhle (1982) has argued that non-canonical syntactic constructions in German typically have fewer information structural options compared to canonical sentence patterns. The same has been argued for English. Ward (1988) concludes that the preposing constructions in (1)-(2) require the (meaning of the) preposed constituent to be a backward looking center. Similarly, Birner (1996) shows that inversion constructions like (3) are felicitous only if the preposed constituent is at least as discourse-familiar as the postposed NP:

(1) *One of these rugs* Chambers delivered TO HARRY DEXTER WHITE.

(2) (It was necessary to pass the exam and) *pass* I DID.

(3) *On the desk* was A BIG LAMP.

There is a generalization that cuts across these English constructions and others:[1] in their prototypical use

1. the italicized constituent is the leftmost constituent of its predicate-argument complex, and
2. it is followed by another constituent of the same predicate-argument complex which is prosodically more prominent than it;
3. each sentence is more "about" the meaning of the italicized constituent than the meaning of the constituent in small caps (backgrounded, contrastive topic).

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[1] The generalization extends to German as well.

Previous work on information structure in HPSG (e.g. Vallduvi (1992)) has not derived this generalization. The work reported here is part of a larger research project which aims at developing a theoretical architecture that makes it possible to state this generalization in HPSG while also accounting for the properties specific to each non-canonical sentence pattern. The present article will only deal with a small portion of this subject matter, namely predicate preposing.

2 Case Study: Predicate Preposing

Ward (1988) provides the following attested examples of predicate topicalization sentences:[2]

(4) As members of the Gray Panthers committee, WE WENT TO CANADA TO LEARN, and *learn we did.*
[*Philadelphia Inquirer,* 6/16/85]

(5) THE KING HAS INSTRUCTED ME TO BE BRIEF, and since I am His Majesty's loyal subject, *brief I will be.*
[*A Man for All Seasons,* Messenger]

He arrives at the following conclusion concerning the felitous use of this sentence form:

Ward's Generalization Ward (1988)

Predicate preposing is associated with the function of proposition affirmation. Proposition affirmation serves to affirm a proposition explicitly evoked in the discourse.

The contrast in (6) serves to illustrate this analysis. (6c) cannot felicitously follow (6a), since the proposition affirmed by (6c), namely that *I have enough money* is not explicitly introduced into the discourse by (6a). That there is nothing wrong with this sequence of meanings in principle is shown by (6b) which can felicitously follow (6a). The difference is that unlike predicate preposing the emphatic do-support construction (the *verum focus* of Höhle (1992)) does not require the proposition it affirms to have been *explicitly* evoked in the previous discourse:

(6) a. I want to buy a car.
b. And I DO have enough money.
c. # And *have enough money I* DO.

As predicted by Ward's assumptions, if (6c) is put into a discourse context where the affirmed proposition has been introduced explicity, its use becomes felicitous:

(7) They said I WOULDN'T HAVE ENOUGH MONEY TO BUY A CAR, but *have enough money I* DO.

[2] Most of the examples in this article that relate to predicate preposing are taken from Ward (1988), by far the most careful and sophisticated study of the construction.

3 Towards an Architecture for Information Structure in HPSG

The theory of the relationship between syntax, semantics, and information structure developed below is based on the assumption that there are dependencies and interrelations between meanings and context that can only be expressed by a semantic representation language that makes reference to objects of specific semantic types, in particular properties (or their extensions). Moreover, it should be possible to impose discourse-anaphoric requirements on semantic pieces of constructions (and likely also rhetorical relations). A natural choice for this purpose is Discourse Representation Theory (Kamp and Reyle (1993)), in particular Lambda-DRT, because the latter is typed.

Another important question that arises concerns the degree of articulation of the information structure. Krifka (1992) and Jacobs (2001) draw a four-way distinction between topic-comment and background-focus. de Kuthy (2000), in essence following Vallduvi (1992), distinguishes between background and focus and adds a (contrastive) topic in the sense of Büring (1997). For the purposes of this paper, the three-way distinction appears to be sufficient and I will consequently adopt it.

Borrowing from the Prague School, Halliday (1967) develops the concepts *theme* which for him is the starting point of an utterance, its leftmost constituent. A related concept is proposed in Jacobs (2001): *semantic subjecthood* is one dimension in Jacobs' multidimensional conception of topichood. According to Jacobs, the semantic subject of a clause is the highest term that specifies a variable in the meaning of the clause's main predicate. As a consequence of the syntax-semantics interface, a sentence-initial constituent will frequently (but not always) contribute the semantic subject to the clause's logical form.

I will adopt Jacobs' idea of theme[3] as a configurational notion in logical form and even generalize it to the case where a predicate itself is topical in the sense under discussion.

Overall, then, the architecture that is developed in this paper, consists on the one hand of the information structural triad *background-focus-(contrastive) topic* and on the other hand of the notion of *theme*. I believe that these two dimensions of information structure have different functions in the system of choices that a natural language grammar represents. This is stated in the following hypothesis.

Hypothesis

Syntactic non-canonicality is strongly associated with the choice of theme. On the other hand, prosody is more concerned with the information structural triad of background-focus-(contrastive)topic.

Of course, elements which appear in syntactically non-canonical positions may also be prosodically prominent, so that the two concepts will often interact. Crucial

[3]I prefer Halliday's name *theme* to Jacobs' own name *semantic subject* for Jacobs' concept.

evidence for the relevance of the notion *theme* comes from inversion constructions. Birner (1996) has shown that this sentence type serves an information packaging function in the sense of Chafe (1976). The following data show, however, that this function is independent of the triad background-focus-topic and needs to be characterized in some other fashion. In (8), the initial PP is in the background, given the context question:

(8) a. Witness, when you walked into the office, what was on the desk?
b. [$_{bg}$ On the desk was] [$_{foc}$ a KNIFE].

It is also possible for the inverted PP to be a contrastive topic:

(9) a. Witness, you told us that was on the shelf, but what was on the desk?
b. [$_{top}$ On the DESK] [$_{bg}$ was] [$_{foc}$ a KNIFE].

And, finally, inversion sentences can be all-focus, as is shown by (10):

(10) a. Witness, when you walked into the office, what did you see?
b. [$_{foc}$ On the desk was a KNIFE].

Discourses like the last one thus show that the preverbal and the postverbal constituents of inversion sentences can be in focus at the same time. Yet, even those sentences are felt to be more about the meaning of the initial PP than the meaning of the final NP. I would like to argue that what underlies this intuition is that inversion sentences are characterized by the following combination of information structural constraints:

(11) 1. The preverbal constituent of an inversion is the theme (in Jacobs' sense).
2. The postveral constituent of an inversion is part of the focus.

Furthermore, I postulate the following preference principles (which could be seen in terms of harmonic alignment in Optimality Theory):

(12) 1. Preferably, themes are unfocused.
2. Preferably, themes are discourse-familiar.

This combination of assumptions derives the observation in Birner (1996) that the initial constituent in inversions prefers to be discourse-familiar over being discourse-new by a ratio of about 10:1. Assuming that information foci typically are discourse-new, this is compatible with Birner's finding that the ratio for the postverbal NP in inversions is practically the reverse.

We anticipate that it will be useful to have a notion of relative aboutness that is more general than that of a *theme*, e.g. in order to capture the typical information-structural differences between the two objects in the double object construction of English discussed in detail by Bresnan in recent years (e.g. Bresnan et al. (2007)) and the effects typically associated with scrambling in languages like German (e.g. Webelhuth (1992), Haider and Rosengren (1998)). To this end, we define a relation *more thematic than* in terms of logical form configurations, as follows:[4]

[4]The symbol $\triangleleft$ represents the relation that holds between two LF terms iff the first one is a (not necessarily proper) subconstituent of the second one.

(13) Definition of ”more thematic than” ($\ll$)

$\alpha \ll \beta$ in LF $\Lambda =_{df} \exists\gamma \triangleleft \Lambda$ such that

1. $\gamma = \begin{bmatrix} \textit{appl} & \\ \text{FUNC} & \beta' \\ \text{ARG} & \alpha' \end{bmatrix}$
2. $\alpha \triangleleft \alpha'$
3. $\beta \triangleleft \beta'$

The representation format is heavily influenced by Sailer (2000). (13) then says that an argument and any term it contains is more thematic than the functor that applies to it and any term contained in the functor. Assuming a function-argument structure for ditransitive verbs where the verb semantically combines with its arguments in the order oblique $<$ direct object $<$ subject, this makes the meaning of the subject more thematic than the meanings of both objects and the meaning of the direct object more oblique than the meaning of the oblique object. As the results of Bresnan's studies on the English double object construction referred to above show, these assumptions are in line with the predictions of (12).
The effect of the definition of relative thematicity can be illustrated with an example from inversion:

(14) On the desk was a knife.

For the purposes of illustration, (14) can be given the logical form below,

(15) $\begin{bmatrix} \textit{appl} & \\ \text{FUNC} & \lambda P.\exists y[knife(y) \wedge P(y)] \\ \text{ARG} & \lambda x.\iota z[desk(z) \wedge on(x,z)] \end{bmatrix}$

which predicates of (the extension of) the property of being on the desk that the generalized quantifier *a knife* applies to it. According to (13), this makes the property more thematic than the generalized quantifier which is the desired result considering the discussion in connection with (8)-(10).

4 Sketch of the Formal Architecture

In this section, I will sketch the architecture that embeds the semantic and information structural assumptions introduced above in HPSG data structures.[5]
We begin by describing the structure of the type *local*:

[5]Length limitations on the article make it impossible to describe every detail of the architecture or the analysis. Moreover, as the analysis below does not involve contrastive topics, this will also allow us to simplify and shorten the exposition by ignoring topics in the current paper. These shortcomings will be remedied in a future publication.

(16) $$\begin{bmatrix} \textit{loc} & \\ \text{CAT} & \textit{cat} \\ \text{CONT} & \begin{bmatrix} \textit{cont} & \\ \text{BG} & \begin{bmatrix} \textit{bg} & \\ \text{FVARS} & \textit{list} \\ \text{CORE} & \textit{me} \end{bmatrix} \\ \text{FOC} & \textit{list} \end{bmatrix} \end{bmatrix}$$

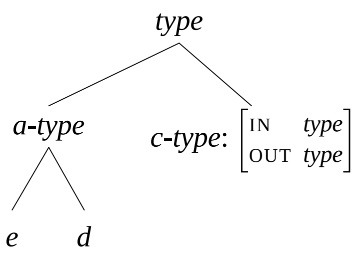
Objects of type *loc* carry category and content information. The value of the CONT(ENT) attribute is an object of type *cont* which is a meaning structured into background and focus. The most important part of the background is the core which is a meaningful expression. The second component of the background is the list-valued attribute FOCUS VARIABLES (FVARS). As a whole, the content thus is structured into three pieces: the core, a list of foci, and a list of focus variables inside the core. There is a one-to-one relationship between the elements on the focus list and the elements on the list of focus variables in accordance with the original proposal in Krifka (1992). The focus list is empty if and only if the list of focus variables is empty. The core must always be present and represents an all-background logical form if there is no focus.

In accordance with what was said above, meaningful expressions are typed:

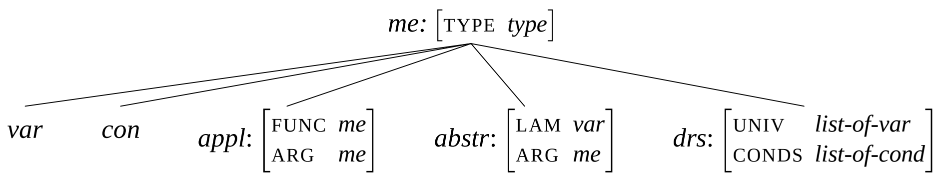
(17) $$\begin{bmatrix} \textit{me} & \\ \text{TYPE} & \textit{type} \end{bmatrix}$$

Types are either atomic (*a-type*) or complex (*c-type*). The types *e* and *d* stand for entities and discourse representation structures, respectively. Complex types have input and output types:

(18)



The major types of meaningful expressions are given below:



As expected, there are variables and constants. Applications apply a functor to an argument, abstractions abstract over a variable inside an argument expression, and discourse representation structures consist of lists of variables and lists of conditions.

5 Examples of contents

The next two structures illustrate the use of the semantic representations that were just defined.

(19) Fido_{bg}: $$\begin{bmatrix} \textit{word} & \\ \text{SS} & \begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CONT} & \begin{bmatrix} \text{BG} & \begin{bmatrix} \text{FVARS} & \langle\rangle \\ \text{CORE} & f_e \end{bmatrix} \\ \text{FOC} & \langle\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The word *Fido*, marked as backgrounded, has as the core of the background a constant of type *e*[6]. The focus list is empty and correspondingly the core does not contain a variable representing the focus which means that the lis of focus variables is emtpy as well.

Next, I illustrate a focused word:

(20) barked_{foc}: $$\begin{bmatrix} \textit{word} & \\ \text{SS} & \begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CONT} & \begin{bmatrix} \text{BG} & \begin{bmatrix} \text{FVARS} & \langle P_{ed} \rangle \\ \text{CORE} & P_{ed} \end{bmatrix} \\ \text{FOC} & \left\langle \begin{bmatrix} \textit{abstr} & \\ \text{TYPE} & \textit{ed} \\ \text{LAM} & x_e \\ \text{ARG} & \begin{bmatrix} \textit{drs} & \\ \text{UNIV} & \langle\rangle \\ \text{CONDS} & \langle \textit{bark}(x_e) \rangle \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

I am treating the meaning of *bark* as of type *ed*, i.e. a function from individuals *x* into DRSs that contain the condition that *x* barks. As the word above is focused, this meaning appears as the single member of the word's focus list. The core of the background consists of the variable *P* of the same type as the focus. As this variable represents the focus, it is bound in FVARS.

6 Semantic composition

This section illustrates the process of the composition of meanings in complex constituents. There are several different cases to consider that are treated with different principles. Recall that the FOC and FVARS lists may both be empty, leaving the CORE as the only obligatory semantic contribution of an expression. In an expression with two subexpressions, the cores must be type compatible with function-argument application, since the core of the mother is the result of applying the core of one daughter to the core of the other. To this end, we make use of a relational constraint *apply* that performs a type check on its two arguments and if possible creates a proper application data structure. As the remaining attributes

[6] Muskens (1996) justifies translating names as constants.

have lists as their values, the values of the lists in the mother are simply the *append* of the corresponding lists in the two daughter constituents:

(21)

$$\begin{bmatrix} \textit{non-hd-fill-ph} \\ \text{S}|\text{L}|\text{CONT} \begin{bmatrix} \text{BG} & \begin{bmatrix} \text{FVARS} & \boxed{1} \oplus \boxed{2} \\ \text{CORE} & \textit{apply}(\boxed{3},\boxed{4}) \end{bmatrix} \\ \text{FOC} & \boxed{5} \oplus \boxed{6} \end{bmatrix} \end{bmatrix}$$

$$\overset{\text{N}}{\begin{bmatrix} \text{S}|\text{L}|\text{CONT} \begin{bmatrix} \text{BG} & \begin{bmatrix} \text{FVARS} & \boxed{1} \\ \text{CORE} & \boxed{3} \end{bmatrix} \\ \text{FOC} & \boxed{5} \end{bmatrix} \end{bmatrix}} \quad \overset{\text{H}}{\begin{bmatrix} \text{S}|\text{L}|\text{CONT} \begin{bmatrix} \text{BG} & \begin{bmatrix} \text{FVARS} & \boxed{2} \\ \text{CORE} & \boxed{4} \end{bmatrix} \\ \text{FOC} & \boxed{6} \end{bmatrix} \end{bmatrix}}$$

This principle applies only in non-head-filler-phrases. Head-filler phrases need to be treated separately, since they are assumed to contain a gap of the filler which contributes a semantic variable ($\boxed{7}$ below) to its core, the only component of its content which is substantively obligatory. This variable needs to be abstracted over before the meanings of the two core constituents enter into the *apply* relation, to avoid a type incompatibility. This is the only difference between this principle and the previous one, as is shown below:

(22)

$$\begin{bmatrix} \textit{hd-fill-ph} \\ \text{S}|\text{L}|\text{CONT} \begin{bmatrix} \text{BG} & \begin{bmatrix} \text{FVARS} & \boxed{1} \oplus \boxed{2} \\ \text{CORE} & \textit{apply}\left(\boxed{3}, \begin{bmatrix} \textit{abstr} \\ \text{LAM} & \boxed{7} \\ \text{ARG} & \boxed{4} \end{bmatrix}\right) \end{bmatrix} \\ \text{FOC} & \boxed{5} \oplus \boxed{6} \end{bmatrix} \end{bmatrix}$$

$$\overset{\text{N}}{\begin{bmatrix} \text{S}|\text{L}|\text{CONT} \begin{bmatrix} \text{BG} & \begin{bmatrix} \text{FVARS} & \boxed{1} \\ \text{CORE} & \boxed{3} \end{bmatrix} \\ \text{FOC} & \boxed{5} \end{bmatrix} \end{bmatrix}} \quad \overset{\text{H}}{\begin{bmatrix} \text{S} \begin{bmatrix} \text{L}|\text{CONT} \begin{bmatrix} \text{BG} & \begin{bmatrix} \text{FVARS} & \boxed{2} \\ \text{CORE} & \boxed{4} \end{bmatrix} \\ \text{FOC} & \boxed{6} \end{bmatrix} \\ \text{N}|\text{SLASH} \left\langle \begin{bmatrix} \text{CONT}|\text{BG}|\text{CORE} & \boxed{7} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}}$$

7 Example

We are now in a position to show the effect of combining the meanings of the two lexical entries from section 5, as used in the sentence *Fido*$_{bg}$ *barked*$_{foc}$:

(23) Fido$_{bg}$ barked$_{foc}$:

$$\begin{bmatrix} \text{CONT} \begin{bmatrix} \text{BG} & \begin{bmatrix} \text{FVARS} & \langle P_{ed} \rangle \\ \text{CORE} & \begin{bmatrix} \textit{appl} \\ \text{FUNC} & P_{ed} \\ \text{ARG} & f_e \end{bmatrix} \end{bmatrix} \\ \text{FOC} & \left\langle \lambda x_e \begin{array}{|c|} \hline \\ \hline \textit{bark}(x_e) \\ \hline \end{array} \right\rangle \end{bmatrix} \end{bmatrix}$$

The meaning of the focused word *barked* appears on the focus list of the mother.[7] The core consists of the application of the two cores of the daughter constituents: the constant f_e contributed by the word *Fido* and the focus variable contributed by *barked*. This focus variable is bound from FVARS.
We can paraphrase this structured meaning informally as follows: the sentence asserts of the set of all properties of Fido that barking is one of them.

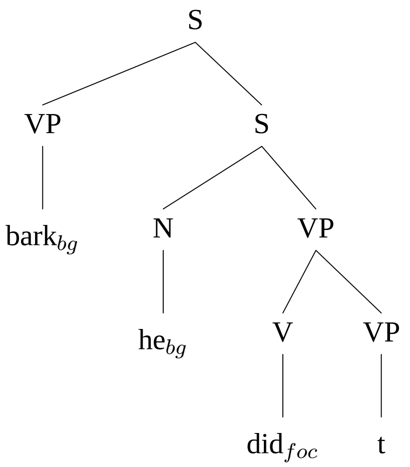
8 An Example Involving VP-Preposing

We now return to VP-preposing and its conditions of use. I will analyze the italicized portion of the following example:

(24) I was sure that Fido would bark and *bark he did*

I postulate the following structure for this sentence:

(25)



Principles to be introduced later will require that the auxiliary be in focus and the remainder of the sentence in the background.
The semantic composition of this sentence proceeds as follows. The trace of the preposed VP has the following content determined by the lexical entry of the trace: its core consists of a variable of type *ed*; the focus and focus variable lists are empty:

(26) t: $\begin{bmatrix} \text{CONT} & \begin{bmatrix} \text{BG} & \begin{bmatrix} \text{FVARS} & \langle\rangle \\ \text{CORE} & Q_{ed} \end{bmatrix} \\ \text{FOC} & \langle\rangle \end{bmatrix} \end{bmatrix}$

Restricting the semantic contribution of a trace to a variable in its core means that the trace in essence remains semantically neutral as far as the structured meaning

[7] We liberally use notational simplifications where this improves readability.

is concerned. Semantic composition can proceed normally and the information structural properties of the filler are in no way predetermined by the status of the trace.

The backgrounded pronoun *he* has empty focus and focus variable lists. Its core consists of a variable as well:[8]

(27) he_{bg}: $\left[\textsc{cont}\ \left[\begin{array}{ll}\textsc{bg} & \left[\begin{array}{ll}\textsc{fvars} & \langle\rangle \\ \textsc{core} & z_e\end{array}\right] \\ \textsc{foc} & \langle\rangle\end{array}\right]\right]$

The focused auxiliary is more interesting. We take its ordinary meaning to be the identity function within the semantic domain of type *ed*, i.e. it maps functions from discourse referents to DRSs into themselves. As *did* is focused, this meaning is stored as the single member of the word's focus list. This focus is represented by the variable *R* of type *ed(ed)* in the core and is bound from FVARS:

(28) did_{foc}: $\left[\textsc{cont}\ \left[\begin{array}{ll}\textsc{bg} & \left[\begin{array}{ll}\textsc{fvars} & \left\langle R_{ed(ed)}\right\rangle \\ \textsc{core} & R_{ed(ed)}\end{array}\right] \\ \textsc{foc} & \left\langle \lambda P_{ed}.P_{ed}\right\rangle\end{array}\right]\right]$

The content of the lower S-node in (25) is the result of a double application: first, the meaning of the auxiliary is applied to the variable contributed by the trace; then, the result is applied to the variable contributed by the subject pronoun:

(29) $\text{he}_{bg}\ \text{did}_{foc}$ t: $\left[\textsc{cont}\ \left[\begin{array}{ll}\textsc{bg} & \left[\begin{array}{ll}\textsc{fvars} & \left\langle R_{ed(ed)}\right\rangle \\ \textsc{core} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{appl}} \\ \textsc{func} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{appl}} \\ \textsc{func} & R_{ed(ed)} \\ \textsc{arg} & Q_{ed}\end{array}\right] \\ \textsc{arg} & z_e\end{array}\right]\end{array}\right] \\ \textsc{foc} & \left\langle \lambda P_{ed}.P_{ed}\right\rangle\end{array}\right]\right]$

The top node of (25) is a head-filler phrase. Recall that (22) requires that the variable contributed to the core of the head daughter by the trace is abstracted over before the two daughters of the head-filler-phrase are combined semantically via the apply-relational constraint. We first take care of the abstraction:

[8]The variable will be treated like a discourse referent that must find an accessible antecedent in the previous discourse, according to the standard treatment of pronouns in DRT.

(30) he$_{bg}$ did$_{foc}$ t: $\left[\begin{array}{ll}\textsc{cont} & \left[\begin{array}{ll}\textsc{bg} & \left[\begin{array}{ll}\textsc{fvars} & \left\langle R_{ed(ed)}\right\rangle \\ \textsc{core} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{abstr}} \\ \textsc{lam} & Q_{ed} \\ \textsc{arg} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{appl}} \\ \textsc{func} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{appl}} \\ \textsc{func} & R_{ed(ed)} \\ \textsc{arg} & Q_{ed}\end{array}\right] \\ \textsc{arg} & z_e\end{array}\right]\end{array}\right]\end{array}\right] \\ \textsc{foc} & \left\langle \lambda P_{ed}.P_{ed}\right\rangle\end{array}\right]\end{array}\right]$

The meaning of *bark* is straigtforward, as the expression is backgrounded. The focus and focus variable lists are both empty:

(31) bark$_{bg}$: $\left[\begin{array}{ll}\textsc{cont} & \left[\begin{array}{ll}\textsc{bg} & \left[\begin{array}{ll}\textsc{fvars} & \langle\rangle \\ \textsc{core} & \lambda x_e \begin{array}{|c|}\hline \\ \hline \textit{bark}(x_e) \\ \hline\end{array}\end{array}\right] \\ \textsc{foc} & \langle\rangle\end{array}\right]\end{array}\right]$

Finally, we combine (30) and (31) via (22) to arrive at the meaning of the top node of our example sentence:

(32) bark$_{bg}$ he$_{bg}$ did$_{foc}$ t:

$$\left[\begin{array}{ll}\textsc{cont} & \left[\begin{array}{ll}\textsc{bg} & \left[\begin{array}{ll}\textsc{fvars} & \left\langle R_{ed(ed)}\right\rangle \\ \textsc{core} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{appl}} \\ \textsc{func} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{abstr}} \\ \textsc{lam} & Q_{ed} \\ \textsc{arg} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{appl}} \\ \textsc{func} & \left[\begin{array}{ll}\multicolumn{2}{l}{\textit{appl}} \\ \textsc{func} & R_{ed(ed)} \\ \textsc{arg} & Q_{ed}\end{array}\right] \\ \textsc{arg} & z_e\end{array}\right]\end{array}\right] \\ \textsc{arg} & \lambda x_e \begin{array}{|c|}\hline \\ \hline \textit{bark}(x_e) \\ \hline\end{array}\end{array}\right]\end{array}\right] \\ \textsc{foc} & \left\langle \lambda P_{ed}.P_{ed}\right\rangle\end{array}\right]\end{array}\right]$$

Note that the focus and focus variables stored in the content of the head daughter have been carried up correctly to the corresponding lists of the head-filler phrase. Informally, we can characterize the resulting content as follows: the sentence asserts of the set of relations that hold between the property of barking and the denotation of the subject pronoun *he* that this set contains the relation that holds between a property and an individual if and only if the property applies to the referent. Or, more colloquially: against the background of the issue of which relations hold between barking and the referent of *he* the sentence asserts that barking is one of the properties of that referent.

9 Deriving the Distribution of the Bg and Foc properties

(25) assumes that the preposed VP and the subject of (24) are backgrounded and that the auxiliary *did* is focused. This does not follow from anything we have said so far and still needs to be derived. To this end, we impose appropriate lexical and constructional constraints on predicate preposing constructions. We assume that these constraints are part of the speaker-hearer's knowledge of the use of this language-particular construction.[9]

The first constraint we need applies to auxiliary words whose second argument is a *gap-synsem*. This singles out auxiliaries whose predicate complement has been preposed. The constraint requires two things: (i) the auxiliary's value of the attribute STATUS is *focus* and (ii) the status of its first argument (its subject) is *background*:[10]

(33) $\begin{bmatrix} \textit{aux-wd} & \\ \textsc{arg-s} & \langle \textit{NP},\textit{gap-ss} \rangle \end{bmatrix} \Rightarrow \begin{bmatrix} \textsc{ss}|\textsc{status} & \textit{foc} \\ \textsc{arg-s} & \langle [\textsc{status}\ \ \textit{bg}],\textit{gap-ss} \rangle \end{bmatrix}$

A second principle applies to predicate preposing phrases and requires of their filler daughter that its status be *background*:

(34) $[\textit{pred-prepos-ph}] \Rightarrow \begin{bmatrix} \textit{hd-fill-ph} & \\ \textsc{non-hd-dtr} & [\textsc{ss}|\textsc{status}\ \ \textit{bg}] \end{bmatrix}$

These two constraints will only yield the intended effect if it is guaranteed that the auxiliaries constrained by (33) occur in a predicate preposing phrase and vice versa. In other words, we must make sure that the pieces that make up the predicate preposing construction all occur with each other.

To achieve this, we need to add information to (33) and (34). We introduce a feature CONSTRUCTION (CX) that is borne by the pieces of a construction that may be realized discontinuously.[11] We now modify (33) by requiring that the auxiliary find the constructional feature *pred-prepos-cx*. This feature will "float" up the tree until it is bound by an instance of the predicate preposing construction:

(35) $\begin{bmatrix} \textit{aux-wd} & \\ \textsc{arg-s} & \langle \textit{NP},\textit{gap-ss} \rangle \end{bmatrix} \Rightarrow \begin{bmatrix} \textsc{ss}|\textsc{status} & \textit{foc} \\ \textsc{arg-s} & \langle [\textsc{status}\ \ \textit{bg}],\textit{gap-ss} \rangle \\ \textsc{cx} & \begin{bmatrix} \textit{cx} & \\ \textsc{find} & \langle \textit{pred-prepos-cx} \rangle \bigcirc L \end{bmatrix} \end{bmatrix}$

[9] The assumption that we are dealing with a language-particular construction is motivated in light of the fact that German and English sentences with preposed predicates have different usage conditions.

[10] The feature STATUS is appropriate for *synsem* objects and encodes the information structure status of a *synsem*.

[11] In (24), the auxiliary whose predicate has been preposed is the head of the predicate preposing phrase. But there are examples where this is not the case: *I was afraid that Fido would bark and bark he may have.* The CX-feature functions in some ways like the COLL-feature of Sailer (2000).

Of course, auxiliaries whose predicate complement stays in situ do not float the *pred-prepos-cx* find-feature:

$$(36)\ \begin{bmatrix} \textit{aux-wd} \\ \text{ARG-S}\ \langle \textit{NP,canon-ss} \rangle \end{bmatrix} \Rightarrow \begin{bmatrix} \text{CX} \begin{bmatrix} \textit{cx} \\ \text{FIND}\ L \end{bmatrix} \end{bmatrix} \wedge pred-prepos-cx \notin L.$$

Predicate preposing phrases, in turn, are required to have a head daughter that is looking for a predicate preposing phrase. Moreover, they bind off the feature *pred-prepos-cx*, as expected:

$$(37)\ \begin{bmatrix} \textit{pred-prepos-ph} \end{bmatrix} \Rightarrow \begin{bmatrix} \textit{hd-fill-ph} & \\ \text{HD-DTR} & \begin{bmatrix} \text{CX} \begin{bmatrix} \textit{cx} \\ \text{FIND}\ \langle \textit{pred-prepos-cx} \rangle \bigcirc L \end{bmatrix} \end{bmatrix} \\ \text{CX} & \begin{bmatrix} \textit{cx} \\ \text{FOUND}\ \langle \textit{pred-prepos-cx} \rangle \end{bmatrix} \end{bmatrix}$$

10 Capturing Ward's Generalization

Recall Ward's characterization of the felicity conditions of predicate preposing:

Ward's Generalization Ward (1988)

Predicate preposing is associated with the function of proposition affirmation.

Proposition affirmation serves to affirm a proposition explicitly evoked in the discourse.

The semantic representation (32) of (24) does not capture Ward's insight yet. More work is needed to capture the full conditions of use of sentences involving predicate preposing. We begin with the portion of the requirement that predicate preposing must affirm a proposition that has been *explicitly evoked in the discourse*. We will impose a slightly different constraint, namely that the background of the content of predicate preposing phrases must have an antecedent in the discourse that has not been accomodated:

$$(38)\ \begin{bmatrix} \textit{pred-prepos-ph} \end{bmatrix} \Rightarrow \begin{bmatrix} \text{CONT}|\text{BG} & \boxed{1} \\ \text{CONX}|\text{PRESUPP} & \left\langle \begin{bmatrix} \text{ANTEC} & \boxed{1} \\ \text{ACCOM} & - \end{bmatrix} \right\rangle \bigcirc L \end{bmatrix}$$

Applying this constraint to (32) yields the following representation:

$$
(39)\quad \begin{bmatrix}
\text{CONT} & \begin{bmatrix}
\text{BG} & \boxed{1}\begin{bmatrix} \text{FVARS} & \left\langle R_{ed(ed)}\right\rangle \\ \text{CORE} & \begin{bmatrix} \textit{appl} & \\ \text{FUNC} & \begin{bmatrix}\textit{abstr} & \\ \text{LAM} & Q_{ed} \\ \text{ARG} & \begin{bmatrix}\textit{appl} & \\ \text{FUNC} & \begin{bmatrix}\textit{appl} & \\ \text{FUNC} & R_{ed(ed)} \\ \text{ARG} & Q_{ed}\end{bmatrix} \\ \text{ARG} & z_e \end{bmatrix}\end{bmatrix} \\ \text{ARG} & \lambda x_e \begin{array}{|c|}\hline \\ \hline \textit{bark}(x_e) \\ \hline \end{array}\end{bmatrix}\end{bmatrix} \\
\text{FOC} & \left\langle \lambda P_{ed}.P_{ed}\right\rangle &
\end{bmatrix} \\
\text{CONX}|\text{PRESUPP} & \left\langle \begin{bmatrix}\text{ANTEC} & \boxed{1} \\ \text{ACCOM} & - \end{bmatrix}\right\rangle
\end{bmatrix}
$$

This structure now requires that the issue of which relationships hold between barking and the referent of the subject pronoun *he* must have been introduced into the discourse explicitly and the sentence then asserts that barking indeed *is* a property of that referent.

This leaves the other portion of Ward's Generalization to be derived, the part which says that the sentence must affirm rather than deny the evoked proposition. We will express this constraint as the requirement that the content of the non-head daughter of a predicate preposing phrase must satisfy an *affirmativitiy constraint* relative to the content of its mother:

$$
(40)\quad \begin{bmatrix} \textit{pred-prepos-ph} & \\ \text{S}|\text{L}|\text{CONT} & \boxed{1} \\ \text{NON-HD-DTR} & \begin{bmatrix}\text{S}|\text{L}|\text{CONT} & \boxed{2}\end{bmatrix} \end{bmatrix} \Rightarrow \textit{affirmativity-constraint}(\boxed{2},\boxed{1})
$$

The affirmativity constraint does two things: (i) Speaking in a procedural metaphor, it first takes its two arguments (which are structured meanings) and reduces them to single meaningful expressions by recursively applying the background to the list of foci followed by a β-reduction. We assume that this is accomplished by the auxiliary relation called *focus-reduction*. (ii) Secondly, it checks that the focus-reduced content of the non-head daughter does not appear in the scope of negation within the focus-reduced content of the whole phrase:

$$
(41)\quad \textit{affirmativity-constraint}(\boxed{2},\boxed{1}) \text{ iff focus-reduction}(\boxed{2},\boxed{2'}) \wedge \\
\text{focus-reduction}(\boxed{1},\boxed{1'}) \wedge \neg\exists\phi,\psi[\phi \lhd \boxed{1'} \wedge \phi \textit{ is of the form } \neg\psi \wedge \boxed{2'} \lhd \psi]
$$

As there is no negation at all in (39), the filler daughter of (25) satisfies the affirmativity constraint and hence Ward's Generalization on predicate preposing.

11 Predictions

The theory of predicate preposing that was developed in the previous sections derives the following correct predictions. (6a) can felicitously be followed by (6b) but not by (6c), since (6c) requires a context which has its background represented without accomodation. Utterances of (6a) do not create such a context. Utterances of (7) do provide the right context for the preposing of the predicate in the second conjunct.

(42b) is not a felicitous response to the question in (42a) since the question requires the preposed predicate of (42b) to be in focus and this contradicts (34):

(42) a. A: I know that during the spring cleaning Mary washed the windows and Tom cleaned the attic. But what did Jill do?
 b. # B: [Wash the FLOORS] she did!

(43) below imposes an unresolvable conflict on the subject pronoun *she* of the response: the contrastive intent of the utterance requires the pronoun to be focused while the preposing construction's auxiliary constraint in (35) forces the subject to be backgrounded:

(43) a. A: I know that during the spring cleaning Mary washed the windows and Tom cleaned the attic.
 b. # B: Actually, [clean the attic] SHE did!

12 Summary

Based on Krifka (1992) and de Kuthy (2000), we have developed an architecture for complex topic-comment structures in HPSG and have applied it to predicate fronting in English with the goal of capturing the insights of Ward (1988) on this construction. We argued that predicate fronting is a distributed constructional form consisting of an auxiliary occurring in a predicate preposing phrase. The use of predicate preposing is a function of a combination of simultaneous constraints on its theme structure, its background-focus distribution, and its presuppositional structure. It was shown that these constraints can be made explicit within the HPSG architecture developed here. Future work will have to show whether the type of analysis of this paper scales up to other non-canonical constructions in English and other languages.

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Evidence for the linearization-based theory of semantic composition

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Abstract

The result of questionnaire studies are presented which shows (i) that conjuncts are scope islands in Japanese and (ii) that left-node raising can nullify such scope islands. This finding confirms the theory advanced in Yatabe (2001), in which semantic composition is almost entirely carried out within order domains, and arguably contradicts the theory proposed in Beavers and Sag (2004), which introduces a mechanism called Optional Quantifier Merger to deal with the fact that right-node raising and left-node raising can have semantic effects.

1 Introduction

It is undeniable that right-node raising (RNR) and left-node raising (LNR) (see Yatabe (2001)) can affect semantic interpretation. At the same time, there seems to be a growing consensus that RNR and LNR should be analyzed in terms of some linearization-related mechanism rather than the SLASH mechanism and its equivalents (see Yatabe (2001) and Beavers and Sag (2004) for some recent discussion within the context of HPSG). Thus an adequate theory of RNR and LNR must be able to explain how it is that linearization-related mechanisms can affect semantic interpretation; a theory like that presented in Kathol and Pollard (1995), which is based on the assumption that semantic composition is not affected by what happens in order domains, turns out to be inadequate.

There have been two proposals regarding how to allow semantic interpretation to be affected by linearization-related mechanisms. One is the theory advanced in Yatabe (2001), in which semantic composition is almost entirely carried out within order domains. The other is the theory proposed in Beavers and Sag (2004), which retains the more conventional view of semantic composition and in which the relevant observations are explained by simply adding a mechanism called *Optional Quantifier Merger* to the grammar.

The aim of this paper is to present evidence that favors the former theory over the latter. First, in Section 2, problems with SLASH-based theories of RNR and LNR will be enumerated. In Section 3, the two linearization-based theories of RNR and LNR that are to be compared will be described in some detail. Then, in Section 4, evidence will be presented which appears to favor the theory proposed in Yatabe (2001). Finally, it will be examined in Section 5 whether the analysis that is proposed for Japanese in this paper is applicable to English as well.

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2 Problems for SLASH-based theories of RNR and LNR

RNR and LNR are clearly capable of affecting the meaning of a sentence, as shown by examples such as (1), taken from Abbott (1976).

(1) a. I borrowed, and my sister stole, a total of $3000 from the bank.

b. I borrowed a total of $3000 from the bank and my sister stole a total of $3000 from the bank.

Given the standard theory of semantic composition, this seems to mean that RNR and LNR alter the syntactic structure of a sentence; more specifically, it seems to mean that RNR and LNR should be given a treatment in terms of the SLASH mechanism or its equivalents in other frameworks, as in Gazdar (1981).

However, there are numerous differences between RNR and LNR on the one hand and instances of leftward extraction such as topicalization and relativization on the other that are difficult to account for if RNR and LNR constructions are to be viewed as instances of SLASH dependency.

First, RNR can strand prepositions even in languages such as Irish, Polish, and Spanish, in which leftward extraction is not allowed to strand prepositions (McCloskey, 1986).

Second, part of a word can be right-node-raised, as in (2), an example taken from Wilder (1997) (see also Booij (1984)).

(2) the in- and the output of this machine

Part of a word can also be left-node-raised, as shown by the Japanese example (3b), which is arguably a result of applying LNR to (3a) (see Yatabe (2001)). The verb *omoidas-* 'to recall' that is used in these examples is a compound verb made up of two verb stems, *omoi-* 'to think' and *das-* 'to get (something) out'.

(3) a. [Omoidasu ka] [omoidasanai ka] ga mondai da.
[recall-PRES Q] [recall-NEG-PRES Q] NOM problem COP-PRES
'Whether (you) can recall (it) or (you) cannot recall (it) is the problem.'

b. Omoidasu ka dasanai ka ga mondai da. <12, 3, 1, 0>

The figures immediately following (3b), (4b), and (4c) represent the result of a questionnaire study conducted in 2006. The respondents in this study consisted of students at the University of Tokyo who were not linguists, and they were compensated for their time. Where the relative acceptability of two or more examples was of interest, the order between those examples was randomized for each respondent. The four figures show the number of respondents who stated 'The sentence is completely natural (under the intended reading)', 'The sentence is slightly unnatural (under the intended reading)', 'The sentence is considerably unnatural (under the intended reading)', and 'The sentence is completely impossible (under the intended reading)', respectively.[1]

Japanese does not allow part of a compound to be left unpronounced, as shown by the contrast between (4b) and (4c); (4b) but not (4c) can be uttered as an appropriate answer to the question in (4a).

(4) a. Omoidashita?
recall-PAST
'Have (you) succeeded in recalling it?'

b. Iya, omoidasanai. <12, 2, 1, 1>
no recall-NEG-PRES
'No, (I) cannot recall (it).'

c. ??Iya, dasanai. <3, 3, 4, 6>

Given this observation, the fact that not only (3a) but also (3b) is acceptable shows that Japanese allows left-node raising of part of a compound (the string *omoi* in the present case).

Third, a non-constituent can be right-node-raised, as in (5), again an example taken from Wilder (1997), in which the non-constituent string *charged particle* has been right-node-raised.

(5) a negatively- and a positively-charged particle

A non-constituent can also be left-node-raised, as in (6b), which is arguably a result of left-node-raising the string *sugu ni omoi* in (6a).

(6) a. [Sugu ni omoidasu ka] [sugu ni omoidasanai ka] ga
[immediately recall-PRES Q] [immediately recall-NEG-PRES Q] NOM
mondai da.
problem COP-PRES
'Whether (you) can recall (it) immediately or (you) cannot recall (it) immediately is the problem.'

b. Sugu ni omoidasu ka dasanai ka ga mondai da.

Fourth, a string α can be right-node-raised out of a phrase β only if α constitutes the right periphery of β, as shown by (7), while there is no comparable restriction on leftward extraction.

[1]The *average rating* for a linguistic material L, which will be represented as $r(L)$, is defined here as $(1a+2b+3c+4d)/(a+b+c+d)$, when the questionnaire result for L is $<a,b,c,d>$. A linguistic material L that is associated with a questionnaire result is shown here with no diacritic if $1 \leq r(L) < 2$, with '?' if $2 \leq r(L) < 2.5$, with '??' if $2.5 \leq r(L) < 3$, with '?*' if $3 \leq r(L) < 3.5$, and with '*' if $3.5 \leq r(L) \leq 4$. The notion of average rating is only intended as an expedient; the way it is defined and used here is arbitrary to a certain extent.

(7)*I first offered apples and then sold peaches the immigrant from Paraguay. (from Postal (1998))

Likewise, a string α can be left-node-raised out of a phrase β only if α constitutes the left periphery of β, as shown by (8), which is the result of attempting to left-node-raise the string *omoi* in (6a).

(8)*Omoi sugu ni dasu ka sugu ni dasanai ka ga mondai da.

Fifth, when two or more constituents are right-node-raised or left-node-raised out of a phrase, the linear order between those constituents must be preserved, as shown by (9) and (10). (9) is the result of attempting to exchange the two right-node-raised expressions *charged* and *particle* in (5), and (10) is the result of attempting to exchange the two left-node-raised expressions *sugu ni* and *omoi* in (6b).

(9)*a negatively- and a positively- particle charged

(10)*Omoi sugu ni dasu ka dasanai ka ga mondai da.

Leftward extraction in English, on the other hand, is not subject to a comparable constraint, as revealed by the fact (noted in Pollard and Sag (1994, p. 171)) that a sentence like (11) is more or less acceptable; notice that the phrase *someone that stupid* precedes the phrase *how much time* whereas the gap corresponding to the former follows the gap corresponding to the latter.

(11) Someone that stupid, how much time do we really want to waste arguing with?

And sixth, the 'landing site' of a right-node-raised or left-node-raised expression must be adjacent to the coordinate structure[2] out of which it has been dislocated. Thus, RNR like (12b) is not possible, while RNR like (12a) is possible; in (12b), the 'landing site' of C is separated from the coordinate structure by F.

(12) a. [[A B C] and [D E C]] $\longrightarrow$ [[A B] and [D E]] C

b. [[A B C] and [D E C]] F $\longrightarrow$ [[A B] and [D E]] F C

This would be a puzzling restriction, if RNR and LNR were to be viewed as instances of unbounded dependency mediated by SLASH inheritance.

It has been claimed in Sabbagh (2007) that RNR like (12b) is in fact possible. This claim, however, is unfounded. The following are sentences that are cited as evidence for this claim in Sabbagh (2007).

[2]RNR and LNR can apply to a non-coordinate structure as well, but here let us restrict our attention to RNR and LNR out of a coordinate structure.

(13) Joss will sell to a library, and donate to a shelter on the same day, all of his manuscript.

(14) Jamie read a short review, and two longer reviews for the same journal, of my recent book.

According to the analysis presented in Sabbagh (2007), the expression *on the same day* in (13) and the expression *for the same journal* in (14) separate the right-node-raised expressions in these examples from the coordinate structures that they have been dislocated out of. However, that is not the only possible analysis of these sentences. The expression *on the same day* in (13) and the expression *for the same journal* in (14) could be part of the right-node-raised expressions, along with *all of his manuscript* in (13) and *of my recent book* in (14). It might also be possible to treat the expression *on the same day* in (13) and the expression *for the same journal* in (14) as part of the second conjuncts. Thus, it remains likely that RNR like (12b) is impossible. Nothing comparable is true of leftward extraction such as topicalization and relativization.

These observations all indicate that RNR and LNR are fundamentally different from phenomena that are successfully analyzed in terms of SLASH inheritance.

3 Linearization-based theories of RNR and LNR

The linearization-based theories of RNR and LNR, proposed in Yatabe (2001) and Beavers and Sag (2004), do not encounter the problems that SLASH-based theories do.

In Yatabe's theory, RNR and LNR are each claimed to come in two varieties: a purely phonological variety and a syntactic variety. The purely phonological variety of RNR and LNR is assumed to be nothing but phonological deletion; a phrase like (2) is assumed to be derived from *the input of this machine and the output of this machine* by deleting the first occurrence of *-put of this machine*.[3] On the other hand, the syntactic variety of RNR and LNR is assumed to merge two or more domain objects into one. Since the theory is coupled with a novel theory of semantic composition[4] in which domain objects rather than signs are treated as

[3]As noted in Yatabe (2004), the purely phonological type of RNR can also be taken to be responsible for a German sentence like *Peter beschreibt den, und Martin beschreibt das Quark* 'Peter describes the fresh cheese and Martin describes the quark', discussed in Hartmann (2000). The word *Quark* has two senses; with the masculine article, it refers to fresh cheese, while with the neuter article, it refers to an elementary particle. In the sentence in question, the right-node-raised expression *Quark* is a masculine noun for the first conjunct and a neuter noun for the second conjunct.

[4]Here the term *semantic composition* is being used to refer to the process through which successively larger semantic representations (such as Minimal Recursion Semantics representations) are constructed. It is not being used to refer to a process dealing with model-theoretic objects such as functions from individuals to truth-values.

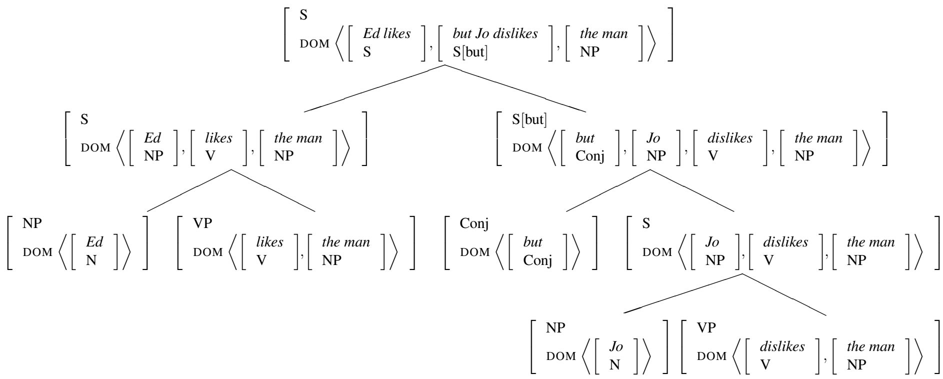

Figure 1: Syntactic RNR in Yatabe's theory

the principal units of semantic composition,[5] this means that the syntactic variety of RNR and LNR is capable of affecting the meaning of the sentences involved.[6] Figure 1 illustrates the way this theory handles the syntax of RNR in English.

In Beavers and Sag's theory, on the other hand, RNR and LNR are assumed to be essentially phonological deletion in all cases, and what they call Optional Quantifier Merger is introduced to explain the fact that RNR and LNR are capable of affecting semantic interpretation. Optional Quantifier Merger is a modification of what is proposed in Crysmann (2003), and is described as in (15).

(15) Optional Quantifier Merger: For any elided phrase denoting a generalized quantifier in the domain of either conjunct, the semantics of that phrase may optionally be identified with the semantics of its non-elided counterpart.

In both Yatabe's theory and Beavers and Sag's theory, it is expected that there should be numerous differences between RNR and LNR on the one hand and instances of leftward extraction such as topicalization and relativization on the other. Both theories presuppose what is called the Persistence Constraint in Kathol (1995), given in (16).

(16) The Persistence Constraint:
Any ordering relation that holds between domain objects α and β in one order domain must also hold between α and β in all other order domains that α and β are members of.

[5]In the proposed theory, the CONTENT values of signs represent only constructional meaning, that is, meaning that is expressed not by individual words but by grammatical constructions. Meaning that is expressed by individual words is represented in the CONTENT values of domain objects.

[6]Note, however, that it is not claimed in Yatabe (2001) that syntactic phrase structure is irrelevant in semantic composition. For instance, the theory in question is not incompatible with the reasonable and most probably correct view that the scope of an adjunct is determined on the basis of syntactic phrase structure (see for example the treatment of the semantics of the word *only* presented in Yatabe and Hayakawa (2005, Section 3)).

The Persistence Constraint captures two of the facts noted in Section 2, namely the fact that RNR and LNR are possible only from the right edge and the left edge of a phrase respectively, and the fact that the order of the two or more expressions that are right-node-raised or left-node-raised must be preserved.

The predictions of Yatabe's theory and Beavers and Sag's theory are indistinguishable in many cases, but there are two empirically testable differences between the two theories. One difference, which is syntactic in nature and is thus only indirectly related to the central topic of this paper, concerns what is called summative agreement in Yatabe (2003), a phenomenon exemplified by (17).

(17) The pilot claimed that the first nurse, and the sailor proved that the second nurse, were spies. (from Postal (1998))

Summative agreement is problematic for Beavers and Sag's account; it is not possible to analyze sentence (17) as a result of simple phonological deletion of the VP *were spies* in the first conjunct, as the VP *were spies* is in the plural form whereas its subjects (*the first nurse* and *the second nurse*) are both singular.[7] Beavers and Sag propose to deal with this problem by viewing examples like this as acceptable but ungrammatical sentences, on a par with an example like (18).

(18) One of the children are not feeling well.

Their proposal is not compelling, however. For one thing, sentence (17) does not contain a plural NP that could have tricked the performance system into accepting the plural agreement on the VP, unlike sentences like (18).[8] For another thing, their proposal is not consistent with the fact that there are languages in which summative agreement is obligatory. According to Kazenin (2002), a Russian sentence of the form (19a) is acceptable whereas a sentence of the form (19b) is not.

(19) a. Singular Subject - Object - Singular Subject - Object - Plural Verb

b.*Singular Subject - Object - Singular Subject - Object - Singular Verb

This shows that Beavers and Sag's account of sentences like (17) is not a general enough solution of the problem posed by summative agreement. Yatabe's theory, on the other hand, easily accommodates the phenomenon of summative agreement, as shown in Yatabe (2003).

[7] The phenomenon of summative agreement is problematic for analyses of RNR and LNR within Categorial Grammar too, as noted in Yatabe (2003).

[8] Beavers and Sag do not subscribe to the view (expressed in Pullum (1984) among other places) that a sentence like (18) sounds acceptable simply because there is a plural NP that could trick the performance system. However, five of the six examples of performance-based plural agreement that they discuss contain a plural NP and are thus consistent with such a view. The relative acceptability of the remaining example, namely their sentence (41c), *The pump as well as the motor are defective*, could be attributed to the possibility of reanalyzing the phrase *as well as* as a conjunction, and hence does not contradict the view in question either.

The second empirical difference between the two theories is a semantic one. In Beavers and Sag's theory, the only semantic effect that RNR and LNR can have is reduction of the number of quantifiers involved; neither RNR nor LNR is expected to be capable of nullifying scope island effects. In contrast, in Yatabe's theory, it is expected that RNR and LNR might be able to nullify some scope island effects; since this theory implies (roughly) that a quantifier α is not retrieved from quantifier storage (i.e. it is not assigned a scope) until the domain object that represents α is merged with some other domain object(s) by the total or partial compaction operation, a syntactically right-node-raised or left-node-raised quantifier is predicted to have a tendency to be assigned a wide scope, possibly a scope that it would not have been able to be associated with had it not been syntactically right-node-raised or left-node-raised.

It is claimed in Yatabe (2001) that LNR in Japanese is indeed capable of nullifying scope island effects. However, the only evidence adduced for this claim in that paper is the author's acceptability judgments; evidence of a more objective nature is clearly called for.

4 LNR out of scope islands

Two questionnaire studies were conducted in order to test whether LNR in Japanese is capable of overriding scope island effects. In the studies, students at the University of Tokyo who were linguistically naive native speakers of Japanese were asked to judge the acceptability of sentence-interpretation pairs using the following 4-point scale:
1 = "It is completely natural to interpret the sentence in the intended way."
2 = "It is slightly unnatural to interpret the sentence in the intended way."
3 = "It is considerably unnatural to interpret the sentence in the intended way."
4 = "It is completely impossible to interpret the sentence in the intended way."
The experimental sentence-interpretation pairs were sent to the participants via email together with various non-experimental sentence-interpretation pairs whose status was also to be judged. The order of the sentence-interpretation pairs was randomized for each participant. The sentences were all presented without any use of punctuations; it was stated in the preamble of the questionnaires that the sentences the participants were going to read did not have any punctuations in it. The respondents were compensated for their time.

4.1 Questionnaire 1

The following were the experimental sentence-interpretation pairs in the first questionnaire, in which 40 people participated. The participants were divided into two groups; one group judged the acceptability of each intended interpretation of (20) and (21), the other group judged the acceptability of each intended interpretation of (22) and (23), and both groups judged the acceptability of the same twelve filler sentence-interpretation pairs.

(20) [Shichi-nin-ijô no kokkaigiin no] [jikihitsu no] shomei o
[seven or more GEN congressperson GEN] [hand-written] signature ACC
morau ka giin-bajji o kashite morau ka
obtain-PRES or congressional badge ACC lend-GER 'receive'-PRES or
shinakereba naranai
do-NEG-PROV 'become'-NEG-PRES

Interpretation 1 'We have to take one or the other of the following two actions: (i) obtaining seven or more congresspeople's hand-written signatures and (ii) borrowing seven or more congresspeople's congressional badges.'

Interpretation 2 'For each of seven or more congresspeople, we have to either obtain that congressperson's hand-written signature or borrow that congressperson's congressional badge. One way to do this would be to obtain three congresspeople's hand-written signatures and borrow four congresspeople's congressional badges.'

(21) [Jikihitsu no] [shichi-nin-ijô no kokkaigiin no] shomei o
[hand-written] [seven or more GEN congressperson GEN] signature ACC
morau ka giin-bajji o kashite morau ka
obtain-PRES or congressional badge ACC lend-GER 'receive'-PRES or
shinakereba naranai
do-NEG-PROV 'become'-NEG-PRES

Interpretation 1 (Same as Interpretation 1 of (20).)

Interpretation 2 (Same as Interpretation 2 of (20).)

(22) [Yattsu-ijô no chiten no] [kyô shôgo no jiten de no]
[eight or more GEN location GEN] [today noon GEN moment at GEN]
kion o keisoku suru ka kinô no saikô kion
temperature ACC measure-PRES or yesterday GEN maximum temperature
o toiawaseru ka shinakereba naranai
ACC inquire-PRES or do-NEG-PROV 'become'-NEG-PRES

Interpretation 1 'We have to take one or the other of the following two actions: (i) measuring the temperature at eight or more locations at noon today and (ii) inquiring about yesterday's maximum temperature at eight or more locations.'

Interpretation 2 'For each of eight or more locations, we have to either measure the temperature at that location at noon today or inquire about yesterday's maximum temperature at that location. One way to do this would be to measure the temperature at noon today at three locations and inquire about yesterday's maximum temperature at five locations.'

(23) [Kyô shôgo no jiten de no] [yattsu-ijô no chiten no]
[today noon GEN moment at GEN] [eight or more GEN location GEN]
kion o keisoku suru ka kinô no saikô kion
temperature ACC measure-PRES or yesterday GEN maximum temperature
o toiawaseru ka shinakereba naranai
ACC inquire-PRES or do-NEG-PROV 'become'-NEG-PRES

Interpretation 1 (Same as Interpretation 1 of (22).)

Interpretation 2 (Same as Interpretation 2 of (22).)

A phrase of the form *X ka Y ka* means 'either X or Y', and the phrase *shinakereba naranai* means 'must'. The only difference between (20) and (21) is the order between the two prenominal expressions *shichi-nin-ijô no kokkaigiin no* and *jikihitsu no*. In (20), the quantificational expression *shichi-nin-ijô no kokkaigiin no* 'seven or more congresspeople's' is at the left edge of the coordinate structure, and can be interpreted as having been left-node-raised out of the two conjuncts (the first conjunct which means "to obtain seven or more congresspeople's hand-written signatures" and the second conjunct which means "to borrow seven or more congresspeople's congressional badges"). In (21), on the other hand, the quantificational expression *shichi-nin-ijô no kokkaigiin no* is embedded within the first conjunct; it cannot be interpreted as having been left-node-raised out of the two conjuncts, since it is preceded by a phrase that is unambiguously a part of the first conjunct (*jikihitsu no*). In both cases, Interpretation 1 is the reading in which the quantificational expression *shichi-nin-ijô no kokkaigiin no* takes narrow scope within the first conjunct, and Interpretation 2 is the reading in which the quantificational expression takes wide scope over the entire coordinate structure.

Yatabe's theory and Beavers and Sag's theory both predict that Interpretation 1 of (20) and Interpretation 1 of (21) must be possible, because the noun *giin-bajji* 'congressional badge' in the second conjuncts of these sentences can be taken to have a syntactically unrealized possessor slot (or, equivalently, a syntactically realized possessor slot that is filled by a zero pronoun), which can be interpreted as meaning 'seven or more congresspeople's'. In the case of (20), there is one more way to obtain Interpretation 1, in both theories. In Yatabe's theory, the interpretation can be obtained by analyzing the sentence as a result of applying the purely phonological, semantically inert variety of LNR to the quantifier *shichi-nin-ijô no kokkaigiin no*. In Beavers and Sag's theory, the interpretation can likewise be obtained by positing that the LNR involved in generating the sentence was not accompanied by an application of Optional Quantifier Merger.

On the assumption that conjuncts are scope islands in Japanese or, to be somewhat more precise, on the assumption that a domain object corresponding to a conjunct (such as the domain object in Figure 1 whose PHON value is *Ed likes*) cannot be associated with a non-empty quantifier storage in Japanese, Yatabe's theory predicts that Interpretation 2 should be possible in (20) but not in (21), because the quantifier can be interpreted as having been left-node-raised out of the first conjunct only in (20). On the other hand, if conjuncts are not scope islands, the theory predicts that there should not be any difference in acceptability between Interpretation 2 of (20) and Interpretation 2 of (21).

On the other hand, Beavers and Sag's theory arguably predicts that there should not be any difference in acceptability between Interpretation 2 of example (20) and Interpretation 2 of example (21) irrespective of whether conjuncts are scope islands in Japanese; the quantifier inside the first conjunct must be able to take wide scope over the entire coordinate structure in both (20) and (21) if conjuncts are not scope islands, and it must not be able to take such wide scope in either (20) or (21) if conjuncts are scope islands. Note that all that is necessary to achieve Interpretation 2 of (21) within Beavers and Sag's theory is for the quantifier *shichi-nin-ijô no kokkaigiin no* 'seven or more congresspeople's' in the first conjunct to be able to take scope over the entire coordinate structure; it is not necessary for the quantifier to be able to bind the unpronounced possessor slot of the noun *giin-bajji* 'congressional badge' in the second conjunct, because the noun *giin-bajji* in the second conjunct can be interpreted as meaning 'a congressional badge' (as opposed to 'his or her congressional badge'), and Interpretation 2 of (21) will result under such an interpretation as well.

The structure of (22) and (23) is analogous to that of (20) and (21) respectively. The only difference between (22) and (23) is the order between the two prenominal expressions *yattsu-ijô no chiten no* 'of eight or more locations' and *kyô shôgo no jiten de no* 'at noon today'. In (22), the quantificational expression *yattsu-ijô no chiten no* 'of eight or more locations' is at the left edge of the coordinate structure, and can be interpreted as having been left-node-raised out of the two conjuncts (the first conjunct which means "to measure the temperature at eight or more locations at noon today" and the second conjunct which means "to inquire about yesterday's maximum temperature at eight or more locations"). In (23), on the other hand, the quantificational expression *yattsu-ijô no chiten no* is embedded within the first conjunct; it cannot be interpreted as having been left-node-raised out of the two conjuncts, since it is preceded by a phrase that is unambiguously a part of the first conjunct (*kyô shôgo no jiten de no*). The predictions of the two theories concerning (22) and (23) are thus parallel to those discussed in relation to (20) and (21).

The result of this questionnaire is summarized in Table 1. In the column named *Number of each rating*, the figures in each 4-tuple represent the numbers of participants whose responses were 1 ("completely natural"), 2 ("slightly unnatural"), 3 ("considerably unnatural"), and 4 ("completely impossible") respectively. Interpretation 2 of sentence (20) was judged to be significantly more acceptable than Interpretation 2 of sentence (21) ($T = 17.5$, $n = 16$, $p < 0.01$). Likewise, Interpretation 2 of sentence (22) was judged to be significantly more acceptable than Interpretation 2 of sentence (23) ($T = 21$, $n = 13$, $p < 0.05$). Also, Interpretation 2 of sentence (21) and Interpretation 2 of (23) were the only cases where the mean rating was larger than 2.5; the other sentence-interpretation pairs were judged to be more acceptable than not. (The mean rating can range from 1 ("completely natural") to 4 ("completely impossible").)

	Interpretation	Number of each rating	Mean rating
Sentence (20)	1	<12, 5, 2, 1>	1.60
	2	<7, 6, 4, 3>	2.15
Sentence (21)	1	<5, 7, 5, 3>	2.30
	2	<1, 3, 10, 6>	3.05
Sentence (22)	1	<14, 5, 1, 0>	1.35
	2	<6, 3, 7, 4>	2.45
Sentence (23)	1	<3, 9, 5, 3>	2.40
	2	<2, 5, 4, 9>	3.00

Table 1: The result of Questionnaire 1

These results are all consistent with the predictions of Yatabe's theory and, at first blush, seem to contradict Beavers and Sag's theory. However, it turns out that these results alone do not allow us to choose between the two theories. Since (21) and (23) were judged to be worse than (20) and (22) respectively under Interpretation 1 as well as under Interpretation 2, the following possibility arises; the reason Interpretation 2 of (21) and Interpretation 2 of (23) were judged to be relatively unacceptable might have been simply that (21) and (23) are syntactically awkward compared to (20) and (22) and that a wide-scope reading like Interpretation 2 of these sentences tends to be harder to obtain compared to a narrow-scope reading like Interpretation 1. Such an explanation is consistent not just with Yatabe's theory but also with Beavers and Sag's theory.

The results above, however, place a constraint on Beavers and Sag's theory. In order for their theory to be consistent with these results, it has to be assumed that a conjunct is not a strong scope island in Japanese, because otherwise Interpretation 2 of (20) and Interpretation 2 of (22) would both be wrongly predicted to be impossible.

4.2 Questionnaire 2

The following were the experimental sentence-interpretation pairs in the second questionnaire, in which 14 people participated. All 14 participants rated all four of the experimental sentence-interpretation pairs, as well as seven filler sentence-interpretation pairs.

(24) Shichi-nin-ijô no kokkaigiin ga jinin suru ka kyôjû ni
seven or more GEN congressperson NOM resign-PRES or by the end of today
jûman-en o yôi suru ka shinakereba naranai
100,000 yen ACC prepare-PRES or do-NEG-PROV 'become'-NEG-PRES

Interpretation 1 'One or the other of the following two events must take place: (i) an event in which seven or more congresspeople resign and (ii) an event in which we prepare 100,000 yen by the end of today.'

Interpretation 2 ‘Seven or more congresspeople must each take one or the other of the following two actions: (i) resigning and (ii) preparing 100,000 yen by the end of today. This requirement will be met if, say, four congresspeople resign and three congresspeople prepare, by the end of today, 100,000 yen each, totaling 300,000 yen.’

(25) [Shichi-nin-ijô no kokkaigiin no jikihitsu no shomei o
[seven or more GEN congressperson GEN hand-written signature ACC

morau ka] [kyôjû ni jûman-en o yôi suru ka]
obtain-PRES or] [by the end of today 100,000 yen ACC prepare-PRES or]

shinakereba naranai
do-NEG-PROV ‘become’-NEG-PRES

Interpretation 1 ‘We have to take one or the other of the following two actions: (i) obtaining seven or more congresspeople’s hand-written signatures and (ii) preparing 100,000 yen by the end of today.’

Interpretation 2 ‘For each of seven or more congresspeople, we have to either obtain that congressperson’s hand-written signature or prepare 100,000 yen by the end of today. One way to do this would be to obtain four congresspeople’s hand-written signatures and prepare 300,000 yen by the end of today.’

Interpretation 1 of (24) results when the sentence is interpreted as involving coordination of two sentences, the second of which lacks an overt subject NP, and Interpretation 2 of (24) results when it is interpreted as involving two conjoined verb phrases whose common subject is the sentence-initial NP, meaning ‘seven or more congresspeople’. On the other hand, (25) is a sentence that unambiguously involves coordination of two verb phrases, the first of which contains a quantificational NP meaning ‘seven or more congresspeople’. Neither sentence involves LNR. The first ten words of (25), which constitute the first conjunct in the sentence, are identical to the first ten words of (20), and the rest of (25) is identical to the last nine words of (24).

Yatabe’s theory and Beavers and Sag’s theory both predict that (24) should be acceptable under Interpretation 1 as well as under Interpretation 2. On the other hand, the predictions of the two theories diverge with regard to (25), as long as Yatabe’s theory is coupled with the assumption that a conjunct is a scope island in Japanese. Beavers and Sag’s theory predicts that Interpretation 1 and Interpretation 2 of (25) should both be possible, partly because a conjunct in Japanese cannot be assumed to be a strong scope island in their theory, as noted above at the end of subsection 4.1. Yatabe’s theory also predicts that Interpretation 1 of (25) should be possible, but, on the assumption that a conjunct is a scope island in Japanese, it predicts that Interpretation 2 of (25) should be impossible.

There is one complication that needs to be considered before we can be certain that Beavers and Sag’s theory predicts that Interpretation 2 of (25) must be acceptable. As discussed in Fox (2000), in a multidimensional analysis of coordination,

	Interpretation	Number of each rating	Mean rating
Sentence (24)	1	<7, 2, 4, 1>	1.93
	2	<5, 3, 5, 1>	2.14
Sentence (25)	1	<13, 1, 0, 0>	1.07
	2	<1, 0, 4, 9>	3.50

Table 2: The result of Questionnaire 2

in which a sentence like (26) is taken to consist of two components (27a) and (27b), any attempt to let the quantifier in a sentence like (25) or (26) take wide scope over the entire coordinate structure necessarily results in vacuous quantification in the second component, as there is nothing in the second conjunct that is coindexed with the quantifier.[9]

(26) We have to either obtain seven or more congresspeople's hand-written signatures or prepare 100,000 yen by the end of today.

(27) a. We have to obtain seven or more congresspeople's hand-written signatures.

b. We have to prepare 100,000 yen by the end of today.

Thus, if a multidimensional analysis of coordination is adopted, Interpretation 2 of (25) is expected to be unacceptable due to the occurrence of vacuous quantification, irrespective of how the other aspects of the sentence are analyzed. This consideration, however, does not affect the predictions made by Beavers and Sag's theory, since it is not possible to combine Beavers and Sag's theory with a multidimensional analysis of coordination. Therefore it is safe to conclude that Yatabe's theory and Beavers and Sag's theory make different predictions regarding Interpretation 2 of (25), as long as the former is coupled with the assumption that conjuncts are scope islands in Japanese.

The result of Questionnaire 2 is summarized in Table 2. As in Table 1, in the column named *Number of each rating*, the figures in each 4-tuple represent the numbers of participants whose responses were 1 ("completely natural"), 2 ("slightly unnatural"), 3 ("considerably unnatural"), and 4 ("completely impossible") respectively. The mean rating for Interpretation 2 of (25) was greater than 2.5, whereas the mean rating for the other three sentence-interpretation pairs was less than 2.5. The Wilcoxon signed-rank test revealed that Interpretation 2 of (25) was significantly less acceptable than Interpretation 2 of (24) ($T = 0$, $n = 10$, $p < 0.001$).[10]

[9] Fox (2000) attributes this observation to Eddy Ruys's 1993 doctoral dissertation, submitted to Universiteit Utrecht.

[10] Likewise, the Mann-Whitney test showed that Interpretation 2 of (25) was significantly less acceptable than Interpretation 2 of (20) ($U = 50$, $n_1 = 14$, $n_2 = 20$, $p < 0.001$). It has to be conceded,

This result is consistent with the prediction that Yatabe's theory makes when coupled with the assumption that conjuncts are scope islands in Japanese. It is not compatible with Beavers and Sag's theory; since Interpretation 1 of (25) is perfectly acceptable (unlike Interpretation 1 of (21) and Interpretation 1 of (23)), it is not possible to attribute the low acceptability of Interpretation 2 of (25) to the syntactic awkwardness of the sentence.

5 Comparison of Japanese and English

In this section, it will be examined whether the analysis defended for Japanese in the previous section can be carried over to English. It turns out that the pattern of facts seen in English is a little more complicated than the pattern of facts seen in Japanese.

There are facts which, at first blush, appear to demonstrate that something analogous to what has been claimed for Japanese above is true for English as well. For example, Sabbagh (2007) notes that there is a scope ambiguity involving multiple quantifiers in the case of (28) but not in the case of (29).

(28) Some nurse gave a flu shot to, and administered a blood test for, every patient who was admitted last night.

(29) Some nurse gave a flu shot to every patient, and administered a blood test for every patient.

(28) has two readings, namely a reading in which the universal quantifier *every patient who was admitted last night* takes wide scope over the existential quantifier *some nurse* and another reading in which the scope relation is reversed. Under the former reading, the sentence means that, for each patient, there was a possibly different nurse who gave him or her a flu shot and administered a blood test for him or her. Under the latter reading, the sentence means that there was a certain nurse who gave flu shots and administered blood tests for all patients. In contrast, (29) only has a reading in which the existential quantifier takes scope over the two universal quantifiers. One way to explain this observation in a theory like that proposed in Yatabe (2001) would be to say that conjuncts are scope islands in English and that RNR can nullify such scope islands. On the other hand, there is no obvious way to deal with this observation within Beavers and Sag's theory. The two readings of (28) could be generated by the mechanism of Optional Quantifier Merger, but an account along this line arguably prevents us from postulating that the VP conjuncts in sentences like (28) and (29) are scope islands, thus making it difficult to capture the fact that the universal quantifiers in (29) cannot take wide scope over the existential quantifier.

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however, that there is a possibility that this difference in acceptability is merely a result of the two sentence-interpretation pairs being part of different questionnaires and being surrounded by different sentence-interpretation pairs.

Although this observation appears to show that English is quite similar to Japanese in the relevant respects, there is nevertheless an important difference between the two: while conjuncts invariably function as scope islands in Japanese, conjuncts in English function as scope islands only under certain circumstances.

Fox (2000, Section 2.3) discusses various English sentences in which conjuncts do not seem to be functioning as scope islands. (30) and (31) are two of his examples.[11]

(30) A (different) student [likes every professor$_i$] and [wants him$_i$ to be on his committee].

(31) John can love three of the women he knows. However, he can [love only one of them] and [expect her to love him back].

According to Fox, in (30), the universal quantifier *every professor* in the first conjunct can take scope over the existential quantifier *a (different) student* outside the coordinate structure and bind the pronoun *him* in the second conjunct. Likewise, in (31), the NP *only one of them* in the first conjunct in the second sentence can bind the pronoun *her* in the second conjunct, thus preventing the discourse from becoming incoherent.

In fact, Fox's discussion is not fully convincing. According to one school of thought, what seems to be VPs conjoined by the word *and* in English may sometimes consist of a head and one or more adjuncts (see Pullum (1990)), without constituting a real coordinate structure. In a sentence like (32), it does seem reasonable to analyze the string *go and get the paper* as something other than a coordinate structure, and it is possible that an analogous analysis is appropriate for some of the other cases which on the surface appear to involve VPs conjoined by *and*.

(32) I told you to go and get the paper.

Given this possibility, sentences like (30) and (31) do not establish that conjuncts in English are not always scope islands, as they both involve two VPs seemingly conjoined by *and*.

However, there are two kinds of observations reported in the literature that demonstrate convincingly that conjuncts do not always function as scope islands in English.

First, Keshet (2007) observes that in (33) the universal quantifier *every girl in this class* in the first conjunct can bind the pronoun *her* in the second conjunct.

(33) Billy [wants to date every girl in this class$_i$] or [has already asked her$_i$ out].

The intended interpretation of this sentence is somewhat redundant, making the example less than optimal, but an example like (34) shows that Keshet's observation is valid.

[11] Fox attributes the observation exemplified by (30) to Ruys (see footnote 9).

(34) Billy has (either) [sent a letter to every congresswoman] or [talked to her directly].

Irrespective of whether the word *either* is present or not, (34) can mean that every congresswoman was either sent a letter or talked to by Billy. This indicates that the quantifier inside the first conjunct can take scope over the entire coordinate structure and bind the pronoun in the second conjunct. In an example like this, in which the VPs are conjoined not by *and* but by *or*, there is little doubt that what is involved is real coordination.

This contrasts with the situation in Japanese; the sentence in (35), which is a rather faithful Japanese translation of sentence (34), clearly does not have the interpretation in which the quantifier in the first conjunct takes scope over the disjunction. In other words, the sentence cannot mean that every one of the congresspeople has already been sent a letter or directly talked to by Billy.

(35)

[Birî	wa],	[tegami	o	[kokkaigiin	no	daremo	ni]	okuru
[Billy	TOP]	[letter	ACC	[congressperson	GEN	every one	DAT]	send-PRES

ka],	[chokusetsu	hanasu	ka]	shita.
or]	[directly	talk-PRES	or]	do-PAST

‘Billy has sent a letter to every one of the congresspeople or talked to him or her.’

The reading that assigns wide scope to the conjunct-internal quantifier is also robustly unavailable in (36), which is the result of replacing the NP *kokkaigiin no daremo* in (35) with the NP *shichi-nin-ijô no kokkaigiin*, which is used in (20), (21), (24), and (25) as well.

(36)

[Birî	wa],	[tegami	o	[shichi-nin-ijô	no	kokkaigiin	ni]
[Billy	TOP]	[letter	ACC	[seven or more	GEN	congressperson	DAT]

okuru	ka],	[chokusetsu	hanasu	ka]	shita.
send-PRES	or]	[directly	talk-PRES	or]	do-PAST

‘Billy has sent a letter to seven or more congresspeople or talked to them.’

Thus, this is likely to be a genuine difference between the two languages.

Second, sentences like (37), discussed in Carpenter (1997, p. 325) and Chaves (2005), also provide potential evidence that conjuncts are not always scope islands in English.

(37) Every student and his or her supervisor met.

In this sentence, the predicate requires a group of people as opposed to a single person as its subject argument, so an analysis that treats the entire subject NP *every student and his or her supervisor* as a quantifier is not plausible if not inconceivable. It seems more reasonable to view the initial conjunct *every student* as the sole quantifier in the sentence and to allow it to take scope over the entire sentence. A more complicated example like *Every student and his or her supervisor and every lawyer and his or her client met*, in which the quantifiers involved are proper subparts of larger conjuncts, seems to show the same pattern. Since what is involved here is not apparent VP coordination but NP coordination and is thus impossible to reanalyze as something other than coordination, examples like these show, more convincingly than examples like (30) and (31) do, that conjuncts are not necessarily scope islands in English.

The fact that not all conjuncts are scope islands necessitates a modification to the theory described in Yatabe (2001). The theory stipulates (via constraints imposed on the relevant H-CONS values by the definition of total compaction given in (28) of Yatabe (2001)) that, when some domain objects are compacted into a single, larger domain object, all the quantifiers properly contained in the original smaller domain objects must take scope inside the resulting, larger domain object. In conjunction with the assumption (stated in (30e) of Yatabe (2001)) that conjuncts must always be totally compacted, this stipulation entails that conjuncts are always scope islands. Obviously, the stipulation must be replaced by a less stringent one at least in the case of English.

However, none of the English facts considered in this section invalidates the claims made in Section 4 above. All the arguments in Section 4 are based on Japanese facts, and therefore are not affected by findings about coordination in English. What has been shown in this section is that the definition of compaction proposed in Yatabe (2001) needs to be modified in order to accommodate the fact that conjuncts are not always scope islands in English.

6 Summary

The result of questionnaire studies have been presented which shows that conjuncts are scope islands in Japanese and that LNR can nullify such scope islands. This finding favors the theory advanced in Yatabe (2001), which entails that RNR and LNR can alter the scope of quantifiers, over the theory proposed in Beavers and Sag (2004), which entails that the only semantic effect that RNR and LNR can have is reduction of the number of quantifiers involved. Additionally, the way quantification and coordination interact in English was examined and was found to be slightly different from the way they interact in Japanese.

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Part II

Contributions to the Workshop on *Constructions and Grammatical Theory*

The role of default constructions in the processing of mismatch: the case of possessive free relatives

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Abstract

Townsend and Bever (2001) and Ferreira (2003) argue that simple templates representing the most commonly used orderings of arguments within a clause (e.g., NP-V-NP = Agent-Action-Patient) are used early in sentence comprehension to derive a preliminary interpretation before a full parse is completed. Sentences which match these templates (e.g., active sentences, subject clefts) are understood quickly and accurately, while sentences which deviate from the templates (e.g. passive sentences, object clefts) require additional processing to arrive at the correct interpretation. The present study extends the idea of canonical templates to the domain of noun phrases. I report on two experiments showing that possessive free relative clauses in English, which involve a non-canonical ordering of the head noun, are more difficult to understand than canonically headed noun phrases. I propose two reasons for this finding: (1) possessive free relatives deviate from the canonical template for interpreting noun phrases; and (2) the formal cues for interpreting possessive free relatives are relatively subtle. More generally I suggest that canonical templates help constrain mismatch in language by making certain kinds of mismatches costly for language users. Finally, I argue that evidence for canonical templates fits best within a parallel-architecture, constructionist theory of grammar.

1. Introduction

Languages are full of mismatches or deviations from the canonical mappings between form and meaning.[↑] For example, passive constructions violate the usual correlation between grammatical subject and semantic agent, while object-fronting constructions violate the normal ordering of the direct object in relation to the verb. Although such constructions are common in languages and fulfill useful discourse functions, they come at some cost for language users. Experimental evidence shows that sentences with a non-canonical ordering of arguments are understood more slowly and less

[↑] I am grateful to Yanhong Zhang for assistance with computer programming and data collection. Thanks also to workshop organizers Gert Webelhuth and Ivan Sag, audiences at HPSG 2007 in Stanford and at Purdue University, and Bob Channon, Pat Deevy, David Kemmerer, Alex Francis, Adele Goldberg, Philip Hofmeister, Stefan Müller, Tom Wasow, Ronnie Wilbur, Etsuyo Yuasa, and three anonymous reviewers for their assistance at various stages. This research was funded by Purdue University, College of Liberal Arts.

accurately than sentences with canonical orderings (Ferreira 2003, Townsend and Bever 2001, Love and Swinney 1998).

Why are non-canonical sentence types more difficult to process? Townsend and Bever (2001) and Ferreira (2003) argue compellingly that at least some effects of canonicity can be explained in terms of 'canonical sentence templates.' They argue that simple templates representing the most commonly used orderings of arguments within a clause (e.g., NP-V-NP = Agent-Action-Patient) are used early in sentence comprehension to derive a preliminary interpretation before a full parse is completed. Sentences which match these templates (e.g., active sentences, subject clefts) are understood quickly and accurately. However, sentences which deviate from the templates (e.g. passive sentences, object clefts) require additional processing to arrive at the correct interpretation, leading to slower response times and more comprehension errors.

In this paper, I report on two experiments which further support the hypothesis that canonical sentence templates play a role in sentence comprehension. While previous work in this area has focused exclusively on non-canonical orderings of verbal arguments within clauses, I extend this line of research to mismatches involving a non-canonical positioning of the head noun within the noun phrase. Specifically, I report on two experiments showing that possessive free relative clauses in English, which involve a non-canonical ordering of the head noun, are more difficult to understand than canonically headed noun phrases. I propose two reasons for this finding: (1) possessive free relatives deviate from the canonical templates normally used for interpreting noun phrases; and (2) the formal cues for correctly interpreting possessive free relatives are relatively subtle. More generally I suggest that canonical templates play a role in sentence comprehension and help constrain mismatch in language by making certain kinds of mismatches especially costly for language users. Finally, I argue that evidence for canonical templates fits best within a parallel-architecture, constructionist theory of grammar. In a constructionist theory, canonical templates may be represented directly in the competence grammar (as default constructions), thus simplifying the explanation of their role in sentence processing.

The paper is organized as follows. Section 2 discusses the psycholinguistic motivation for canonical templates and the idea of "good-enough" processing. Section 3 discusses the special properties of English free relative clauses and reports the results of two sentence comprehension experiments. Section 4 discusses some general implications of this study for theories of grammar and theories of sentence comprehension.

2. Why is Canonical Form Simple?

The term 'canonical form' usually refers to the most frequently occurring orderings of arguments within a simple clause in a particular language.[1] Non-canonical structures therefore include function-changing constructions such as the passive construction as well as reordering constructions such as object relatives and object clefts. Menn (2000) observes that canonical sentence form has been shown, in general, to be simpler for processing than non-canonical sentence form. Various explanations have been offered in the literature on sentence comprehension. One is that canonical sentence types have fewer dependencies involving gaps/traces than non-canonical sentence types do (e.g., Grodzinsky 1995). A second explanation is that individual verbs are lexically biased to occur in certain sentence frames (Gahl et al 2003, Menn 2000). For example, highly transitive verbs like *kick* and *break* are biased toward an active interpretation in which the agent comes first, whereas verbs like *elect* and *injure* are biased toward a passive interpretation in which the patient comes first. Thus, processing difficulty arises when the verb is not used in its preferred sentence frame. A third explanation is that 'canonical templates' specifying a particular linear ordering of semantic arguments are used for the initial interpretation of clauses and sentences (Ferreira 2003, Townsend and Bever 2001). Processing difficulty ensues when a sentence violates the relevant template. This explanation is similar to the verb bias explanation, except that canonical templates are specified at a more abstract level independent of any particular lexical items. While all three explanations are well supported at least for certain types of data, the present study focuses only on the third type of explanation.

Townsend and Bever (2001) propose various 'canonical sentence templates' relevant for the comprehension of clauses and sentences. Canonical templates, which are language-specific, specify linear ordering of constituents and their associated semantic roles. Templates do not include information about hierarchical constituent structure. For example, the so-called Noun-Verb-Noun (NVN) template for English is specified as follows (Townsend and Bever 2001: 247):

(1)	Linear order:	NP	V	NP
	Semantic role:	Agent	Action	Patient
		The dogs	destroyed	the garden.

---

[1] The terms canonical and non-canonical must be defined differently for languages with relatively free word order. For example, Stamenov and Andonova (1998) show that object-fronting constructions in Bulgarian do not show the kind of filler-gap effects in processing that have been found for English. In free word order languages, canonical form might be defined in terms of certain combinations of case marking, agreement marking, prosodic structure, and semantic roles.

Townsend and Bever (2001) interpret numerous studies showing slower processing for non-canonical clauses and sentences in terms of simple templates such as NVN. Further supporting this idea, Ferreira (2003) used a thematic role decision task to show that passive sentences and object clefts, both of which violate the NVN template, are not only processed more slowly but also *misunderstood* significantly more often than active sentences and subject clefts. This was true even for simple, unambiguous, semantically-plausible sentences with no garden-path structures and no subordinate clauses. For example, for sentences like (2a), participants were 99% correct on agent decisions, whereas for sentences like (2b), participants were only 88% correct (Ferreira 2003: 176). A similar difference was found for patient decisions (97% for actives, 92% for passives).

(2) a. The dog bit the man.
    b. The man was bitten by the dog.

Based on the results of three experiments, Ferreira argues that listeners and readers use simple templates for a rough and ready ('good-enough') interpretation of sentences before full syntactic and semantic processing is complete. Importantly, her study showed that incorrect interpretations may linger, leading listeners to misinterpret the intended meaning of the sentence. In the following section I extend this line of research to the realm of noun phrases.

3. Comprehension of English Free Relative Clauses

Ferreira (2003) has shown that canonical templates appear to play a role in the comprehension of simple sentences. In this section, I explore whether similar canonical templates might play a role in noun phrase comprehension. In section 3.1, I propose a set of templates for English noun phrases and show that possessive free relative clauses in English violate the proposed templates. Specifically, possessive free relatives violate the normal ordering of the head noun with respect to its specifiers/modifiers. In sections 3.2 and 3.3, I report on two psycholinguistic experiments, both of which confirm that possessive free relatives are more difficult to comprehend than other types of possessive and non-possessive relative clauses.

3.1 Form-function Mismatch in Possessive Free Relatives

Free relative clauses contrast with normally headed relative clauses in that they do not seem to have any external head. In (3a), the restrictive relative clause *who said that* modifies the noun *person.* However, in (3b) and (3c), there appears to be no overt head preceding the relative clause.

(3) a. The person who said that is a fool.
b. Whoever said that is a fool.
c. Whichever person said that is a fool.

In general, free relatives have the distribution of the category to which the relative pronoun belongs. For example, *whoever*-clauses as in (3b) and *whichever*-clauses as in (3c) (in which *whichever* functions as a determiner) have the distribution of NPs. Therefore, some authors have analyzed free relative pronouns as heads in a position external to the relative clause (e.g., Bresnan and Grimshaw 1978, Larson 1987). However, because of parallels between free relative clauses and other kinds of *wh*-clauses, the free relative pronoun has more commonly been analyzed as occurring in a position internal to the relative clause, such as Spec CP (Grosu 2002). In clause-internal analyses, distributional facts are generally attributed to the presence of an empty head (Grosu and Landman 1998) or a unary projection (Müller 1999) that allows the clause to function as a NP argument of other heads.[2]

The distinction between these various syntactic analyses is not crucial to the current study, however. Most important for our purposes is the semantic content of the free relative pronoun, which includes the referential index of the NP as part of its meaning. For example, the pronoun *whoever* is understood as 'the person who' or 'anyone who'. Thus, in a subject relative such as (3b-c), the relative pronoun *whoever* or the relative phrase *whichever person* is understood to refer both to the subject of the relative clause (the person who said that) and the subject of the matrix clause (the person who is a fool).

Possessive free relative clauses in English are unique among free relative clauses in that the possessive relative pronoun *whoever's* is interpreted as possessor of the following noun within the relative clause, but also as head of a matrix clause NP. While *whoever's* in (4a) functions within the relative clause similarly to the relative pronoun *whose* in (4b), *whoever's* must also include the referential index of the matrix clause NP. Thus, *whoever's* is interpreted as 'the person whose' or 'anyone whose', and it is the person (not the idea) that is a fool. A few additional examples from naturally occurring internet discourse are included in (5a-c) below.

(4) a. Whoever's idea that was is a fool.
b. The person whose idea that was is a fool.

[2] See also Wright and Kathol (2003) for a constructional view of the headedness mismatch in free relative clauses.

(5) a. “There were rose petals scattered across the floor and some had writing on them. One said, ‘I'll love you forever’, and another said, ‘Be mine till the end of time.’ How sweet, *whoever's boyfriend did this is a lucky girl*.” (Quizilla.com, 2-20-2007)

b. “…as far as the kids on stage behind Roger, I agree with Basje on this one too - that's pretty unprofessional...I am pretty sure *whoever's kids those were could afford a nanny or sitter for that night*.” (Queenzone.com, 3-31-2005)

c. “I bet *whoever's car that is is having a worse day than you.*” (Stereokiller.com, 4-16-2007, referring to a picture of a car smashed by a fallen tree)

It is interesting to note that although possessive free relatives are used in casual discourse, and readily interpretable in an appropriate context, they are, at least intuitively, a bit strange and more difficult to understand than ordinary possessive relative clauses as in (4b) above. Here, I capture this intuition in terms of Townsend and Bever’s (2001) idea of canonical templates.

Extending the idea of canonical templates to the realm of NP structure, I propose that there exist language-specific canonical templates for NP which pair a certain linear ordering of constituents with a certain semantic role. In English, these templates order the determiner (as in 6) or possessor (as in 7) before the head, where head is defined semantically as bearer of the referential index for NP:[3]

(6)

Linear Order:	Det	N	S
Semantic Role:	Specifier	Head	Modifier
	[The	dogs	that got loose] are in trouble.

(7)

Linear Order:	Possessor	N	S
Semantic Role:	Specifier	Head	Modifier
	[John’s	dogs	that got loose] are in trouble.

Ordinary possessive relative clauses are syntactically and semantically complex, but still conform to same the canonical template for NP, as shown in (8):

[3] The question of whether free relative pronouns like *whoever* really are in a head position external to the relative clause, or whether they are internal to the relative clause, is not important for our purposes. It is clear that they are the only overt cue to the semantic index of the NP.

(8)	Linear Order:	Det	N	S	
	Semantic Role:	Specifier	Head	Modifier	
		[The	guy	whose dogs got loose]	is in trouble.

Furthermore, non-possessive free relative clauses as in (9) below also conform to the canonical template, despite the (possible) presence of an empty head in the syntax. In terms of identifying the referential index of NP, *whichever dogs* in (9) functions similarly to *the dogs* in (6) above.

(9)	Linear Order:	Possessor	N	S	
	Semantic Role:	Specifier	Head	Modifier	
		[Whichever	dogs	got loose]	are in trouble.

Superficially, possessive free relatives look similar to possessive phrases as in (7) and *whichever*-phrases as in (9). However, they have an interpretation more similar to that of possessive relative clauses as in (8). In (10), the interpretation of the referential index for the NP depends on the possessive pronoun *whoever's*, thus violating expected interpretation specified by the canonical template:

(10)	Linear Order:	Possessor	N	S
	Expected Semantic Role:	Specifier	Head	Modifier
	Actual Semantic Role:	Head	Modifier	
		[Whoever's	dogs got loose] is in trouble.	

Following Ferreira's (2003) 'good-enough' theory of sentence processing, NPs which violate the canonical template should be more difficult to process than those which do not. For example, the theory predicts that listeners/readers should process sentences such as (10) more slowly than regular possessive relative clauses such as (8) above. In addition, although *whoever's* in (10) refers to the owner of the dogs, listeners/readers should at least occasionally interpret the sentence in (10) to mean that the dogs are in trouble rather than their owner. Such misinterpretations are possible for regular possessive relatives as in (8) as well, but should be less likely since regular possessive relatives conform to the relevant template for NP. In the following sections, I report on two experiments which tested these hypotheses.

3.2 Experiment 1: Verb Decision Task

It is predicted that possessive free relatives should be more frequently misunderstood and more slowly processed than similar phrases that conform to the ordering defaults for NP. To test this, we used a decision task in which participants were presented with written sentences with the verb missing and asked to fill in the correct verb form ("is" or "are") by pressing a button. Although this particular task has not previously been used in the literature on sentence comprehension, it follows a similar logic to that of the thematic role decision task of Ferreira (2003). Subject-verb agreement is used as an indirect measure of sentence comprehension, since an accurate response requires participants to correctly identify the referent of the subject noun phrase. As with other decision tasks, slower decision time is assumed to indicate more difficulty in processing.

3.2.1 Methods

Materials: Ten sets of stimuli like the set in Table 1 below were constructed by combining each of two levels of two factors (possessive/non-possessive and free/normal). Multiple versions of each sentence type were constructed to counterbalance number specification on the relevant nouns, such that each stimulus set included ten sentences: four for each normal possessive sentence type (with number varied on *guy* and *dog*) and two for each of the other sentence types (with number varied on *dog*).[4]

Sentence Types	*Example Sentence*
normal possessive	The guy whose dogs got loose is in trouble.
free possessive	Whoever's dogs got loose is in trouble.
normal non-possessive	The dogs that got loose are in trouble.
free non-possessive	Whichever dogs got loose are in trouble.

Table 1: Stimulus Materials

Procedure: Following a brief background questionnaire, readers were presented with a series of sentences in which main verb is missing, as in (11):

(11) Whoever's dogs got loose __ in trouble.

[4] Because it was only possible to vary the number of the head noun in the normal possessive sentence type, I included only sentences with the singular version of the head noun (*guy* in Table 1 above) in the statistical analysis. I assumed that the relative pronoun *whoever's* is always grammatically singular, given the ungrammaticality of sentences like: **Whoever's dog did that are in trouble.* Thus, two tokens of each type, varying the number of the relative clause subject (*dog* in Table 1), were included in the analysis.

Upon reading each sentence on the computer screen, participants pressed a button on a response box choosing either 'is' or 'are' to complete the sentence. Participants must identify the head noun in the subject of the matrix clause to make a correct response. A correct response for sentence (11) above, for example, would be 'is', since it is the owner (not the dogs) who is in trouble. Stimuli were presented in five blocks of 40 sentences each (20 test sentences including two tokens from each of the ten stimulus sets, 20 fillers in each block), with random ordering of sentences within each block and random ordering of blocks. Accuracy and response time data were recorded automatically by the E-Prime program used to present the sentences.

Participants: 42 Purdue University students, ranging in age from 18 to 51 (average age 23), participated. Of these, 16 were men and 26 were women. All were native speakers of a North American variety of English. Participants gave informed consent and were compensated with a choice of either $3 or course credit from certain instructors, for a 15-20 minute session.

3.2.2 Results and Discussion

Accuracy: Mean proportion of correct responses for each condition was calculated and analyzed using repeated measures analyses of variance with two factors (possessive/non-possessive and free/normal) of two levels each. Separate analyses were conducted with participants ($F1$) and items ($F2$) as random effects. Accuracy data are shown in Figure 1 below.

As predicted, participants' responses were less accurate for sentences with possessive free relative clauses (78% correct) than for the other three sentence types (94-97% correct). Possessives were significantly less accurate than non-possessives both by participants and by items: $F1(1, 41) = 33.27$, $p < 0.01$; $F2(1, 9) = 43.90$, $p < 0.01$. Similarly, free relatives were significantly less accurate than regular relatives both by participants and by items: $F1(1, 41) = 60.29$, $p < 0.01$; $F2(1,9) = 72.57$, $p < 0.01$. There was also a significant interaction between the factors possessive and free both by participants and by items: $F1(1,41) = 26.40$, $p < 0.01$; $F2(1,9) = 36.13$, $p < 0.01$.

Response time: Mean response times were calculated and analyzed using the same methods as for accuracy (above). The mean response times for accurate responses in each condition are given in Figure 2 below. Inaccurate responses were excluded from the analysis.

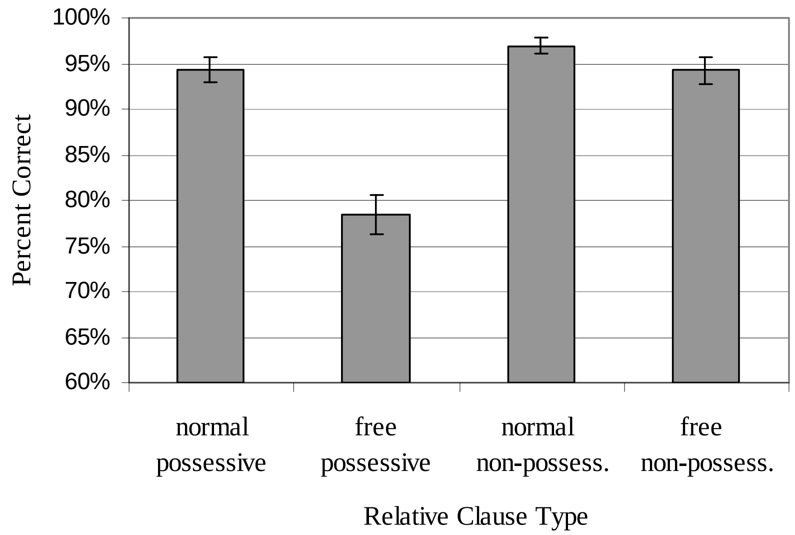

Figure 1: Percent correct for verb decision task. Error bars indicate standard error of the mean.

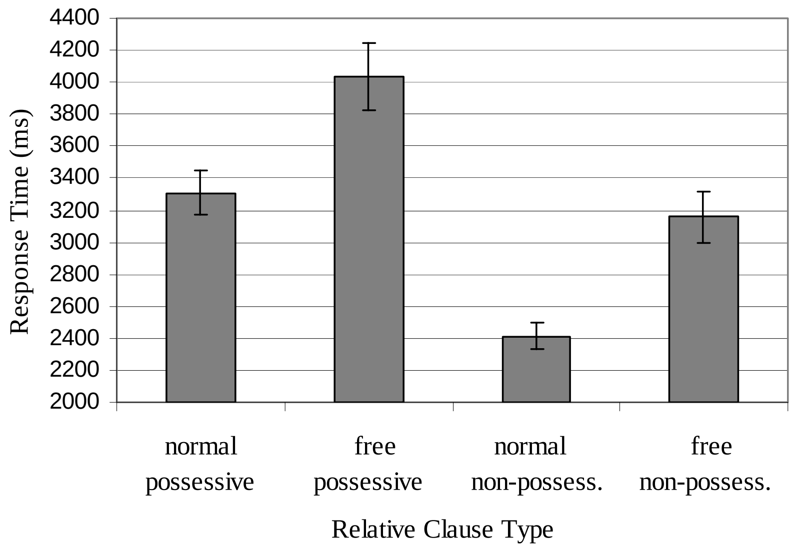

Figure 2: Response time for verb decision task. Error bars indicate standard error of the mean.

As predicted, participants' responses were slowest for sentences with possessive free relative clauses. Possessives were significantly slower than non-possessives both by participants (*F*1) and by items (*F*2): $F1(1, 41) = 105.83$, $p < 0.01$; $F2(1, 9) = 47.33$, $p < 0.01$. Similarly, free relatives were significantly slower than regular relatives both by participants and by items: $F1(1, 41) = 44.95$, $p < 0.01$; $F2(1,9) = 72.57$, $p < 0.01$. However, unlike with the accuracy data, there was no significant interaction between the factors possessive and free: $F1(1,41) = 0.01$, $p = 0.91$; $F2(1,9) = 4.31$, $p = 0.07$.

Participants were least accurate and had the slowest response times for possessive free relatives. Thus, the results for accuracy appear to confirm the initial hypothesis that non-canonical structure contributes to more frequent miscomprehension, since possessive free relatives were the only sentence type with significantly lower accuracy. Results for response time are less conclusive. These results indicate that possessives are processed more slowly than non-possessives, and that free relatives are processed more slowly than normal relatives. However free relatives were slower than normal relatives to about the same degree, regardless of whether they were possessive or not. Since non-possessive free relatives (see Table 1 above) conform to the canonical template for NP, the response time data cannot be explained on the basis of the non-canonical position of the head noun. One possible explanation is that response times were influenced by the special quantificational meaning of free relative pronouns with -*ever*, which is shared by both possessive *whoever's* and non-possessive *whichever* (see Grosu 2002: 148). Another possibility is that the morphological similarity of *whoever's* and *whichever* created confusion (see section 4 below).

3.3 Experiment 2: True-False Decision Task

Because subject-verb agreement in English is subject to factors other than the grammatical number of the head, the results in Experiment 1 might not be a direct reflection of participants' understanding of the subject noun phrases. For example, an anonymous reviewer pointed out that it is possible that participants might have chosen the plural verb in cases where the referent of *whoever* was understood to potentially refer to more than one person (e.g., *whoever's dogs* is understood as *the people whose dogs*). Experiment 2 tested the same hypotheses as Experiment 1 using a different task in which subject-verb agreement was held constant.

3.3.1 Methods

Materials: Test stimuli were constructed in the same way as in Experiment 1, with the same sentence types tested (see Table 1 above). However, number on the nouns was not varied in this experiment. Instead, all nouns occurring in the subject NP were made singular to ensure that information about subject-verb agreement did not influence participants' responses. There were ten stimulus sets, each including one token of each of the four sentence types.

Procedure: Following a brief background questionnaire, a series of sentences was presented on the computer screen, each followed by either a true statement or a false statement. For example:

(12) Sentence: Whoever's dog got loose is in trouble.

[Pause with blank screen]

Statement: Some dog is in trouble. (True or False?)

Participants must press a button on the response box choosing 'true' or 'false' to indicate the truth of the statement in relation to the original sentence. To respond accurately, participants must identify the head noun in the subject of the matrix clause. For example (12) above, the correct answer would be 'false' since it is the owner, not the dog, who is in trouble. There were four balanced blocks of 30 sentences each (10 test sentences including one sentence from each of the ten stimulus sets, 20 fillers in each block). Sentences were ordered randomly within each block, and blocks were also ordered randomly. Accuracy and response time data were recorded automatically by the E-Prime program used to present the sentences.

Participants: 25 Purdue University students, ranging in age from 18 to 23 (average age 20), participated. Of these, 5 were men and 20 were women. Except for one subject (whose data were excluded from the final analysis), all were native speakers of a North American variety of English. Participants gave informed consent and were compensated with a choice of either $6 or course credit from certain instructors, for a 35-40 minute session. Three subjects were excluded from the analysis: one due to a computer error, one who failed to pay attention to the task, and one who turned out to be a native speaker of Spanish.

3.3.2 Results and Discussion

Accuracy: As in Experiment 1, mean proportion of correct responses for each condition was calculated and analyzed using repeated measures analyses of variance with two factors (possessive/non-possessive and free/normal) of two levels each. Separate analyses were conducted with participants ($F1$) and items ($F2$) as random effects. Accuracy data are shown in Figure 3 below.

Results for accuracy were very similar to Experiment 1. As predicted, participants' responses were less accurate for sentences with possessive free relative clauses (69% correct) than for the other three sentence types (95-98% correct). Possessives were significantly less accurate than non-possessives both by participants ($F1$) and by items ($F2$): $F1(1, 21) = 56.19$, $p < 0.01$; $F2(1, 9) = 26.03$, $p < 0.01$. Similarly, free relatives were significantly less accurate than regular relatives both by participants and by items: $F1(1, 21) = 24.97$, $p < 0.01$; $F2(1,9) = 13.34$, $p < 0.01$. There was also a significant interaction between the factors possessive and free both by participants and by items: $F1(1,21) = 59.88$, $p < 0.01$; $F2(1,9) = 20.55$, $p < 0.01$.

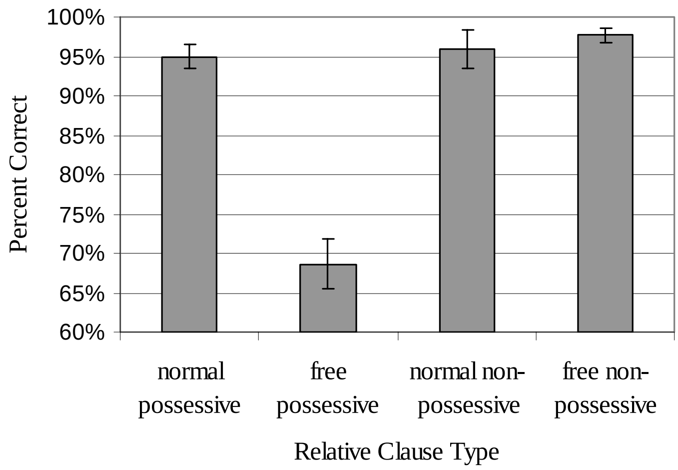

Figure 3: Percent correct for true-false decision task. Error bars indicate standard error of the mean.

Response time: Mean responses times were calculated and analyzed using the same methods as for accuracy (above). The mean response times for accurate responses in each condition are given in Figure 4 below. Inaccurate responses were excluded from the analysis.

As predicted, participants' responses were slowest for sentences with possessive free relative clauses. Possessives were slower on average than non-possessives (2198ms vs. 1813ms). This difference was significant both by participants and by items: $F1(1, 21) = 13.37$, $p < 0.01$; $F2(1, 9) = 20.86$, $p < 0.01$. Although free relatives were also slower than regular relatives (2043ms vs. 1968ms), this difference was not significant: $F1(1, 21) = 1.16$, $p = 0.29$; $F2(1,9) = 0.73$, $p = 0.41$. There was also no significant interaction between the factors possessive and free: $F1(1,21) = 0.32$, $p = 0.58$; $F2(1,9) = 0.83$, $p = 0.39$.

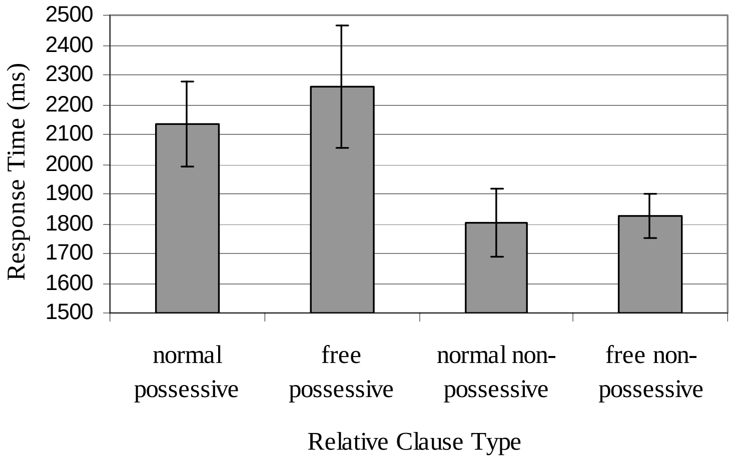

Figure 4: Response time for true-false decision task. Error bars indicate standard error of the mean.

As in Experiment 1, participants in Experiment 2 were least accurate and had the slowest response times for possessive free relatives. The results for accuracy again appear to confirm the hypothesis that non-canonical structure contributes to more frequent miscomprehension. Possessive free relatives showed by far the lowest accuracy (69% as compared with 95-98% for the other three sentence types). As in Experiment 1, results for response time are inconclusive. While the results show that possessives are processed more slowly than non-possesives, the difference between free relatives and normal relatives was not significant. Thus, accuracy results but not response time results support the hypothesis that possessive free relatives should be more difficult to comprehend than the other sentence types.

4. Conclusions and Implications

Two experiments on possessive free relative clauses suggest that simple canonical templates for NP may play a role in comprehension of both canonical and non-canonical NPs. Violation of the default appears to affect basic understanding of NP meaning, as shown in the accuracy results for both experiments. Following Ferreira (2003, 2002), this kind of evidence suggests a ‘good-enough’ model of sentence processing in which listeners’ or readers’ interpretations are initially based on information from simple canonical templates. When the language input violates the relevant template, there are at least two possibilities: (1) the violation is recognized and the correct interpretation is computed, overriding the initial interpretation; or (2) the syntactic information in the sentence is not fully processed and the incorrect interpretation lingers. Such a model can explain our accuracy results for possessive free relative clauses: for accurate responses, the violation is recognized and repaired, while for inaccurate responses, the initial interpretation lingers. This helps explain the significant differences we found between regular possessive relative clauses and possessive free relatives. There is still, of course, the possibility that some responses were inaccurate for independent reasons. However, such as possibility is necessary anyway to explain why some of the control sentences also yielded inaccurate responses.

The idea of canonical templates and 'good-enough' processing has general implications for the nature of language as well. The use of canonical templates in processing may help constrain the occurrence of non-canonical construction types in languages by making certain linear order mismatches especially costly for language users. In a relatively fixed word order language, deviations from the canonical ordering of the verb's arguments typically require special formal marking in the grammar and/or lexicon (Hawkins 2004: 147-167). For example, the grammar of English does not permit the kind of mismatch that would result in an interpretation of example (13a) below in which the cat is the agent of the action. Such an interpretation is at least conceivable, given the existence of alternations as in (13b-c), where a lexical difference between the verbs *like* and *please* indicates a reversed ordering of argument roles.

(13) a. The dog chased the cat.
b. The dog likes the cat.
c. The cat pleases the dog.
d. The cat was chased by the dog.

However, lack of any kind of formal marking would result in a high degree of ambiguity, thus making sentences involving non-canonical ordering of arguments more difficult to comprehend even in an appropriate discourse context. Thus, in cases where the template is violated, languages tend to mark the difference by using different verbs (as in 13b-c), or by using explicit grammatical markings. In (13d), for example a passive sentence with explicit formal marking (auxiliary verb *be*, preposition *by*) is used to express a reversal of argument role ordering.

In the light of this general preference for explicit marking of non-canonical structures, it is possible that possessive free relatives are confusing because the possessive pronoun *whoever's* is the *only* linguistic cue to the intended interpretation and may be confusable with other morphologically similar pronouns. This is in contrast to passive sentences, which contain multiple formal cues. The lexical meaning of *whoever's* 'the person whose' includes the meaning associated with the head noun in a regular relative clause.[5] Most of the time, this cue was sufficient for interpreting possessive free relatives accurately (78% in Experiment 1, 69% in Experiment 2), but it was not in a significant minority of cases. It is therefore possible that possessive free relatives are especially hard because of the morphological similarity between the relative pronouns *whoever's* and *whichever*. Since *whichever* conforms to the NP template, confusability with *whoever's* does not significantly affect accuracy of interpretation. However, this potential confusability could explain why non-possessive free relatives with *whichever* showed longer response times than regular non-possessive relatives in Experiment 1 (see Figure 2 in section 3.2.2 above).

Evidence for canonical templates also suggests that certain models of competence grammar may be preferable to others. Townsend and Bever (2001) adopt a Principles and Parameters style theory of syntax. Because this type of theory does not permit form-meaning pairings ('constructions') directly in the grammar, Townsend and Bever must put canonical templates into a special level of 'pseudo-syntax' distinct from the grammar. However, the idea of canonical templates fits easily into a parallel-architecture, constructionist view of grammar (e.g., Jackendoff 2007, Goldberg 2006, Goldberg and Bencini 2005, Yuasa 2005, Sag 1997). Using such a theory, canonical templates can be understood as 'default constructions' that specify basic mappings between linear order (not hierarchical structure) of constituents and semantic roles. Specific constructions such as passive contain the relevant information to override the defaults, but in online comprehension, this information is not always accessed in time to ensure a correct interpretation. Thus, using a constructionist theory allows us to simplify the representation of linguistic knowledge that is relevant for sentence processing.

Finally, I suggest that the approach taken here is compatible with at least some aspects of usage-based models of grammar and processing (e.g., MacDonald, Pearlmutter, and Seidenberg 1994).[6] Usage-based models emphasize the importance of frequency effects and lexical biases. In this light, default constructions can be understood as constructional biases of clauses or phrases, akin to lexical biases of verbs. Constructional biases are based on frequency of certain linear order-semantic role mappings, distinct

[5] In a Google search of internet discourse, I found a few examples in which *whoever's* did not seem to indicate the head noun. For example: "I took a shower while whoever's kids these were did homework" (DISboards.com, 12-05-2005). The difficulty of this construction may be prompting a re-analysis of *whoever's* as meaning 'some unknown person's' rather than the 'the person whose'. This issue needs to be investigated and controlled for in future research on this topic.

[6] What is not predicted by usage-based models, however, is Ferreira's finding that incorrect interpretations of non-canonical structures may linger after disambiguating information is presented. This goes against the idea that all relevant information is used as soon as it becomes available.

from the frequencies of particular lexical items or particular constructions such as the passive construction. Infrequent constructions that conform to the relevant linear order default are predicted to be easier to understand than equally infrequent constructions that violate the default, all else being equal. Ferreira (2003: 179-184) provides some evidence for this. Her study found that comprehension of subject clefts (e.g., *It was the dog who bit the man*), which conform to the canonical templates but are infrequently used, is more similar to that of active canonical sentences than to that of object clefts or passives. While the current study cannot speak directly to this issue, since frequency information was not collected, these predictions suggest interesting directions for future research.

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Two Types of Multiple Nominative Construction: A Constructional Approach

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Abstract

'Multiple nominative constructions' (MNCs) in Korean have two main subtypes: possessive and adjunct types. This paper shows that a grammar allowing the interaction of declarative constraints on types of signs – in particular, having constructions (phrases and clauses) – can provide a robust and efficient way of encoding generalizations for two different MNCs. The feasibility of the grammar developed here has been checked with its implementation into the LKB (Linguistic Knowledge Building) system

1 Recognizing the Two Types of Multiple Nominative Construction

The 'multiple' nominative constructions (henceforth MNCs) exemplified in (1) are some of the more puzzling phenomena in topic-prominent languages like Korean, Japanese, and Chinese (Yoon 2004).[1]

(1) a. John-i/-uy son-i khu-ta
John-NOM/GEN hand-NOM big-DECL
'John's hand is big.'

b. yelum-i/-ey/*-uy maykcwu-ka choyko-i-ta
summer-NOM/-LOC/-GEN beer-NOM best-COP-DECL
'Summer is the best time to have beer.'

In both examples, it is not the first but the second nominative (NOM) phrase that is the argument of the intransitive matrix predicate: it is the hand that is big, and it is the beer that tastes good in summer. *John* and *summer* are not direct arguments of the matrix predicate. Considering that a clause usually contains at most one subject, expressed as a NOM phrase, the function of the first NOM is then a puzzle.

In terms of pragmatic conditions, the first NOM phrase in both cases characterizes the remaining part (which is often called 'sentential predicate'). For example, in (1)a having a big hand is a characterizing property of John whereas in (1)b, tasty beer is a characteristic of summer. If there is no such relation, the first phrase cannot be NOM, though it can be a genitive modifier:

(2) a. John-uy/*-i [swuep-i ttapwunha-ta]
John-GEN/-NOM class-NOM boring-DECL
'John's class is boring.'

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[1]The abbreviations for the glosses and attributes used in this paper are ACC (accusative), ARG (argument), C-CONT (constructional content), DAT (dative), DECL (declarative), LBL (label), LOC (locative), LTOP (local top), NOM (nominative), PL (plural), PRE (predicate), PST (past), IND (index), RELS (relations), TOP (topic).

b. yelum-ey/*-i [John-i congcong mikwuk-ul ka-n-ta]
summer-LOC John-NOM often America-ACC go-PRES-DECL
'In summer, John often goes to America.'

However, the first NOM in these examples also behaves differently. In examples like (2)a (which we we call the possessive nominative construction (PNC)), the two consecutive NOM phrases are in a possessive relation, as shown by the alternation with the possessive marker on the first NOM. Meanwhile, in examples like (2)b (which we call the adjunct nominative construction (ANC)), there is no such a relation. The first phrase functions more like an adjunct, as indicated by the locative marker.

There are also other differences between the first NOM phrase in the PNC and the ANC. For example, only the former can function as a raised object:

(3) a. Mary-nun [John-ul] son-i khu-ta-lako mitessta
Mary-TOP John-ACC hand-NOM big-DECL-COMP believed
'Mary believed John's hand is big.'

b.??/*na-nun [ecey-lul] nalssi-ka acwu
I-TOP yesterday-ACC weather-NOM very
tewu-ess-ta-ko sayngkakha-n-ta
hot-PAST-DECL-COMP think-PRES-DECL
'I think yesterday the weather was really hot.'

The first NOM in the PNC can also serve as the antecedent of a floating quantifier, whereas this is not possible in the ANC:

(4) a. haksayng-tul-i khi-ka [sey myeng-i] khu-ta
students-NOM height-NOM three CL-NOM tall
'Three students are tall.'

b. *tosi-ka nalssi-ka [sey kos-i] cwup-ta
city-NOM weather-NOM three CL-NOM cold
'In three cities, the weather is cold.'

These differences indicate that the language has at least two different MNCs. However, this does not mean that the two do not share some properties. As noted earlier, the first NOM in both the PNC and ANC is in a characterizing relation with the remaining parts ('sentential predicate'). In addition, we can show that the first NOM in both constructions is the realization of information focus (cf. O'Grady 1991, Schüze 1996, Yang 1999). The evidence that the first NOM marks focus can be drawn from several phenomena. For example, the first nominative (unlike a genitive NP) receives an exhaustive reading, a canonical property of focus. The impossibility of having the exclamatory expression *ceki* 'here' in (5)a, which is generally not used for exhaustive listing, but rather for neutral description, could be attributed to the exhaustive list reading of *John-i*.

(5) a. *ceki John-i apeci-ka o-si-nta!
over.there John-NOM father-NOM come-HON-DECL

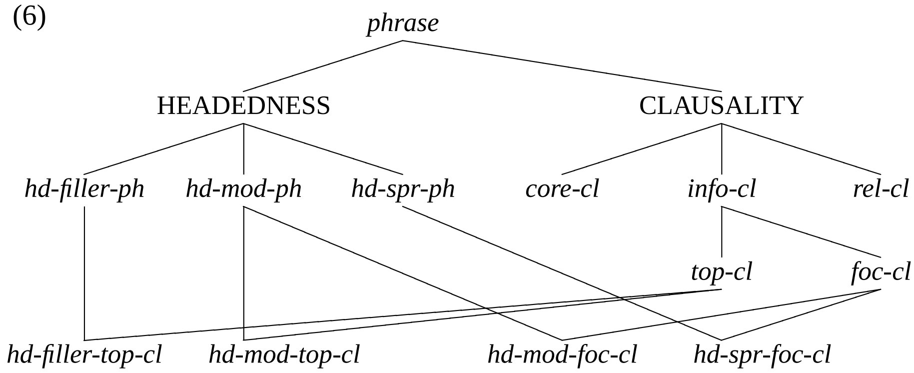
b. ceki John-uy apeci-ka o-si-nta!
over.there John-GEN father-NOM come-HON-DECL

Observing the similarities and differences between the two constructions we have shown so far, the questions that arise with respect to parsing such constructions are (a) how to license the first NOM phrase which is not an argument of the main predicate, (b) how to process its semantic and pragmatic contributions to the sentence as a whole, and (c) how to recognize and represent the different properties of these two constructions.

2 A Construction-Based Analysis

As a way of capturing generalizations about the shared properties of diverse construction types (including the MNCs here), our grammar adopts the notion of constructions from Ginzburg and Sag (2001) and classifies phrases in terms of HEADEDNESS and CLAUSALITY, as represented in (6):

(6)



As shown in the hierarchy here, each type of phrase is cross-classified, inheriting both from the CLAUSALITY type and from a HEADEDNESS type. The constraints on the subtypes of HEADEDNESS will license well-formed phrases in the language.[2]

(7) a. $\text{XP}[\textit{hd-spr-ph}] \rightarrow \boxed{1}, \textbf{H}\left[\text{SPR } \langle \boxed{1} \rangle\right]$

b. $\text{XP}[\textit{hd-mod-ph}] \rightarrow \left[\text{MOD } \langle \boxed{1} \rangle\right], \boxed{1}\textbf{H}$

[2]In addition to these well-formed phrases, the language has *hd-subj-ph*, *hd-comp-ph*, and *hd-lex-ex* for the combination of head with its subject, head with its complement, and head with another lexical element to form a complex predicate, respectively. See Kim (2004).

c. $\text{S}[\textit{hd-filler-ph}] \rightarrow \boxed{1}\text{XP, S}\begin{bmatrix}\text{GAP } \langle \boxed{1} \rangle\end{bmatrix}$

These constraints on well-formed phrases, similar to X′ rules, allow the combination of a head and its specifier, a head and its modifier, and a head and its filler, respectively. These constraints inherit to their subtypes like *hd-filler-top-cl* and *hd-mod-top-cl*, which also function as the subtypes of CLAUSALITY.

The subtypes of CLAUSALITY include *core-cl*, *rel(ative)-cl*, and *info-cl*. The *core-cl* type includes canonical types like declarative and imperative. The constraints on *info-cl* are the locus of our treatment of the PNC and ANC. The type *info-cl* has at least two subtypes: *top-cl* and *foc-cl*, which have either a positive TOP(IC) or FOC(US) value. Each has its own constraints that are inherited to its subtypes. For example, *top-cl* and *foc-cl* are declared to have the following constraints which will be inherited to their subtypes:

(8) a. *top-cl*:

$$\begin{bmatrix}\text{C-CONT} \mid \text{RELS} \left\langle \begin{bmatrix}\text{PRED } \textit{about} \\ \text{ARG1 } \textit{h3} \\ \text{ARG2 } \textit{h4}\end{bmatrix} \right\rangle\end{bmatrix} \rightarrow \begin{bmatrix}\text{LBL } \textit{h3} \\ \text{TOP +}\end{bmatrix}, \ \mathbf{S}\begin{bmatrix}\text{MOOD } \textit{decl} \\ \text{LBL } \textit{h4} \\ \text{IC +} \\ \text{SUBJ } \langle \quad \rangle\end{bmatrix}$$

b. *foc-cl*:

$$\begin{bmatrix}\text{SPR } \langle \quad \rangle \\ \text{C-CONT} \mid \text{RELS} \left\langle \begin{bmatrix}\text{PRED } \textit{characterizing} \\ \text{ARG1 } \textit{h3} \\ \text{ARG2 } \textit{h4}\end{bmatrix} \right\rangle\end{bmatrix} \rightarrow$$

$$\boxed{1}\text{NP}\begin{bmatrix}\text{GCASE } \textit{nom} \\ \text{FOC} + \\ \text{LBL } \textit{h3}\end{bmatrix}, \quad \text{S}\begin{bmatrix}\text{SPR} \langle \boxed{1} \rangle \\ \text{LBL } \textit{h4}\end{bmatrix}$$

The topic clause (*top-cl*) has as its constructional content (C-CONT) an *about-relation*: the topic phrase tells us what the main clause is about. The value of LBL is a handle, which is a token to its elementary predicate (EP) in the MRS system. We can see that the ARG values of *about* are the value of the topic phrase's LBL (h3) and that of the head S (h4). Meanwhile, the focus phrase (*foc-cl*) also has a constructional constraint indicated by the relation *characterizing*. That is, in a *foc-cl*, the focused initial phrase (having a grammatical case (GCASE) such as nominative and also being marked as a FOC phrase) is characterized by the following S. Notice that the *top-cl* has two subtypes: *hd-filler-top-cl* and *hd-mod-top-cl*. The existence of two types of topic clause has been well attested in the literature:

(9) a. ku chayk-un [Edward-i _ ilk-ess-ta] (*hd-filler-top-cl*)
the book-TOP Edward-NOM read-PAST-DECL
'The book, Edward read _ .'

b. [ecey-nun [nalssi-ka chwu-ess-ta]] (*hd-mod-top-cl*)
yesterday-TOP weather-NOM cold-PAST-DECL
'As for yesterday, it was cold.'

In (9)a, the topic phrase *ku chayk-un* is an argument of the main predicate *ilk-ess-ta* and enters into a Filler-Head relation, whereas in (9)b, the topic *ecey-nun* is just an adjunct.

Similarly, the type *foc-cl* (focus clause construction) also has at least two subtypes, depending on the grammatical function of the first NOM phrase. As defined, the PNC is an instance of *hd-spr-foc-cl* whereas the ANC is an instance of *hd-mod-foc-cl*. This classification is motivated by the fact that in the PNC the first NOM functions as the specifier of the second NOM NP, whereas in the ANC it is just an adjunct. This kind of multiple inheritance system for clausal types allows us to capture the generalizations among constructions by appropriate type declarations. The constructional constraints on *foc-cl* are inherited to its subtypes, *hd-spr-foc-cl* and *hd-mod-foc-cl*. One thing to notice here is that in the *hd-mod-foc-cl* (ANC), the first NOM can be freely introduced if it has a positive MOD value. Meanwhile, in the *hd-mod-foc-cl* PNC, the first NOM phrase is introduced as a specifier in accordance with the following lexical rule:

(10) SPR Lexical Rule:

$$\textit{v-stative} \rightarrow \begin{bmatrix} \textit{v-spr} \\ \text{VAL} \begin{bmatrix} \text{SPR} \langle \boxed{2}_i \rangle \\ \text{SUBJ} \left\langle \begin{bmatrix} \text{SPR} \langle \boxed{2} \rangle \\ \text{LBL } \textit{h6} \end{bmatrix}_j \right\rangle \end{bmatrix} \\ \text{SEM} \mid \text{RELS} \left\langle \ldots, \begin{bmatrix} \text{PRED} & \textit{subordinate} \\ \text{ARG1} & i \\ \text{ARG2} & j \end{bmatrix}, \ldots \right\rangle \end{bmatrix}$$

The effects of this lexical rule are as follows. It allows a stative verb taking one argument to be turned into a verb that selects an additional specifier which is in a *subordinate* relation to the subject.[3]

The two consecutive NOM phrases need to be in a certain semantic relation (e.g., the subordinate relation) in the PNC, as can be seen from the evidence in (11):

(11) a. pyeng-uy/-*i akhwak-ka i kyolkwa-lul cholayhayessta
illness-GEN/NOM worsening this result caused
'The worsening of the illness caused this condition.'

[3]The term *subordination* is borrowed from Na and Huck (1993). X is *thematically subordinate* to an entity Y iff Y's having the properties that it does entails that X has the properties that it does.

b. John-uy/*-i iphak-i wuli-lul nolla-key hayessta
John-GEN/NOM admission-NOM we-ACC surprise-COMP did
'John's admission surprised us.'

An intransitive predicate like 'big' will be turned into a *v-spr* word by the lexical rule above:

(12) a.
$$\begin{bmatrix} \text{PHON} & \langle \text{khu-} \rangle \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{VAL} \mid \text{SUBJ} & \langle \boxed{1}\text{NP}_i \rangle \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{1} \rangle \\ \text{SEM} \mid \text{RELS} & \left\langle \begin{bmatrix} \text{PRED } \textit{big} \\ \text{ARG0 } \textit{s1} \\ \text{ARG1 } \textit{i} \end{bmatrix} \right\rangle \end{bmatrix}$$

b.
$$\begin{bmatrix} \textit{v-spr} & \\ \text{PHON} & \langle \text{khu} \rangle \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{VAL} & \begin{bmatrix} \text{SPR } \langle \boxed{3}\text{NP}_i \rangle \\ \text{SUBJ } \langle \text{N}'_j[\text{SPR } \langle \boxed{3} \rangle] \rangle \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{1} \rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX } \textit{s1} & \\ \text{RELS} & \left\langle \begin{bmatrix} \text{PRED } \textit{big} \\ \text{ARG0 } \textit{s1} \\ \text{ARG1 } \textit{i} \end{bmatrix}, \begin{bmatrix} \text{PRED } \textit{subordinate} \\ \text{ARG1 } \textit{i} \\ \text{ARG2 } \textit{j} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

As sketched here, the generation of the PNC and the ANC is dependent upon interactions among different grammatical components, assigning the appropriate structures for the two different types of MNCs.

3 A Computational Implementation of the Analysis

The analysis we have presented so far has been incorporated into the typed-feature structure grammar HPSG for Korean (Korean Resource Grammar) aiming at working with real-world data (cf. Kim (2001, 2004)).To test the performance and feasibility of the analysis, we have implemented this into the LKB (Linguistic Knowledge Building) system.[4] The test results give the proper syntactic as well as semantic structures for the two different focus constructions. For example, the following is the parsing result of the sentence (1a):

We can see here that the MRS that the grammar generates provides enriched information of the phrase. The value of LTOP is the local top handle, the handle of

[4]The current Korean Resource Grammar has 394 type definitions, 36 grammar rules, 77 inflectional rules, 1100 lexical entries, and 2100 test-suite sentences, and aims to expand its coverage on real-life data.

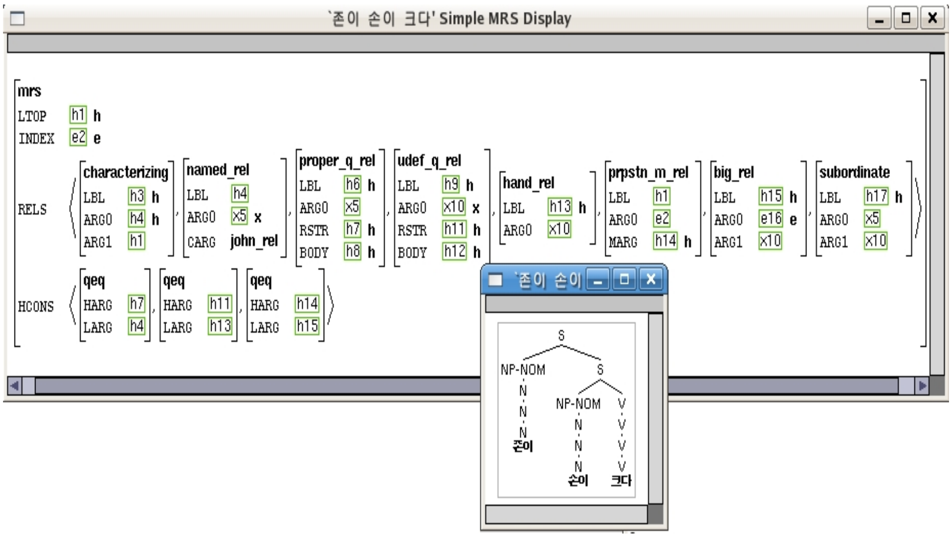


Figure 1: Parsed Tree and MRS for ‘It is John whose hand is big.’

the relation with the widest scope within the constituent. The INDEX value here is identified with the ARG0 value of the *prpstn_m_rel* (propositional message). The attribute RELS is basically a bag of elementary predications (EP) each of whose values is a *relation*.Each of the types *relation* has at least three features LBL, PRED (represented here as a type), and ARG0. We can see that the LBL value of *named_rel* and that of the *prpstn_m_rel* are both the arguments of the PRED relation *characterizing*, capturing the pragmatic relations in the MNC. The two NOM phrases are also linked by the relation *subordinate* whose ARG0 and ARG1 values are x5 and x10, respectively.

4 Conclusion

‘Multiple nominative’ constructions present challenges to theoretical as well as computational linguists. In particular, the functions of the first NOM phrase in MNCs are not straightforward. The first NOM can be either a specifier or an adjunct, and it has a specific semantic relation with regard to the remaining sentence – it is ‘characterized’ by the rest of the sentence.

This paper shows that a grammar allowing interactions of declarative constraints on types of signs – in particular, constructions (phrases and clauses) – can provide an robust and efficient way of parsing these two different types of MNC.

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Phrasal or Lexical Constructions: Some Comments on Underspecification of Constituent Order, Compositionality, and Control

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Abstract

In this paper I want to discuss Goldberg's claim that phrasal Constructions can be regarded as underspecified statements about dominance and that therefore my claim that she would have to assume 218 Constructions to account for resultative secondary predication in German is wrong. I will discuss earlier HPSG approaches to particle verbs, which are similar to resultatives in many respects.

In addition to this I will provide more data against a surface-based phrasal solution.

1 Introduction

The main topic of this paper is resultative constructions like the one in (1).

(1) weil niemand den Teich leer fischt
because nobody$_{nom}$ the pond$_{acc}$ empty fishes
'because nobody fishes the pond empty'

Resultatives involving unergative verbs usually consist of a main verb that selects for a subject, a secondary predicate (in German, adjective or PP) and an accusative object. The secondary predicate predicates over the accusative. In some cases the accusative can be interpreted as an argument of the main verb, but as (1) shows, this is not necessarily the case.

(1) has a meaning that involves more than the predicates *empty* and *to fish*: The action of fishing stands in a causal relation to the result predicate. The question of interest here is: Where does this additional meaning come from? There are two main ways of answering this question.

Answer 1 It is there since the NP[nom], NP[acc], Pred and V are used in a certain phrasal configuration.

Answer 2 It is there since a special lexical item selects for NP[nom], NP[acc], Pred and contributes the appropriate meaning.[1]

[†]This paper was presented at the Workshop *Constructions and Grammatical Theory* which was part of the HPSG conference that was organized in conjunction with the 2007 LSA Linguistic Institute. This paper address a number of issues raised by Adele Goldberg in the class she and Michael Tomasello gave at that institute.

I want to thank Ivan Sag and Gert Webelhuth for the invitation to the workshop and the audience for discussion and comments on the talk. During the institute I had a lot of discussion that was connected to the preparation of the talk. I want to thank Farrell Ackerman, Doug Arnold, Emily M. Bender, Jürgen Bohnemeyer, James Blevins, Adele Goldberg, Petter Haugereid, Gerald Penn, Ivan Sag, Thomas Stolz, Michael Tomasello, Gert Webelhuth, and Shravan Vasishth for the discussion of different perspectives on phrasality, morphology, periphrasis, underspecification, iteration, and other connected topics.

Thanks to Petter Haugereid for the discussion of his phrasal analysis and to Frank Richter, Ivan Sag, Manfred Sailer, Gert Webelhuth and Stephen Wechsler for comments on an earlier version of this paper. I thank Philippa Cook for proof-reading.

[1]There are different versions of the lexical analysis that will be discussed below.

The phrasal approach was suggested by Goldberg (1995) and by Goldberg and Jackendoff (2004). The respective authors suggest the following phrasal configurations:

(2) a. [SUBJ [V OBJ OBL]] (Goldberg, 1995, p. 192)
b. VP $\rightarrow$ V NP AP/PP (Goldberg and Jackendoff, 2004)

In both approaches the semantics is associated with the whole object, that is with [SUBJ [V OBJ OBL]] or with the VP, respectively.

Lexical analyses were suggested by Simpson (1983), **?**, p. 45, Verspoor (1997), Wechsler (1997), Wechsler and Noh (2001), and Müller (2002a) for English, German, and Korean. The authors assume a lexical rule that relates the lexical item with the resultative semantics to the lexical item of the verb that is used in constructions without a result predicate.

As was discussed in Müller, 2006, the difference between the two approaches is rather small. This can be seen by looking at the picture in Figure 1. While in the syntactic analysis the lexical item is inserted into a certain phrase structural configuration which provides the resultative meaning, in the lexical rule-based approach, the lexical item is mapped to another lexical item that provides the resultative reading. Under one view of lexical rules, lexical rules are equivalent to unary branching rules (Krieger and Nerbonne, 1993, Chapter 7.4.1; Copestake and Briscoe, 1992; Meurers, 2001).

	phrasal approach	approach using lexical rules
syntax	[SUBJ [V OBJ OBL]] fischen(X) & become(pred(Y))	[NP[*nom*] [NP[*acc*] [Pred V]]]
words in the lexicon		V[SUBCAT $\left\langle \text{NP}[\textit{str}]_{\boxed{1}}, \text{NP}[\textit{str}]_{\boxed{2}}, \text{Pred} \right\rangle$, CONTENT fischen($\boxed{1}$) & become(pred($\boxed{2}$))]
listed	fischen(X)	V[SUBCAT $\left\langle \text{NP}[\textit{str}]_{\boxed{1}} \right\rangle$, CONTENT fischen($\boxed{1}$)]

Figure 1: Phrasal vs. Lexical Rule-Based Analyses

The figure shows that the differences between the two analyses are small. However, as I pointed out in Müller, 2006 the consequences are severe if one takes a closer look at the interaction of the resultative construction with other phenomena in grammar. Depending on the assumptions one makes, one needs 218 Constructions to account for different ordering patterns and for interactions with valence changing processes like active and passive. If one is willing to abstract away from local reorderings one still needs to stipulate 32 Constructions.

A possible counter argument to this view might be that a phrasal Construction does not make any claims about the order of the construction parts and that it is only the interaction with other constructions that determines the actual order of the material.[2]

In her lecture, Goldberg discussed the Ditransitive Construction, which consists of subject, verb, obj1, and obj2:[3]

(3) V SUBJ OBJ1 OBJ2

She claimed that this construction is phrasal but does not make any statement about the constituent order. The constituent order facts follow from the ways this construction interacts with other Constructions. For simple sentences with ditransitive verbs (3) interacts with the Subject-Predicate Construction and with the VP Construction (Kay and Fillmore, 1999, p. 8, p. 13). Assuming a parallel treatment for the Resultative Construction, it should have the form in (4) rather than the one given in (2a).

(4) V SUBJ OBJ OBL

The rest of the paper will be structured as follows: I will discuss the problems that one runs into if one assumes that phrasal Constructions are simple form-meaning pairs that connect a dominance constraint to a meaning without making reference to internal structure. The alternative to an approach that does not refer to internal structure is approaches that make internal structure available to higher nodes in the tree (constituent order approaches relying on additional features like DOMAIN (Reape, 1994) or approaches that collect all words that are dominated by a certain node (Riehemann, 2001)). I will start discussing constituent order in Section 2. Sections 4 and 5 deal with two other phenomena that are problematic for phrasal analyses: control constructions and valence changing processes like passive.

Before I start discussing the various points, I want to summarize the basic assumptions Goldberg makes: She assumes that there are no transformations (Goldberg 1995, p. 7; 2006, p. 205), a view that is shared by everybody working in constraint-based theories. Furthermore she does not allow for empty elements (Michaelis and Ruppenhofer, 2001, p. 49–50; Goldberg, 2006, p. 10).

2 Constituent Order

In this section I want to look at the interaction between the Construction in (4) and other Constructions in a local context. The first part deals with the problems that

[2]Goldberg (lecture at the LSA institute and presentation at the Workshop on *Constructions in Grammatical Theory* in 2007 in Stanford).

[3]Constructions are form-meaning pairs. Both (3) and (4) are associated with a meaning. Since the details of the meaning representation are irrelevant in the present context, they are omitted here.

arise if one does not assign any internal structure to phrasal Constructions.

2.1 Descriptions without Reference to Syntactic Structure

Linguistic objects are usually described by feature value pairs. Construction Grammar (CxG) and HPSG share the view that both syntactic and semantic properties of linguistic objects have to be described in the same representation of the linguistic object. CxG and all variants of HPSG share the view that simple lexical items (lexemes, words) are form meaning pairs and are described by one feature description. The constraints on possible lexical items can be represented in a type hierarchy in a non-redundant way. By making use of a type hierarchy, generalizations over linguistic objects are captured.

Similarly we can describe the properties of mother nodes of complex linguistic objects by feature descriptions and we can use the type hierarchy to organize the respective constraints. The relations of the mother node to its immediate daughters can also be represented by feature value pairs and the constraints can be grouped in the hierarchy. Depending on the assumptions one makes in the theory, it is possible to describe complex trees of arbitrary depth and properties of parts of such trees. Accessing the internal structure of complex linguistic objects should be avoided where possible, but it might be needed for the analysis of idioms (Sailer, 2000). Sign-Based CxG (Sag, 2007b,a) and some versions of HPSG (Sag, Wasow and Bender, 2003) try to exclude the last option explicitly by setting up the feature geometry in a way that makes it difficult to access the internal structure of linguistic objects.[4]

After these introductory remarks we can now look at the structure in Figure 2.

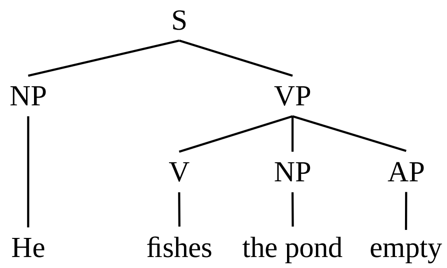

Figure 2: The Resultative Construction in Interaction with the Subj-Pred and VP Construction

If (4) is a form-meaning pair, it has to be a constraint on the S node since only this node contains the subject and the assumption is that (4) is a phrasal construction. If we assign the meaning to the highest node that contains all material that is part of a Construction, we get a problem with the compositional determination of the semantics of utterances. For example consider the embedding of the VP under a modal as it is depicted in Figure 3. To get the right compositional semantics for

[4] See Müller, 2007a, Section 12.3 for discussion.

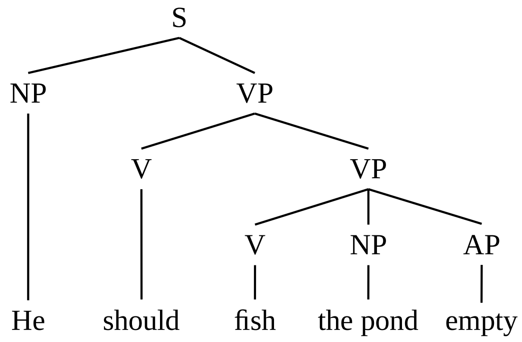

Figure 3: Auxiliaries and modals may intervene

sentences like the one in Figure 3, the meaning of the Resultative Construction has to be present at the VP node that is embedded under the modal.[5] The consequence is that there has to be some VP node in the description of the Resultative Constructions since the phrasal approach refuses to assign the resultative semantics to the V node. Therefore one has to assume a more structured description, namely [SUBJ [V OBJ OBL]] which is the representation that was suggested in Goldberg, 1995, p. 192.[6] Once one refers to nodes in more complex linguistic objects, one necessarily reduces the degree of freedom in constituent order.[7] The statement in (2a) involves the two linguistic objects Subj and [V OBJ OL] and if one ignores analyses that assume discontinuous constituents such a statement leaves only two possibilities for constituent order: Subj [V OBJ OL] and [V OBJ OL] Subj.

Note that a VP seems to be necessary for another reason: The combination of the verb with the accusative element and the predicate has to be licensed syntactically. Since neither the NP nor the secondary predicate is an argument of the verb in (4), there is nothing that licenses the two elements in the configuration in Figure 2. If one allows a VP node, the two elements could be licensed in a special VP configuration in the spirit of Goldberg, 1995, p. 192.

If one wants to do without a VP node in the Resultative Construction, one would have to represent the constraints on the semantic contribution in an underspecified way. This could be done by using a semantics formalism like *Minimal Recursion Semantics* (Copestake, Flickinger, Pollard and Sag, 2005) or a semantic description language like CLLRS (Penn and Richter, 2004). In any case one has to make sure that the resultative semantics is introduced at a node below the modal/

[5]It is possible that one can find ways to encode the semantic representation by making use of elaborated pointer mechanisms and similar semantic constraints, but the analysis in which *should* embeds the content of the VP (modulo quantifiers) will always be simpler and therefore preferable.

[6]Note also that neither *the pond* nor *empty* are arguments of the base verb *fish* in *fish the pond empty*. There has to be a way to ensure that these components of the resultative construction (and no other constituents) are present in the VP node. Since there is no lexical item that selects these elements, the assumption of a special VP node that ensures that this material appears together in the VP seems to be the most straightforward solution.

[7]However, see Section 2.2 for a discussion of approaches that assume discontinuous constituents.

auxiliary, which is not straightforward without any additional machinery.[8]

One could suggest not specifying the subject as part of the phrasal configuration. This is basically the approach that Goldberg and Jackendoff (2004) suggest. Note that this approach is similar to the valence based approach since the subject slot of the VP is open and the constraints on subjects would be represented as valence features in the description of the VP.

I want to turn to German now. The example in (5) involves an adverb that scopes over the resultative meaning:

(5)	weil	niemand	den	Teich	absichtlich	leer	fischt
	because	nobody$_{nom}$	the	pond$_{acc}$	deliberately	empty	fishes

‘because nobody fishes the pond empty deliberately’

In a transformational framework one could assume that *den Teich leer fischt* forms a VP and that *absichtlich* modifies this VP. *den Teich* would be scrambled out of the VP in a later step of the derivation of (5). Since Construction Grammar does not allow transformational derivations and since reorderings like the one in (5) are usually not modeled in a way that uses the devices that are analogous to movement in transformational theories (SLASH), the resultative meaning has to be present at the node for *leer fischt*. The consequence would be that the resultative construction involves reference to a predicate complex in German while it refers to a VP in English. In the lexical treatment, English and German (and Korean) are parallel, the differences follow from the general syntactic constraints that hold for the respective languages but not from the stipulations that have to be made with respect to the resultative construction.[9]

A way to avoid this difference might be the assumption of discontinuous constituents, a proposal I turn to in the next section.

2.2 Discontinuous Constituents

A suggestion to fix the problems that were touched on in the previous section may involve discontinuous constituents. Discontinuous constituents would allow us to talk about the relationships that have to hold between the involved linguistic objects: There has to be a predicative element of a certain category, it predicates over an object, and the verb comes together with a subject. Since the construction can be discontinuous, we predict that parts of the construction appear in other parts of

[8] See for instance Riehemann, 2001 for an analysis of idioms using MRS. The event variable and pointers to the semantic contribution of idiomatic constructions are provided at lower nodes, but the semantic contribution of a Construction is stated higher up in the tree. In order to apply this technique to the case at hand one would have to make sure that the event variable belonging to the resultative semantics is introduced at the node of the embedded VP, that is, reference to this node would be necessary.

[9] As Gert Webelhuth pointed out to me, this argument is parallel to the argument by Perlmutter and Postal (1977, Section 2.1) against the Chomskian transformational theory of passive: The transformations that were suggested for the English passive were highly language specific and did not capture the general properties of the phenomenon.

the sentence and are not necessarily adjacent to each other. This would give us enough flexibility to talk about the relations among the constituents in a certain well-defined syntactic environment and would allow us to account for the sentence in Figure 3, provided we allow for the respective discontinuous constituent.

Everything I have said thus far on this issue has involved statements about possible suggestions and those were rather vague. In order to get more concrete, I would like to discuss proposals that were made in the literature. These proposals deal with particle verbs, which are similar to resultative constructions in many respects. For instance some particles license arguments that are not arguments of the base verb. In the cases where particle frontings are possible, they have to obey the restrictions that hold for partial frontings of resultatives. See Müller, 2002a for a detailed discussion of the data. In what follows I discuss linearization-based analyses of particle verbs.

Kathol (1995, p. 244–248), Booij (2002, Section 2), and Blom (2005) suggested phrasal analyses of particle verbs in the framework of HPSG, CxG, and LFG. These analyses come with the following claim: Particles cannot be fronted without their verb. This claim is sometimes restricted to certain types of particle verbs. Kathol, for instance, distinguishes between particle verbs with a frontable particle and those that do not allow for particle fronting.

The general claim that particles cannot be fronted is not empirically valid: Both German and Dutch allow particle fronting (Hoeksema, 1991; Bennis, 1991; Lüdeling, 1997, 2001; Müller, 2002a,b, 2007a). The data is rather complicated and even for the particle verbs that are said to be non-compositional fronting examples can be found. The following is an example involving Kathol's *aufwachen*:

(6) Nach einigen Zügen, „die irgendwie komisch schmeckten", fielen dem Interviewten die Augen zu. **Auf wachte** der „39jährige Mitarbeiter des Mitropa-Fahrbetriebes, Mitglied der SED. Glücklich verheiratet, drei Kinder" erst wieder im Westen – gerade rechtzeitig, um „einen Packen D-Mark-Scheine auf dem Tisch" des „gewissenlosen Schleppers" zu sehen.[10]

Kathol suggested the lexical item in (7) for *aufwachen*:

(7) *aufwachen* (following Kathol (1995, p. 246)):

$$\left[\begin{array}{l} \ldots|\mathrm{HEAD}\ \boxed{1}\ \textit{verb} \\ \ldots|\mathrm{VCOMP}\ \langle\rangle \\ \mathrm{DOM} \left\langle \left[\begin{array}{l}\langle\ \textit{wachen}\ \rangle \\ \ldots|\mathrm{HEAD}\ \boxed{1} \\ \ldots|\mathrm{VCOMP}\ \langle\ \boxed{2}\ \rangle\end{array}\right] \right\rangle \bigcirc \left\langle \left[\begin{array}{l} \langle\ \textit{auf}\ \rangle \\ \mathrm{SYNSEM}\ \boxed{2} \left[\ldots|\mathrm{HEAD} \left[\begin{array}{l}\mathrm{FLIP}\ - \\ \textit{sepref}\end{array}\right]\right] \\ \textit{vc}\end{array}\right]\right\rangle \end{array}\right]$$

The DOMAIN feature has as its value a list of domain objects that describe the parts of the particle verb. The order of the elements in a domain list corresponds to their surface realization. $\bigcirc$ is Reape's shuffle operator (Reape, 1994). As far as (7) is

[10] Die Menthol-Affäre, taz, 03.11.2004, p. 17.

concerned, the combination of the two lists containing *wachen* and *auf* allows for both orders in (8):

(8) a. weil er aufwacht
because he up.wakes
'because he wakes up'

b. Wacht er auf?
wakes he up
'Does he wake up?'

In (8a) the particle is serialized to the left of the verb, in (8b) it is the other way round. (8b) is an example of the discontinuous serialization of the particle verb: When bigger structures are built, constituent order domains are unioned, which allows for the serialization of objects that are higher up in the tree between the parts of the word. This analysis of particle verbs is attractive since the phonology of the particle is constrained in the lexical item. One does not have to refer to phonological properties of the particle in the valence representation of the verb (Crysmann, 2002, Chapter 4.2). However, examples like (6) cannot be analyzed with the lexical entry in (7) since the particle is specified to appear in the verbal cluster (*vc*) and in (6) it appears in the Vorfeld. One could try to fix this by disjunctively assigning the particle to the verbal complex or the Vorfeld ($vc \vee vf$) and by assuming a linearization analysis for short frontings (Nunberg, Sag and Wasow, 1994, Kathol, 1995, Crysmann, 2002).[11] Crysmann's account of the reordering of particles works for sentences like (6) in which the particle is the only element in the Vorfeld, but it fails for more complex examples like the ones in (9):[12]

(9) a. [$_{vf}$ [$_{mf}$ Den Atem] [$_{vc}$ an]] hielt die ganze Judenheit.[13]
the breath PART held the whole Jewish.community
'The whole Jewish community held their breath.'

b. [$_{vf}$ [$_{mf}$ Wieder] [$_{vc}$ an]] treten auch die beiden Sozialdemokraten.[14]
again PART kick also the two social.democrats
'The two Social Democrates are also running for office again.'

c. [$_{vf}$ [$_{vc}$ Los] [$_{nf}$ damit]] geht es schon am 15. April.[15]
PART there.with went it already at.the 15 April
'It already started on April the 15th.'

The problem with the data in (9) is that the Vorfeld is complex. The particle constitutes the right sentence bracket in the complex Vorfeld, *den Atem* and *wieder* are serialized in the Mittelfeld of the complex Vorfeld and *damit* is serialized to the right of the particle in the Nachfeld of the complex Vorfeld. If (9) were analyzed as

[11] See also Gunkel, 2003 for an analysis of German clauses with a totally flat structure.

[12] See also Müller, To Appear; 2007a, Section 18.3.1.

[13] Lion Feuchtwanger, *Jud Süß*, p. 276, quoted from Grubačić, 1965, p. 56.

[14] taz, bremen, 24.05.2004, p. 21.

[15] taz, 01.03.2002, p. 8.

simple reordering, the verbs and the particle would be in the same ordering domain and the order constraints would enforce an order in which the particle would be realized to the right of the verb and the constituents that are marked *nf* for Nachfeld would be realized to the right of the particle at the right periphery of the whole clause. The data in (9) demonstrates that a more complex domain object is needed that has an internal structure and that allows for separate topological fields inside the Vorfeld that do not interact in terms of linearization constraints with the rest of the sentence. In order to license this type of complex Vorfeld one would have to have relational constraints that select a subset of the domain objects in the clause and construct a new domain object that is placed in the Vorfeld. Kathol and Pollard (1995) suggested relational constraints for the formation of new domain objects for extraposition. The constraints that would be needed for cases like (9) are much more complex and they are not needed at all if one relies on the analysis of the verbal complex and partial fronting that is usually assumed in HPSG (Hinrichs and Nakazawa, 1989, 1994; Kiss, 1995; Meurers, 1999; Kathol, 1998; Müller, 1996, 1999, 2002a, 2007a). If this analysis is combined with an analysis of verb movement that relies on an empty verbal head, cases of multiple frontings and complex frontings like (9) can be accounted for (Müller, 2005a,b).

The fact that particle verbs and resultative constructions share a lot of properties should be captured by an analysis. Since the domain-based analysis has problems with data like (9), particle verbs have to be analyzed in a different way, which means that the domain-based analysis should not be used for resultatives either if an analysis is available that explains both particle verbs and resultative constructions in similar ways. The analysis developed in Müller, 2002a captures the similarities of the two constructions by assuming that both the particle and the result predicate are selected by the verb.

2.3 Constraints on Dominated Words

Riehemann suggests another way to analyze particle verbs: she develops an analysis of idioms in which she assumes that a bag of all the words that are dominated by a certain node is accessible at this node. For the particle verb *einschalten* ('to switch on') she assumes the following representation:

(10) *einschalten* ('to switch on') Riehemann (2001, p. 292):

$$\begin{bmatrix} \textsc{words} & \left\{ \begin{array}{l} \begin{bmatrix} \ldots\textsc{lzt} & \langle\, \textit{empty\_rel}\,\rangle \\ \ldots\textsc{comps} & \langle\, \textsc{np}\,\rangle \end{bmatrix} \overset{<}{\sqcap} \begin{bmatrix} \ldots\textsc{lzt}\ \langle\, \textit{schalt\_rel}\,\rangle \\ \textit{verb} \end{bmatrix}, \\ \begin{bmatrix} \ldots\textsc{lzt}\ \langle\, \textit{empty\_rel}\,\rangle \\ \textit{ein\_sep\_pref} \end{bmatrix} \end{array} \right\} \\ \textsc{c-cont} & \langle\, \textit{switch\_on\_rel}\,\rangle \\ \textit{schalt\_ein\_spv} & \end{bmatrix}$$

The value of WORDS in (10) is a bag containing two elements: a form of the verb *schalten* and the particle *ein*. $\stackrel{<}{\sqcap}$ stands for default unification. Riehemann uses defaults to capture the fact that the verb in the WORDS bag is similar to the normal verb *schalten*. The semantic contribution of the verb and its COMPS list are overridden. The verb does not contribute semantically.[16] C-CONT is a feature that is used in Minimal Recursion Semantics (MRS) to represent semantic information that is contributed by a Construction as a whole rather than by the individual parts (Copestake, Flickinger, Pollard and Sag, 2005). MRS uses pointers (handles) to refer to parts of the semantic contribution. The relation contributed in C-CONT has the same handle as the verb in the WORDS bag (which is not shown in (10)). Therefore the problem that was discussed in Section 2.1 does not occur in Riehemann's account: Although the semantic contribution is introduced at a higher node, it can be interpreted at the word node.

Riehemann's approach does not have problems with the examples in (9) since it does not involve statements about the Vorfeld, it just mentions the words that are part of the Construction. However, Riehemann's proposal is not without problems either: the question to be asked is: What is *schalt_ein_spv* a constraint on? (11) shows local environments that contain the two elements of the WORDS bag.

(11) a. Einschalten!
on.switch
'Switch it on!'

b. Schaltet er das Radio ein?
switched he the radio on
'Does he switch the radio on?'

c. Ein hat er es nicht geschaltet.
on has he it not switched
'He did not switch it on.'

In (11a) we have the particle and the verb in a word or—depending on the analysis—in a *head-cluster-phrase*. (11b) is an example of a verb first clause (*head-argument-phrase*) and (11c) is a verb second clause (*head-filler-phrase*). This means that all three phrase types have to be compatible with C-CONT $\langle\rangle$ and with C-CONT $\langle \ldots \rangle$. The C-CONT would be the empty list in cases were no particle verb is present and a list containing (at least) the particle verb relation in cases were a particle verb is part of the dominated words. The case in which C-CONT is the empty list must not apply in cases in which a particle verb is present. To ensure this, one has to either extend the type system by a type *non_particle_verb_phrase* and crossclassify all phrases with respect to particle verbs and this additional type or one has to have

[16] I think that this is the wrong analysis of *einschalten*. *einschalten* is very similar to resultative constructions in syntax and meaning and therefore *ein* should be treated as a predicate and the *schalten* that is part of *einschalten* should be analyzed as the intransitive version of the verb *schalten*. However there are other particle verbs which are non-compositional and Riehemann's analysis could be used to account for them in a way analogous to (10).

negative constraints on the word bag which rule out particle verbs in it. Note that this is not trivial since multiple particle verbs can occur in an utterance:

(12) Er schaltete das Radio, das ich ausgeschaltet habe, wieder ein.
he switched the radio that I off.switched have again on
'He switched the radio that I switched off on again.'

The semantic contribution of all the particle verbs could be contributed at every dominating node which leads to a high amount of spurious ambiguities (see Sailer, 2000, p. 315 for a similar point regarding an earlier idiom analysis of Riehemann's).

One way to reduce the spurious ambiguities is to use the idiom analysis that Riehemann developed in other parts of her thesis.[17] In this analysis the idiom constraints attach to the root node. At the root node it is ensured that all parts of idioms are found in the bag of words. One would have to find a way to introduce the constructional semantics at this level (since neither *schalten* nor *ein* contributes meaning in Riehemann's analysis, the contribution has to be done constructionally[18]), which is not straightforward since one does not know how many particles are present in an utterance. Therefore no statement about the length of the C-CONT list should be made at the root node.

Note that Riehemann's proposal for particle verbs cannot be extended to resultatives straightforwardly. In order to be licensed in head argument phrases, both the object and the resultative predicate have to appear in a valence list. Furthermore, the semantics of the resultative construction which embeds the semantics of the base verb has to be available at the node where the verb is used in the syntactic structure. For example, in (13) the resultative semantics has to be present below the modal verb *will* ('wants'), which is in turn embedded under the assertion operator, *glauben* ('to believe'), and the negation.

(13) Leer glaub' ich nicht, dass er den Teich fischen will.
empty believe I$_{nom}$ not that he$_{nom}$ the pond$_{acc}$ fish wants.to
'I do not believe that he wants to fish the pond empty.'

A semantic representation for (14a) in the framework of MRS could be (14b):

(14) a. der Mann den Teich leer fischt
the man the pond empty fishes
b. h1:man(x), h2:pond(y), h3:empty(e1,y), h4:fish(e2,x), h5:cause(e3,h4,h6), h6:become(e4,h3)

In order for the MRS mechanics to work, the handle h5 and the event variable e3 have to be present below *will* ('want') in (13). This means that the handle of the description in the WORDS bag that refers to the verb would have to point to the

[17] See Sailer, 2000, p. 316 for criticism of this analysis.

[18] Of course one could stipulate that *schalten* contributes the relation for *einschalten* in this particular Construction, but this would require a lexical entry that is exactly like *schalten*, except that it means *einschalten*. See Section 6 on implausible verb senses.

cause relation, that is, the pointer to the relation of the main verb (h4) had to be overridden. At the same time the meaning of the whole construction has to refer to the meaning contributed by the main verb (h4) since h4 is an argument of the *cause* relation. This is impossible without the use of auxiliary features.

3 Haugereid (2007)

Haugereid (2007) suggests an analysis in which the meaning of an utterance is determined by the argument slots that are filled. He assumes a neo-Davidsonian semantic representation together with slots for arguments which he numbers arg1 to arg5. In the case of resultative constructions arg1 (subject), arg2 (object), and arg4 (secondary predicate) are filled. According to Haugereid (2007, p.c.), the sentence in (15a) gets the semantic interpretation in (15b):

(15) a. der Mann den Teich leer fischt
the man the pond empty fishes

b. h1:man(x), h2:pond(y), h3:empty(e), h4:fish(e2), h4:arg1(x), h4:arg2(y), h4:arg4(h3)

The representation is an MRS representation. Each elementary predication comes with a handle. The only argument of the *fish* relation is an event variable and there are other relations that express the arguments of *fish*. The fact that the arguments belong to a certain predicate is expressed by the identification of the handles. In (15b), the arg1, arg2, and arg4 relations have the same handle as the *fish* relation. According to the definitions given in Haugereid, 2007 this means that the arg2 is the patient of the event. This makes the wrong predictions in cases like (15a) since the accusative element is not a semantic argument of the main verb. It is a semantic argument of the secondary predicate and raised to the object of the resultative construction. Depending on the analysis one assumes, the accusative element is a syntactic argument of the verb, but never a semantic argument that fills an argument role in the relation of the main verb. In addition to this problem, the fact that *empty* predicates over the object is not captured in (15b). Haugereid (2007, p.c.) suggests that this is implicit in the representation and follows from the fact that all arg4s predicate over arg2s.

The lexical rule-based analysis allows for a much more fine-grained semantic representation that allows one to specify the actual semantic relations between the involved elements and it also accounts for the fact that the accusative element does not necessarily stand in a thematic relation to the main verb.

Haugereid sketches the syntax of German clauses and deals with active/passive alternations. However, he does not explain how other parts of the grammar work. In particular it is not straightforward to account for more complex sentences involving AcI verbs like *see*. The arguments of embedded verbs and matrix verbs can be permuted in such constructions. Haugereid (2007, p.c.) assumes special grammar rules that allow the arguments of an embedded verb to be saturated. That is, there is a special rule for an arg2 argument of an argument. In order to combine *das Nilpferd* with *füttern helfen läßt*, he would have to assume a special grammar rule that combines an argument of a verb that is embedded two levels deep:

(16) weil Hans Cecilia John das Nilpferd füttern helfen läßt.
because Hans Cecilia John the hippo feed help let
'because Hans lets Cecilia help John feed the hippo.'

As was argued in Müller (2004, p. 220), several complex-forming predicates can be combined in German clauses; it is only performance that blocks more complex clusters. Verbal complexes with more than four verbs are hardly acceptable in German. However, as was pointed out by Evers (1975, p. 58–59) the situation is different for Dutch where complexes with five verbs are more acceptable. Evers suggests that this is due to the different branching of the Dutch verbal complex and the higher processing load for German verbal complexes. Haugereid would have to assume that there are more rules for Dutch than for German. This would just be a stipulation and not an explanation of the unacceptability of very complex verbal complexes.

Note also that the problem of proliferation of Constructions creeps in again: Haugereid has to assume five Constructions that combine a head with one of the arguments (arg1–arg5). In addition, Constructions for the realization of the arguments of embedded heads have to be stipulated. Haugereid assumes special extraction Constructions for each of the arguments. Respective extraction Constructions would have to be stipulated for arguments of embedded heads as well. This would result in a combinatorial explosion that is similar to the one that was criticized in Müller, 2006. In comparison, the approach suggested in Müller, 2002a assumes one Head-Argument Schema and Predicate Complex formation.

Until now, I have been dealing with constituent order phenomena and ways that might be suggested to save a phrasal analysis without the stipulation of lots of Constructions for the various surface patterns that can be observed. In what follows I want to address other phenomena that are problematic for the phrasal approach under certain assumptions.

4 Control Constructions

Control constructions are problematic for a phrasal approach since the subject of the resultative construction is not realized at the surface. (17) gives an example for such a control construction. The subject of *leer zu fischen* is not visible in (17):

(17) Peter zwingt den Mann, den Teich leer zu fischen.
Peter$_{nom}$ forces the man$_{acc}$ the pond$_{acc}$ empty to fish
'Peter forces the man to fish the pond empty.'

As Höhle (1983, Chapter 6) has shown, the subjects of *zu* infinitives have nominative case (see also Müller, 2002a, p. 49–53 for a publication of the data in English).

Since the case of the subject is nominative, the subject cannot be identical to *den Mann*, which is accusative.[19]

Therefore one either has to assume an empty element as the subject of *den Teich leer zu fischen* or admit that at least the subject is represented as a valent and is not part of the phrasal Construction. Since the lexical rule-based analysis treats subject, object, and predicate as valents, it does not have any problem with data like (17) and does not have to assume an empty element, but can use the standard analysis of control (Pollard and Sag, 1994).

Assuming that subjects are not part of the Resultative Construction as was suggested by Goldberg and Jackendoff (2004) would not help, since the object is part of the Construction, and passive infinitives can be embedded under control verbs:

(18) Der kranke Mann wünschte sich, tot geschossen zu werden.
the ill man wished SELF dead shot to be
'The ill man wanted to be shot dead.'

The new subject of *tot geschossen zu werden* is not expressed in (18). To avoid empty elements in control constructions, all subjects of all controllable Constructions have to be valents.

5 Open Issues for the Phrasal Analysis

As was pointed out in Müller, 2006, p. 867–868, the valence extending or valence reducing variants of Constructions cannot be modeled by inheritance hierarchies. The reason is that multiple inheritance from the same description does not add new information. I explained the problem with data from Yukatek Maya that involve passivization, causativization, and passivization. However, Jürgen Bohnemeyer informed me that this pattern is not productive in current Yucatec Maya. There are some other cases in the language, so it might have been productive. However, there are other languages that allow for similar things (Stolz, 2003). An example is Turkish, which allows double and even triple causation (Lewis, 1967):

(19) Öl-dür-t-tür-t-
'to cause somebody to cause somebody to kill somebody'

The *t* and *tür* is the causative morpheme (-t-/-d- after vowels or sonorants and -tVr- /-dVr after consonants, where V stands for a vowel in vowel harmony).

One could argue that Turkish data is not relevant for English, but there is another problem for the inheritance-based analysis of active/passive alternations: The interaction of various Constructions does not follow from anything. As was shown in Müller, 2006 the algorithm that was suggested by Kay (2002) to compute possible interactions between Constructions is not without problems. Even if it can be

[19]See also Hennis, 1989; Andrews, 1982; Neidle, 1982; Bresnan, 1982 for similar conclusions regarding subjects in control constructions based on data from Icelandic, Russian, Malayalam.

made to work, it cannot be applied to Goldberg's grammars since she relies on defaults and the overridings cannot be solved automatically in all cases. The problem is the following: Once a learner has acquired the parts of grammar that are needed for passive, he or she can apply this knowledge to new items (Tomasello, 2000). In the inheritance-based view the interaction between valence changing Constructions and other Constructions has to be stipulated, that is, the theory predicts, that the interaction has to be learned for all Constructions.

Goldberg suggested that GPSG-like metarules could be used to relate active and passive variants of Constructions. However, there is a crucial difference between the GPSG metarules and the metarules that Goldberg would need: GPSG metarules applied to context free rules, that is to local trees. Goldberg's rules would have to apply to complex trees or to dominance constraints which means that these rules would be much much more powerful. In essence, they are transformations,[20] which Goldberg does not want to be part of her theory.

6 Implausible Verb Senses

Goldberg argues against lexical rule-based approaches since these have to assume what she calls "implausible verb senses". According to her it is implausible to assume that *fish* means *cause to become Pred by fishing*; but note that this is not what is claimed by the lexical analysis. The lexical analysis should rather be understood as making the following claim: If the word *fish* is used together with a subject, an object, and a predicate, then the sentence means X's fishing caused Y to become Pred.

I want to point out here that Goldberg's argument can be turned around: She claims that certain words have a certain meaning when they are used together. However, if we look at the words that occur in the utterance, they sometimes have a meaning outside of the idiom. Sometimes the words are ambiguous and it is not clear syncronically which of the verb senses actually lead to the formation of the idiom. In such cases assuming one of the available senses would be a stipulation. An example would be *darstellen* ('represent'), which has *stellen* as the main verb, which can be translated as 'provide' or 'put'. Riehemann addressed this issue by overriding the semantic contribution of used words by the *empty_rel*, but this amounts to saying that there are lexical entries for verbs that do not mean anything. Instead of stipulating lexical items for verbs with no meaning contribution or assuming arbitrary verbs inside of idiomatic expressions, I prefer to have lexical items in the grammar that correspond to statements of the type mentioned above: If this word is used with the specified arguments (including certain modifiers), it means whatever it means.

[20]With the possible difference that the trees they map lack terminal nodes.

7 Conclusion

It is very difficult to come up with all possible suggestions that could be made to save a certain account and I have probably failed to achieve this goal. A participant of the workshop commented that the only thing I can say about the phrasal approach is that it is not worked out in detail. This is probably true, but I nevertheless hope that this paper has some value, even if the value is limited to having shown that some analyses in the spirit of Goldberg that have actually been worked out have empirical or technical problems.

In comparison to Goldberg's suggestions, there is a fully worked out analysis for resultative constructions and particle verbs that relies on lexical rules (Müller, 2002a). It can account for valence alternations (active/passive/middle/free datives), local constituent order, partial fronting and nonlocal dependencies (V2, relatives, interrogatives), interacts with derivational morphology and is compatible with restrictions on locality (Sag, 2007a). It has none of the problems that phrasal accounts have. It works for German, English, and Korean, and probably some other languages as well. The particular syntax of the languages differs, but the resultative construction is described in the same way. Therefore the generalizations regarding resultative constructions are captured.

One aspect of CxG that is very attractive is the language acquisition research that is connected to the framework. The idea that children learn patterns and generalize from them is straightforward, very intuitive, and supported by evidence from experiments (Tomasello, 2006). However, if one looks at more complex utterances, it is clear that adjacency is not required for a Construction to be recognized. What children have to learn is that an utterance has a certain meaning if certain material appears together in an utterance. This is what Goldberg tries to save by saying that Argument Structure Constructions do not make any statement about linear order. But this is exactly what is expressed in the valence-based approach: If a head appears together with its arguments, the respective combination has a certain meaning.

Finally, I would like to repeat a point that I made in Müller, 2006, p. 878: I am not claiming that all observable patterns should be treated lexically. Especially in cases in which one cannot treat one part of a phrase as a functor, a phrasal analysis seems to be more appropriate than a lexical one. Examples for such cases are certain date expressions (Müller and Kasper, 2000), word iteration (Stolz, 2006), or fully fixed expressions. While phrases like *by and large* could be assigned an internal structure, this does not seem to be very enlightening and simply listing them as full phrases in the lexicon is probably the analysis that should be preferred over an analysis that makes *and* (or any other word) the functor selecting for the remaining words.

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Remarks on Locality

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Abstract

This paper proposes a modification of HPSG theory – Sign-Based Construction Grammar – that incorporates a strong theory of both selectional and constructional locality. A number of empirical phenomena that give the appearance of requiring nonlocal constraints are given a principled, localist analysis consistent with this general approach, which incorporates certain insights from work in the tradition of Berkeley Construction Grammar, as exemplified by Fillmore et al. (1988), Kay and Fillmore (1999), and related work.

1 Introduction

Locality of selection is the problem of delimiting what syntactic and semantic information lexical items select. Related issues include the proper analysis of idiomatic expressions, control of overt pronominals, and cross-linguistic variation in lexical sensitivity to filler-gap dependencies.[1] For example, while it is commonplace to find a language containing a verb like *go*, which allows a directional PP complement, but not a NP object, there are no languages (as far as we know) where we find a verb like *go* that imposed the same requirement on the complementation pattern realized within its sentential complement. That is we would not expect to find a verb *og* whose selectional properties produced contrasts like the following:

(1) a. Lee **oged** that someone ran $\boxed{\text{into the room}}$.

b. *Lee **oged** that someone proved $\boxed{\text{a theorem}}$.

The question of locality of subcategorization seems to have fallen by the wayside within mainstream generative grammar. It is important to realize, however, that '$\overline{\text{X}}$ Theory', as first developed in Chomsky 1970 (but cf. Harris 1946), bears on this question. A verb that selects an NP complement (a transitive verb) is really selecting for a phrase with a (nonpredicative) nominal head. And $\overline{\text{X}}$ Theory, which relies on the reformulation of syntactic categories as feature structures, provides a way of projecting the category information of the lexical head 'up' to its maximal

[†]Some of the ideas developed here were first presented at the 2001 HPSG Conference, held at NTNU in Trondheim, Norway. I would like to thank Emily Bender, Bill Croft, Bruno Estigarribia, Charles Fillmore, Dan Flickinger, Adele Goldberg, Andreas Kathol, Paul Kay, Bob Levine, Detmar Meurers, Laura Michaelis, Carl Pollard, Jan Strunk, and Tom Wasow for valuable discussions about locality. I am particularly grateful to Doug Ball, Detmar Meurers and Stefan Müller for detailed comments on an earlier draft of this paper. This work was supported in part by grant BCS-0094638 from the National Science Foundation to Stanford University and in part by the Research Collaboration between NTT Communication Science Laboratories, Nippon Telegraph and Telephone Corporation and CSLI, Stanford University.

[1]The locality of selection is one of the theoretical issues that were hotly debated during the 1960s. For further discussion and historical review, see Sag to appear a.

projection (e.g. the maximal NP headed by a given noun, the maximal AP headed by a given adjective, etc.). $\overline{\text{X}}$ Theory thus plays a crucial role in considerations of locality – a verb refers to the category features of the phrases it combines with, i.e. the phrases (NP, AP, etc.) that are sisters of the verb and it follows that those phrases will be headed by a word of the appropriate syntactic category.

These ramifications of $\overline{\text{X}}$ Theory played an important role in the development of Generalized Phrase Structure Grammar (GPSG). Gazdar (1981) and Gazdar et al. (1985) argued that $\overline{\text{X}}$ Theory, with a slightly enriched inventory of syntactic features, provides the basis for a wholesale revision of linguistic theory, one that eliminates transformational operations altogether. GPSG researchers proposed that the 'HEAD' features, those whose specifications were passed up from head daughter to mother in a headed structure, included not only N and V, which (following Chomsky) were used to (coarsely) distinguish grammatical categories, but also such features as CASE, VFORM, NFORM, PFORM, PRED, AUX, and SLASH. With this feature inventory, the explanatory domain of $\overline{\text{X}}$ Theory is expanded to include not only the locality of category selection, but also the locality of case assignment, verb form government, selection of expletives, preposition selection, auxiliary selection, and the selection of phrases containing gaps of a particular kind (e.g. by *tough*-adjectives in English). Assuming that the values for these features are 'percolated up' from lexical heads to the phrases they project (by the Head Feature Principle (HFP), an uncontroversial principle of $\overline{\text{X}}$ Theory), the information relevant to all these phenomena becomes locally accessible to the lexical items that combine with those phrasal projections.

In fact, given the possibility of modification and the unbounded expansion of 'slashed' constituents, the domain over which subcategorization is allowed in a GPSG/HPSG approach is in principle unbounded, as it should be, given across-the-board effects in coordination, and unbounded effects in modification, extraposition, and other structures, as illustrated for VFORM selection in (2):

(2) a. Kim will [**leave/*leaving/*left** home].

b. Kim will [[**leave** home] and [**get** famous]].

c. Kim will [apparently [never [**leave** home]]].

d. Kim will [[[**drink** [so much]] [at the party]] [that we'll be embarrassed]].

To put it somewhat differently, GPSG did not deny that there were long-distance dependency phenomena of the sort just illustrated. Rather, the claim made by GPSG (and also by HPSG) is that non-local dependency phenomena are a consequence of strictly local constraints (e.g. lexical specifications involving the category, meaning, case, etc. of a word's selected dependents) and their interaction with independent principles of grammar, such as the HFP.

Closely related to selectional locality is the issue of **locality of construction** – the problem of delimiting the syntactic and semantic information accessible to

$$\left[\begin{array}{ll} \textit{phrase} & \\ \text{PHONOLOGY} & \ldots \\ \text{SYNTAX} & \left[\begin{array}{ll} \text{LOCAL} & \left[\begin{array}{ll}\text{HEAD} & \ldots \\ \text{SUBCAT} & \textit{list}(\textit{sign})\end{array}\right] \\ \text{NONLOCAL} & \ldots \end{array}\right] \\ \text{SEMANTICS} & \ldots \\ \text{DTRS} & \left[\begin{array}{ll}\text{HD-DTR} & \textit{sign} \\ \text{COMP-DTRS} & \textit{list}(\textit{sign}) \\ \ldots & \end{array}\right]\end{array}\right]$$

Figure 1: Feature Geometry of Pollard and Sag 1987

grammar rules. That is, just as we observe empirically that there are no languages with extended subcategorization of the sort illustrated in (1) above, I would argue that there are also no languages where one must propose a grammar rule that directly relates two elements across clauses. In all apparent cases of this that I am familiar with, there is a satisfying feature-based analysis of the construction in question that conforms to a strict localist architecture.

2 The SYNSEM Locality Hypothesis

The feature geometry proposed by Pollard and Sag (1987) [henceforth P&S-87] (sketched in Figure 1, taken together with their Subcategorization Principle in (3)), failed to place sufficient constraints on which elements could be selected by a given word.[2]

(3) **Subcategorization Principle** (P&S-87: 71):

$$\left[\begin{array}{ll}\text{DTRS} & \textit{head-struc}\end{array}\right] \Rightarrow \left[\begin{array}{ll} \text{SYN}|\text{LOC}|\text{SUBCAT} & \boxed{A} \\ \text{DTRS} & \left[\begin{array}{ll}\text{HD-DTR} & \left[\begin{array}{ll}\text{SYN}|\text{LOC}|\text{SUBCAT} & \boxed{A} \oplus \boxed{B}\end{array}\right] \\ \text{COMP-DTRS} & \boxed{B}\end{array}\right]\end{array}\right]$$

In this set-up, since phrasal signs have daughters, the elements on a verb's SUBCAT list do too. Hence a lexical entry could easily be written for a verb that is subcategorized for a VP complement that must contain a direct object NP or (even more permissively) for an S whose VP contained an S whose VP contained an object specified as, say, [CASE dative]. Early HPSG thus embodied little in the way of a theory of subcategorization locality.

[2]For uniformity of presentation, I here reverse the order of elements on SUBCAT lists from that assumed in P&S-87. The symbol '$\oplus$' denotes list concatenation (also referred to as the 'addition' or the 'appending' of two lists.)

$$\begin{bmatrix} \textit{phrase} & \\ \textsc{phonology} & \ldots \\ \textsc{synsem} & \begin{bmatrix} \textit{synsem} & \ldots \\ \textsc{local} & \begin{bmatrix} \textsc{category} & \begin{bmatrix} \textsc{head} & \ldots \\ \textsc{subcat} & \textit{list}(\textit{synsem}) \end{bmatrix} \\ \textsc{content} & \ldots \end{bmatrix} \\ \textsc{nonlocal} & \ldots \end{bmatrix} \\ \textsc{dtrs} & \begin{bmatrix} \textsc{hd-dtr} & \textit{sign} \\ \textsc{comp-dtrs} & \textit{list}(\textit{sign}) \\ \ldots & \end{bmatrix} \end{bmatrix}$$

Figure 2: Feature Geometry of Pollard and Sag 1994

The proposals made by Pollard and Sag (1994) [henceforth P&S-94] embodied an attempt to remedy this defect. By introducing the feature SYNSEM and the syntactico-semantic complexes ('synsem objects') that served as values of SYNSEM, P&S-94 were able to limit the information that was accessible under lexical selection, as shown in Figure 2.

This feature geometry worked together with a revised Subcategorization Principle, formulated in (4):[3]

(4) **Subcategorization Principle** (a formalization of P&S-94: 34):

$$\begin{bmatrix} \textsc{dtrs} & \textit{head-struc} \end{bmatrix} \Rightarrow \begin{bmatrix} \textsc{ss}|\textsc{loc}|\textsc{cat}|\textsc{subcat} & \boxed{A} \\ \textsc{dtrs} & \begin{bmatrix} \textsc{hd-dtr}|\textsc{ss}|\textsc{loc}|\textsc{cat}|\textsc{subcat} & \boxed{A} \oplus \texttt{s2s}(\boxed{B}) \\ \textsc{comp-dtrs} & \boxed{B} \end{bmatrix} \end{bmatrix}$$

We may refer to the feature geometry in Figure 2, taken together with the Subcategorization Principle in (4), as the SYNSEM Locality Hypothesis (SSLH).[4]

The SSLH ensures that if a lexical entry includes a constraint on a member of the SUBCAT list, that constraint will apply to the SYNSEM value of the corresponding valent (subject, complement, or specifier) that that word cooccurs with. There is no direct access to information about any element that appears within those valents, e.g. a direct object within a VP complement, or an object within a sentential complement of a sentential complement. There is only indirect access to such elements whenever certain SYNSEM properties of a given valent are determined by or correlated with those of some element it contains.

[3]The function `s2s` (`signs-to-synsems`) maps a list of signs onto the corresponding list of synsem objects.

[4]The SSLH also includes the prediction that (morpho-)phonological information is unavailable for lexical selection. Space limitations prevent a proper evaluation of this independent issue here.

The SSLH embodies a quite particular claim: taken together with a theory of what SYNSEM values are, it ensures that the grammatical constraints that concern the following phenomena all function within the same locality domain: **category selection** (strict subcategorization in Chomsky's sense), **case assignment**, **government** (of the form of a complement's head), and **(non-anaphoric) agreement**. In many clear cases, these predictions are correct, though there remain certain issues of controversy, some of which I discuss below.

Note that under these assumptions it is not possible to write a lexical entry that selects for a gap appearing at some fixed level of embedding. That is, the 'localist' analysis of filler-gap dependencies that has emerged from the GPSG/HPSG tradition comes close to predicting (correctly, to the best of my knowledge) that no grammar for a natural language can impose an arbitrary depth on a filler-gap dependency. The positions in which the gap can appear are always determined by general constraints on the 'inheritance' of SLASH specifications.[5]

I note in passing that the hypothesis that information about filler-gap dependencies should be locally encoded has been confirmed now by evidence from numerous languages. All of the following phenomena, for example, are sensitive to the presence of a filler-gap dependency and are easily described given the localist, feature-based approach to unbounded dependencies pioneered in GPSG/HPSG research: Irish Complementizers, 'Stylistic' Inversion (Romance), Kikuyu Downstep Suppression, Austronesian Verb Agreement, Yiddish Inversion, Icelandic Expletives, Thompson Salish Verb Morphology, Adyghe '*wh*-agreement'.[6]

3 Locality of Construction

Since the inception of work in HPSG, it has been assumed that there are two kinds of signs – words and phrases, with the feature DAUGHTERS (DTRS) declared appropriate for the type *phrase*. Grammar schemata were introduced in PS-94 as the HPSG analog of grammar rules. These schemata specified an inventory of phrase types, where phrases had the geometry shown in Figure 2 above. Since phrases contained daughter structures of arbitrary depth and schemata imposed constraints directly on phrases, there was nothing in this set-up that imposed any notion of locality. Nothing but an unspoken 'gentleman's agreement' prevented the HPSG grammarian from writing a schema that directly referenced a daughter's daughters, or in fact elements that appear at any arbitrary depth of embedding. HPSG had thus evolved far from its GPSG (CFG) roots, an evolutionary path that did not go unnoticed. For example, Copestake (1992) observed that:

[5]This should be compared with a different approach that could also be incorporated within HPSG, namely the use of regular expressions to characterize the relation between fillers and gaps. Under this alternative (cf. its deployment within LFG under the rubric of 'functional uncertainty'), one could write a lexical entry that forced that gap to appear at some fixed depth within the infinitival complement of *hard*, an expressible, but cross-linguistically non-occurring possibility.

[6]For further discussion, see Hukari and Levine 1995, Levine and Hukari 2006, Sag to appear a, and the references cited there.

> [...] it is unclear that the HPSG account of phrasal signs as feature structures which incorporate their daughters is the best one to adopt. Constraint resolution can be used to perform operations which cannot be straightforwardly mimicked by more conventional grammar rules. [...]. However, it is not clear to me whether HPSG currently takes advantage of this possibility in any very significant way. There have to be good reasons to adopt an approach which makes most known parsing technology inapplicable.

Copestake's observation still has force today, though of course there is now considerable work developing analyses based on linearization theory,[7] which uses a DOMAIN feature to allow 'liberation' of embedded elements, making them locally accessible at 'higher' levels of tectogrammatical derivation.[8] Apart from this line of research, there are to my knowledge no HPSG analyses that propose a grammatical schema making direct reference to embedded structure. The practice of the HPSG community seems to adhere to the notion of locality that is inherent in CFGs.

English tag questions pose an interesting challenge to constructional locality, since they involve agreement between the main clause subject and the subject pronoun realized within the tag:

(5) a. He is going to get into trouble, isn't he/*she/it?

b. *He is going to get into trouble, aren't they/you/we?

Bender and Flickinger (1999) assume that the agreement between the two subjects is syntactic, and hence that the two verbs and the two subjects in any tag question must all agree. This view, however, is inconsistent with well known data like (6), which argues that the agreement in question is semantic, rather than syntactic:[9]

(6) a. Sears is open, aren't they?

b. At least one of us is sure to win, aren't we?

But however the agreement in question is to be analyzed, the agreement relation between the two subjects is non-local, i.e. it involves agreement between two elements that are not sisters, as shown in Figure 3.

As Bender and Flickinger argue, the English tag-question construction argues not for an analysis in terms of nonlocal constraints, but rather for a treatment in terms of a feature that 'passes up' information about the subject NP to the clausal level, i.e. to the S. Under such an analysis it is possible to treat the agreement in tag questions locally, i.e. via a local constraint requiring the relevant identity (coindexing) between the values of the subject-encoding feature of the main clause and that of the tag clause (the clauses that are shaded in Figure 3).

[7] See, for example, Reape (1994, 1996), Kathol 2000, and Daniels and Meurers 2004.

[8] For critical discussion of this approach, see Müller 2004, 2005.

[9] See Kay 2002 and the references cited there.

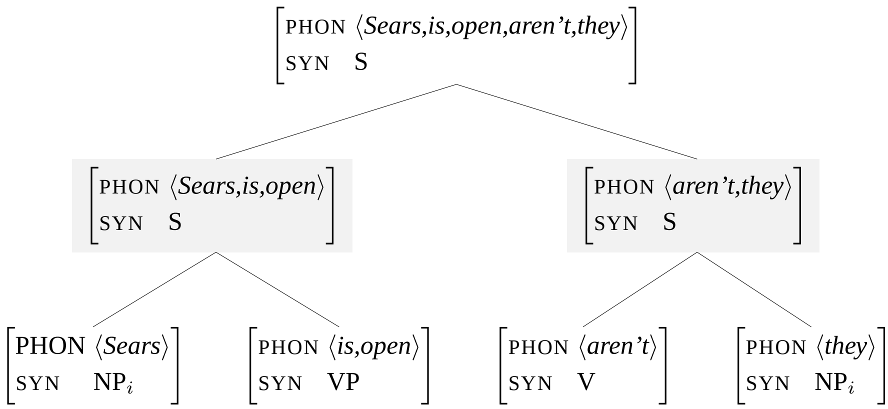

Figure 3: A Tag-Question

4 Signs, Constructions, and Constructs

I propose to modify HPSG theory so as to incorporate the strong constraints of the actual practice of the HPSG community. To this end, phrases should not be endowed with the feature DTRS. Phrases, like words, specify values for the features PHONOLOGY, SYNTAX, and SEMANTICS. Second, signs should be distinguished from the constructions that license them. (What I mean by this will become clear in a moment.)

A construction, like a schema in PS-94, is intuitively a constraint defining a local pattern of sign combination. That is, a construction places restrictions on what properties signs must have if they are to directly combine with one another and in addition puts constraints on the sign that results from such a combination. On this conception, a construction is a CFG-like grammar rule that provides a particular set of constraints on the form, syntactic category, meaning, and use conditions of the mother sign, stated in terms of the properties of its daughters. The objects defined by constructions are thus configurations of signs: a set of daughter signs and one more sign that is the mother of those daughters. Let us call each such configuration a 'construct'.

Notice that we may now return to a simpler feature geometry like the one in PS-87, eliminating the feature SYNSEM. In addition, with no distortion of the grammar's intended effect, we may reformulate constructs as feature structures, as shown in (7):[10] This last move is in fact easily achieved by the type declarations sketched in Figure 5, which define part of the type hierarchy shown in Figure 6:

Of course, this system of grammar doesn't define complex expressions until

[10]For expositional purposes, I will sometimes represent constructs in tree notation and will use SYNTAX and SEMANTICS values, as in Figure 4.

$$
\begin{bmatrix}
\textit{phr-cxt} & \\
\text{MTR} & \begin{bmatrix} \textit{phrase} & \\ \text{PHON} & \langle \textit{Kim}, \textit{walks} \rangle \\ \text{SYN} & \text{S} \\ \text{SEM} & \textbf{walk}(\textbf{k}) \end{bmatrix} \\
\text{DTRS} & \left\langle \begin{bmatrix} \text{PHON} & \langle \textit{Kim} \rangle \\ \text{SYN} & \text{NP} \\ \text{SEM} & \textbf{k} \end{bmatrix}, \begin{bmatrix} \text{PHON} & \langle \textit{walks} \rangle \\ \text{SYN} & \text{V} \\ \text{SEM} & \textbf{walk} \end{bmatrix} \right\rangle
\end{bmatrix}
$$

Figure 4: A Clausal Construct

$$
\textit{cxt} : \begin{bmatrix} \text{MOTHER} & \textit{sign} \\ \text{DTRS} & \textit{list(sign)} \end{bmatrix}
$$

$$
\textit{ph-cxt} : \begin{bmatrix} \text{MOTHER} & \textit{phrase} \end{bmatrix}
$$

$$
\textit{hd-cxt} : \begin{bmatrix} \text{HD-DTR} & \textit{sign} \end{bmatrix}
$$

$$
\textit{sign} : \begin{bmatrix} \text{PHON} & \textit{list(phon-structure)} \\ \text{FORM} & \textit{list(morph-form)} \\ \text{SYNTAX} & \textit{syn-obj} \\ \text{SEMANTICS} & \textit{sem-obj} \end{bmatrix}
$$

Figure 5: Type Declarations

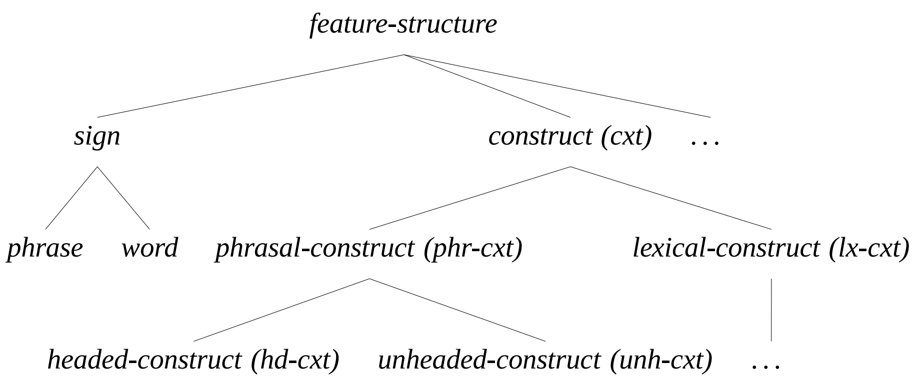

Figure 6: A SBCG Type Hierarchy

we include a principle like the the following, which allows recursive application of constructions:

(7) **The Sign Principle:**

Every sign must be lexically or constructionally licensed, where:
a sign is lexically licensed only if it satisfies some lexical entry and
a sign is constructionally licensed only if it is the mother of some construct.

I will refer to any framework that draws the distinction between signs and constructs as **Sign-Based Construction Grammar** (**SBCG**),[11] though of course this is still a kind of HPSG, given that it embodies signs, linguistically motivated types, type constraints, and a hierarchically organized lexicon, *inter alia*.

It follows from SBCG, as a matter of principle, that a construction cannot have direct access to properties of a mother and its granddaughters. If we observe that there is some such dependency, then we must provide an analysis in terms of some property of the granddaughter that is systematically encoded on the daughter, and hence rendered locally accessible at the higher level. This has the virtue of making explicit exactly where nonlocality resides in linguistic descriptions. It also fosters the development of general principles constraining the distribution of feature specifications across constructs. In fact, the fundamental principles of P&S-94 are now recast as constraints on constructions, as shown in (8):[12]

(8) **Head Feature Principle:**

$$\textit{hd-cxt} \Rightarrow \begin{bmatrix} \text{MTR} & \begin{bmatrix}\text{SYN}|\text{CAT} & \boxed{1}\end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix}\text{SYN}|\text{CAT} & \boxed{1}\end{bmatrix} \end{bmatrix}$$

Subcategorization Principle:

$$\textit{hd-cxt} \Rightarrow \begin{bmatrix} \text{MTR} & \begin{bmatrix}\text{SYN}|\text{VAL} & \boxed{A}\end{bmatrix} \\ \text{DTRS} & \boxed{B} \bigcirc \langle \boxed{1} \rangle \\ \text{HD-DTR} & \boxed{1}\begin{bmatrix}\text{SYN}|\text{VAL} & \boxed{A} \oplus \boxed{B}\end{bmatrix} \end{bmatrix}$$

Note that the Subcategorization Principle is stated here without appeal to the *signs-to-synsems* relation.

Finally, this proposal also provides a new way of making sense of lexical rules, i.e. by treating them as varieties of lexical construction. We may posit three sub-

[11] For an early formulation, see Chapter 16 of Sag, Wasow, and Bender 2003. Here I follow the detailed presentation of SBCG in Sag 2007, where various features (e.g. SYNSEM, LOCAL, NONLOCAL, HEAD) are eliminated and SUBCAT is replaced by VALENCE (VAL).

[12] '$\bigcirc$' is Reape's domain union operator: '$\boxed{A} \bigcirc \boxed{B}$' is satisfied by any list containing exactly the elements of $\boxed{A}$ and $\boxed{B}$, as long as any α which precedes some β in $\boxed{A}$ or in $\boxed{B}$ also precedes β in $\boxed{A} \bigcirc \boxed{B}$. '$\bigcirc$' is thus a 'shuffle' operator.

types of lexical construct: *inflectional-construct*, *derivational-construct*, and *post-inflectional-construct*, each with its own properties. Following in the main Sag et al. 2003 (see especially Chap 16), we may assume that lexical entries in general describe feature structures of type *lexeme* (rather than *word*). Hence derivational constructions involve constructs (of type *deriv-cxt*) whose mother is of type *lexeme*; inflectional constructions involve unary constructs (of type *infl-cxt*) whose mother is of type *word* and whose daughter is of type *lexeme*; and post-inflectional constructions involve unary constructs (of type *post-infl-cxt*) where both mother and daughter are of type *word*. This proposal thus provides a unified approach to the construction of words and phrases, allowing for hierarchical generalizations of varying grain, without the need for ancillary devices.

5 Some Analytic Issues

The SBCG framework is attractive for its simplicity and strong predictive power. However, its predictions may be too strong, as there remain various empirical phenomena that, at least in their outward appearance, appear to defy the localism embodied in SBCG. In the remainder of this paper, I will examine a number of such phenomena, showing that an attractive localist analysis is available.

5.1 Nonlocal Case Assignment in English

English *for/to* clauses present an interesting analytic challenge for the locality of case assignment. In order to analyze contrasts like the one in (9), it is necessary that an accusative case constraint be imposed somehow:

(9) a. I prefer [for [*they to be happy]]

b. I prefer [for [them to be happy]].

But given the standardly assumed structure in (9), the subject NP of the infinitive is not locally accessible to the complementizer *for*, which selects for the infinitival S either as a head (via VAL) or as a marker (via SPEC). Nor can the infinitive marker *to* assign accusative case to its subject, as in examples like (10), that subject must be compatible with nominative case:

(10) [He/*Him seems [to be happy]].

Sag (1997) argues that the standard structure for *for/to*-clauses should be replaced by the flat head-complement structure in Figure 7.[13] Assuming this structure, rather than the one in (9), the lexical entry for the complementizer *for* can simply require that its first VALENCE element be an accusative NP. The problematic NP is now locally accessible.

[13] Here and throughout this section, I have regularized valence features and the attendant feature geometry to conform with the preceding discussion.

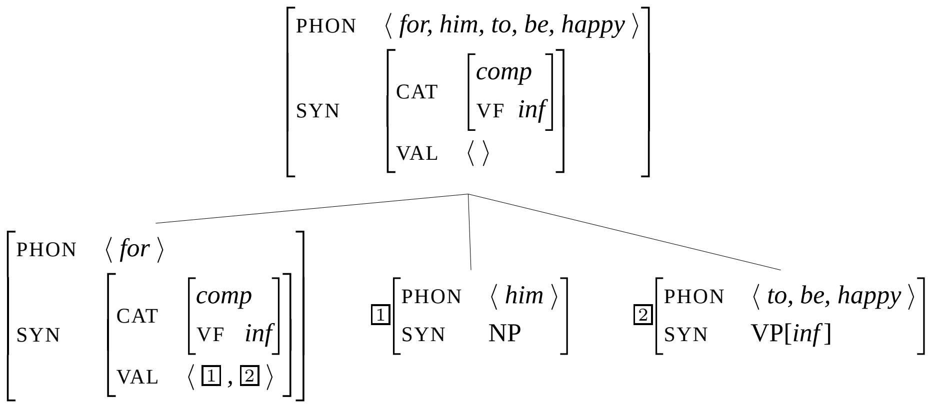

Figure 7: A *For-To* Clause

Moreover, the structure in (10) is independently motivated, for it provides an immediate account of contrasts like the following, first noted by Emonds (1976):

(11) a. Mary asked me [if, in St. Louis, [John could rent a house cheap]].

b. He doesn't intend [that, in these circumstances, [we be rehired]].

c. *Mary arranged for, *in St. Louis*, John to rent a house cheap.

d. *He doesn't intend for, *in these circumstances*, us to be rehired.

Assuming that only finite CPs have the traditional structure indicated in (11a-b), there is no constituent for the italicized modifiers to modify in (11c-d). The deviance of these examples follows from the same constraints that disallow the indicated modifiers in (12a-b), whose structure is analogous to the new *for/to*-clausal structure:

(12) a. *Kim persuaded *in St. Louis* Sandy to rent a house cheap.

b. *Lee believed *in these circumstances* Sandy to be in the right.

5.2 Case Stacking Languages

One of the best-known examples of apparent nonlocal case assignment come from languages that allow case 'stacking', as in the following examples from Martuthunira, a Pama-Nyungan language:

(13)

Ngayu	nhuwa-lalha	tharnta-a	kupuyu-marta-a	thara-ngka-marta-a.
1SG.NOM	spear-PAST	euro-ACC	little-PROP-ACC	pouch-LOC-PROP-ACC

'I speared a euro with a little one in its pouch.'
(Dench and Evans (1988))

(14) Ngunhu wartirra puni-lha ngurnu-ngara-mulyarra kanyara-ngara-mulyarra
the woman go-PAST that-PL-ALL man-PL-ALL
kapunmarnu-marta-ngara-mulyarra jirli-wirra-marta-ngara-mulyarra.
shirt-PROP-PL-ALL arm-PRIV-PROP-PL-ALL
'That woman went towards those men with shirts without sleeves.'
(Andrews 1996)

The operant generalization about these examples is that nominals within NPs are inflected not only in accordance with their local grammatical function, but also so as to reflect the function of the NPs that contain them. The unbounded case dependency phenomenon illustrated in (13)–(14) seems to pose a serious challenge for any locality hypothesis, and certainly for the SSLH.

However, an elegant analysis of this phenomenon in terms of purely local constraints has been developed by Malouf (2000). Malouf proposes that in case stacking languages the value of the feature CASE is not an atomic case, but rather a list of such atoms. Assuming that nouns select for their NP dependents, the lexical entry for the noun *tharnt* 'euro'[14] looks like (15):

(15)
$$\begin{bmatrix} \text{PHON} & \langle \textit{tharnt-} \rangle \\ \text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{noun} & \\ \text{CASE} & \boxed{B} \end{bmatrix} \\ \text{VAL} & \left\langle \text{NP}[\text{CASE } \langle \textit{prop} \rangle \oplus \boxed{B}\,] \right\rangle \end{bmatrix} \end{bmatrix}$$

The key thing to see here is that every word formed from this stem will bear a particular case specification that is then passed on to the NP on that word's VAL list.

Malouf's treatment of nouns interacts with the analysis of verbs, which is sketched in (16):

(16)
$$\begin{bmatrix} \text{PHON} & \langle \textit{nhuwalalha} \rangle \\ \text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{verb} & \\ \text{CASE} & \boxed{B} \langle\, \rangle \end{bmatrix} \\ \text{VAL} & \left\langle \text{NP}[\langle \textit{nom} \rangle \oplus \boxed{B}], \text{NP}[\langle \textit{acc} \rangle \oplus \boxed{B}] \right\rangle \end{bmatrix} \end{bmatrix}$$

Finite verbs bear an empty CASE specification. However, (16) is formulated so as to illustrate the general principle that lexical heads add their own CASE value to that of their dependents. As a result of this case addition, CASE values become longer with embedding, as shown in Figure 8.

Long-distance case stacking is thus a consequence of CASE specifications that pass the case properties of a superordinate context down into a subordinate one, adding only the case information that reflects the local grammatical function of a

[14] A euro is a kind of marsupial distinct from kangaroos, wallabies, pademelons, and potoroos.

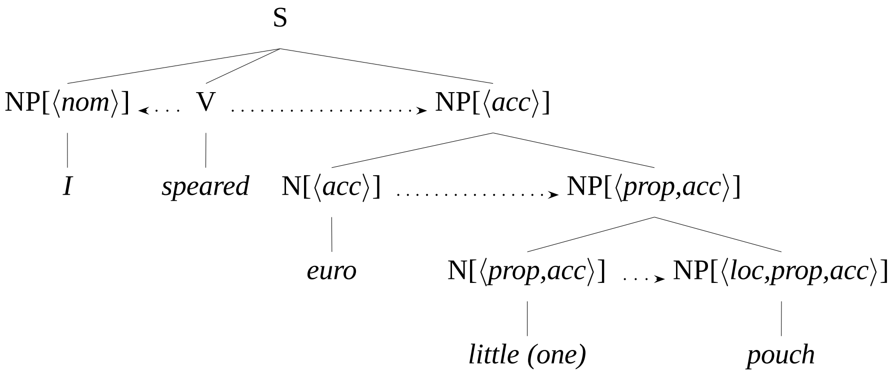

Figure 8: Case Government in Martuthunira

given head-dependent combination. The morphological case inflections are based on local CASE specfications, just as they are in languages that lack case stacking. But when multiple case affixes are present (e.g. on *pouch* in (16), it follows that the CASE specification of the noun is non-singleton. This in turn entails that the immediately embedding syntactic context (e.g. little (one)) must introduce an appropriate case specification. Otherwise, the maximal NP in (16) would fail to meet the VALENCE requirements of the verb *speared*. The local constraints of lexical items and general grammatical principles thus interact to guarantee a long-distance case dependency that is bounded only by the complexity of the embedding environment.

5.3 The Role of Subjects

Earlier I mentioned the presumed locality of semantic role assignment. However, as a number of researchers have recently argued, there are phenomena in a variety of languages whose analysis requires, for example, that a verb selecting a sentential complement must be able to place constraints on the subject realized within that complement. One of these is English ‘copy raising’ (Rogers 1974, Potsdam and Runner 2001, Asudeh 2002), illustrated in (17):

(17) There looks like there’s going to be a storm/*it’s going to rain/*Kim’s going to win.

Also relevant are controlled pronominal subjects in Serbo-Croatian (Zec 1987), Halkomelem Salish (Gerdts and Hukari 2001) and other languages, where a control verb requires that the subject pronoun realized within its clausal complement be coindexed with one of the other arguments of the control verb (its subject (*promise*-type) or its object (*persuade*-type)), as shown in (18):

(18) a. NP_i promise [CMP he_i VP]

b. NP persuade NP_i [CMP he_i VP]

The problems of raising across Polish prepositions (Przepiórkowski 1999, Dickinson 2004), and complementizer agreement in Eastern Dutch dialects (Höhle 1997) are similar: a particular argument realized within a given expression must be 'visible' to an external entity that combines with that expression. Moreover, as is well known, there are many English idioms that require referential and agreement identity between a subject and a possessor within an object NP, or which assign a semantic role to the object's possessor. These are illustrated in (19):

(19) a. He_i lost [his_i/*her_j marbles].

b. They_i kept/lost [their_i/*our_j cool].

A principled solution to all of these problems, suggested independently by a number of these researchers, is the introduction of a feature (distinct from VAL) that passes up to a given phrase information about one of the daughters used to construct that phrase. Kiss (1995) proposed such a feature for the subject of nonfinite verbal clauses in German, calling it SUBJECT, and this feature has been used by Meurers (1999, 2001) and others.[15]

However, it would be desirable to use the same feature to make genitive pronouns that are realized within a given NP available for selection by elements outside that NP. In addition, the Polish preposition raising phenomenon discussed by Przepiórkowski (1999) and Dickinson (2004) motivates an analysis where the object of certain prepositions is available for selection by elements external to the PP that the preposition projects. In sum, there is some variation as to which element within a phrase is externally accessible. Since 'subject' is too narrow a notion empirically, SUBJECT is an inappropriate name for the feature in question. I have previously proposed instead to name the relevant feature EXTERNAL ARGUMENT (XARG).[16] Because XARG is a category feature, it percolates information about a designated phrasal constituent, as illustrated in Figure 9.

Assuming, following Pollard and Sag (1994), that there are three subtypes of the type *index* (*ref* (*referential-index*), *it* (*expletive-it-index*), and *there* (*expletive-there-index*)), the copy raising examples mentioned in (17) above can be treated simply by associating the relevant lexical entry for *looks* (*like*) with the VAL list in (20):

(20) $$\left[\text{VAL}\ \left\langle \text{NP}_i\ ,\ \overset{\text{S}}{\left[\text{XARG}\ \ \text{NP}[\textit{pro}]_i\right]} \right\rangle\right]$$

[15]Kiss's proposal is an extension of earlier proposals that have been made within GPSG/HPSG, e.g. the AGR feature of Gazdar et al. (1985) and Pollard's (1994) ERG feature.

[16]Sag and Pollard (1991) proposed a semantic feature EXTERNAL-ARGUMENT (XARG), which makes only the index of the subject argument available at the clausal level. This analysis has been incorporated into Minimal Recursion Semantics (and the English Resource Grammar) by Flickinger and Bender (2003).

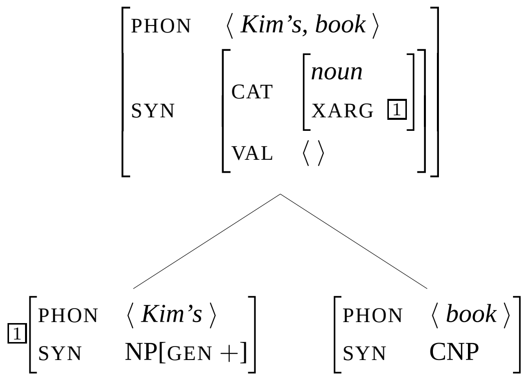

Figure 9: XARG Analysis of Genitive-Embedding NP

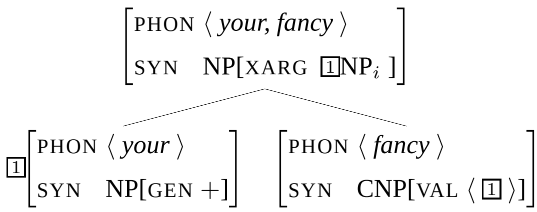

Figure 10: XARG Analysis of *your fancy*

And if an object NP includes information about its (prenominal) possessor in its XARG value, then an idiomatic verb like *lose* can be specified as in (21):

(21)
$$\begin{bmatrix} \text{PHON} & \langle \textit{lose} \rangle \\ \text{SYN} & \begin{bmatrix} \text{CAT} & \textit{verb} \\ \text{VAL} & \left\langle \text{NP}_i , \begin{bmatrix} \text{XARG} & \text{NP}[\textit{pro}]_i \end{bmatrix}^{\text{NP}} \right\rangle \end{bmatrix} \end{bmatrix}$$

Similarly, an idiomatic verb like *tickle* can assign a semantic role to its object's possessor. In both cases, all that is required is that the NP's XARG value be identified with the NP's possessor, as sketched in Figure 10.

All of the phenomena just enumerated, in addition to the tag-question construction discussed earlier, provide motivation for XARG specifications as part of the CAT value of sentential and NP signs. Note that the XARG value (either a sign or the distinguished atom *none*) differs from the VAL value (a list of signs) in that only the latter undergoes 'cancellation' in the construction of phrasal signs.

5.4 Idiomatic Expressions

Idioms also potentially pose a locality issue. It is well known that certain idiomatic interpretations arise only when the particular pieces of the idiom are in construction with one another. The proper characterization of the notion of 'in construction with', however, remains controversial. Since Nunberg et al. 1994, it has generally been agreed that syntactic flexibility is related to semantic decomposability. Thus a particularly decomposable idiom like *pull strings*, occurs flexibly in a variety of configurations, as illustrated in (22):

(22) a. Sandy *pulled strings* to get Kim the job.

b. *Strings* were *pulled* to get Kim the job.

c. The *strings* that seem likely to have been *pulled* to get Kim the job were an offense to man and nature.

d. We objected to the *strings* that Sandy had to *pull* to get Kim the job.

e. Sandy *pulled* the *strings* that got Kim the job.

f. The *strings* that Sandy *pulled*, nobody else could have *pulled*.

Idioms vary considerably in terms of their syntactic flexibility and it is perhaps unclear where to draw the line between an idiomatic sentence that should be allowed by the grammar and an extension of the grammar (or 'language play'). However, it is reasonably clear that copredication is a necessary condition for idiomaticity. That is, in order for *pull strings* to receive its idiomatic interpretation, the second semantic argument of *pull* must also have *strings* predicated of it, however the grammar allows for that to happen.[17]

My proposal, presented more fully in Sag to appear b, uses the persistent defaults of Lascarides and Copestake (1999) to write lexical entries like those in (23) (LID is the feature LEXICAL-IDENTIFIER explained more fully in Sag 2007):

[17] Sailer (2000) proposes a treatment of flexible idioms in terms of lexical constraints (called 'conditions on lexical licensing' (COLL)) that can access arbitrarily distant elements within a given phrasal structure. Sailer argues that the domain of COLL constraints should be the entire sentence (a sentential sign) in which the idiomatic word occurs. This is necessary, he claims, in order to describe what he takes to be purely syntactic restrictions on particular idiom 'chunks'. Space limitations prevent me from providing a fuller discussion of Sailer's proposals, or the subsequent attempts to improve upon them by Soehn (2004, 2006). My approach differs from these in treating each idiom in terms of a single local constraint that interacts with other aspects of the grammar.

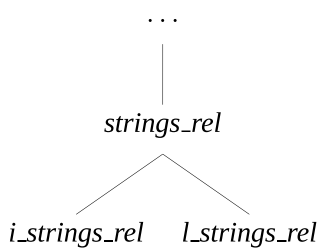

Figure 11: Literal and Idiomatic Strings Relations

(23)
$$\begin{bmatrix} \text{PHON} & \langle \textit{strings} \rangle \\ \text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{noun} \\ \text{LID} \ \boxed{0}[\mathit{strings\_rel} \ /_p \ \mathit{l\_strings\_rel}] \end{bmatrix} \\ \text{VAL} & \langle \ \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} \ i \\ \text{RELS} \ \langle \ h_0{:}\boxed{0}(i) \ \rangle \end{bmatrix} \end{bmatrix}$$

Assuming that literal and idiomatic relations are hierarchically organized as shown in Figure 11, then the noun *strings* will default to its literal interpretation except when its LID value is resolved to the idiomatic relation $i\_strings\_rel$ by the lexical entry for the idiomatic verb *pull*, whose lexical entry is sketched in (24):

(24)
$$\begin{bmatrix} \text{PHON} & \langle \textit{pull} \rangle \\ \text{SYN} & \begin{bmatrix} \text{VAL} \left\langle \begin{bmatrix} \text{SYN NP}_i \end{bmatrix}, \begin{bmatrix} \text{LID} \ \mathit{i\_strings\_rel} \\ \text{SYN NP}_j \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{RELS} \ \langle \ h_0{:}\mathit{i\_pull\_rel}(i,j) \ \rangle \end{bmatrix} \end{bmatrix}$$

Making the reasonable assumption that the LID of a gap and its filler are identified in a filler-gap construction, it follows that the idiomatic resolution can take place in examples (22d-f), as well as (22a-c), thus solving what Nunberg et al. (1994) refer to as 'McCawley's Paradox'. This account of syntactically flexible, semantically decomposable idioms is fully compatible with the localist perspective of SBCG.

6 Conclusion

In this paper, I have surveyed and offered localist solutions to a number of problems involving nonlocal grammatical dependencies. I have proposed a version of HPSG theory – Sign-Based Construction Grammar – that is based on a distinction between signs and constructs. Drawing the distinctions in the way I have outlined provides numerous advantages, including the following:

- Solutions are offered to a number of problems not solved by previous versions of HPSG (e.g. Pollard and Sag 1994 or Ginzburg and Sag 2000).
- Lexical selection is localized in a principled fashion.
- Previous results in HPSG are preserved.
- Principles, e.g. the Subcategorization Principle, are simplified, e.g. by eliminating the need for relational constraints such as `signs-to-synsems`.
- Phrasal schemata (constructions) are localized, i.e. they are fundamentally like CFG grammar rules.

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The Big Mess Construction

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Abstract

There is a construction in English, exemplified by *how long a bridge*, which is so irregular that it has been named the Big Mess Construction, see Berman (1974). This paper first sketches its main characteristics (section 1) and a treatment of the internal structure of the noun phrase which serves as a background for the analysis (section 2). It then presents three ways in which the Big Mess Construction can be analysed; two of them are lexicalist and are shown to be implausible; the third is constructivist and is argued to be superior (section 3). In a next step, the discussion is extended to two other types of constructions. The first concerns the English adnominal reflexives, as in *the children themselves*, and is shown to require a constructivist analysis which is similar but not identical to the one for the Big Mess Construction (section 4). The second concerns the combination of *such* and *what* with the indefinite article, as in *such a pleasure*. In spite of its obvious resemblance with the Big Mess Construction this combination does not require a constructivist analysis; instead, it fits the lexicalist mould of most of the rest of HPSG (section 5).

1 The Big Mess Construction

In English noun phrases the determiner canonically precedes the prenominal adjectives, both the lexical and the phrasal ones.

(1) a. a big house
    b. a very big house

(2) a. * big a house
    b. * very big a house

A notable exception are the adjectival phrases which are introduced by *as, so, too, how, this* and *that*. When they occur in a nominal which contains the indefinite article, they precede the determiner (Huddleston and Pullum, 2002, 435).

(3) a. It's so good a bargain I can't resist buying it.
    b. How serious a problem is it?

(4) a. * It's a so good bargain I can't resist buying it.
    b. * A how serious problem is it?

This construction, for which Berman (1974) coined the term Big Mess Construction, only ocurs in nominals with an indefinite article. It does not occur in nominals with another kind of determiner, as in (5a), nor in nominals without determiner, as in (5b).

†For their comments and suggestions for improvement I thank the anonymous reviewers of the HPSG-2007 programme committee, the attendants of the workshop on constructions and grammatical theory (Stanford, July 21 2007) and my colleagues at the Centre for Computational Linguistics in Leuven.

(5) a. * How serious some problem is it?
b. * They are so good bargains I can't resist buying them.

A further complication is provided by the APs which are introduced by *more* or *less*. They can either occur in the canonical position or in the exceptional one (Huddleston and Pullum, 2002, 435).

(6) a. This is a more serious problem than the other.
b. This is more serious a problem than the other.

Also here, the exceptional position is only possible in combination with the indefinite article.

What makes the Big Mess Construction interesting is not only its idiosyncracy and the descriptive challenges which it raises, but also the light which its treatment sheds on the issue of the trade-off between lexicalism and constructivism in formal grammar. To pave the way for the treatment I first present my analysis of the internal structure of the noun phrase (section 2). It deals with the canonical order, as exemplified by (1) and (6a). The exceptional order, as exemplified by (3) and (6b), is modeled in section 3.

2 The internal structure of the noun phrase

My treatment of the internal structure of the noun phrase is based on two assumptions. First, that the noun is the head of the noun phrase and, second, that the prenominal dependents are functors, in the sense of Allegranza (1998) and Van Eynde (1998). Since the first assumption is controversial, given the fact that many authors treat the determiner as the head of the noun phrase (cf. Abney (1987), Hudson (1990) and Netter (1994)), and since the second assumption may be unfamiliar, I start with a defense of the former and a succinct presentation of the latter.

2.1 The head of the noun phrase

To substantiate the claim that the noun is the head of the noun phrase adopt the commonly, though often tacitly, made assumption that a noun phrase shares its person, number, gender and case values with its head daughter. Of special relevance are, hence, the noun phrases in which the determiner has other values for these features than the noun, since they allow us to identify the head by simple observation. Here are some of such examples:

(7) My neighbors are/*am rich.

(8) a. What birds have/*has two wings and four legs?
b. What comes/*come next?

(9) a. A good many pages are/*is lost forever.

b. A few pages are/*is still missing.

Given the form of the finite verb in (7) the subject NP must be plural, which implies that its head daughter can be the third person plural *neighbours*, but not the first person singular *my*. A similar remark applies to the interrogative determiner in (8a). Given the form of the finite verb, the subject NP in (8a) must be plural, which meshes well with the assumption that the plural *birds* is the head, but not with the alternative assumption that the interrogative *what* is the head, since *what* is by itself singular, as shown by (8b). Further evidence is provided by the quantifying determiners in (9). Also here, the form of the finite verb demonstrates that the subject NPs are plural, and while this is perfectly compatible with the assumption that the plural *pages* is the head, it is at odds with the alternative assumption that the head is the quantifying *a good many* and *a few*, since these are both singular, as demonstrated by their compatibility with the indefinite article. To provide an example which turns on the case distinction I switch to Dutch.

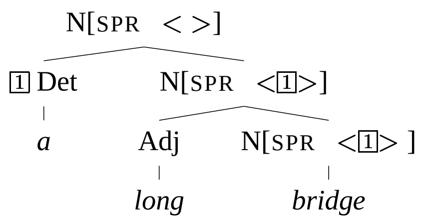
(10) Wiens paard heeft hij gestolen?
whose horse has he stolen?
'Whose horse did he steal?'

The fronted NP *wiens paard* 'whose horse' is the object of *gestolen* 'stolen' and, hence, accusative. This is compatible with the assumption that the non-genitive *paard* 'horse' is the head, but not with the alternative assumption that the genitive *wiens* 'whose' is the head. For more arguments in favor of the NP-hypothesis and against the DP-hypothesis, see Van Eynde (2006).

2.2 The prenominal dependents

Turning now to the prenominal dependents the central assumption of the functor treatment is that specifiers and modifiers had better be treated along the same lines. The distinction between specifying determiners and modifiers goes back to Chomsky (1970) and is motivated a.o. by the fact that a head can take at most one specifier, whereas it can take any number of modifiers. Within the lexicalist HPSG framework this is reflected by the assumption that a noun lexically selects its specifier, but not its modifiers, see Pollard and Sag (1994) and Ginzburg and Sag (2000). The feature which models the selection of the specifier is a valence feature, called SPR, and its role in the analysis of the noun phrase is illustrated in (11).

(11)



The noun selects a determiner as its specifier, and as soon as the determiner is added, the SPR list of the nominal is made empty. The modifying adjective, by contrast, is not selected by the noun and its addition has no effect on the noun's SPR value.

A problem for this dichotomy between modifiers and specifiers is that it complicates the modeling of those properties which the determiners and the other prenominal dependents have in common. Notice, for instance, that in languages which mark number and gender by inflectional affixes, such as Italian, one finds the same morphological variation and the same constraints on agreement for the determiners and the adjectives.

(12) questa bella bambina
this-SG.FEM beautiful-SG.FEM child-SG.FEM
'this beautiful child'

The singular feminine determiner *questa* 'this' requires a singular feminine nominal in exactly the same way as the singular feminine adjective *bella* 'beautiful'. For these and other reasons Allegranza (1998) and Van Eynde (2003) have proposed a more uniform treatment of the adnominals, in which the specifiers and the modifiers are both treated as functors. Phrased in HPSG terminology, functors are nonhead daughters which select their head sister. To spell this out in formal terms I start from the following phrase type hierarchy, adapted from Ginzburg and Sag (2000).[1]

(13)

- *phrase*
  - *headed-phr*
    - *head-argument-phr*
      - *head-comp-phr*
      - ...
    - *head-adjunct-phr*
      - *head-functor-phr*
      - ...
  - *non-hd-phr*

All headed phrases have a head daughter, and are constrained by the HEAD FEATURE PRINCIPLE. The head-adjunct phrases, of which the head-functor phrases are a subtype, also have an adjunct daughter.

(14) $\begin{bmatrix} \textit{headed-phr} & \\ \text{HEAD-DTR} & \textit{sign} \end{bmatrix}$ $\begin{bmatrix} \textit{head-adjunct-phr} & \\ \text{ADJ-DTR} & \textit{sign} \end{bmatrix}$

The main difference between head-argument phrases and head-adjunct phrases is that the head daughter selects its non-head sister(s) in the former, but not in the latter. The verb *bites*, for instance, selects an NP object and a third person singular subject, but it does not select a manner adverb or a locational adjunct. Similarly, the

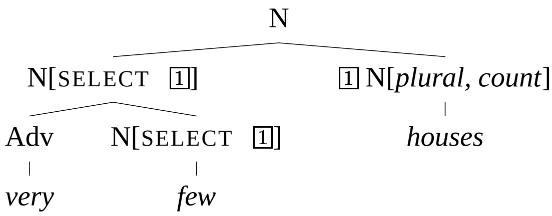
[1] The notion *adjunct* is understood in a broad sense, subsuming modifiers as well as specifiers and appositions. Some examples of the latter are given in section 3, see (30) and (31).

noun *houses* does not select an adjective; nor does it select a determiner.[2] Instead, it is the functors which select their head sister. The determiner *every*, for instance, selects a singular count noun, while *few* selects a plural count noun. This is modeled by the feature SELECT. It takes an object of type *synsem* as its value,[3] which is shared with the SYNSEM value of the head sister, as stipulated in the SELECTOR PRINCIPLE.[4]

(15) $$\begin{bmatrix} \textit{head-functor-phr} \\ \text{HEAD-DTR} \mid \text{SYNSEM} \quad \boxed{1}\ \textit{synsem} \\ \text{ADJ-DTR} \mid \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{HEAD} \mid \text{SELECT} \quad \boxed{1} \end{bmatrix}$$

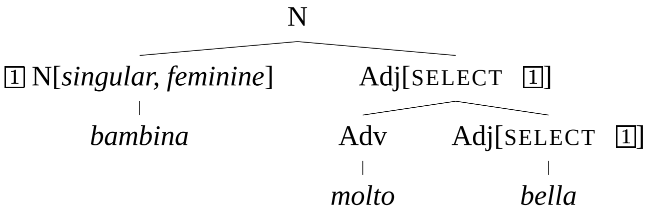
The reason why the SELECT feature is included in the HEAD value of the adjunct daughter is that the selectional properties of a phrasal functor are shared with the one of its head daughter. *Very few, a few* and *that few*, for instance, all require a plural count nominal, because *few* requires a plural count nominal.

(16)



The Selector Principle can also be used to model the number and gender agreement in Italian noun phrases. The determiner *questa* 'this' and the adjective *bella* 'beautiful', for instance, select a singular feminine noun, as in (12). Moreover, *molto bella* 'very beautiful' requires a singular feminine nominal, just like *bella*.

(17)



In sum, the functors are adjuncts which lexically select their head sister. Since they subsume both the determiners and the other prenominal dependents (as well as a

[2]This is a difference with the specifier treatment, in which the determiner is selected by the noun. Arguments against the lexical selection of specifiers are provided in Van Eynde (2006).

[3]Most signs which are used as functors can also be used in other ways. Adjectives, for instance, are functors in adnominal position, but in predicate position they are complements of copular verbs. In that case their SELECT value is *none*.

[4]For those who are familiar with Pollard and Sag (1994), this principle subsumes both the Spec Principle and the constraint that the MOD value of an adjunct is token-identical to the SYNSEM value of its head sister. The SELECT feature, hence, replaces and subsumes both SPEC and MOD. A similar neutralization is proposed in Soehn and Sailer (2003).

large variety of other types of adjuncts), this treatment straightforwardly deals with the properties which the prenominals have in common.

At the same time, a full treatment also requires the means to differentiate the determiners from the other prenominal dependents. We should, for instance, distinguish between *long bridges*, which can be preceded by another prenominal, and *the bridges*, which cannot be preceded by another determiner or adjective. To model this the functor treatment employs the MARKING feature. It is part of the CAT(EGORY) value of all signs and its value is shared between the mother and the adjunct daughter, as spelled out in the MARKING PRINCIPLE.

(18) $$\begin{bmatrix} \textit{head-adjunct-phr} & \\ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{MARKING} & \boxed{1}\ \textit{marking} \\ \text{ADJ-DTR} \mid \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{MARKING} & \boxed{1} \end{bmatrix}$$

The MARKING feature was already used in Pollard and Sag (1994), where it plays a role in the treatment of the English complementizers (*that*, *if*, *for* ...), but because of its limited range of application it got ignored in much of the subsequent HPSG literature. In the functor treatment of Allegranza (1998) and Van Eynde (2003), however, it plays a much more prominent role. Assuming that categories can be marked or unmarked, as in Pollard and Sag (1994), it is used to distinguish the nominals which are compatible with a specifier (the unmarked ones) from those which are not (the marked ones). The common nouns, for instance, are unmarked, and the addition of an adjectival modifier does not change this, since these modifiers are unmarked themselves, but the specifying determiners are marked and, therefore, change the MARKING value of the nominal.[5]

(19)
N[MARKING $\boxed{1}$ *marked*]
- N[MARKING $\boxed{1}$] — *those*
- N[MARKING $\boxed{2}$ *unmarked*]
  - Adj[MARKING $\boxed{2}$] — *long*
  - N[*unmarked*] — *bridges*

In combination with the assumption that the prenominals select an unmarked nominal as their head sister, this accounts for the ungrammaticality of *the those bridges* and *long those bridges*. The distinction between marked and unmarked nominals corresponds to the one between nominals with an empty and a non-empty SPR list, but this does not imply that the MARKING feature is just another name for the SPR feature. Some major differences are the following. First, the functor treatment does not assume that the nouns lexically select their determiner. Second, nominals without determiner are not treated as incomplete, but simply as unmarked. Third, the use of the MARKING feature makes it possible to make finer-grained

[5]Nouns which do not take a determiner, such as the pronouns and most of the proper nouns, are inherently marked.

distinctions, to be captured by subtypes of resp. *marked* and *unmarked*. The latter, for instance, are differentiated into bare nominals and incomplete nominals in Van Eynde (2006) to distinguish those that can be used without determiner from those that cannot. Similarly, it is possible to distinguish between different types of marked nominals by introducing more specific subtypes of *marked*. This possibility will be exploited in the treatment of the Big Mess Construction in section 3.

Since a prenominal functor can be a phrase, which in turn contains a functor, the propagation of the MARKING value is iterative, as illustrated in the representations of *very large house* and *a few pages*.[6]

(20)

N[MARKING $\boxed{1}$ *unmarked*]
  Adj[MARKING $\boxed{1}$]
    Adv[MARKING $\boxed{1}$]
      very
    Adj[*unmarked*]
      large
  N[*unmarked*]
    house

(21)

N[MARKING $\boxed{1}$ *marked*]
  N[MARKING $\boxed{1}$]
    Art[MARKING $\boxed{1}$]
      a
    N[*unmarked*]
      few
  N[*unmarked*]
    pages

The MARKING value of *very* is shared with the one of *very large*, which is in turn shared with the one of *very large house*. The latter is, hence, unmarked, which implies that it can be combined with another adjective or a determiner, as in *that very large house*. Conversely, the determiner *a* with its value of type *marked* makes the prenominal *a few* marked, and hence also the nominal *a few pages*, so that the latter is no longer compatible with another determiner.[7]

Since the MARKING PRINCIPLE in (18) only deals with the phrases of type *head-adjunct*, we still need to spell out how the MARKING values are propagated in other types of phrases. For the head-argument phrases I assume that the MARKING value is shared with the head daughter.[8]

(22)
$$\begin{bmatrix} \textit{head-argument-phr} \\ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{MARKING} \quad \boxed{1}\ \textit{marking} \\ \text{HEAD-DTR} \mid \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{MARKING} \quad \boxed{1} \end{bmatrix}$$

[6]This is where my version of the functor treatment differs from the one of Allegranza (1998), in which iterative propagation is blocked.

[7]That *few* is unmarked is not only clear from its compatibility with *a*, but also from the fact that a nominal which contains it can be preceded by a determiner, as in *those few pages*.

[8]Since headed phrases are either head-adjunct or head-argument phrases, (18) and (22) jointly subsume all types of headed phrases. The propagation in nonheaded phrases is left for future work.

A relevant example is the prenominal in the German *uns unbekannte Frauen* '(to) us unknown women',

(23)

N[MARKING $\boxed{1}$ *unmarked*]

Adj[MARKING $\boxed{1}$] N[*unmarked*]

N[*marked*] Adj[MARKING $\boxed{1}$] *Frauen*

uns *unbekannte*

The MARKING value of the AP is identified with the one of the adjective *unbekannte* rather than with the one of its pronominal argument. Since the adjective is unmarked, the nominal can be preceded by a determiner, as in *die uns unbekannte Frauen* 'the (to) us unknown women'.

2.3 Summary

Summing up, I assume that the adnominal dependents are functors which lexically select their head sister and which leave a mark on the phrases to which they are adjoined, as proposed in Allegranza (1998) and Van Eynde (2003). There is just one difference between these sources and the present treatment. While the former apply the Selector Principle and the Marking Principle to the same types of phrases, i.e. the head-functor phrases, the present treatment applies the Marking Principle to all of the head-adjunct phrases and the Selector Principle only to the head-functor phrases. Since the latter is a subtype of the former, it is still true that the head-functor phrases are constrained by both principles, but since the functors are not the only types of adjuncts, it follows that there may be adjuncts which are constrained by the Marking Principle, but not by the Selector Principle. This will turn out to be crucial for the treatment of the Big Mess Construction.

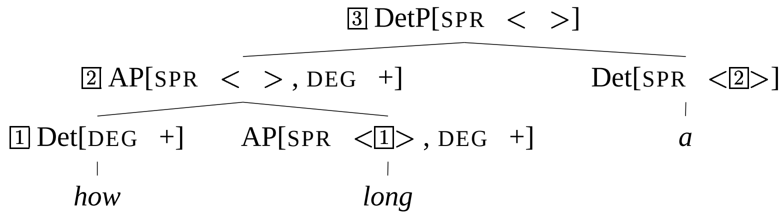
3 Returning to the Big Mess

Having dealt with the canonical combinations of prenominal APs and their nominal head sisters I now return to the Big Mess Construction. The discussion comes in three parts. First, I present the specifier treatment of this construction in Ginzburg and Sag (2000) and show why it is implausible. Second, I show why the functor treatment is equally implausible. Third, I present an alternative.

3.1 The specifier treatment

The treatment in Ginzburg and Sag (2000) is based on the assumption that all words can select a specifier. In the same way as nouns can select a determiner as their specifier, the adjectives can select a degree marker as their specifier and — pushing the envelope somewhat beyond the usual— the indefinite article can select a degree marked AP as its specifier. A phrase like *how long a bridge* is, hence, assigned a left branching structure, in which the degree marker *how* is the specifier of the adjective *long*, yielding an AP, which is in turn the specifier of the indefinite article.

(24)



The resulting DETP is then the specifier of the common noun *bridge*. The DEGREE feature plays a crucial role in this analysis, since only the APs with a positive DEG(REE) value can be specifiers of the indefinite article. Because it is a HEAD feature, the AP shares its DEG value with the adjective, which in turn shares it with its specifier (Ginzburg and Sag, 2000, 198). An asset of this treatment is that it neatly accounts for the fact that the Big Mess Construction only occurs in combination with the indefinite article. The combination with other determiners is excluded since the other determiners do not take a degree marked AP as their specifier.

At the same time, the specifier treatment has a number of problems. First, it begs the question of what the feature [DEG(REE) +] means. If it stands for a degree denoting expression, as the name suggests, then it does not draw the distinction we need, since not all of the degree markers allow the Big Mess Construction. *Very*, *enough* and *somewhat*, for instance, are degree markers, just like *how*, *too* and *so*, but do not occur in the Big Mess Construction.

(25) a. * very big a house (= (2b))
b. * big enough a house
c. * somewhat underdeveloped a country

Second, we need a stipulation to block the ill-formed *a how big bridge*. For this purpose it is suggested that "a constraint on the prenominal adjective construction requiring the modifier daughter to be [DEG(REE) –] may well suffice." (Ginzburg and Sag, 2000, 200) Technically, though, the notation of Ginzburg and Sag (2000) does not provide the means to express this constraint, which explains why it is only given in prose, and conceptually, the constraint begs the question of what it means to be [DEG(REE) –], given that *a more modest statement*, *a somewhat underdeveloped country* and *a big enough room* are all well-formed. Third, the left branching structure is at odds with one of the classical tests for constituency, i.e. the one of permutability.

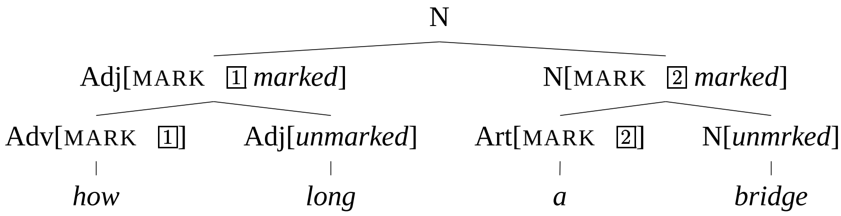
(26) a. Never before had we seen that big a bridge.
b. Never before had we seen a bridge that big.
c. * never before had we seen bridge that big a

It is possible to permute the AP and the NP, as in (26b), but not the AP with the article and the rest of the nominal, as in (26c). Fourth, the left branching structure complicates the syntax-semantics interface, for the AP does not provide information about the length of the indefiniteness, as (24) suggests, but rather about the length of the bridge.

3.2 The functor treatment

As an alternative, I propose an analysis in which the article is a sister of the nominal, rather than of the AP. More specifically, the article is a functor of the noun, yielding a marked NP and the degree marking *how* is a functor of the adjective, yielding a marked AP. The two resulting phrases are sisters, as in:[9]

(27)



This structure accounts for the permutability facts in (26) and provides a useful starting point for the semantic interpretation, since the AP is a sister of the nominal that it modifies. It also avoids the problem with the interpretation of the DEGREE feature, since the crucial distinction is not defined in terms of a semantically motivated dichotomy, but rather in terms of a purely syntactic distinction between marked and unmarked selectors of gradable adjectives. It is a matter of lexical stipulation that *so, too* and *how* are marked, whereas *very, enough* and *somewhat* are unmarked. Another advantage of this treatment is that it provides a straightforward account of the ungrammaticality of *a how big bridge*, for since the indefinite article selects an unmarked nominal, it cannot precede a marked AP.

At the same time, the analysis in (27) leaves us with the problem of figuring out how the combination of the adjectival phrase and the noun phrase can be modeled. An obvious choice, it would seem, is to assign functor status to the AP, but this cannot be right, for in that case the head daughter of the AP is predicted to lexically select a marked NP, so that one inadvertently licenses *(very) long a bridge*.

3.3 The independent adjunct treatment

To solve this problem I will assume that the AP is not a functor, but an independent adjunct. More specifically, its combination with the lower NP is modeled in terms of a type of phrase which I have called the *head-independent-phr(ase)* in Van Eynde (2005). This is a subtype of the *head-adjunct-phr(ase)*, but not of

[9]The MARKING value of the top node is provisionally left out. How its value is determined is spelled out toward the end of the section, see (34).

head-functor-phr(ase), which implies that it is subsumed by the Marking Principle and the Head Feature Principle, but not by the Selector Principle.

(28)

headed-phr

head-arg-phr *head-adjunct-phr*

head-functor-phr *head-independent-phr* ...

In other words, the nonhead daughters in the phrases of type *head-independent* share their MARKING value with the mother, but they do not lexically select their head sister. Their SELECT value is, hence, *none* (see footnote 3). Since the head daughter does not select its nonhead sister either, this means that there is no selection. Instead, what connects the two daughters is the fact that they share their index.

(29)

$$\begin{bmatrix} \textit{head-independent-phr} \\ \text{HEAD-DTR}\,|\,\text{SYNSEM}\,|\,\text{LOC}\,|\,\text{CONTENT}\,|\,\text{INDEX}\quad \boxed{1} \\ \text{ADJ-DTR}\,|\,\text{SYNSEM}\,|\,\text{LOC}\ \begin{bmatrix} \text{CAT}\,|\,\text{HEAD}\,|\,\text{SELECT}\quad \textit{none} \\ \text{CONTENT}\,|\,\text{INDEX}\quad \boxed{1} \end{bmatrix} \end{bmatrix}$$

This phrase type was introduced in Van Eynde (2005) to model cases of asymmetric coordination and apposition in Dutch, as exemplifi ed by the subject NP in (30) and the prenominal in (31).

(30) Mijn beste vriend en kamergenoot is/*zijn vertrokken.
my best friend and roommate is/*are left
'My best friend and roommate has left.'

(31) Jan zijn ouders zijn/*is verhuisd.
John his parents are/*is moved
'John's parents have moved.'

The coordinated nominal in (30) is not a case of canonical conjunction, as in *John and Mary*, since it does not denote a pair of persons, but rather one person who is both my best friend and my roommate. This singularity, which is confi rmed by the form of the fi nite verb, is modeled straightforwardly if one treats the nominal as a phrase of type *head-independent*, for since the daughters share their index, they are both third person singular, and since the head daughter (the fi rst conjunct) shares its index with the mother, it follows that the subject NP as a whole is third person singular as well. Similar remarks apply to the prenominal in *Jan zijn ouders*. The lower NP and the possessive pronoun must agree in person, number and gender: *Jan mijn/hun/haar ouders* 'John my/their/her parents', for instance, are all ill-formed. This is modeled straightforwardly if one treats the pronoun as the head and the lower NP as an independent adjunct. Coindexing is, hence, a hallmark of the *head-independent-phrase,* both in asymmetric coordination and apposition. The lack of lexical selection which is the other defining characteristic is also exemplified in (30): it would make little sense to assume that *vriend* selects *kamergenoot* or vice versa. The same holds for *Jan* and *zijn* in (31).

Returning now to the English Big Mess Construction we find the same two properties. The index sharing accounts for the fact that the AP denotes a property of the referent of the lower NP, and the absence of lexical selection solves the problem with the functor treatment.[10] This implies that the Big Mess Construction can be modeled in terms of a subtype of *head-independent-phrase*.

What remains to be modeled at this point are the properties which set the Big Mess Construction apart from the other constructions of type *head-independent*, such as the condition that the lower NP must contain the indefinite article and that the AP must contain a degree denoting word of the appropriate kind. For this purpose, I assume that the *head-independent* phrase type has a number of more specific subtypes, one of which is the *big-mess-phr(ase)* type. Its properties are spelled out in (32).

(32)
$$\begin{bmatrix} \textit{big-mess-phr} & \\ \text{HEAD-DTR} \mid \text{SYNSEM} \mid \text{LOC} & \begin{bmatrix} \text{CAT} \mid \text{MARKING} & \textit{a} \\ \text{CONTENT} & \textit{parameter} \end{bmatrix} \\ \text{ADJ-DTR} \mid \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{MARKING} & \begin{bmatrix} \textit{marked} & \\ \text{DEGREE} & + \end{bmatrix} \end{bmatrix}$$

The head daughter is required to have a MARKING value of type *a*, which is a subtype of *marked*. This correctly excludes the combination with unmarked nominals, as in *how warm (nice) water*, and otherwise marked nominals, as in *too big some house*, and *how big anyone*. The requirement that the head daughter denote an object of type *parameter* captures the fact that it must not be a quantified NP. This blocks the ill-formed *that big a few houses*.[11]

The adjunct daughter is required to have a MARKING value of type *marked*. This correctly excludes single adjectives, as in *big a house*, and adjectives with an unmarked functor, as in *very big a house*. The adjunct is also required to have a positive value for DEGREE. This feature is homonymous to the one of Ginzburg and Sag (2000), but its role and interpretation are different. First, it is not a HEAD

[10] Functors may also share their index with their head sister, but this is not a general property of the *head-functor-phrase* type. The possessive in (7), the interrogative determiner in (8) and the quantifying determiners in (9), for instance, do not share the index of the nominals which they introduce, since they have non-matching NUMBER values.

[11] In the type hierarchy of CONTENT values which is employed in Ginzburg and Sag (2000), the quantified NPs are of type *quant-rel* and the non-quantified ones of type *parameter*. That the indefinite article does not introduce a quantifier is one of the main tenets of both Discourse Representation Theory and File Change Semantics, see resp. Kamp (1981) and Heim (1982). Notice that the ill-formedness of *that big a few houses* raises yet another problem for the specifier treatment, since it requires extra stipulations to rule out the combination of the indefinite article with a degree marking AP when the indefinite article is part of a quantifying adnominal.

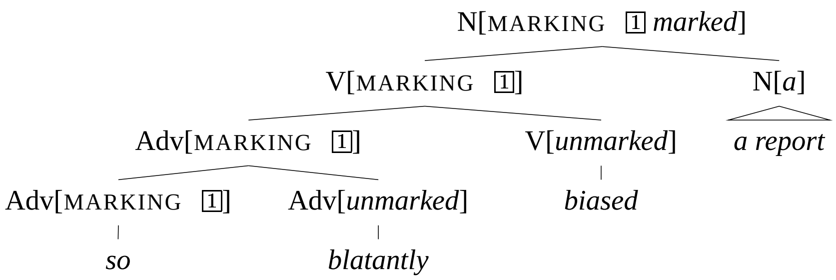
feature, but a MARKING feature, so that its value is shared with the AP. Second, its value is positive for all of the degree denoting words, and not only for those which license the Big Mess Construction; *very, somewhat* and *enough*, for instance, have a positive DEGREE value, just like *so, how* and *too*. What differentiates them is not their DEGREE value, but rather their MARKING value. The mutual independence of the DEGREE and MARKING distinctions also facilitates the treatment of the comparative *more* and *less*. By assigning them the underspecified value *marking* in the lexicon, one subsumes both the unmarked use in *a more serious problem* and the marked one in *more serious a problem*, while keeping the DEGREE value constant.

Since the *big-mess-phrase* inherits the properties of its supertypes, it follows that its MARKING value is identified with the one of its adjunct daughter. The resulting chain of propagation can be quite long, as in the following example quoted from (Huddleston and Pullum, 2002, 435).

(33) It was so blatantly biased a report that no one took any notice of it.

The MARKING value of *so* is propagated to the ADVP *so blatantly*, the participial *so blatantly biased* and the nominal *so blatantly biased a report*.

(34)



The propagation of the MARKING value accounts for the impossibility of iterative application. *Too long so big a bridge*, for instance, is not licensed, since the addition of *so big* to *a bridge* triggers a switch from the negative DEGREE value of the indefinite article to the positive value of the degree denoting *so*.

It is worth adding that some of the degree denoting adverbs license the addition of another dependent: *so*, for instance, licenses a *that*-clause, as in (33), and *too* a gapped VP[*to*], as in *too complex a problem to solve here and now*. How the licensing and the addition of the extra dependent can best be modeled is an interesting topic in its own right, but it will not be addressed here, since it is independent of the treatment of the Big Mess Construction. There are indeed marked degree words which do not license an additional dependent, such as *this*, *that* and *how*, and that there are unmarked degree words which do, such as *enough*, which licenses a gapped VP[*to*], and *more* and *less*, which license a *than*-phrase.

3.4 Summary

Summing up, I have presented three treatments of the English Big Mess Construction: the specifier treatment of Ginzburg and Sag (2000), a functor treatment in the line of Allegranza (1998) and Van Eynde (2006) and the independent adjunct treatment in the line of Van Eynde (2005). The former two can be called lexicalist, since they rely on lexical selection, either in terms of the valence feature SPR or in terms of the HEAD|SELECT feature. The latter, by contrast, is constructivist since the constraints on the combination are spelled out in terms of properties of the construction as a whole. Since it involves the postulation of a highly specific phrase type (*big-mess-phr(ase)*), there is an obvious risk of missing generalizations. This, however, is counterbalanced by its integration in the phrase type hierarchy, which provides the possibilty to factor out what the Big Mess Construction has in common with other less idiosyncratic constructions and to capture those common properties in terms of constraints which are associated with its supertypes, such *head-independent* and *head-adjunct*. It is also counterbalanced by the existence of other types of combinations which call for a constructivist treatment. Apposition and asymmetric coordination are two examples which have already been dealt with in previous work (for Dutch). I will now discuss another such example from English.

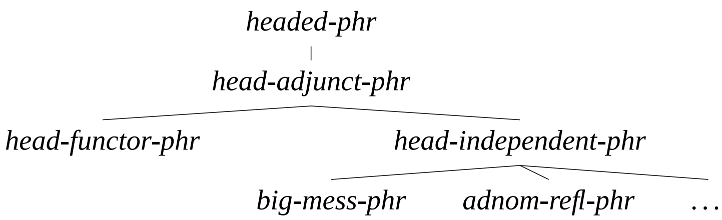
4 Adnominal reflexives

English allows the combination of a noun phrase with an emphatic reflexive, as in:

(35) a. I myself would never do such a thing.
b. The children themselves are not satisfied about their work.
c. We met the lady of the house herself.

In these combinations the head must be the lower NP, since it shares its CASE value with the mother: *I myself*, for instance, is nominative, just like the personal pronoun. The accusative reflexive pronoun is its non-head sister and shows the typical properties of an independent adjunct. It shows agreement in person, number and gender with the preceding NP, as required by the index sharing, and it does not lexically select the NP. To capture its other characteristics I add another subtype of *head-independent-phrase*, to be called *adnominal-reflexive-phrase*, with the properties that are spelled out in (37).

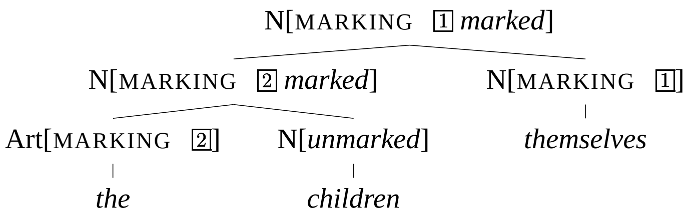
(36)



(37)
$$\begin{bmatrix} \textit{adnominal-reflexive-phr} \\ \text{HEAD-DTR}\,|\,\text{SYNSEM}\,|\,\text{LOC} \begin{bmatrix} \text{CAT}\,|\,\text{MARKING} & \textit{marked} \\ \text{CONTENT} & \textit{parameter} \end{bmatrix} \\ \text{ADJ-DTR}\,|\,\text{SYNSEM}\,|\,\text{LOC}\,|\,\text{CONTENT} \quad \textit{reflexive} \end{bmatrix}$$

The requirement that the head daughter be marked and non-quantificational blocks such ill-formed combinations as the unmarked *children themselves* and the quantified *any woman herself* and *some soldiers themselves*. The requirement that the adjunct daughter be reflexive correctly excludes other types of pronouns, as in *the children them* and *we each other*.[12] Since the reflexives are pronouns and, hence, marked, and since the adjunct shares its MARKING value with the mother, it follows that the combination as a whole is also marked.

(38)



In sum, the constraints which are characteristic of the *head-independent-phr(ase)* type (index sharing and absence of lexical selection) are not restricted to the Big Mess Construction, but are shared by the English adnominal reflexives and by a number of coordinate and appositive constructions in Dutch. This shows that the addition of a modicum of constructivism to the otherwise lexicalist framework of HPSG is not tantamount to a wallowing in anomaly and particularism. Instead, if one exploits the possibilities of a phrase type hierarchy à la Sag (1997) and Ginzburg and Sag (2000), this constructivism is perfectly compatible with the aim of maximum generality and simplicity.

5 *Such a* and *what a*

A combination which superficially resembles the Big Mess Construction is the one of *what* and *such* with the indefinite article, as in:

(39) a. What a mess it was!
b. It was such a mess.

(40) a. * A what mess it was!
b. * It was a such mess.

The non-canonical order and the degree denoting nature are similar to the prenominal APs in the Big Mess Construction, but unlike the latter, *what* and *such* are invariably lexical: if the nominal which they introduce contains an adjective, this adjective does not occur before the determiner.

(41) a. What a long speech it was!
b. It was such a long speech.

[12]In Pollard and Sag (1994) *reflexive* is one of the possible values of the CONTENT attribute.

(42) a. * what long a speech it was!
b. * it was such long a speech

Another difference is that they are compatible with bare nominals.

(43) a. What promise she had shown!
b. What fools they are!
c. She had shown such promise.
d. I had never met such people.

This demonstrates that these combinations are not subsumed by the *big-mess-phrase* type, as defined in (32). As a matter of fact, I assume that they are not subsumed by *head-independent-phrase* either, but rather by *head-functor-phrase*. In other words, I assume that the exclamative *what* and the demonstrative *such* lexically select a nominal which is either unmarked or introduced by the indefinite article. The resulting structure is right branching:

(44)
$$\left[\text{N[MARKING } \boxed{2}\ \textit{marked}] \ \ \text{Det[MARKING } \boxed{2}] \ \left(\textit{what} / \textit{such}\right) \ \ \text{N[MARKING } \boxed{1}\ \textit{a}] \ \left[\text{Art[MARKING } \boxed{1}] \ (\textit{a}) \ \ \text{N[}\textit{unmarked}] \ (\textit{mess})\right]\right]$$

The relevant constraint on *what* is spelled out in (45).

(45)
$$\begin{bmatrix} \textit{word} & \\ \text{PHON} & \langle \textit{what} \rangle \\ \text{SS} \mid \text{LOC} \mid \text{CAT} & \begin{bmatrix} \text{HEAD} \mid \text{SEL} \mid \text{LOC} \mid \text{CAT} \mid \text{MARKING} & \textit{unmarked} \vee \textit{a} \\ \text{MARKING} & \begin{bmatrix} \textit{marked} & \\ \text{DEGREE} & + \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

This subsumes the use of *what* in (39a), (41a) and (43a-b). Since the indefinite article has a negative DEGREE value, iterative propagation, as in *what what a mess* is blocked.

In the case of *such*, we need two lexical entries: one which selects a nominal which is introduced by the indefinite article and which is itself marked, as in (39b) and (41b). The other selects an unmarked nominal and is itself unmarked, just like the adjectival modifiers. This subsumes the use in (43c-d) and (46).

(46) no such luck, many such problems, one such device

In sum, the *such a* and *what a* combinations do not need a constructivist treatment, since their relevant properties can exhaustively be captured in terms of lexical constraints, on the one hand, and the head-functor type of phrase, on the other hand.

6 Conclusion

This paper has provided an HPSG treatment of the English Big Mess Construction. Crucial for the treatment is the distinction between two types of adjuncts. Besides the functors, which lexically select their head sister, there are the independent adjuncts, which lack lexical selection, but which share their index with their head sister. The paper has demonstrated that a treatment in terms of lexical selection is inappropriate for the Big Mess Construction and that the independent adjunct treatment is more plausible. Further work is needed to identify other types of independent adjuncts and to model their properties in a way which differentiates the construction-specifi c idiosyncratic properties from those which they share with other types of independent adjuncts. How this can be done has been illustrated with the English adnominal reflexives.

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