Proceedings of the 19th International Conference on Head-Driven Phrase Structure Grammar

Chungnam National University Daejeon

Stefan Müller (Editor)

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Contents

Editor's note

The 19th International Conference on Head-Driven Phrase Structure Grammar (2012) was held at the Chungnam National University Daejeon.

The conference featured 1 invited talk and 20 papers selected by the program committee (Anne Abeillé, Doug Arnold Emily M. Bender, Francis Bond, Oliver Bonami, Bob Borsley, Rui Chaves, Ann Copestake, Berthold Crysmann, Elisabet Engdahl, Dan Flickinger, Jong-Bok Kim (Chair), Tibor Kiss, Jean-Pierre Koenig, Valia Kordoni, Bob Levine, Laura Michaelis, Stefan Müller, Tsuneko Nakazawa, Jeff Runner, Ivan Sag, Manfred Sailer, Frank Van Eynde, Gert Webelhuth, Eun-Jung Yoo, Stephen Wechsler, and Shuichi Yatabe).

A workshop about *Ellipsis and Formal Grammar* was attached to the conference. It featured one invited talk and 7 papers and a poster, selected by the program committee of this workshop (Doug Arnold, John Beavers, Rui Chaves, Jong-Bok Kim (Chair), Jason Merchant, Stefan Müller, Myung-Kwan Park, Eric Potsdam, Ivan Sag, Mark Steedman, Tom Wasow, Shuichi Yatabe, and Eun-Jung Yoo).

We want to thank the respective program committees for putting this nice program together.

Thanks go to Byong-Rae Ryu (chair) and Hee-Rahk Chae (Hankuk University of Foreign Studies), Myong-Hi Chai (Chosun College of Science and Technology), Sae-Youn Cho (Kangwon National University), Incheol Choi (Kyungpook National University), Chan Chung (Dongseo University), Munpyo Hong (Sungkyunkwan University), Hanmin Jung (Korea Institute of Science and Technology Information), Kil-Soo Ko (Seoul National University), Hae-Yun Lee (Hankuk University of Foreign Studies), Nam-Keun Lee (Chosun University), Seungwoo Lee (Korea Institute of Science and Technology Information), Yonghun Lee (Chungnam National University), Kyung-Sub Lim (Dongshin University), Yongkyoon No (Chungnam National University), Hyopil Shin (Seoul National University), Won-Kyung Sung (Korea Institute of Science and Technology Information), and Cheongmin Yook (Keimyung University), who were in charge of local arrangements.

We also thank the conference chair, Byung-Soo Park (Kyunghee University, emeritus), and the members of the Advisory Committee for the Local Organizing Committee, especially Suk-Jin Chang (Seoul National University, emeritus), Kiyong Lee (Korea University, emeritus), Ik-Hwan Lee (Sangmyung University), Chungmin Lee (Seoul National University, emeritus), Key-Sun Choi (KAIST), Jae-Woong Choe (Korea University), Sang-Kyu Park (Electronics and Telecommunications Research Institute), and Seungho Nam (Seoul National University).

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 Joshua Crowgey (the poster), David Erschler, Mark Steedman, and Takafumi Maekawa.

Part I
Contributions to the Main Conference

An HPSG approach to free relatives in Arabic

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Abstract

This paper describes free relative constructions in Modern Standard Arabic (henceforth, MSA) and aims to provide an HPSG analysis for them. MSA has two types of free relative constructions. One, which is introduced by the complementizer *ʔallaði*, looks just like a relative clause. The other, which is introduced by the elements *man* and *maa*, which also appear to be complementizers, does not look like a relative clause. Both types can be analysed in term of unary-branching structures (as NPs consisting just of a CP). In *ʔallaði* free relatives, the NP and the value of SLASH can be coindexed via the value of MOD on the CP. In *man* and *maa* free relatives, the NP and the value of SLASH must be coindexed directly.

1 Introduction

There has been a limited amount discussion of free relatives within the HPSG framework. Kim (2001), Lee (2001) and Wright & Kathol (2002) have proposed an HPSG analysis for free relatives in English. Müller (1999) has discussed free relatives in German and Borsley (2008) has analyzed free relatives in Welsh. The central question in these proposals is whether the initial *wh*-phrase is treated as the head, as the filler or as both. However, to the best of knowledge, Arabic free relatives have not been discussed within HPSG framework yet. As we will see, they raise somewhat different issues from free relatives in English, German and Welsh.

In this paper, I will propose a unary-branching approach for Arabic free relatives which is somewhat like Müller's (1999) approach for German free relatives. However, the analysis developed here is different from Müller's analysis since the properties of Arabic free relatives are different from those of German free relatives and many other languages. Arabic free relatives are introduced by a complementizer and not by a *wh*-phrase, as will be discussed in Section 3. Therefore, the question of whether the initial *wh*-phrase is treated as the head, as the filler or as both does not arise here. This suggests that the analysis of free relatives will be rather different from the analysis of free relatives in English and other languages that have been discussed within the HPSG framework.

↑ I am grateful to my supervisor, Bob Borsley, Stefan Müller and three anonymous reviewers of HPSG 2012 for their constructive and helpful comments. I would also like to thank Michael Hahn and the audience of HPSG 2012 for the insightful discussions we had during the conference sessions. Any errors or inaccuracies are my responsibility alone.

2 The data

Free relatives in MSA are unbounded dependency constructions which involve both gaps and resumptive clitics and involve three different free relative markers *ʔallaði*, *man* and *maa*. I use the term 'free relative marker' (FRM) for these elements pending discussion of their syntactic status.

(1) jaaʔa [*llaði* faaza ___ fi l-musabaqat-i].
came. 3.M.SG FRM.M.SG won.3.M.SG in DEF-competition-GEN
'The one that won the competition came.'

(2) raʔaytu [*man* yuħib-**haa** Ali].
saw.1.SG FRM like.3.M.SG-3.F.SG Ali
'I saw the one (female) that Ali likes.'

(3) ħadaθaa [*maa* ʔaxšaa-**hu**].
happened.3.M.SG FRM fear.1.SG-3.M.SG
'The thing that I fear happened.'

There is a semantic difference between the three markers *ʔallaði*, *man* and *maa*. *man* and *maa* have certain restrictions on their reference. The former is used in free relative clauses that refer to animate entities whereas the latter is used in free relative clauses that refer to inanimate entities. The following ungrammatical examples with *man* and *maa* illustrate these restrictions**.**

(4) *jaaʔa [*maa* faaza ___ fi l-musabaqat-i].
came. 3.M.SG FRM won.3.M.SG in DEF-competition-GEN
Intended:'The thing that won the competition came.'

(5) *ħadaθaa [*man* ʔaxšaa-**hu**].
happened.3.M.SG FRM fear.1.SG-3.M.SG
Intended: 'The one that I fear happened.'

ʔallaði, on the other hand, can be associated with both animate and inanimate entities and hence it can replace *man* and *maa*.

The markers *man* and *maa* are invariant but *ʔallaði* is inflected for number, gender and sometimes for case as the following table illustrates.

	Masculine	**Feminine**
Singular	*ʔallaði*	*ʔallati*
Dual-NOM	*ʔallaðaani*	*ʔallataani*
Dual-ACC/GEN	*ʔallaðayni*	*ʔallatayni*
Plural	*ʔallaðiina*	*ʔallaati-allawaati*

This might suggest that *ʔallaði* is a kind of *wh*-pronoun. However, I will argue in Section 3 that the free relative markers *ʔallaði*, *man* and *maa* are complementizers and not *wh*-pronouns.

As one might expect, free relatives in SA can appear in the full set of NP positions. The following examples show that they can appear in subject position as in (6a) and (6b), in object position as in (6c), in the prepositional object position as in (6d) and in possessor position as in (6e). The following examples are given with the free relative marker *ʔallaði*. Free relatives with the markers *man* and *maa* have the same distribution.

(6) a. ħadaθaa [*llaði* ʔaxšaa-**hu**].
happened.3.M.SG FRM.M.SG fear.1.SG-3.M.SG
'The thing that I fear happened.'
b. [*llaði* ʔaxšaa-**hu**.] ħadaθaa.
FRM.M.SG fear.1.SG-3.M.SG happened.3.M.SG
'The thing that I fear happened.'
c. raʔaytu [*llatayni* yuħib-**humaa** Ali].
saw.1.SG FRM.F.DUAL.ACC like.3.M.SG-3.F.DUAL Ali
'I saw the two (female) that Ali likes.'
d. taħdaθtu maʕa [*llaði* taħdaθta mʕa-**hu**].
spoke.1.SG with FRM.M.SG spoke.2.M.SG with-3.M.SG
'I spoke with the one that you spoke with.'
e. ʔimtalaktu qalba [*llati* ʔuħib-**haa**].
posessed.1.SG heart FRM.F.SG love.1.SG-3.F.SG
'I possessed the heart of the one that I love.'

When the free relative is in the subject position as in (6a) and (6b), the verb of the main clause agrees with *ʔallaði* in person, number and gender. In addition, when case is visible, it reflects the position of the free relative as in (6c).

The relative marker *ʔallaði* and its various forms also appear in ordinary relative clauses modifying an NP. In fact, there are two types of restrictive relative clauses: restrictive relatives with a definite relativized antecedent (definite relatives) as in (7a) and restrictive relatives with an indefinite relativized antecedent (indefinite relatives) as in (7b). (see. Aoun et al., 2010; Alqurashi and Borsley, 2012). The relative marker *ʔallaði* appears only in definite relatives but the markers *man* and *maa* do not as illustrated by the following examples.[1]

(7) a. raʔaytu l-fatat-a [*llati* ʔuħib-**ha**].[2]
saw.1.SG DEF-girl-ACC RM.F.SG like.1.SG-3.F.SG
'I saw the girl that I like.'

[1] The indefinite relatives are bare clauses modifying an indefinite antecedent in which *ʔallaði* does not appear. (see Alqurashi and Borsley, 2012).
[2] I gloss *ʔallati* as 'relative marker' (RM) and not as FRM because it is used here to introduce a restrictive relative clause, not a free relative clause.

b. raʔaytu fatatt-an [ʔuħib-**ha**].
saw.1.SG girl-ACC like.1.SG-3.F.SG
'I saw a girl that I like.'

(8) *raʔaytu l-fatat-a [*man* ʔuħib-**ha**].
saw.1.SG DEF-girl-ACC FRM.F.SG like.1.SG-3.F.SG
Intended: 'I saw the girl that I like.'

(9) *šahadtu l-šayʔ-a [*maa* ħadaθa].
witnessed.1.SG DEF-thing-ACC FRM happened.3.M.SG
Intended: 'I witnessed the thing that happened.'

The feminine form *ʔallati* in (7a) agrees with the antecedent *l-fatat-a* and with the clitic *ha* in number and gender. In free relatives, the relative markers *ʔallaði* and its various forms, *man* and *maa* agree in number and gender with the clitic or the gap inside the relative clause. This can be identified either by the verb inside the relative clause in case where a gap is involved or by the clitic where resumption is involved.

(10) a. qaabaltu [*ʔallaðiina* faaz**uu** fi l-musabaqat-i].
met.1.SG FRM.M.PL won.3M.PL in DEF-competition-GEN
'I met the ones that won the competition.'
b. raʔaytu [*ʔallaðiina* yuħib-**hum** Ali].
met.1.SG FRM.M.PL like.3.M.SG-3.M.PL Ali
'I saw the ones that Ali likes.'
c. raʔaytu [*man* yuħib-**hum** Ali].
met.1.SG FRM like.3.M.SG-3M.PL Ali
'I saw the ones that Ali likes.'
d. ʔaʕrifu [*maa* taxšaa-**huma** Hind].
know.1.SG FRM fear.3.F.SG-RP.DUAL Hind
'I know the two things that Hind fears.'

A further point that we should consider here is whether Arabic free relatives can be extraposed like in German, for example. Let us first consider the German data and then compare them with the Arabic ones.

Müller (1999) points out that free relative clauses in German, as in (11d), can be extraposed like ordinary relative clauses, as in (11a). According to Müller (1999:70), "relative clauses in German are finite clauses with the finite verb in final position if nothing is extraposed and if the verbs are in normal order" as illustrated by the example in (11a). The following examples are taken form Groos and van Riemsdijk (1981:185).

(11) a. Der Hans hat [das Geld, das er gestohlen hat], zurückgegeben.
the Hans has the money that he stolen has returned
'Hans has returned the money that he has stolen.'

b. Der Hans hat [das Geld t_i] zurückgegeben, [das er gestohlen hat]$_i$.
the Hans has the money returned that he stolen has
c.*Der Hans hat t_i zurückgegeben, [das Geld, das er gestohlen hat]$_i$.
the Hans has returned the money that he stolen has
d. Der Hans hat t_i zurückgegeben, [was er gestohlen hat]$_i$.
the Hans has returned what he stolen has
'Hans has returned what he has stolen.'

A first glance at the Arabic free relative example in (12) below might suggest that they too can be extraposed. The free relative clause in the following example appears in final position although it is understood as the subject.

(12) jaaʔa ʔila l-lbayt-i [*llaði* ušbihhu
came.3.M.SG to DEF-house-GEN FRM.M.SG looks like.3.M.SG
ʔaba-**hu**].
father-3.M.SG
'The one that looks like his father came to the house.'

However, Arabic relative clauses cannot be extraposed as the following example illustrates:

(13) *jaaʔa [l-walad-u] ʔila l-lbayt-i [*llaði*
came.3.M.SG DEF-boy-NOM to DEF-house-GEN RM.M.SG
ušbihhu ʔaba-**hu**].
looks like.3.M.SG father-3.M.SG
'The boy that looks like his father came to the house.'

In fact, it seems that what we have in (12) is not an extraposition, but rather an example of a complex subject occupying a noncanonical position. This is supported by the fact that complex NPs containing a relative clause can appear in the same position.

(14) jaaʔa ʔila l-lbayti [l-walad-u *llaði*
came.3.M.SG to DEF-house-GEN DEF-boy-NOM RM.M.SG
ušbihhu ʔaba-**hu**].
looks like.3.M.SG father-3.M.SG
'The boy that looks like his father came to the house.'

Moreover, Arabic free relatives have the same distribution as equally complex NPs. They have certain marked word order as illustrated by the following examples:

(15) **Complex NPs in subject position:**

a. ʔazʕaja [kalam-u Ahmad-in] Hind-an.
annoyed.3.M.SG speech-NOM Ahamd-GEN Hind-ACC

b. ʔazʕaja Hind-an [kalam-u Ahmad-in].
annoyed.3.M.SG Hind-ACC speech-NOM Ahamd-GEN
'Ahmad's speech annoyed Hind.'

(16) **Free relative in Subject position:**

a. ʔazʕaja [*maa* qala-**hu** Ahmad-un] Hind-an.
annoyed.3.M.SG FRM said.3.M.SG-3.M.SG Ahamd-nom Hind-ACC

b. ʔazʕaja Hind-an [*maa* qala-**hu** Ahmad-un].
annoyed.3.M.SG Hind-ACC FRM said.3.M.SG-3.M.SG Ahamd-NOM
'What Ahmad said annoyed Hind.'

(17) **Complex NPs in object position:**

a. ʔaaðaa Ali-un [mašaʕir-a Hind-in] l-baariħata.
hurt.PAST.3.M.SG Ali-NOM feelings-ACC Hind-GEN DEF-yesterday

b. ʔaaðaa Ali-un l-baariħata [mašaʕir-a Hind-in].
hurt.PAST.3.M.SG Ali-NOM DEF-yesterday feelings-ACC Hind-GEN
'Ali hurt Hind's feelings yesterday.'

(18) **Free relatives in object position:**

a. ʔaaðaa Ali-un [*man* yuħibu-**ha**] l-baariħata.
hurt.PAST.3.M.SG Ali-NOM FRM like.1SG-3.F.SG DEF-yesterday

b. ʔaaðaa Ali-un l-baariħata [*man* yuħibu-**ha**].
hurt.PAST.3.M.SG Ali-NOM DEF-yesterday FRM like.1SG-3.F.SG
'Ali hurt the one whom he loves.'

If restrictive relatives cannot be extraposed as shown in (13) above, it seems reasonable to assume that (12) above is an example of a complex NP in a noncanonical position, not of extraposition.

3 The syntactic status of *ʔallaði*, *man* and *maa*

I argue that the free relative markers: *ʔallaði*, *man* and *maa* are complementizers and not *wh*-pronouns.[3] This position is supported by the fact that these markers cannot be a part of a larger clause-initial constituent as one would expect if they were pronouns. *Wh*-interrogative pronouns, for example,

[3] Aoun, Benmamoun and Choueiri (2010) also assume that *ʔallaði* is a complementizer, but they provide no arguments for this position.

can be part of a larger clause initial phrase as the following examples illustrate.

(19) a. [$_{PP}$ maʕa man] takallamta ?
with whom talked.2.MSG
'With whom did you talk?'
b. [$_{NP}$ ʔom man] maatat?
mother whose died.3.FSG
'Whose mother died?'

In contrast, the free relative markers *ʔallaði*, *man* and *maa* behave differently from *Wh*-interrogative pronouns with respect to pied piping. The following ungrammatical examples in (20) show that *ʔallaði*, *man* and *maa* cannot be a part of a clause-initial PP. The grammatical counterparts shown in (21) have in-situ preposition with a resumptive clitic.

(20) a. *qaabaltu [$_{PP}$ maʕ *llaði*] takallamta.
met.1.SG with RM.M.SG talked.2.M.SG
Intended: 'I met with whom you talked.'
b. *qaabaltu [$_{PP}$ maʕ *man*] takallamta.
met.1.SG with FRM talked.2.M.SG
c. *aʕjabani [$_{PP}$ ʕan *maa*] taħdaθta.
liked.1.SG about FRM spoke.2.M.SG
Intended: 'I liked about what you spoke.'

(21) a. qaabaltu [*llaði* taħdaθta maʕ-**hu**].
met.1.SG RM.M.SG spoke.2.M.SG with-3.M.SG
'I met the one whom you spoke with.'
b. qaabaltu [*man* taħdaθta maʕ-**hu**].
met.1.SG FRM spoke.2.M.SG with-3.M.SG
'I met the one whom you spoke with.'
c. aʕjabani [*maa* taħdaθta ʕan-**hu**].
liked.1.SG FRM spoke.2.M.SG about-3.SG
'I liked the thing that you spoke about.'

However, the above examples in (20) do not prove much because there is an alternative interpretation for the ungrammaticality of these examples. This is that the free relative markers in (20) are *wh*-pronouns and thus the sentence is ungrammatical due to the matching effects which require the initial phrase to be whatever category is required in the position where the free relative appears (see Bresnan and Grimshaw (1978) and Gross and van Riemsdijk (1981) for discussion of the matching effects in free relatives). However, there is another way to reveal the syntactic status of these markers which is to examine whether they can be a possessor within a clause-initial

NP. The following ungrammatical examples in (22) show that this is not possible. Their grammatical counterparts are shown in (23).

(22) a. *ʔaʕrifu [$_{NP}$ ʔbu *llati* maat].
know.1.SG father FRM.F.SG died.3.M.SG
Intended: 'I know the one whose father died.'
b. *ʔaʕrifu [$_{NP}$ ʔbu *man* maat].
know.1.SG father FRM. died.3.M.SG
Intended: 'I know the one whose father died.'
c. *ħadaθaa [$_{NP}$ ʕawaqiba *maa* ʔaxšaa].
happened.3.M.SG consequences FRM fear.1.SG
Intended: 'The thing whose consequences I fear happened.'

(23) a. ʔaʕrifu [*llati* maat ʔbu-**ha**].
know.1.SG FRM.F.SG died.3.M.SG father-3.F.SG
'I know the one whose father died.'
b. ʔaʕrifu [*man* maat ʔbu-**ha**].
know.1.SG FRM.F.SG died.3.M.SG father- 3.F.SG
'I know the one whose father died.'
c. ħadaθaa [*maa* ʔaxšaa ʕawaqiba-**hu**].
happened.3.M.SG FRM fear.1.SG consequences-3.M.SG
'The thing whose consequences I fear happened.'

These examples cannot be ruled out by matching effects. Hence they show clearly that the free relative markers cannot be part of a larger clause initial phrase.

Further evidence supporting the argument that *ʔallaði* is a complementizer comes from relative clauses. As noted above, *ʔallaði* can also appear in ordinary relative clauses modifying an NP in which *ʔallaði* agrees with the antecedent and with the gap in number and gender. However, when case is involved**,** *ʔallaði* bears the case of the antecedent and not that of the gap or the RP in the relativized position.

(24) a. raʔaytu l-waladayni [*llaðayni*
saw.1.SG DEF-boy-DUAL.ACC RM.M.DUAL.ACC
qaabala-**humaa** l-malik-u].
met.3.M.SG-.DUAL DEF-king-NOM
'I saw the two boys whom the king met.'
b. jaaʔa l-waladaani [*llaðaani*
came.3.M.SG DEF-boy-DUAL.NOM RM.M.DUAL.NOM
qaabala-**humaa** l-malik-u].
met.3.M.SG-DUAL DEF-king-NOM
'The two boys whom the king met came.'

In free relatives, *ʔallaði* has a case determined by its position which is different from that of the position relativized as illustrated by the following examples.

(25) a. raʔaytu [*llaðayni* qaabala-**humaa** l-malik-u].
saw.1.SG FRM.M.DUAL.ACC met.3.M.SG-.DUAL DEF-king-NOM
'I saw (the two) whom the king met.'
b. jaaʔa [*llaðaani* qaabala-**humaa** l-malik-u].
came.3.M.SG FRM.M.DUAL.NOM met.3.M.SG-DUAL DEF-king-NOM
'(The two) whom the king met came.'

In addition, *ʔallaði* in ordinary relatives cannot be part of a clause-initial PP as shown by the ungrammatical example in (26a).

(26) a.*r-rajul-u [[PP maʕ *llaði*] takallamta].
DEF-man-NOM with RM.M.SG talked.2.M.SG
Intended: 'The man with that you talked.'
b. r-rajul-u [*llaði* takallamta maʕ-**hu**].
DEF-man- NOM RM.M.SG talked.2.M.SG with-3.M.SG
'The man that you talked with.'

At this stage, we can conclude on the basis of the above discussion that *ʔallaði* is a complementizer. It is natural to conclude that *man* and *maa* are complementizers too. However, it is worth considering the possibility that they are nouns.

I argue that *man* and *maa* cannot be treated as nouns for the following reasons. First, they are invariant in form and in particular that they are not inflected for Case as discussed above. Second, nouns in Arabic can be modified by adjectives. Therefore, if *man* and *maa* were nouns, we would expect them to be modified by adjectives, but the following example show that they cannot.

(27) a. *raʔaytu [*man* l-jamiilat-a yuħib-**haa** Ali].
saw.1.SG FRM.F.SG DEF-beautiful.ACC like.3.M.SG-3.F.SG Ali
Intended: 'I saw the beautiful one (female) that Ali likes.'
b. *ħadaθaa [*maa* l-muzʕij-u ʔaxšaa-**hu**].
happened.3.M.SG FRM DEF-annoying.NOM fear.1.SG-3.M.SG
Intended: 'The annoying thing that I fear happened.'

Finally, nouns don't take a bare clause as a complement, but only a clause introduced by a complementizer as in (28), whereas *man* and *maa* take a bare clause as a complement.

(28) a. ʔal-ħaqiqat-u ʔanna Ahmad-an yuħibu Hind-an.
the-fact that Ahmad-ACC love.3.M.SG Hind- ACC
'The fact is that Ahmad loves Hind.'
b. wajadtu l-kitab-a [llaði tuħib-**hu** Salwa].
found.1.SG DEF-book-ACC RM. M.SG like.1.SG–3.SG Salwa
'I found the book that Salwa likes.'

The question that might arise here is whether *man* and *maa* are indefinite nouns like the antecedent in indefinite relatives which takes a bare clause as its complement. We can exclude this by arguing that the clause following *man* and *maa* cannot be a relative clause given that the latter is optional after the noun it modifies whereas the former is obligatory after *man* and *maa* as demonstrated by (29) and (30) below.

(29) *raʔaytu [*man* …..]
saw.1.SG FRM
Intended: 'I saw the one that ...'
(30) *ħadaθaa [*maa* …..]
happened.3.M.SG FRM
Intended: 'What… happened'

Therefore, I conclude that *ʔallaði*, *man* and *maa* are complementizers. *man* and *maa* appear only in free relatives whereas *ʔallaði* appears in both ordinary relative clauses and free relatives. However, these complementizers are different from the sentential complementizers *ʔan* and *ʔanna* which introduce complement clauses as the following illustrates:

(31) a. ʔiqtarħtu ʔan yušarika Ahmad-un fi l-musabaqah.
suggested.1.SG that participate Ahmad-NOM in DEF-competition
'I suggested that Ahmad participate in the competition.'
b. qultu li-Ahmad ʔanna Hind-an tuħibu-**hu**.
said.1.SG to-Ahmad that Hind-ACC love. 3.F.SG-him
'I said to Ahmad that Hind loves him.'

4 The nature of gaps and resumptive clitics

As noted above, both gaps and resumptive clitics are used in Arabic free relatives. In this section, I will discuss the nature of gaps and resumptive clitics in Arbic free relatives. There are two approaches to resumptive clitics in the HPSG literature. The first is to assume that gaps and resumptive clitics are realizations of two separate NONLOCAL features: SLASH and RESUMP (Vaillette 2000) and the second is to assume that both gaps and resumptive clitics are realizations of SLASH (Borsley, 2010 and

Taghvaipour, 2004 and 2005). Here, there is evidence that both gaps and resumptive clitics in Arabic are analyzed as the realization of the SLASH feature. In accordance with the Coordinate Structure Constraint of Ross (1967:161), an unbounded dependency can not affect one conjunct of a coordinate structure unless it affects the other(s) as the following example illustrates.[4]

(32) *jaaʔat [*llati* ʔuħibu__ wa ʔaʕšaq Salwa].
came.3.F.SG that-F.SG love.1.M.SG and adore.1.M.SG Salwa
Intended: '*The one (female) that I love and adore Salwa came.'

(33) jaaʔat [*llati* ʔuħibu-__ wa ʔaʕšaq-__].
came.3.F.SG that-F.SG love.1.M.SG and adore.1.M.SG
'The one (female) that I love and adore came.'

However, there are certain coordinated structures in which there is a gap in the first conjunct and a resumptive clitic in the second or vice versa as illustrated in (34) and (35).

(34) a. jaaʔat [*llati* ʔuħibu-__ wa ʔaʕšaqu-**ha**].
came.3.F.SG that-F.SG love.1.M.SG and adore.1.M.SG -3.F.SG
'The one (female) that I love and adore came.'

b. jaaʔat [*llati* ʔuħibu__ wa ʔaħras ʕalay-**ha**].
came.3.F.SG that-F.SG love.1.M.SG and care.1.M.SG about-3.F.SG
'The one (female) that I love and care about.'

(35) a. jaaʔat [*llati* ʔuħibu-**ha** wa ʔaʕšaqu-__].
came.3.F.SG that-F.SG love.1.M.SG-3.F.SG and adore.1.M.SG
'The one (female) that I love and adore came.'

b. jaaʔat [*llati* ʔaħras ʕalay-**ha** wa ʔuħibu__].
came.3.F.SG that-F.SG care.1.M.SG about-3.F.SG and love.1.M.SG
'The girl that I love and care about.'

This suggests that gap and resumptive clitics behave in the same way with respect to the Coordinate Structure Constraint and hence both gaps and RPs in Arabic should be realizations of SLASH. This entails that we utilize the SLASH feature to handle both gaps and resumptive clitics and not two separate features: SLASH and RESUMP as in Vaillette (2000).

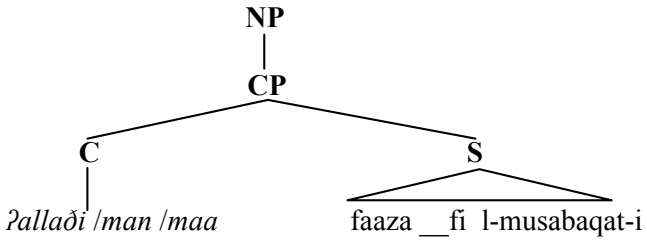
[4] Coordination Structure Constraint:
In a coordination structure, no conjunct may be moved, nor may any element contained in a conjunct be moved out of the conjunct (Ross,1967:161)

5 Analysis

Since there are no previous HPSG analyses of Arabic free relatives, it is reasonable to consider how free relatives are analyzed within transformational grammar. Within a framework like Minimalism, Arabic free relatives would probably be treated like restrictive relative clauses, in which the antecedent is assumed to be base-generated and there is a movement of a null operator, except for the fact that free relatives modify a null antecedent (Alqurashi, in preparation).[5] Someone might propose similar analysis within HPSG in which free relatives are treated like restrictive relative clauses but with a phonologically empty nominal. In fact, there are various objections to such an approach. First, it is not clear how one could insure that this empty nominal constituent does not appear without a relative clause. In other words, if we allow an empty element modified by a relative clause in various positions (e.g. subject, object, etc.), it would be very difficult to prevent this empty element appearing without a relative clause in those positions. We cannot assume, on the other hand, that this empty nominal selects for a clause because it is usually the relative clause that selects the nominal constituent they modify. Second, this analysis is excluded on the assumption that it would be possible only in the case of *ʔallaði*, which would appear in ordinary relative clauses modifying a nominal constituent, but not in the case of *man* and *maa* free relatives, which cannot introduce clauses which modify nominal heads. Our goal here is to treat the three types of free relatives as similarly as possible.

The obvious analysis within HPSG would be to assume that free relatives in Arabic are NPs which have only one daughter which is a clause.

(36)

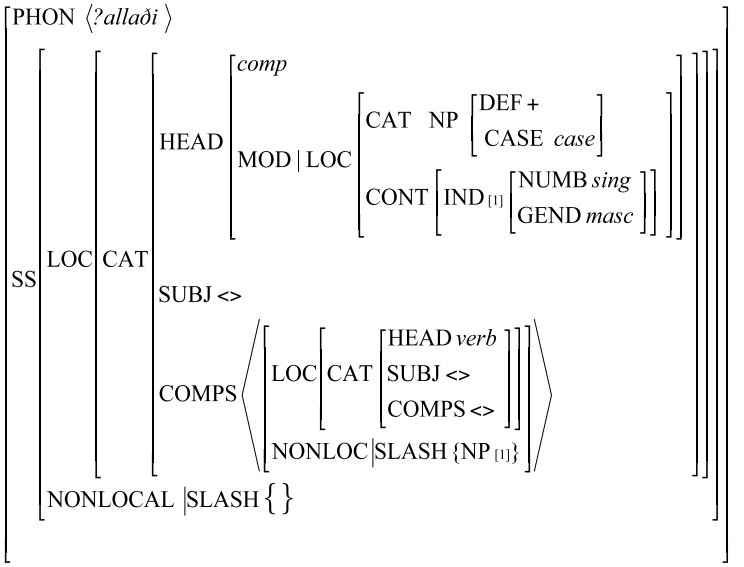


[5] There are few works that discuss Arabic restrictive relative clauses but not free relatives within transformational grammar such as Ouhalla (2004) and Aoun, Benmamoun and Choueri (2010). Aoun et al. (2010) dedicate a whole Chapter for Arabic restrictive relatives but they do not tackle the structure. They point out that 'this issue is a problematic one and is still under debate in the literature dealing with the topic of relativization' (p.189). Ouhalla (2004) develops an analysis of Arabic relative clauses that does not make use of promotion but shares with Kayne's (1994) analysis an antisymmetric view of phrase structure. The main features of Ouhalla's analysis are (a) the idea that relatives are DPs and (b) the idea that they originate in a prenominal position. Arabic free relatives, on the other hand, have been discussed by Fassi Fehri (1978) within transformational grammar, but he uses an old version of transformational analysis which is not assumed any more.

As mentioned above, this is somewhat like Müller's (1999) unary projection approach for German free relatives. However, the analysis developed here is different form Müller's analysis because the Arabic data shown above is quite different from German. Arabic free relatives are introduced by a complementizer and not by a *wh*-phrase and hence we should not concern with the question of whether the initial *wh*-phrase is treated as the head, as the filler or as both. Moreover, as noted above, Arabic free relatives cannot be extraposed unlike German free relatives.

The differences between the complementizer *ʔallaði* and the complementizers *man* and *maa*, outlined above, suggest that they should be treated rather differently. Thus, we need an appropriate lexical description for each complementizer. In addition, we need some constraints to capture the distinctive properties of these two types of free relatives. Let us consider *ʔallaði* free relatives first. We can assume the complementizer *ʔallaði* has the lexical description in (37). The various different forms will have different values for the NUMBER and GENDER features and the CASE of the modified NP.

(37) The lexical description for the complementizer *ʔallaði*:



This indicates that *ʔallaði* takes a clausal complement which contains a gap or a resumptive pronoun and that the CP it heads modifies an NP coindexed with the SLASH value via the value of MOD. This entails that the *ʔallaði* clause can modify an NP as is the case in ordinary relative clauses but it does not entails that it must do. The SLASH Amalgamation Constraint (Ginzburg and Sag, 2000), in (38), which a default constraint, requires a head to have by

default a non empty SLASH value if its complement has a non empty SLASH value.

(38) SLASH-Amalgamation constraint (Ginzburg and Sag, 2000:169):

$$word \Rightarrow / \begin{bmatrix} SS|SLASH\ [1] \cup ... \cup [n] \\ ARG\text{-}ST\langle [SLASH\,[1]\,], ..., [SLASH[n]\,] \rangle \end{bmatrix}$$

This means that the head *ʔallaði* should by default have [SLASH {NP} because its complement (i.e. the relative clause) has [SLASH {NP}] unless there is a stipulation requiring something else. However, the lexical entry in (37) above has a stipulation which ensures that *ʔallaði* has an empty SLASH value. This will prevent the SLASH value of the internal clause form passing any further up the tree. This makes the treatment of *ʔallaði* similar to that of the English adjective *easy*. This adjective, which selects an infinitival complement missing an NP (i.e. it is [SLASH {NP}]) as in (39) below, must have an empty SLASH value which is insured by a stipulation in its lexical description.[6]

(39) Kim is easy to impress ___.

Now, we can assume that *ʔallaði* free relatives are NPs whose only daughter is a relative clause. This suggests that we need a special phrasal type for *ʔilli /ʔallaði* free relatives which is subject to the following constraint:

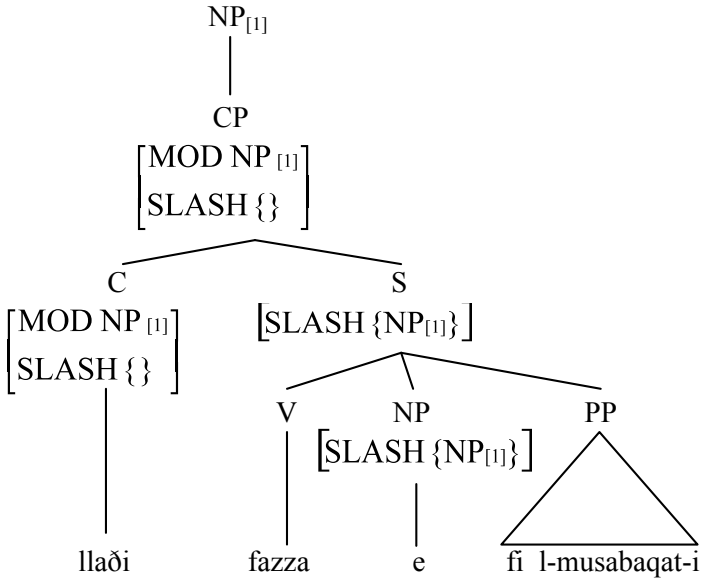
(40) *ʔallaði-free-rel* →

$$\begin{bmatrix} SS\,|\,CAT\ NP[CASE\,[1], INDEX\,[2]] \\ DTRS\,\langle CP[MOD\ NP[CASE\,[1], INDEX\,[2]]] \rangle \end{bmatrix}$$

This indicates that the *ʔallaði* free relative clause is coindexed with the value of MOD and hence has the same number and gender and also has the same CASE as shown in (6) above. The MOD value NP distinguishes *ʔallaði* clauses, which can appear as relative clauses modifying certain NPs and not just as free relatives, from *man* and *maa* clauses which appear only as free relatives as noted above. *ʔallaði* free relatives like the one in (1) above will have the structure in (41) below (I assume with Levine and Hukari (2006) that gaps are empty categories).

[6] See Bouma, Malouf and Sag (2001) for different approach.

(41)



In contrast, *man* and *maa* must be specified [MOD *none*] like other complementizers heading clauses which are not modifiers. In the case of *ʔallaði* free relative clauses, the dominating NP is coindexed with the value of SLASH via the value of MOD. Here, the coindexing must be ensured in some other way. It can be achieved by assuming that CPs headed by *man* and *maa* have the same value for SLASH as their complement. In other words, the complementizers *man* and *maa* should not be specified as [SLASH { }]. Free relatives with *man* and *maa* can be analysed as NPs whose only daughter is a clause but not a relative clause and they are subject to the following constraint:

(42) *man-maa-free-rel* →

$$\begin{bmatrix} \text{SS}\,|\,\text{CAT NP}\,[\text{INDEX}\,[1],\text{SLASH}\,\{\}] \\ \text{DTRS}\left\langle \text{CP}\begin{bmatrix}\text{MOD } \textit{none} \\ \text{SLASH}\,\{\text{NP}[\text{INDEX}\,[1]]\}\end{bmatrix}\right\rangle \end{bmatrix}$$

What is important about this constraint is that it ensures that the free relative is [SLASH {}]. This is not necessary in (40) above because the description for *ʔallaði* in (37) above ensures that the CP is [SLASH {}].

The complementizers *man* and *maa* can be assigned the lexical descriptions in (43) and (44) below. Apart from the value of PHON which distinguishes the phonology of the complementizer *man* from that of the complementizer *maa* , there is also a pragmatic difference between them. The complementizer *man* introduces a free relative referring to an animate entity whereas the complementizer *maa* introduces a free relative referring to an inanimate entity as indicated by the values of BACKGROUND. It is worth

mentioning here that these descriptions do not require *man* and *maa* to be [SLASH { }].

(43)

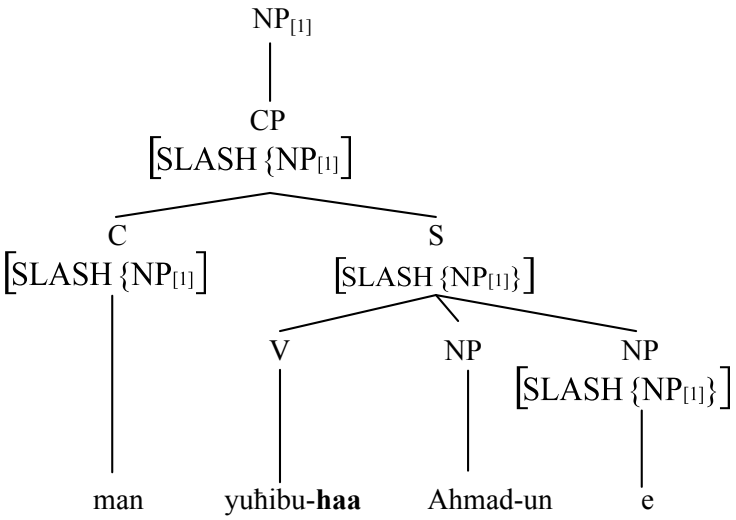
$$\begin{bmatrix} \text{PHON} \langle man \rangle \\ \text{SS|LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \begin{bmatrix} comp \\ \text{MOD} \ none \end{bmatrix} \\ \text{SUBJ} \langle\rangle \\ \text{COMPS} \left\langle \begin{bmatrix} \text{HEAD} \ verb \\ \text{SUBJ} \langle\rangle \\ \text{COMPS} \langle\rangle \\ \text{SLASH} \{\text{NP}_{[1]}\} \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{IND}[1] \end{bmatrix} \\ \text{CONTEXT} \begin{bmatrix} \text{BACKGROUND} \left\{ \begin{bmatrix} \text{RELATION} \ animate \\ \text{INSTANCE} \ [1] \end{bmatrix} \right\} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

(44)

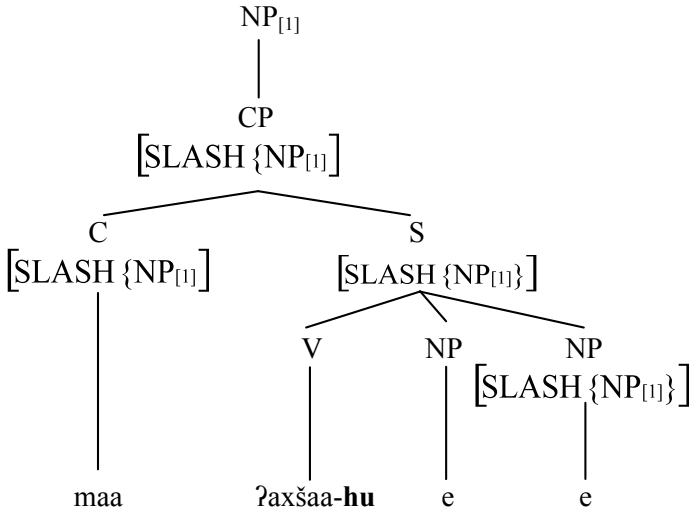
$$\begin{bmatrix} \text{PHON} \langle maa \rangle \\ \text{SS|LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \begin{bmatrix} comp \\ \text{MOD} \ none \end{bmatrix} \\ \text{SUBJ} \langle\rangle \\ \text{COMPS} \left\langle \begin{bmatrix} \text{HEAD} \ verb \\ \text{SUBJ} \langle\rangle \\ \text{COMPS} \langle\rangle \\ \text{SLASH} \{\text{NP}_{[1]}\} \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{IND}[1] \end{bmatrix} \\ \text{CONTEXT} \begin{bmatrix} \text{BACKGROUND} \left\{ \begin{bmatrix} \text{RELATION} \ inanimate \\ \text{INSTANCE} \ [1] \end{bmatrix} \right\} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

With these descriptions, *man* and *maa* free relatives like the ones in (2) and (3) above will have the structures given in (45) and (46) below.[7]

(45)



(46)



[7] I assume that null subjects in Arabic are phonologically empty elements in the constituent structure (and not just members of ARG-ST lists with no counterpart in the constituent structure). I also assume that clitics are realized as suffixes which license an empty argument. This means that both Null subjects and null elements associated with clitics appear in ARG-ST lists, in VALENCE lists and constituent structures.

6 Conclusion

This paper has investigated free relative constructions in Modern Standard Arabic and shown that they can be analyzed in terms of unary-branching structures (i.e. NPs consisting just of a CP) which avoids empty elements. In addition, it was shown that free relative constructions in MSA involve two types: *ʔallaði*-free relatives and *man-maa* free relatives. *ʔallaði*-free relatives look just like relative clauses in which the NP and the value of SLASH can be coindexed via the value of MOD on the CP. The other type, introduced by the complementizers *man* and *maa* does not look like a relative clause and the NP and the value of SLASH must be coindexed directly.

In this paper, I have been concerned with two types of free relatives in MSA which seems somewhat different from those in English and other languages that have been discussed within the HPSG framework. This is due to the fact that Arabic free relatives are introduced by a complementizer and not by a *wh*-phrase. However, the analysis developed here shows that they are no problem for HPSG.

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Arabic relative clauses in HPSG

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Abstract

In HPSG relative clauses have been analyzed in terms of phonologically empty heads in Pollard and Sag (1994) and in terms of a complex system of phrase types in Sag (1997). Modern Standard Arabic has a distinction between relative clauses with a definite antecedent, which are introduced by a special complementizer, and relative clauses with an indefinite antecedent, which are 'bare' clauses. Analyses eschewing empty heads and assuming a complex system of phrase types face a number of problems. An analysis in which relatives with an indefinite antecedent are headed by a phonologically empty complementizer is more satisfactory. Thus, in the case of Arabic, the approach of Pollard and Sag (1994) seems preferable to the approach of Sag (1997).

1 Introduction

Pollard and Sag (1994: Chapter 5) develop an analysis of relative clauses employing a number of phonologically empty heads. Sag (1997) rejects empty heads and instead makes use of a complex system of phrase types. Thus, for any language, major questions about relative clauses are:

- What phrase types are necessary?
- Are any empty heads necessary?

In this paper we will consider the implications of Modern Standard Arabic for these questions. We will argue that analyses which eschew empty heads face a number of problems and that an approach which employs an empty complementizer is more satisfactory.

2 The basic data

Arabic has two main types of finite relative clauses.[1] With a definite antecedent a relative clause consists of the element *ʔallaði* and a clause containing either a gap or resumptive clitic, as in (1).

(1) a. jaaʔa l-walad-u [llaði qaabala ___
came.3.M.SG DEF-boy-NOM that. M.SG met.3.M.SG

↑ We are grateful to Bob Levine, Stefan Müller, the reviewers for the HPSG conference, and the auidence for helpful discussion of the issues discussed here. Any deficiencies are our responsibility.

[1] Arabic also has certain non-finite relatives, discussed e.g. in Melnik (2006). We will not consider how they should be analysed.

l-malik-a]
DEF-king-ACC
'The boy who met the king came.'

b. wajadtu l-kitab-a [llaði tuħib-**hu**
found.1.SG DEF-book-ACC that. M.SG like.3.F.SG-3.M.SG
Hind-un]
Hind-NOM
'I found the book that Hind likes.'

Here and subsequently we mark gaps by '___' and place resumptive clitics in bold. *ʔallaði* is inflected for number, gender and case, and has the following forms:

	Masculine	Feminine
Singular	*ʔallaði*	*ʔallati*
Dual-NOM	*ʔallaðaani*	*ʔallataani*
Dual-ACC/GEN	*ʔallaðayni*	*ʔallatayni*
Plural	*ʔallaðiina*	*ʔallaati-allawaati*

Table 1: Forms of *ʔallaði*

This makes it look like a pronoun. However, as we will see shortly, there is evidence that it is not a pronoun but a complementizer.

With an indefinite antecedent *ʔallaði* does not appear. We just have a 'bare' clause with either a gap or resumptive clitic, as in (2).

(2) a. jaaʔa walad-un [qaabala ___ l-malik-a]
came.3.M.SG boy-NOM met.3.M.SG DEF-king-ACC
'A boy who met the king came,'

b. wajadtu kitab-an [tuħib-**hu** Hind-un]
found.1.SG book-ACC like.3.F.SG-3.M.SG Hind-NOM
'I found a book that Hind likes'

Both definite and indefinite relatives are normally verb-initial, but subject-initial clauses sometimes occur.

Obviously, we must look more closely at the nature of *ʔallaði*. It agrees with the antecedent in number and gender. It also agrees with the gap or resumptive clitic since they agree with the antecedent. The following illustrate:

(3) a. jaaʔa l-walad-u [llaði qaabala ___
came.3.M.SG DEF-boy-NOM that.M.SG met.3.M.SG
l-malik-a]
the-king-ACC
'The boy who met the king came,'

b. wajadtu l-kitab-a [llaði tuħib-**hu**]
found.1.SG DEF-book-ACC that.M.SG like.1.SG-3.M.SG.
'I found the book that I like'

In (3a), *llaði* is masculine singular in agreement with the antecedent *l-walad-u*, and the gap in subject position is also masculine singular, as shown by the associated verb. In (3b), *llaði* is masculine singular in agreement with *l-kitab-a*, and the clitic *hu* is also masculine singular. The situation with case is different. The case of the antecedent and relativized position are not necessarily the same. Where they differ, *ʔallaði* has the case of the antecedent and not that of the relativized position. Consider the following:

(4) a. raʔaytu l-waladayni [llaðayni
saw.1.SG DEF-boy.DUAL.ACC that.M.DUAL.ACC
qaabala-**humaa** l-malik-u]
met.3.M.SG-3.DUAL DEF-king-NOM
'I saw the two boys whom the king met.'

b. jaaʔa l-waladaani [llaðaani
came.3.M.DUAL DEF-boy.DUAL.NOM that.M.DUAL.NOM
qaabala-**humaa** l-malik-u]
met.3.M.SG-3.DUAL DEF-king-NOM
'The two boys whom the king met came.'

In (4a) the antecedent is accusative and the relativized position is also accusative. In (4b), the relativized position is again accusative, but the antecedent is nominative, and *ʔallaði* agrees with it. This suggests that *ʔallaði* is not a relative pronoun but a complementizer.[2]

Further evidence for this conclusion comes from the fact that *ʔallaði* is never part of a larger clause-initial phrase.[3] Thus, for example, (5a) is ungrammatical. Instead we have (5b).

---

2 Aoun, Benmamoun and Choueri (2010) assume that *ʔallaði* is a complementizer, but they provide no arguments for this position.

3 Sag (1997) assumes that English relative *that* is a pronoun although it is never part of a larger phrase. He assumes that it cannot be part of a larger phrase because it is nominative. There is no possibility of taking a similar approach to *ʔallaði* since it is not necessarily nominative.

(5) a. *l-wallad-u [[$_{PP}$ maʕ llaði] takallamta ___]
DEF-boy-NOM with that talked.2.M.SG
'the boy with whom you talked'
b. l-wallad-u [llaði takallamta maʕ-**hu**]
DEF-boy-NOM that talked.2.M.SG with-3.M.SG
'The boy that you talked with'

Similarly, (6a) is ungrammatical, and instead we have (6b).

(6) a. *ʔaʕrifu r-rajul-a [[$_{NP}$ ʔom llaði] ___
know.1.M.SG DEF-man-ACC mother that.M.SG
maatat]]
died.3.F.SG
'I know the man whose mother died.'
b. ʔaʕrifu r-rajul-a [llaði maatat
know.1.M.SG DEF-man-ACC that.M.SG died.3.F.SG
ʔom-**hu**]
mother-3.M.SG.
'I know the man whose mother died.'

Thus, *ʔallaði* is quite different from an interrogative pronoun, which can be part of a complex clause-initial phrase, as the following show:

(7) [$_{PP}$ maʕa man] takallamta ___
with who talked.2.M.SG
'With whom did you talk?'
(8) [$_{NP}$ ʔom man] ___ maatat
mother who died.3.F.SG
'Whose mother died?'

It is fairly clear, then, that *ʔallaði* is not a pronoun but a special inflected complementizer. Its main use is in relative clauses. It also appears in free relatives such as the bracketed examples in (9).

(9) a. jaaʔa [*llaði* ___ faaza fi
came.3.M.SG that.M.SG won.3.M.SG in
l-musabaqat-i]
DEF-competition-GEN
'The one that won the competition came.'
b. raʔaytu [llati ʔuħib-**haa**]
saw.1.SG that.F.SG like.1.SG-3.F.SG
'I saw the one (female) that I like.'

We assume that such free relatives are NPs consisting solely of a relative clause. (See Alqurashi 2012.) We also find *ʔallaði* in certain *wh*-questions, such as (10).

(10) a. man llati aʕTa-**ha** Ahmad kitab-an
who that.F.SG gave.3.M.SG-3.F.SG Ahmad book-ACC
'Who did Ahmad give a book to?
b. man llaði takalamta mʕa-**hu**
who that.M.SG talked.2.M.SG with-3.M.SG
'Whom did you talk to?'

We think that these may be headless clauses consisting of a *wh*-expression and a relative clause. Thus, it may well be that *ʔallaði* only appears in relative clauses. It does not appear in complement clauses, which are introduced by either *ʔan* or *ʔanna*, as the following illustrate:[4]

(11) a. ʔiqtarħtu [ʔan yušarika Ahmad-un
suggested.1.SG that participate Ahmad-NOM
fi l-musabaqah]
in DEF-competition
'I suggested that Ahmad participate in the competition.'
b. qultu li-Ahmad [ʔanna Hind-an tuħibu-**h**]
said.1.SG to-Ahmad that Hind-ACC love.3.F.SG-3.M.SG
'I said to Ahmad that Hind loves him.

We conclude that *ʔallaði* is a special complementizer, probably used solely in relative clauses.[5]

A further point that we should note here is that relative clauses are rather like attributive adjectives. The latter also reflect the definiteness of the associated nominal, having the definiteness marker *al-* if the nominal is definite but not if it is indefinite. We have data like the following:

(12) a. wajadtu l-kitab-a l-qadiim-a [llaði
found.1.SG DEF-book-ACC DEF-old- ACC that.M.SG
tuħib-**hu** Salwa]
like.3.F.SG-3.M.SG Salwa
'I found the old book that Salwa likes'

4 *ʔan* introduces a verb-initial clause, while *ʔanna* introduces a subject-initial clause with an accusative subject.

5 The restricted distribution of *ʔallaði* is highlighted by Ouhalla (2004). However, he sees it as evidence that it is not a complementizer but a determiner. We see no reason to adopt such a radical position.

b. wajadtu kitab-an qadiim-an [tuħib-**hu** Salwa]
found.1.SG book-ACC old-ACC like.3.F.SG-3.M.SG Salwa
'I found an old book that Salwa likes'

In both cases they show agreement in number, gender and case. The similarity is unsurprising if both relative clauses and attributive adjectives are adjuncts modifying a nominal constituent.[6]

A final point that we should note before we seek to develop an analysis is that there is evidence from the distribution of gaps and resumptive clitics that they are similar elements. They behave alike with respect to the Coordinate Structure Constraint. Thus, it is possible to have a gap in one conjunct and a resumptive clitic in the other, as the following illustrates:

(13) l-fatatu [llati ʔu_ibu ___ wa ʔa_ras
DEF-girl.NOM that.F.SG love.1.M.SG and care.1.M.SG
ʕalay-**ha**]
about-3.F.SG
'the girl that I love and care about'

Within HPSG, this suggests that both are realizations of SLASH as in Taghvaipour's (2004) analysis of Persian and that there is no need to invoke a separate RESUMP feature as in Vaillette's (2000) analysis of Hebrew relative clauses.

3 Analyses without empty heads

In this section, we will consider the possibility of an analysis of Arabic relative clauses with no empty heads and a system of phrase-types along the lines of Sag's (1997) analysis of English relatives. We will consider a number of analyses and argue that all face some important problems.

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6 They differ in that adjectives precede while relatives follow a complement, as shown by the following:

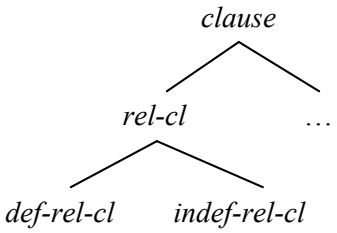
(i) ʔaT-Tariiq-u l-jadiid-u ʔila r-riyadh-i
DEF-road-NOM DEF-new-NOM to DEF-riyadh-GEN
'the new road to Riyadh'

(ii) ʔaT-Tariiq-u ʔila r-riyadh-i llaði yabnuna-hu
DEF-road-NOM to DEF-riyadh-GEN that.M.SG build.3.M.PL-3.M.SG
l-ʔaan
now
'the road to Riyadh that they are building now'

The positioning of relatives is expected if they modify an NP. We will not try to deal with the positioning of adjectives.

An analysis of this kind will need a type *rel-cl* with two subtypes *def-rel-cl* and *indef-rel-cl*. Assuming *rel-cl* is a subtype of *clause*, we will have the following type hierarchy:

(14)



We might propose the following constraint on *rel-cl*:

(15) *rel-cl* ⇒ $\begin{bmatrix} \text{HEAD}[\text{MOD NP}[1]]] \\ \text{SLASH}\{\} \\ \text{HD - DTR}[\text{SLASH}\{\text{NP}[1]\}] \end{bmatrix}$

This essentially combines the constraint on English relative-clauses proposed by Sag (1997: 444) and his constraint on English non-wh-relative-clauses (Sag 1997: 451). It ensures that a relative clause modifies an NP, that it is [SLASH {}], and that its head-daughter has a SLASH value containing an NP coindexed with the value of MOD. The SLASH Amalgamation Principle, which we formulate following Ginzburg and Sag (2000: 199) as (16), will ensure that an argument of the head has the same value.

(16)

$$\textit{word} \Rightarrow / \begin{bmatrix} \text{SLASH}\{[1] \cup \ldots \cup [n]\} \\ \text{ARG - ST} < [\text{SLASH}\{[1]\}], \ldots, [\text{SLASH}\{[n]\}] > \end{bmatrix}$$

This is a default constraint, which will be important later. The coindexing in (15) ensures that the modified NP and the gap or resumptive clitic agree in number and gender.

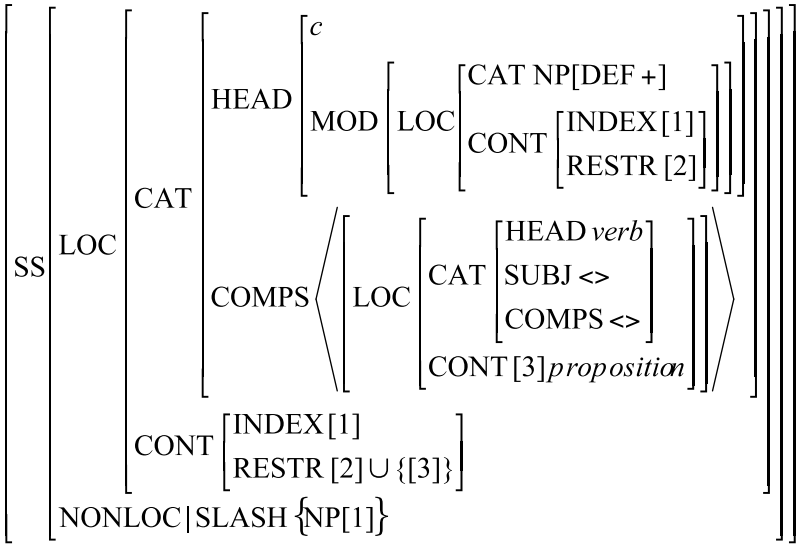
If we assume with Sag (1997) that complementizers are heads, definite relatives will be CPs, and we might propose the following constraints on the two subtypes of relative-clause:

(17) a. *def-rel-cl* ⇒ [SS|LOC|CAT[HEAD *c*]]
b. *indef-rel-cl* ⇒ [SS|LOC|CAT[HEAD *v*]]

These will ensure that definite relatives are headed by a complementizer and indefinite relatives by a verb. Of course, definite relatives cannot be headed by just any complementizer. However, if no other complementizers are [MOD NP], only *ʔallaði* will be possible here.

Obviously we also need appropriate lexical descriptions for forms of *ʔallaði* and verbs. These need to ensure that definite relatives and indefinite relatives modify definite and indefinite NPs, respectively. They also need to ensure that they have the right semantics. We might propose that forms of *ʔallaði* have descriptions of the following form:

(18)



The various different forms will have different values for the NUMBER and GENDER and CASE features of the modified NP.[7] Such descriptions ensure that a relative clause headed by *ʔallaði* modifies a definite NP and that its CONTENT value is a restricted index with restrictions stemming from its complement and the NP it modifies.

What about verbs? It looks as if we need to allow verbs to be [MOD NP[DEF –]] and to have a restricted index as their CONTENT value.

We assume that the combination of NP and relative clause is a head-adjunct-phrase, subject to the following constraint:

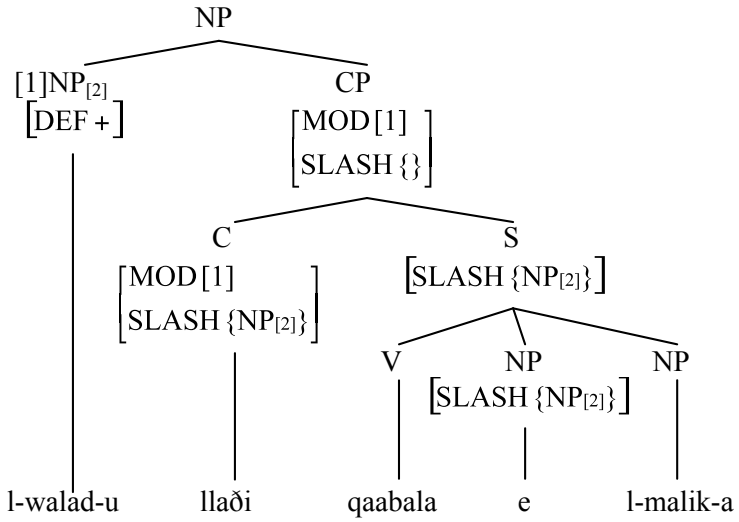
7 Following Kathol (1999), one might bring these features together as the value of an AGR feature. It is not clear to us whether this is necessary.

(19) *hd-adj-ph* ⇒

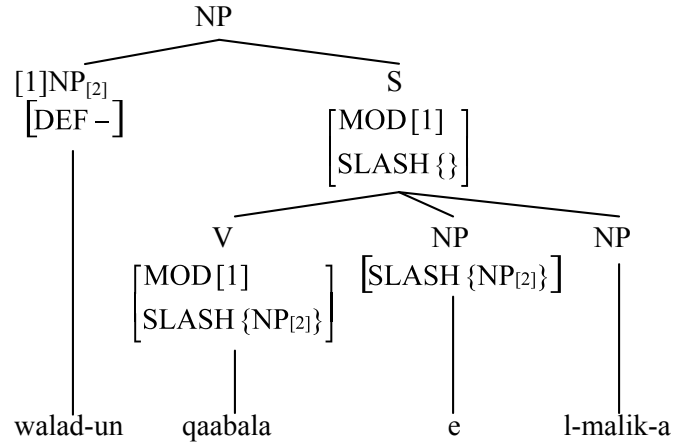
$$\begin{bmatrix} \text{DTRS} < [1][\text{SS}[2]], [\text{SS}\,|\,\text{LOC}\,|\,\text{CAT}\,|\,\text{HEAD}[\text{MOD}[2]]] > \\ \text{HD - DTR}\,[1] \end{bmatrix}$$

This will give the following schematic structures for the complex NPs in (1a) and (2a) (where we assume with Levine and Hukari 2006 that gaps are empty categories):

(20)



(21)



It looks as if the system of phrase types in (14), the constraints in (15) and (17), and appropriate lexical descriptions for forms of *ʔallaði* and finite verbs can handle the data fairly well. However, this analysis has two dubious features. Firstly, it entails that verbs in indefinite relatives are [MOD NP]

unlike verbs elsewhere, which are [MOD *none*]. Since they look just the same as verbs in other contexts, this seems rather dubious. Secondly, it assigns different CONTENT values to verbs in indefinite relatives and verbs in other contexts. As Sag (1997: 474) notes

> There is no independent motivation for assigning a finite verb one kind of semantic content (a restricted index) when it appears as the highest verb in a relative clause and a completely different kind of interpretation (a *proposition* or *qfpsoa*) in all other contexts. Intuitively, finite verbs should have propositional content in all their uses …

Thus, the analysis seems rather unsatisfactory.[8]

Sag (1997) avoids assigning special CONTENT values to verbs in English bare relatives by introducing a special *head-relative-phrase* subtype of *head-adjunct-phrase* subject to the following constraint:[9]

(22)

$$\textit{hd-rel-ph} \Rightarrow \begin{bmatrix} \text{HEAD}\ \textit{noun} \\ \text{CONT} \begin{bmatrix} \text{INDEX}[1] \\ \text{RESTR}[2] \cup \{[3]\} \end{bmatrix} \\ \text{HD-DTR} \begin{bmatrix} \text{INDEX}[1] \\ \text{RESTR}[2] \end{bmatrix} \\ \text{NON-HD-DTRS} \ \langle [\text{CONT}[3]\textit{proposition}] \rangle \end{bmatrix}$$

On this approach the CONTENT value of a relative clause and hence the verb that heads it is a *proposition*. If we adopt this approach, verbs in indefinite relatives will no longer have a special CONTENT value.

What are the implications of this approach for definite relatives? There seem to be two possibilities. Firstly, we might assume that the combination of definite NP and definite relative is not an instance of *head-rel-phrase*. However, this seems counterintuitive. Secondly, we might assume that definite relatives and hence *ʔallaði* have a proposition as their CONTENT value. This approach, however, assigns the same interpretation to *ʔallaði* as other complementizers, and thus makes its restricted distribution rather surprising.

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8 If relative clauses have a restricted index, it will not be possible for them to be a subtype of *clause* if one assumes with Ginzburg and Sag (2000) that the type *clause* has the CONTENT *message*.

9 In Sag (1997) the internal structure of phrases is encoded by the features HD-DTR and NON-HD-DTRS. In more recent work, e.g. Ginzburg and Sag (2000), the latter is replaced by the feature DTRS.

Thus, definite relatives seem problematic for this approach. Notice also that it is still necessary within this approach to assume that verbs in indefinite relatives are [MOD NP] and not [MOD *none*]. Hence, this approach has some important weaknesses.

A rather different analysis is possible if we adopt the Generalized Head Feature Principle (GHFP) of Ginzburg and Sag (2000). In the preceding discussion we have assumed with Sag (1997) that a headed phrase and its head daughter have the same value for HEAD and that the CONTENT value of a headed phrase is the identical to that of the head daughter except in the case of a head-adjunct structure, where it is identical to that of the adjunct. The Generalized Head Feature Principle can be formulated as follows:

(23)

$$\textit{hd-ph} \quad \Rightarrow \quad \begin{bmatrix} \text{SYNSEM } /[1] \\ \text{HD - DTR } [\text{SYNSEM } /[1]] \end{bmatrix}$$

It requires a headed phrase and its head daughter to have the same SYNSEM value by default. As a default principle it can be overridden. Hence, if we adopt this principle, we can assume that the MOD value of an indefinite relative is NP and the CONTENT value of an indefinite relative a restricted INDEX without assuming that verbs have these values. To do this we could replace (17b) by the following much more complex constraint:

(24) *indef-rel-cl* $\Rightarrow$

$$\begin{bmatrix} \text{SS|LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \begin{bmatrix} v \\ \text{MOD} \begin{bmatrix} \text{LOC} \begin{bmatrix} \text{CAT NP[DEF} - \text{]} \\ \text{CONT} \begin{bmatrix} \text{INDEX}[1] \\ \text{RESTR}[2] \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{INDEX}[1] \\ \text{RESTR}[2] \cup \{[3]\} \end{bmatrix} \end{bmatrix} \\ \text{HD - DTR } [\text{CONT}[3] \textit{proposition}] \end{bmatrix}$$

This ensures that indefinite relatives have a restricted INDEX as their CONTENT value and have a head daughter whose CONTENT value is a proposition. The GHFP will ensure that the head is a verb. The constraint also ensures that indefinite relatives modify an indefinite NP. Hence there is no need to associate this information with the verbs that head indefinite relatives and they can be [MOD *none*] like verbs elsewhere.

We need of course to ask about the implications of this approach for definite relatives. One possibility would be to retain the approach outlined

above, that is to have a very simple constraint on definite relatives and to attribute their main properties to the complementizer *ʔallaði*. This, however, would mean that we have radically different analyses for definite and indefinite relatives. An alternative would be to assume that *ʔallaði* like verbs denotes a proposition and is [MOD *none*]. We might propose descriptions of the following form:

(25)

$$\left[\begin{array}{l}\text{SS}\left[\begin{array}{l}\text{LOC}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HEAD}\left[\begin{array}{l}c\\ \text{MOD } none\end{array}\right]\\ \text{COMPS}\left\langle\left[\text{LOC}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HEAD } verb\\ \text{SUBJ } \langle\rangle\\ \text{COMPS } \langle\rangle\end{array}\right]\\ \text{CONT } [3]proposition\end{array}\right]\right]\right\rangle\end{array}\right]\\ \text{CONT } [3]\end{array}\right]\\ \text{NONLOCAL}\,|\,\text{SLASH}\,\{\text{NP}[1]\}\end{array}\right]\end{array}\right]$$

We could then attribute the properties of relative clauses to a more complex constraint on relative clauses:

(26) *rel-cl* ⇒

$$\left[\begin{array}{l}\text{SS}\left[\begin{array}{l}\text{LOC}\left[\begin{array}{l}\text{CAT}\left[\text{HEAD}\left[\text{MOD}\left[\text{LOC}\left[\begin{array}{l}\text{CAT NP}\\ \text{CONT}\left[\begin{array}{l}\text{INDEX}\,[1]\\ \text{RESTR}\,[2]\end{array}\right]\end{array}\right]\right]\right]\right]\\ \text{CONT}\left[\begin{array}{l}\text{INDEX}\,[1]\\ \text{RESTR}\,[2]\cup\{[3]\}\end{array}\right]\end{array}\right]\\ \text{SLASH}\,\{\}\end{array}\right]\\ \text{HD - DTR}\left[\begin{array}{l}\text{HEAD}\,[\text{MOD } none]\\ \text{SLASH}\,\{\text{NP}[1]\}\\ \text{CONT}\,[3]proposition\end{array}\right]\end{array}\right]$$

We could propose the following constraints on the two subtypes of relative-clause:

(27) a. *def-rel-cl* ⇒

$$\left[\text{SS}\,|\,\text{LOC}\left[\text{CAT}\left[\text{HEAD}\left[\begin{matrix}c\\ \text{MOD}\,|\,\text{LOC}\,|\,\text{CAT NP[DEF +]}\end{matrix}\right]\right]\right]\right]$$

b. *indef-rel-cl* ⇒

$$\left[\text{SS}\,|\,\text{LOC}\left[\text{CAT}\left[\text{HEAD}\left[\begin{matrix}c\\ \text{MOD}\,|\,\text{LOC}\,|\,\text{CAT NP[DEF −]}\end{matrix}\right]\right]\right]\right]$$

The problem with this approach is that there is nothing here to ensure that definite relatives are headed by *ʔallaði* and not other complementizers such as *ʔan* or *ʔanna*.

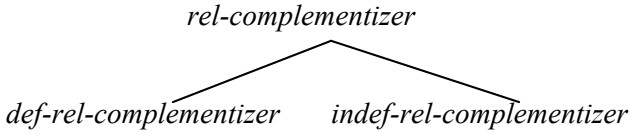
It looks, then, as if there are two main possibilities if we want to analyse Arabic relative clauses without invoking empty heads. One possibility is to treat definite and indefinite relatives in quite different ways. This seems unsatisfactory given that apart from the fact that one has an overt complementizer and the other doesn't, they are quite similar. The other possibility is to assimilate verbs to *ʔallaði* or *ʔallaði* to verbs. The problem with the former approach is that it makes it quite surprising that verbs in relative clauses look just like verbs elsewhere. The problem with the latter is that it makes the restricted distribution of *ʔallaði* surprising.

4 An analysis with an empty head

We have seen that various problems arise for analyses of Arabic relatives like Sag's (1997) analysis of English relatives, which avoid empty heads and employ a complex system of phrase types. It looks, then, as if we should consider an analysis more like Pollard and Sag's (1994: Chapter 5) analysis of English relatives, one, that is, in which indefinite relatives are headed by a phonologically empty counterpart of *ʔallaði*. We will argue that this is more satisfactory than the approach we have just considered.

ʔallaði and its phonologically empty counterpart will of course have many properties in common, but this is no problem since we can treat them as two subtypes of a single type as follows:

(28)



The properties that the two complementizers share can be associated with the type *rel-complementizer* and the properties which are limited to *ʔallaði* or its phonologically empty counterpart can be associated with the two subtypes.

The type *rel-complementizer* will have the following description:

(29)

$$\begin{bmatrix} \textit{rel - complementizer} \\ \text{SS}\left[\text{LOC}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HEAD}\left[\begin{array}{l}c\\ \text{MOD}\left[\text{LOC}\left[\begin{array}{l}\text{CAT NP}\\ \text{CONT}\left[\begin{array}{l}\text{INDEX}[1]\\ \text{RESTR}[2]\end{array}\right]\end{array}\right]\right]\end{array}\right]\\ \text{COMPS}\left\langle\left[\text{LOC}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HEAD}\ \textit{verb}\\ \text{SUBJ}\ \langle\rangle\\ \text{COMPS}\ \langle\rangle\end{array}\right]\\ \text{CONT}[3]\textit{proposition}\end{array}\right]\right]\right\rangle\end{array}\right]\\ \text{CONT}\left[\begin{array}{l}\text{INDEX}[1]\\ \text{RESTR}[2]\cup\{[3]\}\end{array}\right]\end{array}\right]\\ \text{NONLOC}\,|\,\text{SLASH}\,\{\text{NP}[1]\}\end{array}\right]\end{bmatrix}$$

This is essentially the description that we originally proposed for *ʔallaði* minus the stipulation that the modified NP is [DEF +]. It will ensure that relative clauses modify an NP and contain a gap or a resumptive clitic with the same index, thus ensuring that the NP and the gap or resumptive clitic agree in number and gender. It will also ensure that the CONTENT value of a relative clause is a restricted index, with the restrictions stemming from its complement and the NP it modifies. Among other things, this means that there is no need for the special *head-relative-phrase* type.

The two subtypes will have the following descriptions:

(30) a.

$$\begin{bmatrix}\textit{def - rel - complementizer}\\ \text{SS}\,|\,\text{LOCAL}\,|\,\text{CAT}\,|\,\text{HEAD}\,|\,\text{MOD}\,[\text{DEF+}]\end{bmatrix}$$

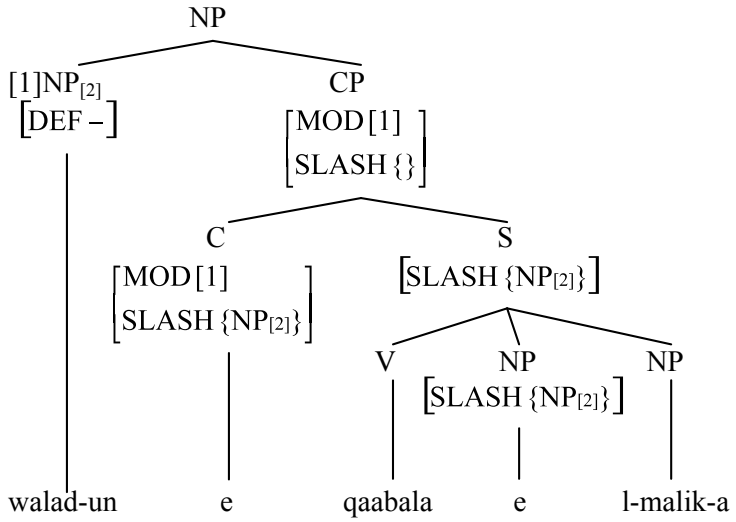
b.

$$\begin{bmatrix} \textit{indef - rel - complementizer} \\ \text{PHON} <> \\ \text{SS|LOCAL|CAT|HEAD|MOD[DEF} - \text{]} \end{bmatrix}$$

def-rel-complementizer will have various different forms depending on the value of the features NUMBER, GENDER and CASE in the modified NP. *indef-rel-complementizer* is phonologically empty.

With these descriptions, definite relatives will have the structure in (20), and indefinite relatives will have a similar structure, as in (31).

(31)



Thus, definite and indefinite relatives have essentially the same structure and differ only in the phonology of their heads. In this analysis, verbs in indefinite relatives have the same category and content as elsewhere, and *ʔallaði* has a description which makes it unsurprising that it is restricted to relative clauses. The analysis also entails a simpler system of phrase types. Not only does it not need the *head-relative-phrase* type, there is also no need for the types of *def-rel-cl* and *indef-rel-cl*. The distinctive properties of the two types of relative clause stem from the properties of their heads.

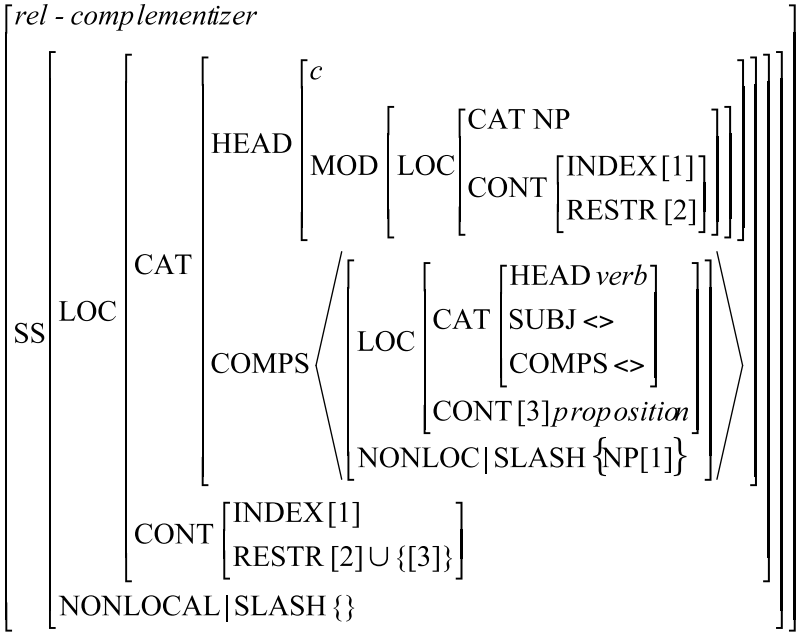
What about the type *rel-cl*? It is fairly easy to dispense with this type as well. The constraint in (15) ensures that a relative clause modifies an NP with the same index as the NP value of SLASH, but this is also ensured by (29). The only nonredundant feature of (15) is the stipulation that relative clauses are [SLASH {}]. There is an obvious alternative way to ensure this. In most head complement structures, if the complement has a non-empty SLASH value, the SLASH Amalgamation Principle requires the head to have the same value. However, there are situations in which the head should not have

this value. For example, in (32) the infinitival complement of *easy* is [SLASH {NP}] but *easy* must be [SLASH {}].

(32) Kim is easy to impress.

If the SLASH Amalgamation Principle is a default constraint, this can be ensured by a stipulating that *easy* takes a complement which is [SLASH {NP}] but is itself [SLASH {}]. We can take the same approach here. That is, we can replace (29) by (33).

(33)



With this revision there is no need for a type *rel-cl* subject to some constraint. Relative clauses are just head-complement structures, whose properties stem from the lexical items that head them, in the case of indefinite relatives a phonologically empty one.

Essentially this analysis makes relative clauses rather like attributive adjectives, which, as we noted in Section 2, they resemble in being sensitive to the definiteness of the modified NP. No special types are required for attributive adjectives. Similarly no special types are required for relative clauses.

On this analysis, relative clauses are not a subtype of *clause*. This might seem like a problematic conclusion. However, we do not think that it is. It does not follow from the fact that relative clauses are called clauses that they are a subtype of *clause*. It is traditional to refer to the bracketed expressions in the following as adverbial clauses:

(34) a. Kim left [before Lee arrived].
b. Lee arrived [after Kim left].

However, it is widely accepted that such expressions are in fact PPs. (See e.g. Huddleston and Pullum (2002: 599–601).) On this view they are not a subtype of *clause*.

It seems, then, that there are good reasons for preferring an analysis of Arabic relatives with a phonologically empty head and no special phrase types to an analysis with no phonologically empty heads and a complex system of phrase types. Thus, whatever may be the case with other languages, with Arabic it looks as though the kind of approach developed in Pollard and Sag (1994) is preferable to the approach developed in Sag (1997).

5 Conclusions

Relative clauses have a basically clausal internal structure but are modifiers of nominal constituents rather like adjectives. Pollard and Sag (1994: Chapter 5) employ a set of phonologically empty heads to capture this dual nature. The heads take a clausal complement and head a phrase which is a nominal modifier. Sag (1997) rejects this approach and develops a complex system of phrase types, in which the dual nature of relatives is mainly the product of a special *head-rel-phrase* type.

In the case of Arabic definite relatives it seems natural to attribute the dual nature to the complementizer *ʔallaði* given that it seems to be confined to relative clauses. But then a problem arises with indefinite clauses. If they are analyzed in much the same way as Sag analyzes English bare relatives, then either definite and indefinite relatives have quite different analyses or the natural analysis of *ʔallaði* must be abandoned, in which case its restricted distribution is quite suprising.

We have argued that the best account of the Arabic data involves the assumption that indefinite relatives are headed by a phonologically empty counterpart of *ʔallaði*. On this analysis, definite and indefinite relatives have essentially the same analysis. Both are head-complement structures, whose properties stem from their head. The properties of definite relatives stem from *ʔallaði* and it is unsurprising that it is confined to relative clauses. Verbs have the same category and content in indefinite relatives as elsewhere. The analysis also has no need for special phrase types, no *rel-cl*, *def-rel-cl* and *indef-rel-cl* and no *head-rel-ph*. At least in the case of Arabic, then, the approach to relative clauses developed in Pollard and Sag (1994) seems preferable to that developed in Sag (1997).

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An analysis of Danish free relatives

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Abstract

This paper presents an analysis of Danish free relative constructions. Following Bresnan and Grimshaw (1978) we will adopt a *wh*-head (in Danish *hv*-head) analysis where the *hv*-phrase is the head of an NP. Also following Bresnan and Grimshaw (1978) we will propose an analysis which does not involve a filler-gap dependency between the *hv*-phrase and the gap in the sister clause. Instead we will propose that the gap in the sister clause is bound off by a constructional constraint. In this way the analysis will be shown to differ from previous HPSG *wh*-head analyses of free relatives.

1 Introduction

In this paper we present an analysis of Danish free relative constructions. Bresnan and Grimshaw (1978) put forward an analysis of English free relatives which proposes that English free relative clauses are not clauses, but rather the *wh*-phrase is base-generated as the head sister of a clause in an NP. Importantly they do not assume a filler-gap dependency between the *wh*-phrase and the gap in the sister clause. Instead the rule of "Controlled Pro Deletion" accounts for the gap.

The *wh*-head analysis has been adopted into various HPSG analyses of free relatives, cf. e.g. Kim (2001), Wright and Kathol (2003), Kubota (2003), Taghvaipour (2005) and Borsley (2008). In contrast to the analysis in Bresnan and Grimshaw (1978), these analyses account for the gap in free relatives by assuming a filler-gap dependency between the *wh*-phrase and the gap in the sister clause.

In this paper we argue for an HPSG analysis of Danish free relatives which sets itself apart from the previous HPSG *wh*-head analyses in that the *wh*-phrase, or *hv*-phrase, does not bind off the gap in the sister clause, and hence there is no filler-gap dependency relation between the *hv*-phrase and the gap in the sister clause. In this respect our analysis resembles that of Bresnan and Grimshaw (1978). We base our analysis on the distribution of the expletive *der*, 'there', and the complementizer *som* in Danish free relatives.

2 Free relatives vs. interrogatives

The example in (1), taken from Müller (1999, p. 83) who in turn has taken them from Eisenberg (1986), illustrates the difference between a free relative and an interrogative.

(1) Ulla weiß, was Egon vermutet.
Ulla knows what Egon suspects

[†]I thank participants at the Third International Workshop on Germanic Languages held in Berlin March 2012 and the reviewers and audience at the 19^{th} HPSG conference in Daejeon for their valuable comments and discussions. Special thanks to Stefan Müller for his detailed comments and discussion of the paper.

The example has two readings. On one reading, Egon suspects that a certain team won the soccer match, but Ulla knows which team won. On the second reading, Egon suspects that a certain team won the soccer match, and Ulla knows which team Egon suspects won.

Syntactically, we can also distinguish free relatives from interrogatives. In (2a) the free relative is shown not to allow clefting, whereas the interrogative in (2b) does allow clefting.

(2) a. * During the week he eats what it is that they serve at daycare for breakfast and lunch.

b. I stepped to the door, and inquired what it was that they wanted.

Another difference is shown in (3). The non-specific pronouns do not appear in interrogatives, only in free relatives, cf. also Bresnan and Grimshaw (1978, p. 334).

(3) a. During the week he eats whatever they serve at daycare for breakfast and lunch.

b. * I stepped to the door, and inquired whatever they wanted.

Also, free relatives do not allow extraposition from *it* as shown in (4b), whereas extraposition is allowed with interrogatives as in (4d), cf. also Kim (2001, p. 38).

(4) a. Hvad der er tilbage er blevet dårligt.
what there is left is become bad
'What is left has gone bad.'

b. * Det er blevet dårligt hvad der er tilbage.
it is become bad what there is left

c. Hvem der har opfundet brillerne er tvivlsomt.
who there has invented glasses.DEF is debatable
'Who invented the glasses is debatable.'

d. Det er tvivlsomt, hvem der har opfundet brillerne.
it is debatable who there has invented glasses.DEF
'It is debatable who invented the glasses.'

And finally, in (5a) the verb *owned*, which requires an NP subject, can occur with a free relative subject and in (5b) the verb *ate*, which requires an NP object, can occur with a free relative object, cf. also Bresnan and Grimshaw (1978, p. 335) and Kim (2001, p. 37). On the other hand, the verbs do not take interrogative complements as shown in (5c) and (5d).

(5) a. Whoever said diamonds are a girl's best friend never owned a horse.

b. They ate what they could find and afford.

c. * Whose friend said diamonds are a girl's best friend never owned a horse.

d. * They ate whose food they could find and afford.

These distributional properties suggest that free relatives are NPs from an external point of view, rather than clauses.

3 The Danish data

The examples in (6) are free relatives where the referent of the free relative pronoun is the same as the "missing" subject of the verb in the sister clause.[1]

(6) a. Hvem, der synder og kommer i Ilden, vil ikke blive i den
who there sins and comes in fire.DEF will not stay in it
for evighed.
for eternity
'Who sins and go to Purgatory will not stay there forever.'

b. I 1-2 års alderen spiser barnet hvad der serveres.
in 1-2 years age.DEF eats child.DEF what there serve.PRES.PAS
'At the age of 1-2 the child eats what is served.'

In (7) the referent of the free relative pronoun is the same as the "missing" object of the verb in the sister clause.

(7) a. Ministeren forsømmer ingen lejlighed til at udpege, hvem
minister.DEF neglects no opportunity to to point out whom
han taler om.
he talks about
'The minister does not neglect any opportunity to point out whom he is talking about.'

b. Hun spiser hvad hun får serveret.
she eats what she gets served
'She eats what she is being served.'

In (8) the referent of the non-specific free relative pronoun is again the same as the "missing" subject of the verb in the sister clause.

(8) a. Vi er altid parat til at gå i dialog med hvem som helst
we are always ready to to enter into dialog with whomever
der accepterer de demokratiske spilleregler.
there accepts the democratic rules
'We are always ready to enter into a dialogue with anybody who accepts the rules of democracy.'

[1] All examples are authentic examples from the Web.

b. I modsætning til mange andre spirituosa kan vodka
in contrast to many other spirits can vodka
produceres af hvad som helst der kan
produce.PRES.PASS of whatever there can
forgæres.
ferment.PRES.PASS
'In contrast to many other spirits vodka can be produced from anything that can be fermented.'

And finally, in (9) the referent of the non-specific free relative pronoun is the same as the "missing" object of the verb in the sister clause.

(9) a. Han faldt i snak med hvem som helst, han mødte.
he fell into talk with whomever he met
'He started to talk to anybody he met.'

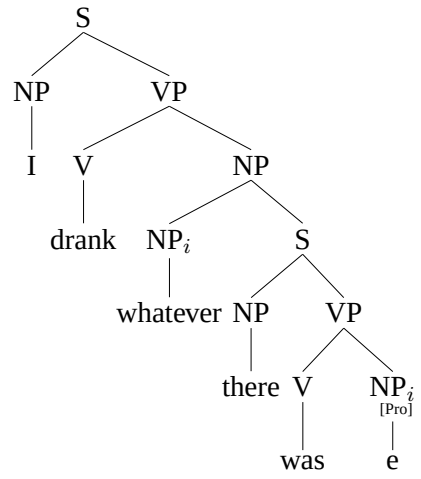
b. Han spiser hvad som helst han kan finde på vejen.
he eats whatever he can find on road.DEF
'He eats whatever he can find on the road.'

A property of the Danish examples is that when the referent is the same as the "missing" subject, the subject expletive *der*, 'there', is inserted in subject position in the sister clause. In Section 6 we will further investigate the distribution of the expletive subject in free relatives as well as the distribution of the Danish complementizer *som*.

4 Free relatives as *wh*-headed NPs

The accounts mentioned in Section 1 agree that free relatives behave as NPs externally. Bresnan and Grimshaw (1978) put forward further arguments that not only is a free relative an NP externally, but internally the *wh*-phrase is the head of the NP. The structure they assume is shown in (10).

(10)



Importantly, the *wh*-prase is assumed to be the head of the NP and the relation between the *wh*-phrase and the gap in the sister clause is not a filler-gap dependency relation where the *wh*-phrase has been "extracted" from the sister clause. The *wh*-phrase and the gap in the sister clause are co-indexed by the process of Pro-deletion, cf. Bresnan and Grimshaw (1978, p. 370).

Bresnan and Grimshaw (1978) argue that a *wh*-head analysis explains the behaviour of English free relatives wrt. e.g. the matching effect, number agreement, the internal NP over S constraint, the independent generation of *wh*-ever phrases and PP pied piping. It should be noted, however, that the disallowance of PP Pied Piping in free relatives has been shown not to apply to all languages, cf. e.g. Müller (1999, p. 57) who also lists examples from Bausewein (1990).

The examples in (11) from Bresnan and Grimshaw (1978, p. 335) show the property that the category of the *wh*-phrase is the same as the category of the complement, e.g. *buy* requires an NP complement and *whatever* is an NP. The *wh*-head analysis predicts this matching effect.

(11) a. I'll buy $[_{NP}[_{NP}$ whatever] you want to sell]
b. John will be $[_{AP}[_{AP}$ however tall] his father was]
c. I'll word my letter $[_{AdvP}[_{AdvP}$ however] you word yours]

Also from Bresnan and Grimshaw (1978, pp. 339-339), the examples in (12) show that there is number agreement between the *wh*-phrase (or the phrase containing the *wh*-pronoun) and the verb. Number agreement is not found in interrogative clauses.

(12) a. The books she has $\left\{\begin{matrix}\text{are}\\ \text{*is}\end{matrix}\right\}$ marked up with her notes.
b. What books she has $\left\{\begin{matrix}\text{isn't}\\ \text{*arent't}\end{matrix}\right\}$ certain.
c. Whatever books she has $\left\{\begin{matrix}\text{*is}\\ \text{are}\end{matrix}\right\}$ marked up with her notes.

(13) illustrates the Internal NP Over S Constraint, again from Bresnan and Grimshaw (1978, p. 339). On the assumption that free relatives are NPs, (13c) is good because its structure of the internal, or non-peripheral, NP is $[_{NP}$ head $\overline{S}]$ rather than $[_{NP}\ \overline{S}]$[2], i.e. NP over S, as is the structure of the questionable interrogative in (13b).

(13) a. Can $[_{NP}$ the books $[_{\overline{S}}$ Mary bought]] be on the table?
b. ? Can $[_{NP}\ [_{\overline{S}}$whether you are right or not]] matter?
c. Can $[_{NP}$ what $[_{\overline{S}}$ you want] be on the table?

[2]Bresnan and Grimshaw (1978, p. 333) assume NP may expand into $\overline{S}$ to account for interrogative clauses in NP positions.

(14) shows that non-specific *wh*-phrases can occur alone without a dependent sister clause, cf. Bresnan and Grimshaw (1978, pp. 339-340).

(14) a. She wrote whenever possible.
b. She'll go wherever possible.
c. She vowed to do whatever possible to vindicate herself.

The examples support the base-generation of the *wh*-pronoun, as there is no sister clause from where it can have been extacted.

Finally, the examples in (15) show that free relatives do no allow PP pied piping. (17b) is ill-formed because on the assumption that the *wh*-phrase is the head of the free relative, a category mismatch occurs because the verb *reread* requires an NP, not a PP, cf. Bresnan and Grimshaw (1978, p. 342).

(15) a. I'll read the paper which John is working on.
b. I'll read the paper on which John is working.

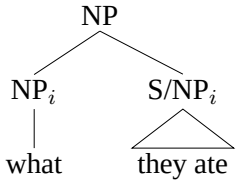
(16) a. I'll like to know which paper John is working on.
b. I'll like to know on which paper John is working.

(17) a. I'll reread whatever paper John has worked on.
b. * I'll reread on whatever paper John has worked.

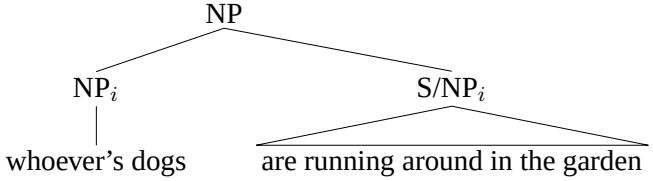
5 Previous HPSG *wh*-head analyses of free relatives

Kim (2001), Wright and Kathol (2003), Kubota (2003), Taghvaipour (2005) and Borsley (2008) all adopt the *wh*-head analysis. (18) through (22) show that these accounts all assume that there is a filler-gap dependency between the *wh*-phrase and a gap in the sister clause.

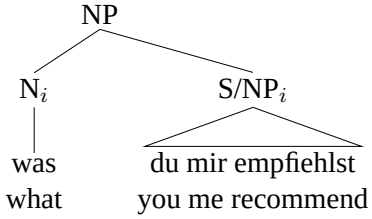
(18) Kim (2001)



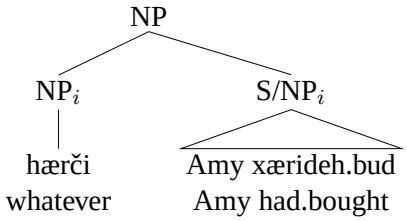
(19) Wright and Kathol (2003)



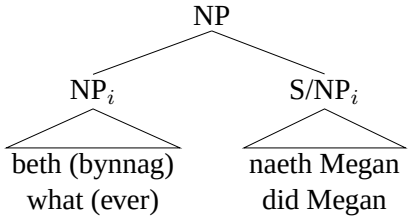
(20) Kubota (2003)



(21) Taghvaipour (2005)



(22) Borsley (2008)



The analyses differ in other respects, assuming e.g. different syntactic functions for the constituents involved. Kim (2001) assumes the clause to be a modifier whereas Kubota (2003) assumes it to be a complement. They also differ wrt. how the gap is bound off. In Kubota (2003) the gap is lexically bound off by the *wh*-phrase, whereas in the other accounts the gap is bound off by a head-filler phrase. Wright and Kathol (2003) introduces an F-REL feature which projects the content of the free relative pronoun to the NP containing it also in cases where the free relative pronoun is not the head of the extracted NP. In Section 6 we will show Danish data which cannot be captured by these analyses, justifying yet another structural account of free relatives.

6 The distribution of *der* and *som* in Danish relative head-filler constructions

We will now show that the distribution of *der*, 'there', and the complementizer *som* in free relatives is different from their distribution in bound *hv*-relative clauses where the *hv*-phrase binds off the gap.

When the *hv*-phrase and the missing subject in the sister clause corefer, *der* is obligatory in the free relative, (23), whereas the insertion of *der* in the bound relative clause reduces its acceptability, as shown in (24) and (25).

(23) a. Vi skal tale om, hvad Bibelen siger om hvem *der* synder.
we shall talk about what Bible.DEF says about who there sins
'We will be talking about what the Bible says about who sins.'

b. * Vi skal tale om, hvad Bibelen siger om hvem synder.
we shall talk about what Bible.DEF says about who sins

(24) a. Jeg har en veninde hvis barn hedder Kastanje.
I have a girl-friend whose child is called Chestnut
'I have a girl-friend whose child is called Chestnut.'

b. ? Jeg har en veninde hvis barn *der* hedder Kastanje.
I have a girl-friend whose child there is called Chestnut
'I have a girl-friend whose child is called Chestnut.'

(25) a. Det er nødvendigt at redegøre for de egenskaber, hvilke danner
it is necessary to account for the features which form
baggrund for den biologiske opbygning
background for the biological makeup
'It is necessary to account for the features which are the basis of the biological makeup.'

b. ? Det er nødvendigt at redegøre for de egenskaber, hvilke *der*
it is necessary to account for the features which there
danner baggrund for den biologiske opbygning
form background for the biological makeup
'It is necessary to account for the features which are the basis of the biological makeup.'

It is possible to use the complementizer *som* instead of the expletive. Again *som* is obligatory in the free relative, (26), whereas the insertion of *som* in the bound relative clause in this case makes it unacceptable, as shown in (27) and (28).

(26) a. Malenes styrke er hendes evne til at skabe gode og trygge
Malene's strenght is her ability to to create good and safe
rammer for hvem, som er gæst i huset.
frames for whom Comp is guest in house.DEF
'Malene's strenght is her ability to create a good and safe environment for whom is a guest in the house.'

b. * Malenes styrke er hendes evne til at skabe gode og trygge
Malene's strenght is her ability to to create good and safe
rammer for hvem er gæst i huset.
frames for whom is guest in house.DEF

(27) a. Jeg er respekteret af de sangere og musikere, hvis respekt
I am respected by the singers and musicians whose respect
betyder noget for mig.
means something for me
'I am respected by the singers and musicians whose respect matters to me.'

b. * Jeg er respekteret af de sangere og musikere, hvis respekt
I am respected by the singers and musicians whose respect
som betyder noget for mig.
Comp means something for me

(28) a. Hotellet tilbyder nem adgang til og fra Amsterdam Schiphol
hotel.DEF offers easy access to and from Amsterdam Schiphol
lufthavn, hvilken ligger omkring 15 km væk.
airport which lies about 15 km away
'The hotel offers easy access to and from Amsterdam Schipol airport which is situated about 15 km away.'

b. * Hotellet tilbyder nem adgang til og fra Amsterdam Schiphol
hotel.DEF offers easy access to and from Amsterdam Schiphol
lufthavn, hvilken *som* ligger omkring 15 km væk.
airport which Comp lies about 15 km away

This distribution of *der* and *som* in Danish free relatives corresponds to their distribution in an entire relative construction with a nominal head and a bound non-*hv*-relative clause, as shown in (29) and (30).

(29) a. Jeg går videre til den bog, *der* var grunden til, at jeg satte
I go further to the book there was reason.DEF to that I sat
mig til tasterne.
myself to keys.DEF
'I'll continue with the book that was the reason I began writing.'

b. * Jeg går videre til den bog var grunden til, at jeg satte
I go further to the book was reason.DEF to that I sat
mig til tasterne.
myself to keys.DEF

(30) a. Vælg den bog *som* falder mest i din smag!
choose the book Comp falls most in your taste
'Choose the book that you like the best!'

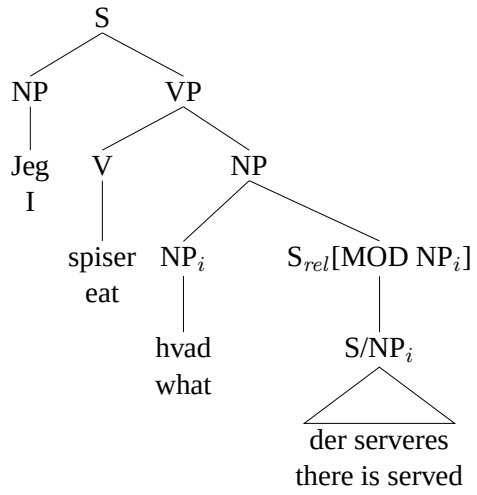
b. * Vælg den bog falder mest i din smag!
choose the book falls most in your taste

As can be seen, *der* or *som* insertion occur in non-*hv*-relative clauses in Danish as in the sister clauses of free relative pronouns, suggesting that free relative constructions contain relative clauses modifying the free relative pronoun head.

7 The proposed analysis for Danish free relatives

The data in Section 6 suggests that the structure of Danish free relatives does not involve a gapped clause and a free *hv*-phrase binding off the gap, as the structures presented in Section 5 propose. Instead we propose that the gap in the sister clause in a free relative is bound off before forming a constituent with the free relative pronoun, and hence the *hv*-phrase does not function as a filler-phrase. The *hv*-phrase is the head of an NP and the sister clause is a relative clause. (31) shows the structure for the free relative *hvad der serveres*, 'what is served'.

(31)

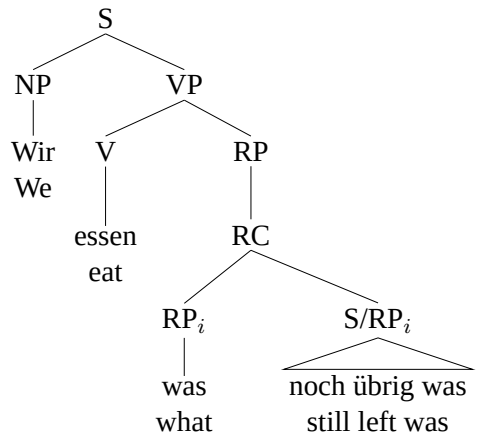


We leave it for further research to explain why the relative clauses in specific free relative constructions are obligatory.

8 An alternative analysis

At this point we need to mention an alternative non-*wh*-head analysis proposed by Müller (1999). He assumes the structure in (32) for German free relatives.

(32)



Müller (1999) discusses the behaviour of German free relatives versus ordinary relatives wrt. extraposition. He gives the examples in (33) taken from Gross and van Riemsdijk (1981, p. 185).

(33) a. Der Hans hat das Geld zurückgegeben, das er gestohlen hat.
the Hans has the money returned that he stolen has
'Hans has returned the money that he has stolen.'

b. * Der Hans hat zurückgegeben das Geld, das er gestohlen hat.

c. Der Hans hat zurückgegeben, was er gestohlen hat.

The argument is that only clauses, not NPs, may appear in the extraposed position in the examples, suggesting that the free relative is a clause at some point in the derivation, as in the structure in (32).

(34) shows that we do find exceptions to the constraint on NP extraposition in Danish with somewhat decreased acceptability, though. The NPs in the examples are extraposed from the position between the verb and the particle. Thus the constraint on NP extraposition is not a clear-cut argument against the *hv*-head analysis for Danish, as we need to allow extraposed NPs, be they ordinary NPs or free relative constructions.

(34) a. En excentrisk milliardær har gemt væk sine penge.
an eccentric billionaire has hidden away his money
'An excentric billionaire has hidden his money.'

b. Vi vil samle op de trafikplaner der allerede er udarbejdet.
we will pick up the traffic plans there already are drawn up
'We will gather the traffic plans that have already been drawn up.'

c. Du kan prøve at slette eller gemme væk de filer som de
you can try to delete or hide away the files Comp they
nævner her.
mention here
'You can try to delete or hide the files they mention here.'

d. Disse forhold betyder, at piloter er nødt til at gemme
these conditions mean that pilots are necessary to to store
væk deres dragefly.
away their dragon plane
'These conditions mean that pilots must store their dragon plane.'

Also, the examples in (35) contain free relatives with the sister clause of the *hv*-phrase extraposed.

(35) a. Du kan slå hvad som helst op, der kan give krydshenvisninger
you can look whatever up there can give cross-references
til Brewster.
to Brewster
'You can look up anything that might provide cross-references to Brewster.'

b. Klods-Hans samler hvad som helst op, som han tilfældigt
Numskull Jack picks whatever up Comp he accidently
finder på vejen.
finds on road.DEF
'Numskull Jack picks up anything he accidently finds on the road.'

c. Han er parat til at køre hvem som helst ned, der står i
he is ready to to drive whomever down there stands in
vejen for ham.
way.DEF for him
'He is prepared to run down anybody who stands in his way.'

This is easily explained on an analysis where the free relative pronoun is the head of an NP and the extraposed clause an extraposed relative clause.

Another argument against the *wh*-head analysis for the German data is the occurrence of complex pied piping examples as the examples in (36), cf. Müller (1999, p. 57) and Pollard and Sag (1994, p. 69).

(36) a. Wessen Birne noch halbwegs in der Fassung steckt, pflegt
whose nut yet halfway in the holder is uses
solcherlei Erloschene zu meiden.
such extinct to avoid
'Those who still have their wits half way about them tend to avoid such vacant characters.'

b. Whoever's dogs are running around in the garden is in big trouble

These examples contradict the *wh*-head analysis, as the noun head of the NP head does not agree in number with the verb of the main clause, rather it is the *wh*-phrase specifier which agrees with the main verb. However, Danish does not allow such complex pied piping examples, and hence the complex pied piping argument is also not clear-cut argument against the *hv*-head analysis for Danish.

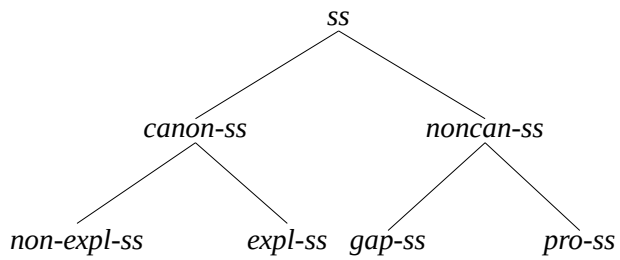
9 Formalization

The formalization is based on Ginzburg and Sag (2000) and Sag (1997), relying on a *gap-ss* type representing the gap in the relative clause, the Argument Realization Principle excluding *gap-ss* arguments from the valence lists, the SLASH-Amalgamation Constraint determining the SLASH value of a word, the Generalized

Head Feature Principle propagating the SLASH value, and a filler-head phrase or constructional gap-binding finally binding off the gap. To account for the Danish expletive, the formalization further adopts the *expl(etive)-ss* type, the revised Argument Realization Principle for Danish and the Expletive SLASH Constraint proposed in Bjerre (2010), Bjerre (2011a) and Bjerre (2011b).

(37) shows the hierarchy of *synsem* types assumed in this analysis, cf. Bjerre (2011b, p. 281).

(37)



Importantly the *canon-ss* type is subtyped into an *expl(etive)-ss* and a *non-expl(etive)-ss*. The former is introduced to account for the expletive occurring in subject position when a subject is missing.

In (38) and (39) the constraints on the *gap-ss*, cf. Sag (1997, p. 446) and Ginzburg and Sag (2000, p. 170), and the *expl-ss*, Bjerre (2011b, p. 282), respectively are shown.

(38) $\textit{gap-ss} \Longrightarrow \begin{bmatrix} \text{LOC } \boxed{1} \\ \text{SLASH } \left\{ \boxed{1} \right\} \end{bmatrix}$

(39) $\textit{expl-ss} \Longrightarrow \begin{bmatrix} \text{LOC} \begin{bmatrix} \text{CAT} \mid \text{HEAD } \textit{expl} \\ \text{CONT } \boxed{1} \end{bmatrix} \\ \text{SLASH} \left\{ \left[\text{CONT } \boxed{1} \right] \right\} \end{bmatrix}$

The difference between the two synsems is that the *gap-ss* has neither syntactic nor semantic content of its own. Its SLASH value will appear in the SLASH set of its head. The *expl-ss*, on the other hand, has syntactic content of its own, i.e. the value of HEAD is the category *expl(etive)*. The *expl-ss* will appear on the SUBJ list of its head in addition to its SLASH value appearing in the SLASH set of its head. The analysis of expletives presented here assumes that expletives have a referential index, i.e. it structure shares its index with its filler.

In (40), the SLASH-Amalgamation Constraint from Ginzburg and Sag (2000, p. 169) is shown. The constraint determines the SLASH value of a head word by amalgamating all the SLASH values of its arguments.

(40) $\textit{word} \Longrightarrow \begin{bmatrix} \text{SS} \mid \text{SLASH } \boxed{\Sigma_1} \cup \ldots \cup \boxed{\Sigma_n} \\ \text{ARG-ST} \left\langle \left[\text{SLASH } \boxed{\Sigma_1} \right], \ldots, \left[\text{SLASH } \boxed{\Sigma_n} \right] \right\rangle \end{bmatrix}$

The Argument Realization Principle for Danish in (41), cf. Bjerre (2011b, p. 282), excludes *gap-ss* arguments from the valence lists. It also excludes *gap-ss* arguments from the SUBJ list, i.e. we analysize subject gaps as being extracted. But it does not exclude *expl-ss* arguments from the SUBJ list, even though they add an element to the SLASH set.

(41) $$\textit{word} \Longrightarrow \begin{bmatrix} \text{SS} \mid \text{LOC} \mid \text{CAT} \begin{bmatrix} \text{SUBJ } \boxed{A} \ominus \textit{list(gap-ss)} \\ \text{SPR } \boxed{B} \\ \text{COMPS } \boxed{C} \ominus \textit{list(gap-ss)} \end{bmatrix} \\ \text{ARG-ST } \boxed{A} \oplus \boxed{B} \oplus \boxed{C} \end{bmatrix}$$

The SLASH value is propagated by the The Generalized Head Feature Principle from Ginzburg and Sag (2000, p. 33). The constraint is a default constraint and the value of SYNSEM is propagated unless some other constraint applies to bind off an element from the SLASH set.

(42) *hd-ph*:
$$\left[\text{SYNSEM} / \boxed{1}\right] \longrightarrow \ldots \mathbf{H}\left[\text{SYNSEM} / \boxed{1}\right]$$

SLASH elements are bound off either by a subtype of the head-filler-phrase or any of its subtypes, or constructionally by the constraint in (43) or any of its subtypes, cf. Sag (1997, p. 36).

(43) *non-wh-rel-cl*:
$$\begin{bmatrix} \text{HEAD} \mid \text{MOD Nom}_i \\ \text{SLASH}\{\} \end{bmatrix} \longrightarrow \mathbf{H}\left[\text{SLASH}\left\{\text{NP}_i\right\}\right]$$

Especially (43) is important to account for the Danish free relative constructions because it is this constraint which binds off the gap of the missing relative pronoun in the relative clause following the free relative pronoun.

Finally, the insertion of the expletive in Danish relative clauses only happens in local extractions or when the pronoun suppossed to be extracted is missing altogether. We therefore need a constraint to exclude SLASH values structure shared with expletive pronouns from being amalgamated by a head word. The *Expletive* SLASH Constraint for Danish is shown in (44), cf. also Bjerre (2011b, p. 283).

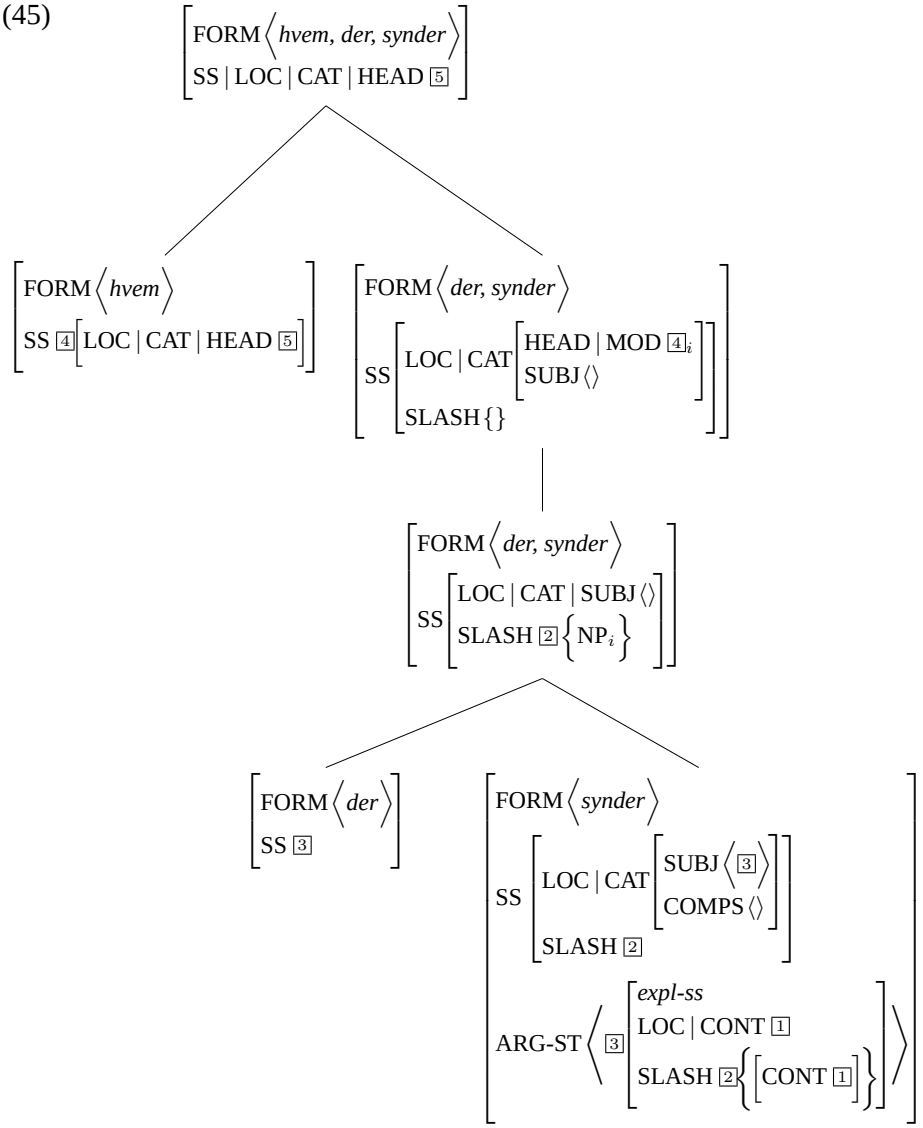
(44) $$\neg \begin{bmatrix} \textit{word} \\ \text{ARG-ST} \left\langle \begin{bmatrix} \text{LOC} \mid \text{CAT} \mid \text{HEAD} \mid \text{SUBJECT } \left\langle \textit{expl-ss}_i \right\rangle \\ \text{SLASH}\left\{\boxed{1}_i\right\} \uplus \boxed{\Sigma} \end{bmatrix}, \ldots \right\rangle \end{bmatrix}$$

(44) is a constraint on SLASH amalgamation in standard Danish. It ensures that heads cannot take clausal arguments with an expletive subject the corresponding

SLASH value of which has not been bound off. The constraint relies on a SUBJECT[3] feature. The *expl-ss* has been cancelled off from the SUBJ list and we need a way of knowing that the clause has an expletive subject. The constraint ensures that if a clause has an expletive subject, then the gap the expletive introduces has been bound off before the clause can function as an argument of some head word.

The representation of the free relative *hvem der synder*, 'who there sins', is shown in (45).

(45)



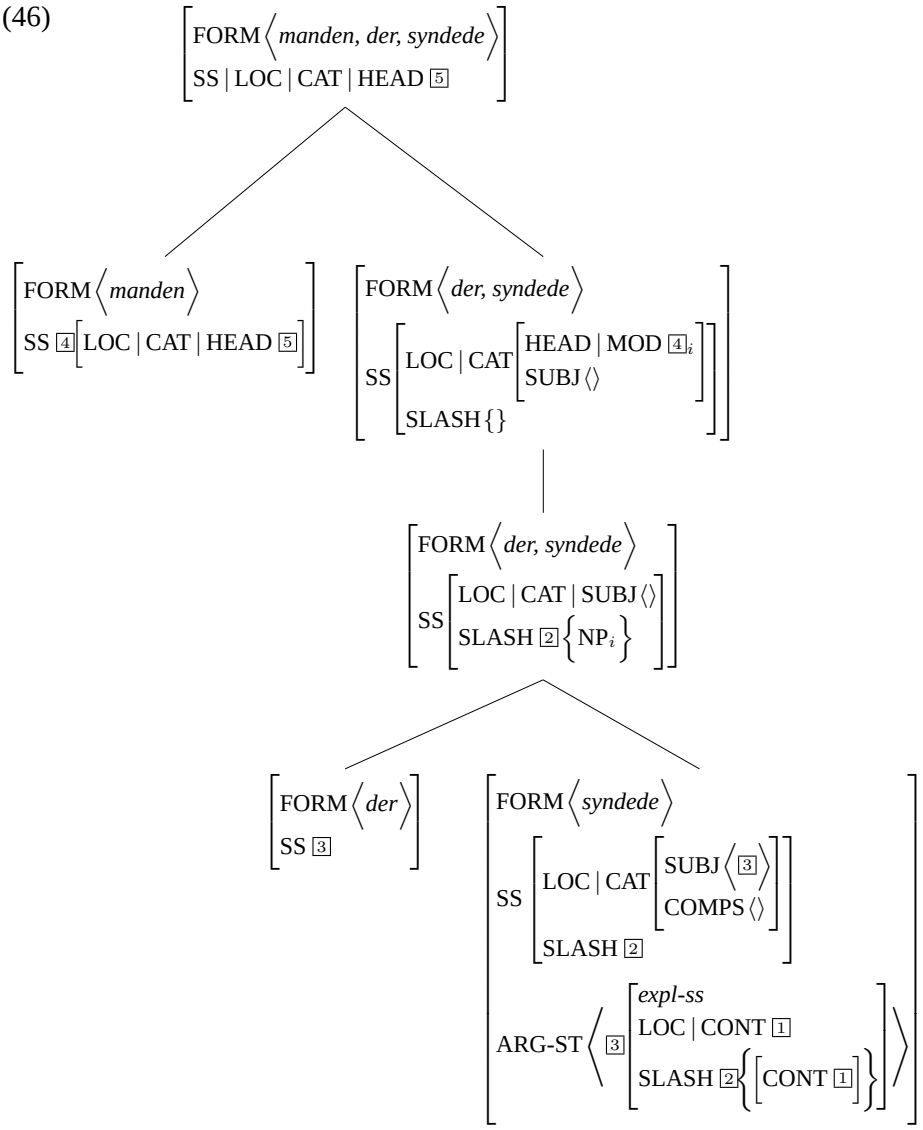
Importantly, the constraint in (43) projects the gapped clause into a relative clause which modifies the *hv*-phrase. This constraint binds off the gap in the clause.

[3]Cf. Meurers (1999) for a discussion of a HEAD feature for subjects. The SUBJECT feature is not represented in the remaining part of this paper, as it is not relevant to the present analysis.

The gap is formally represented by the expletive *der*, i.e. an *expl-ss*, which gives rise to a non-empty SLASH set on the verb.

In order to show that the analysis proposed for free relatives in Danish is similar to the analysis of ordinary relative constructions, the analysis of the relative construction *manden der syndede*, 'man.DEF there sinned', is shown in (46).

(46)



10 Conclusion

In this paper we have presented an analysis of Danish free relatives. We have followed Bresnan and Grimshaw (1978) and proposed a *hv*-head analysis assuming the *hv*-phrase to be the head of an NP. Also following Bresnan and Grimshaw

(1978) we have not assumed a filler-gap relation between the *hv*-phrase and the gap in the sister clause. Instead of assuming that Danish free relatives involve a gapped clause and a *hv*-filler, we have proposed that the gap in the sister clause is bound off by a constructional constraint and that the sister clause is analyzed as a relative clause of the *hv*-phrase head. In this way the analysis has been shown to differ from previous HPSG *wh*-head analyses of free relatives.

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Verbal suffix-repetition construction in Korean: A constraint- and construction-based approach

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Abstract

There are various Verbal Suffix-Repetition (VSR) constructions in Korean, where suffixes such as *-kena/ tun(ci)/ tun(ka)* are attached to the repeated verbs. Calling the VSR Choice-denying Repeated Verbs construction, Lee (2011) claims that the following verb of the VSR, which can be replaced with *mal-*, should contain a negative but the preceding verb should be affirmative in the VSR construction which disallows any NPI within it. Unlike Lee (2011), we claim that the verbs in the VSR can freely occur either in the preceding position or in the following one regardless of their Neg value so long as they share the same verbal suffix forms such as *-tun*(*ka*). Furthermore, NPIs may occur within the VSR construction if they occur with a negative predicate within the same clause. To implement the findings above into HPSG, we have proposed the two lexical entries for *mal-*, the VSR Construction Rule, and the NPI Clause-mate Constraint. These tools enable us to account for the idiosyncratic properties of the VSR constructions under this constraint- and construction-based approach.

1 Introduction

There are so-called "Verbal Suffix-Repetition (VSR)" constructions in Korean, where verbs in a CP functioning as a complement share the same suffixes such as *-kena/ -tun(ci) / -tun(ka)*, as follows:

(1) [Marcia -ka kyelhon-ul ha-**tun** an-ha-**tun**],
M-Nom marry-Acc do-Suf Neg-do-Suf,
na-nun kwansim-epse.
I-Top care-Neg
'Whether Marcia marries or not, I don't care.'

Recently, Lee (2011) calls the VSR Choice-denying Repeated-Verbs (CRV) Construction in the sense that it semantically delivers choice-denying messages. In addition to the semantic properties of the CRV, he claims that the preceding verb in the repeated verbs of the VSR should be affirmative but the following one, negative, assuming that sentence (2) where the preceding verb with a negative precedes an affirmative verb, *an-ha-**tun** ha-**tun,*** is ungrammatical. Further, he suggests that the following verb can be replaced with *mal-* in terms of either the operation 'copy & delete' or 'substitution' as in (2).

(2) [Marcia -ka kyelhon-ul **an-ha-**tun** ha-**tun** /* ha-**tun** *mal-**tun***],
M-Nom marry-Acc Neg-do-Suf do-Suf / do-Suf, not do-Suf
'Whether Marcia marries or not, I don't care.'

In doing so, he argues that any NPI (Negative Polarity Item) cannot occur within the VSR CP on the basis of the fact that (3) is ungrammatical:

(3) *[Ney-ka *amwuto* manna-**tunka** an-manna-**tunka** / mal-**tunka**],
You-Nom none (NPI) meet –Suf Neg-meet-Suf / not do-Suf
'Whether you meet none or not'

However, the fact that sentences like (4) where the VSR, exhibiting the reverse sequence, namely negative verb + affirmative verb, contains an NPI within the clause are construed to be grammatical seems to be a puzzle to Lee (2011):

(4) [Ku phathi-ey **amwuto** **an-o-tunc** mal-tunci]
The party-Loc none Neg-come-Suf stop-Suf
'Whether no one comes to the party or not'

Unlike Lee (2011), we claim here that the verbs in the VSR can freely occur either in the preceding position or in the following one regardless of their Neg value so long as they share the same verbal suffix form. Further, NPIs such as *amwuto* may occur within the VSR construction if they occur with a predicate containing a negative within the same clause.

To support our claim, we provide various properties of the VSR construction especially as to the possibilities of the occurrence of the verbs in the construction with respect to the value of Neg, the characteristics of *mal-* and the distributional behaviors of NPIs in the VSR in Section 2. We propose a constraint- and construction-based analysis of the VSR construction and then demonstrate how it works in Section 3. In conclusion, we suggest the consequences of our theory.[1]

[1] The full version of this paper has been published in Cho & Ku (2012). We thank the audience in the HPSG 2012 conference for their questions and comments.

2 Properties of the VSR Construction

2.1 The Possible Verb Sequences in the VSR

Logically, the verb sequences in the VSR construction, schematized as $_{CP}$[… V+α V+α], can be realized in four ways with respect to the existence of a negative as follows:

(5) a. Pattern I:$_{CP}$[affirmative V+α affirmative V+α]
b. Pattern II:$_{CP}$[affirmative V+α negative V+α]
c. Pattern III: $_{CP}$[negative V+α affirmative V+α]
d. Pattern IV: $_{CP}$[negative V+α negative V+α]
(Where α stands for the suffixes such as *-kena/ -tun(ci) / -tun(ka)*)

Pattern I is basically possible unless the repeated verbs are identical. If the following repeated verb is the exact same morphological form of the preceding verb, it will be ill-formed as in (6).

(6) [Tangsin-i pap-ul **mek-tun** capsusi-tun/ ***mek-tun**],
You-Nom rice-Acc eat-Suf eat-HON-Suf eat-Suf
'Whether you eat rice or not'

As for Pattern II, as Lee (2011) has argued, there is no discrepancy, in grammaticality at least, on this pattern. Against Lee's claim, however, we can find sentences like (7) belonging to the Pattern III and sentences like (8) belonging to the Pattern IV in the Korean Corpus data, *Hanmaru Search Engine of 21 Sejong Project*, which means they are grammatical.

(7) [An-pwa-essten mwuncey i-**tun** pwa-essten mwuncey i-**tun**],
Neg-sa problem be-Suf saw problem be-Suf
'Whether you have seen this question or not' (6CM00002)
(8) [**An**-hanunke-**ten** **mos**-hanunke-**ten**],
Neg-do-Suf Neg–can do-Suf
'Whether he doesn't want to do it or can't do it' (6CM00054)

Throughout the observations, the four sequence patterns in the VSR construction exhibit the following properties:

(9) Properties of the VSR construction on Verb-Sequence Patterns

A. The verbs in the VSR can freely occur either in the preceding position or in the following one regardless of their Neg value so long as they share the same verbal suffix form.

B. When affirmative verbs repeat, they should have different morphological forms.

C. When negative verbs repeat, negative affixes should be different.

2.2 The Characteristics of *Mal-* and the Distributional Behaviors of NPIs in the VSR

As for the verb *mal-*, Lee (2011) suggests that *mal-* can be realized either by the operation "copy & delete" or by substituting the repeated verb in the VSR. The process, copy & delete, however, appears to face difficulties deriving *mal-tunci* because input strings like **yeyppuci-mal-tunci* 'pretty-not-Suf' are ill-formed. Similarly, the substitution operation to get *mal-* in the VSR also seems to undergo difficulties deciding the counterpart input. For example, it is unclear how the string, *an-ka-tunka mal-tunka* 'not go or not not go', can be derived under this operation.

Throughout the reviewing of the demerits of the two approaches to *mal-*, we conclude that there are at least two different '*mal-*'s in Korean: one is the AUX, i.e. *mal*-1, and the other is the non-AUX in the VSR, i.e. *mal*-2. The characteristics of the *mal*-s are summarized as follows:

(10)

	Form	Meaning
Mal- 1	*V-ci malta*	to stop or deny the event referred to by
	[+Neg]	the preceding verb
Mal- 2	*V*-α *mal*-α	to refer to all the events except for that
	[β Neg][β Neg]	referred to by the preceding verb

(Where α stands for suffixes such as *-tunci* and β, the Neg value.)

As shown in (10), unlike Lee (2011), the *mal*-2 in the VSR semantically does not deliver the message of denying the event referred to by the preceding verb. Rather, it refers to all the events except for that referred to by the preceding verb. Thus, we conclude that the meaning of the VSR essentially is the list of events referred to by the repeated verbs in the construction.

According to Lee (2011), the NPI, *amwuto*, cannot appear with an affirmative verb so that both examples belonging to Pattern I and II are predicted to be ungrammatical. However, the fact that the Pattern III and IV, in which the preceding verb contains a negative, are possible cannot be explained under his analysis, since he regards such patterns as ill-formed.

We propose that the preceding verb and the following one of the VSR may have a bi-clausal structure or constitute a syntactic compound while the preceding verb and the *mal*-2 constitutes a syntactic compound only. If this proposal is adopted, (4) is correctly predicted to be grammatical because the preceding negative verb and *mal*-2 constitute a syntactic compound so that the NPI and the negative verb co-occur within a clause, resulting in the observing of the Clause-mate Constraint.

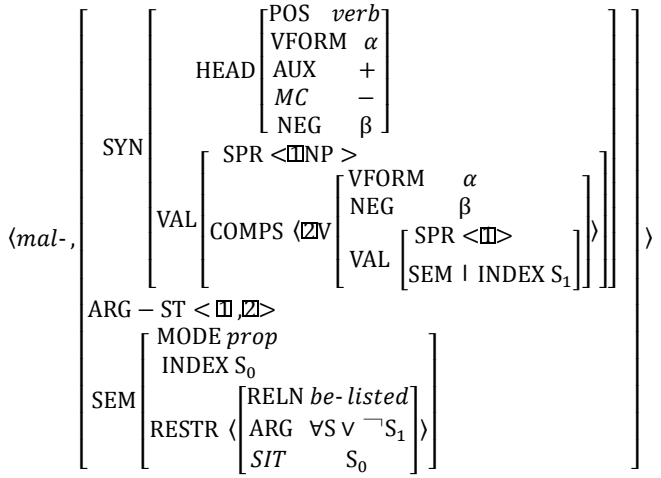
3 A Constraint- and Construction-based Analysis

To implement such observations into current HPSG, we postulate a construction rule for the VSR and a few lexical constraints on *mal-*, assuming the Clause-mate constraint to treat the distributional behaviors of NPIs. First, we posit the following lexical entries for *mal-*:

(11) *mal*-1:

$$\langle mal\text{-}, \begin{bmatrix} \text{SYN} \begin{bmatrix} \text{HEAD} \begin{bmatrix} \text{POS} & verb \\ \text{VFORM} & \alpha \\ \text{AUX} & + \\ \text{NEG} & + \end{bmatrix} \\ \text{VAL} \begin{bmatrix} \text{SPR} \langle \boxed{1} \text{NP} \rangle \\ \text{COMPS} \langle \boxed{2} \text{VP} \begin{bmatrix} \text{VFORM} & -ci \\ \text{SPR} & \boxed{1} \end{bmatrix} \rangle \\ \text{SEM} \mid \text{INDEX} \, \text{S}_1 \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} \langle \boxed{1}, \boxed{2} \rangle \\ \text{SEM} \begin{bmatrix} \text{MODE} \, prop \\ \text{INDEX} \, \text{S}_0 \\ \text{RESTR} \langle \begin{bmatrix} \text{RELN} & stop \\ \text{ARG} & \text{S}_1 \\ \text{SIT} & \text{S}_0 \end{bmatrix} \rangle \end{bmatrix} \end{bmatrix} \rangle$$

(12) *mal*-2:

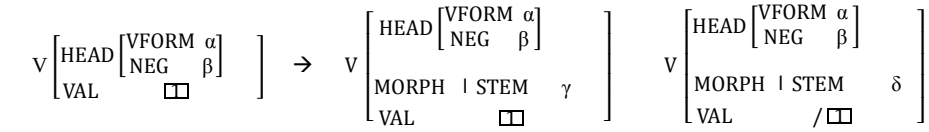


Assuming the Clause-mate constraint in (13) to deal with NPIs, we postulate the "VSR construction" rule in (14) which enables us to obtain not only a bi-clausal structure but also a syntactic compound depending on whether each node V is realized as a lexical verb or a CP:

(13) The Clause-mate Constraint (Informal Version):

NPIs must occur with a verb with [NEG +] within a clause.

(14) The VSR Construction Rule (A Syntactic Compound Rule)[2]:



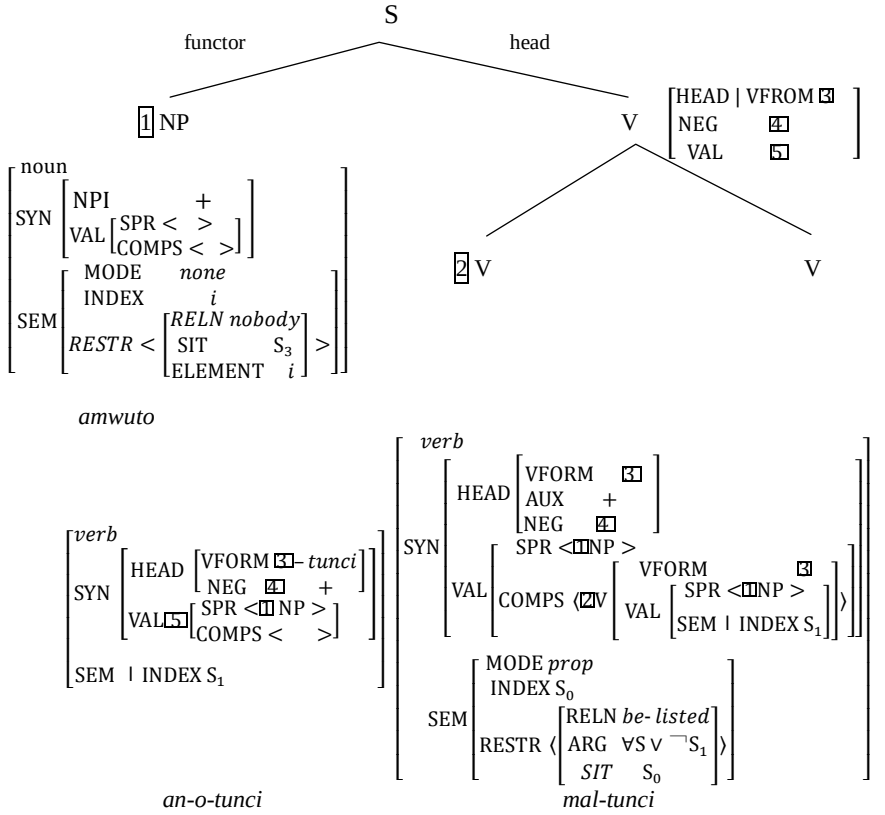
(Where α ∈ *-kena, -tun(ci), tun(ka)*....)

Once these tools are adopted in HPSG, the properties of the VSR construction can be sufficiently accounted for. To show this is so, we demonstrate how our theory analyzes the VSR construction with an NPI in a clause.

[2] As mentioned in the note 2, the semantic contrast or salient factors can be specified in the two daughters in the SEM part, instead of specifying two different STEM values in the MORPH. The notion / in front of 1 refers to ' default' value.

The strings like *amwuto an-o-tunci mal-tunci* as the second type of the Pattern III with an NPI can be represented as follows:

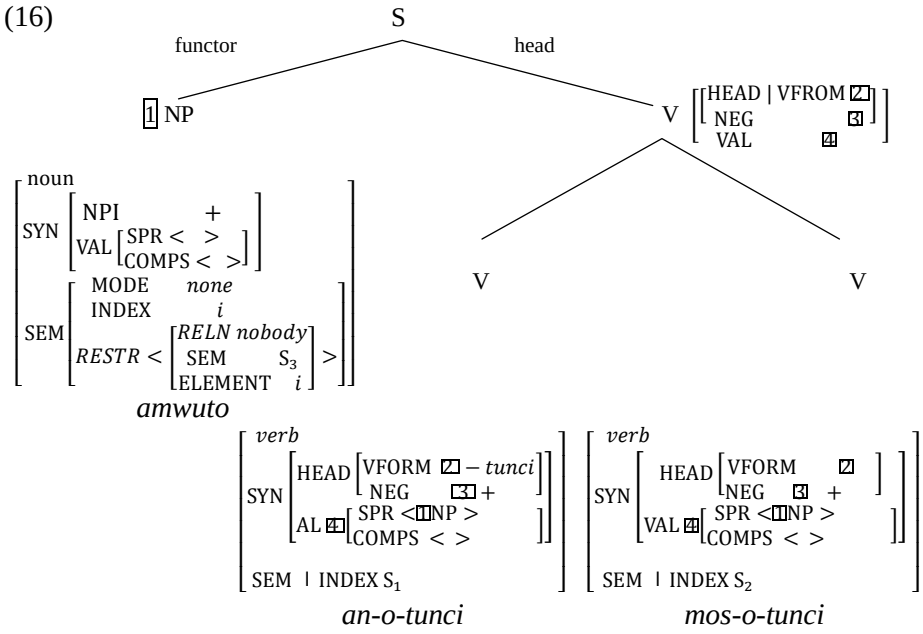
(15)



The strings, *amwuto an-o-tunci mal-tunci,* are possible under this analysis. The local tree in the bottom part is licensed as a syntactic compound in terms of the VSR rule and the lexical information of *mal*-2. Since the NEG value of the mother in the local tree is positive (+), the NPI in the top local tree of the clause satisfies the Clause-mate Constraint. Hence, the strings are well-formed. In addition to the syntactic parts, the semantic RELN (relation) of *mal-tunci* in (15) is *be-listed* and its ARG (argument) is all situations (events) except the situation referred to by the preceding verb *an-o-tunci*, i.e. $\forall S \,\&\, \neg S_1$.

The last example we demonstrate is the strings like *amwuto an-o-tunci mos-o-tunci* as one of Pattern IV examples with an NPI which can be represented as follows:

(16)



When the NPI occurs with the two negative verbs in a bi-clausal structure, the strings are predicted to be well-formed because the NEG value of each verb is positive so that they can observe the Clause-mate Constraint. In a syntactic compound, the strings are also regarded as legal since both negative verbs share the same NEG value, +.

4 Conclusion

There are various Verbal Suffix-Repetition constructions in Korean, where suffixes such as *-kena/ tun(ci)/ tun(ka)* are attached to the verbs. Functionally, this construction may appear either as an adjunct or as a CP complement headed by verbs like *kwansimeps-* 'don't care'. To account for the latter type of VSR construction, which is called CRV construction, Lee (2011) claims that the CRV behaves differently from the VSR construction functioning as an adjunct in that the CRV only allows Pattern II, which disallows any NPI within it.

Unlike Lee (2011), we claim that the verbs in the VSR can freely occur either in the preceding position or in the following one regardless of their NEG value so long as they share the same verbal suffix forms such as *–tun*(*ka*). Furthermore, NPIs may occur within the VSR construction if they

occur with a negative within the same clause. To support our claim, we have provided various properties of the VSR construction especially as to the possibilities of the occurrence of the verbs in the construction with respect to the Neg value, the characteristics of *mal-* and the distributional behaviors of NPIs in the VSR. In doing so, we could observe the idiosyncratic properties of the VSR construction on verb-sequence patterns in (9), two different types of the verb *mal-* in (15), and the distributional behaviors of NPIs with respect to the VSR patterns in (7). On the basis of the observations, we have proposed the two lexical entries for *mal-* in (11) and (12), the VSR Construction Rule as a syntactic compound rule in (14), and the Clause-mate Constraint in (13) in current HPSG. We have shown that given these tools, the idiosyncratic properties of the VSR constructions are sufficiently accounted for under this constraint- and construction-based approach.

In fact, our analysis can be extended to analyze the VSR functioning as an adjunct without any additional tools. In conclusion, we suggest that the CRV should be merely a subtype of the VSR construction in Korean. We believe that the constraint- and construction-based analysis can be a desirable solution to give precise explanations for various complex constructions.

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Sentential specifiers in the Korean clause structure

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Abstract

The Korean double nominative construction exhibits various properties distinguished not only from ordinary subject-object clauses but also from nominative complement constructions. Particularly, the second NP, not the initial NP, triggers the honorific agreement with the verb. I argue that the first NP of the construction is identified as a sentential specifier which exists in addition to the subject (cf. Major subject in Yoon 2004). The sentential specifier can be justified as the characteristic of the topic-prominent language in the sense of Li and Thompson (1976). Specifically I claim that any elements that satisfy the *aboutness* condition can be the sentential specifier. Finally, I show that HPSG's valence value and an optional lexical rule provides an elegant treatment of the construction; SPR list in a sentence level can be utilized for the sentential specifier (cf. Kim et al. 2007).

1. Introduction

The Korean double nominative construction exhibits various properties distinguished from the typical clauses. For example, the first nominative-marked NPs in (1) do not necessarily have a selectional relation with the verbs in the clauses. Instead, the second nominative-marked NPs are the semantic subject of the verb.

(1) a. Ken-i ape.nim-i kyoswu-i-si-ta
Ken-NOM father(HON)-NOM Prof.-COPU-HON-DECL
'As for Ken, his father is a professor.'

b. LA-ka hankwuk. salam-i manhi sa-n-ta
LA-NOM Korean.people-NOM many live-PRES-DECL
'As for LA, many Korean people live there.'

This double nominative construction is distinguished not only from ordinary subject-object clauses but also from nominative complement constructions in (2) in that the first NP in (2) triggers the honorific agreement with the verb in contrast to those in (1).

(2) John-i ape.nim-i silh-(*usi)-ta
John-NOM father.HON-NOM hate-(*HON)-DECL
'John hates his father.'

Previous approaches to the Korean double nominative construction can be categorized into two types. The first type is the focus analyses proposed by Kim (2000), Schütze (2001), and Kim et al. (2007). In this type of approaches, the first NP of the construction is considered the syntactic realization of the focus information. The second type is the movement analyses proposed by Kang (1986) and J-Y Yoon (1989). In this type of analyses, the first NP is formed through a movement starting from the possessive NP position of the subject.

In this paper, I suggest that the previously suggested analyses cannot correctly catch the characteristics of the construction. Instead, I argue that the first NP of the construction is identified as a sentential specifier which exists in addition to the subject (cf. Major subject in Yoon 2004; Small subject in Shibatani 1999; Narrow/Thematic subject in Doron and Heycock 1999). The sentential specifier can be justified as the characteristic of the topic-prominent language in the sense of Li and Thompson (1976). Specifically I claim that any elements that satisfy the *aboutness* condition can be the sentential specifier. That is, if an element is characterized by the subsequent phrase, it satisfies the *aboutness* condition (Kang 1988; O. Grady 1991, Hong 1997, Yoon 2004).

2. Review of the Previous Analyses

2.1 Movement Analyses

Kang (1986), Yoon (1989) and many other scholars suggest that the first NP of the double nominative construction is generated in the possessor position of the subject and moved to the first NP position as illustrated in (3).

(3) a. Ken$_i$-i [$_S$ [$_{NP}$ t$_i$ ape.nim-i] kyoswu-i-si-ta]
Ken-NOM father(HON)-NOM Prof.-COPU-HON-DECL
'As for Ken, his father is a professor.'

However, as shown in (1b) the first NP is not necessarily identified with the possessive NP of the subject. Furthermore, not all the possessive NPs of the subjects can move into the first NP position (Kim 2000).

(4) Yangccok-*i/-uy pulsin-i i sathay-lul
Both.sides-NOM/-GEN distrust-NOM this situation-ACC
cholayhayss-ta
caused-DEC
'The distrust between both sides caused this situation.'

2.2 Focus Analyses

Kim (2000), Schütze (2001), Kim et al. (2007) and many other scholars suggest that the first NP of the construction is the syntactic realization of the focus information which is independent of syntactic relation such as subject and object. According to Kim (2000), the sentence in (5) is ungrammatical because only the first NP of the construction has the focus function, hence able to be *wh*-questioned.

(5) *Ken-i nwu-ka puca-i-si-ni?
Ken-NOM who-NOM rich.man-COP-HON-Q
'Who of Ken's is rich?'

However, even assuming that the first NP is a focus phrase, it does not explain why the subject NP cannot be *wh*-questioned. This is because Korean allows multiple foci in a clause. Further, there are some cases in which the first NP should also be identified as a subject as in (6).

(6) Kim_i-i [t_i cha-ka kocangnass-ko]
Kim-NOM car-NOM broke-CONJ
[t_i ton-to up-ta]
money-either have.no-DECL
'Kim's car broke down, and she has no money.'

In focus analyses, the NP *Kim* will be identified as the focus owing to the unsaturated element in the first conjunct. However, it should also be identified as the subject owing to the unsaturated element of the second conjunct. The unsaturated NP of the second conjunct is a subject while the NP *ton-i* is analyzed as a nominative-marked complement. Therefore, the initial NP in (6) cannot meet the different requirements that are derived from the two conjuncts. This dilemma will not be avoided as long as the first NP is considered as the focus distinguished from typical grammatical relations.

3. Sentential Specifiers

In this paper, I propose that the first NP of the double nominative construction is identified with a sentential specifier. As suggested by Yoon (2004), the sentential specifier is based-generated in a position preceding a subject and takes the following part of the sentence as its sentential

complement (cf. Park 1981). As widely accepted, Korean has both the properties of the subject oriented language and the topic-prominent language. Therefore, it is not completely startling to assume that Korean has the sentential specifier in addition to the subject.

Many scholars of Korean linguistics have mentioned that the double nominative construction has something to do with the semantic *aboutness* condition. That is, the sentential specifier is significantly characterized by the subsequently following parts of the sentence. I also suggest that the aboutness condition is the licensing condition of the sentential specifier. There is ample evidence that supports the proposed sentential specifier analysis. First, as reported by Wechsler and Lee (1995) and Choi (2008), any element that satisfies the *aboutness* condition can undergo the subject to object raising.

(7) a. na-nun Ken-ul$_i$ [t_i ape.nim-i kyoswu-lako]
I-TOP Ken-ACC father(HON)-NOM Prof.-COMP
sayngkakhayssta
believed
'I thought Ken's father is a profeesor.'

b. na-nun LA-lul$_i$ [t$_i$ hankwuk.salam-i manhi
I-TOP LA-ACC Korean people-NOM a lot
santa-ko] sayngkakhayssta
live-COMP believed
'I thought LA is where many Koreans live.'

c. na-nun ecye-lul$_i$ [t$_i$ ol eylum cwung nalssi-ka
I-TOP yesterday-ACC this summer during weather-NOM
kacang tewessta-ko] syangkakhan-ta
most be.hot-COMP think-DEC
'I thought that yesterday was the hottest day in this summer.'

The raised elements in (7) are identical to the sentential speicifier, but not the subjects. This coincidence follows our assumption that what is raised in the Korean raising construction is the sentential specifier. That is, an element that does not satisfy the *aboutness* condition cannot undergo subject-to-object raising, as shown in (8).

(8) ? na-nun Ken-ul$_i$ [t$_i$ pap-ul mekessta-ko] sayngkakhassta
I-TOP Ken-ACC meal-ACC ate.-COMP believed
'I thought that Ken ate his meal.'

A raised question from this analysis may be how we should deal with the cases in which the raised element is a subject as in (9).

(9) Na-nun kim-ul [t cip-ey ton-i up-ta-ko]
I-TOP Kim-ACC home-at money-NOM have.no-CONJ
syangkakhayssta
thought

'I believed Kim to have no money.'

The raised element in (9) is the subject as I mentioned regarding the sentence in (6). However, it also satisfies the *aboutness* condition for the subject NP. Nothing blocks a semantic subject from being realized as a sentential specifier as long as the following VP satisfies the *aboutness* condition for the NP. Therefore, the coordination dilemma shown in (6) will not take place in my approach. This is because what is raised in (9) is the sentential specifier although it is semantically identified as a subject. Therefore, the possibility of the coordination as in (6) itself becomes the supporting evidence of my approach.

Further, the ungrammaticality of the sentence (5) can be well explained in this approach. Specifically, when the subject becomes *wh*-questioned the resultant clause cannot characterize the sentential specifier. However, when the *wh*-questioned element does not significantly undermine the *aboutness* condition, the acceptability of the sentence remarkably improves as shown in (10)

(10) Ken-i ape.nim-i muess-ha-si-ni?
Ken-NOM father(HON)-NOM what-do-HON-Q?
'What does Ken's father do?'

The Korean reflexive binding also supports my approach. As illustrated by the sentence in (11), the sentential specifier can be referred to by the Korean reflexive *caki*(self).

(11) Ken$_i$-i apeci-ka caki$_i$-uy saup-ul taisin hanta
Ken-NOM father-NOM self-GEN business-ACC substitute did
'Ken's father runs the business for Ken.'

In Korean, *caki* is known as a subject oriented reflexive. Therefore, (11) shows that the sentential specifier should be considered as an ARG-ST list member that stands comparison with the subject.

4. HPSG Formalization

In this section, I will show how the proposed ideas can be embraced by the sign-based HPSG formalism. I have shown that the first NP of the Korean double nominative construction is identified as the sentential specifier which satisfies the *aboutness* condition. HPSG's valence value and an optional lexical rule provide an elegant treatment of the construction. Specifically, SPR list in a sentence level can be utilized for the sentential specifier.

(12) SPR lexical rule I (optional)

$$\begin{bmatrix} \text{HEAD } verb \\ \text{DEPS } \langle \dots, \boxed{1} NPi, \dots \rangle \\ \text{INDEX } s \\ \text{RELS } \langle \dots, \begin{bmatrix} \text{PRED } aboutness \\ \text{SIT } s \\ \text{ARG } i \end{bmatrix} \dots \rangle \end{bmatrix}$$

$$\rightarrow \begin{bmatrix} verb \\ \text{VAL } [\text{SPR } \langle \boxed{1} \text{NP}[nom]i \rangle] \end{bmatrix}$$

(13) SPR lexical rule II (optional) [1]

$$\begin{bmatrix} \text{VAL } \begin{bmatrix} \text{SPR } \langle \boxed{1} \rangle \\ \text{SUBJ } \langle \text{NP } [\text{SPR } \langle \boxed{1} \text{NP}i \rangle] \rangle \end{bmatrix} \\ \text{INDEX } s \\ \text{RELS } \langle \dots, \begin{bmatrix} \text{PRED } aboutness \\ \text{SIT } s \\ \text{ARG } i \end{bmatrix}, \dots \rangle \end{bmatrix}$$

[1] On this point, the treatment is similar to Kim et al. (2007) in that the unsaturated specifier of the subject appears in the SPR list of the matrix verb. However, the SPR list here does not host subjects.

(14) a. kyoswu-i-si-ta

$$\begin{bmatrix} \text{VAL} \begin{bmatrix} \text{SPR} \langle \boxed{1} \rangle \\ \text{SUBJ} \langle \text{NP} \left[\text{SPR} \langle \boxed{1} \text{NP}i \rangle \right] \rangle \end{bmatrix} \\ \text{INDEX} \quad s \\ \text{RELS} \langle \dots, \begin{bmatrix} \text{PRED} \ aboutness \\ \text{SIT} \quad s \\ \text{ARG} \quad i \end{bmatrix}, \dots \rangle \end{bmatrix}$$

b. sa-n-ta

$$\begin{bmatrix} \text{HEAD} \quad \boxed{2} \\ \text{VAL} \left[\text{SPR} \langle \boxed{1} \rangle \right] \\ \text{INDEX} \quad s \\ \text{DEPS} \langle \boxed{1} \text{NP} \begin{bmatrix} \text{MOD} \ \boxed{2} \\ \text{CONT} \ \ locative-rel \end{bmatrix}, \dots \rangle \\ \text{RELS} \langle \dots, \begin{bmatrix} \text{PRED} \ aboutness \\ \text{SIT} \quad s \\ \text{ARG} \quad i \end{bmatrix}, \dots \rangle \end{bmatrix}$$

The element that appears in the sentential specifier position is a subject, the specifier of a subject or adjuncts. Following Bouma et al. (2001), I assume that a subject and adjuncts appear in a DEPS list. The rule in (12) declares that any DEPS list member which satisfies the *aboutness* condition can appear in the SPR list. However, the rule in (12) does not apply to specifiers of subjects. To ensure that the specifier of a subject becomes the sentential specifier, we need an additional rule as in (13). Now, with the rules in (12) and (13), all the elements that can satisfy the *aboutness* condition become the member of the SPR list. For example, the rules will change the verb lexemes in (1) to those in (14).

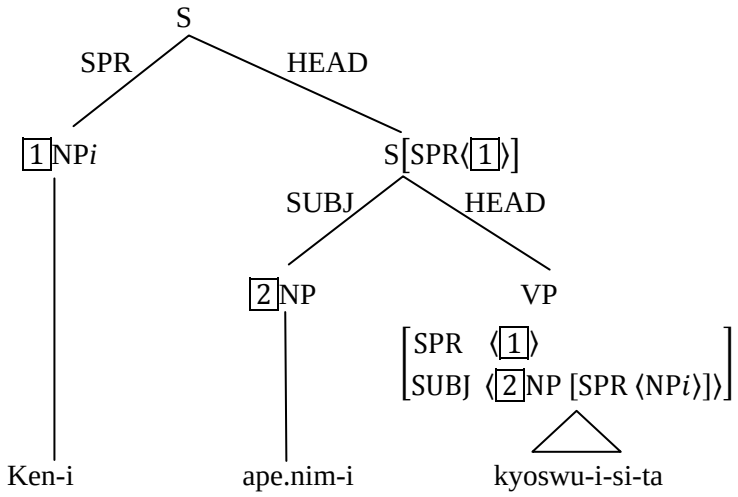
Now, the final step to accommodate this idea in the HPSG framework will be to posit the additional Head-specifier construction rule as in (15).

(15) Head-Specifier Rule

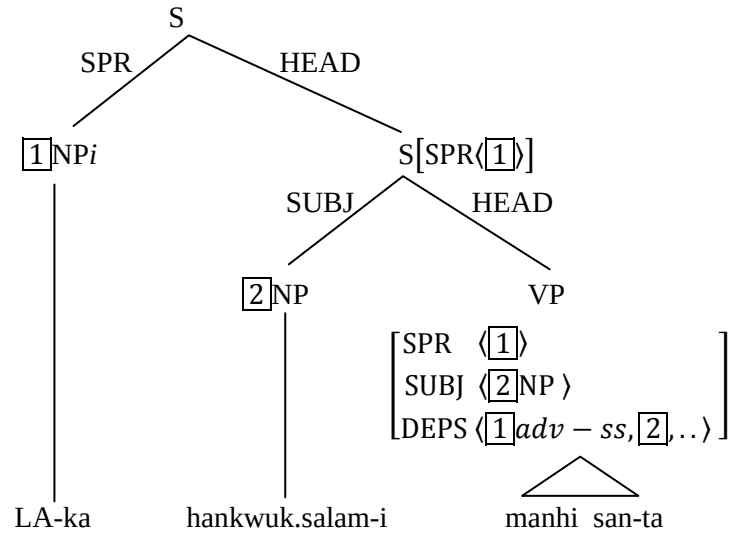
$$\begin{bmatrix} phrase \\ \text{SPR} \langle \quad \rangle \end{bmatrix} \rightarrow \boxed{1} \text{NP} \begin{bmatrix} \text{VAL} \begin{bmatrix} \text{SPR} \langle \boxed{1} \rangle \\ \text{SUBJ} \langle \quad \rangle \\ \text{COMPS} \langle \quad \rangle \end{bmatrix} \end{bmatrix}$$

The rule in (15) allows the phrase whose SUBJ and COMPS lists are already saturated to combine with the sentential specifier. This process is illustrated by the tree diagrams in (16) and (17), which illustrate the syntactic structures of the sentences in (1).

(16)



(17)



5. Conclusion

Under the analysis proposed in this paper, the Korean double nominative construction is interpreted as a characteristic of the topic oriented language. Therefore, the nominative marked first NP of the construction is not an adjunct derived from certain syntactic operation. Instead, in this paper, it is

considered a grammatical relation that exists in addition to the subject, i.e. sentential specifier. Specifically, I suggested that the proposed SPR list licenses the sentential specifier relation. To a certain extent, this proposal embraces the traditional ideas such as Major Subject and sentential predicates in that the SPR list hosts the NPs that are predicated by sentential predicate (Park 1981, Yoon 2004). The HPSG sign-based syntactic treatment neatly deals with this idea by assuming the SPR list is utilized in the verbal syntactic domain.

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Backshift and tense decomposition

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Abstract

Backshift is a phenomenon affecting verb tense that is visible as a mismatch between some specific embedded contexts and other environments. For instance, the indirect speech equivalent of a sentence like *Kim likes reading*, with a present tense verb, may show the same verb in a past tense form, as in *Sandy said Kim liked reading*. We present a general analysis of backshift, pooling data from English and Romance languages. Our analysis acknowledges that tense morphology is ambiguous between different temporal meanings, explicitly models the role of the speech time and the event times involved and takes the aspectual constraints of tenses into consideration.

1 Introduction

The following pairs of sentences, adapted from Michaelis (2006), illustrate the phenomenon of backshift, visible in indirect speech. Each sentence in parentheses is the direct speech counterpart of the embedded clause in the same line:

(1) a. Debra said she **liked** wine. ("I like wine")
b. Debra said she **likes** wine. ("I like wine")
c. Debra said she **brought** the wine. ("I brought the wine")
d. Debra said she **had brought** the wine. ("I brought the wine")
e. Debra said she **would bring** some wine. ("I will bring some wine")

When the matrix verb is a past tense form, the verb tenses found in the embedded clauses are sometimes different from the tenses used in direct speech (1a, 1d, 1e), but not always (1b, 1c). For instance, in this context we sometimes find the simple past instead of the simple present in English (1a). In this respect English is in sharp contrast with Russian, where present tense can be used in similar embedded contexts with the same meanings as the English sentences using the simple past (example from Schlenker (2004)):

(2) Petya skazal, čto on plačet. (present tense in the embedded clause)
Petya said that he was crying.

An initial observation is thus that English uses tense in an absolute way (the embedded past tense in (1a) is used to locate a situation in the past), whereas Russian uses it in a relative way (the embedded present tense in (2) marks a situation that was present at the time that the situation in the matrix clause held). Based on similar data, Comrie (1986) argues that English exclusively uses tense in an absolute way. However, the example in (3), from Rodríguez (2004), shows that in some cases English also uses tense in a relative way. In this example, the past tense is associated with a situation that may hold in the future with respect to the speech time. The past tense here signals precedence with respect to the time of the event in the higher clause (which is in the future). The phenomenon is thus more

complicated than a simple separation between languages that use tense in a relative fashion and languages that use it in an absolute manner.

(3) María will tell us after the party tomorrow that she drank too much.

Several verbs trigger tense shifts in their complement. Reporting verbs are often identified with this group, but other verbs, like belief verbs or verbs like *decide* or *remember*, create similar contexts.

The phenomenon is also known as transposition, sequence of tenses or *consecutio temporum*, although some authors use some of these expressions in a broader sense, encompassing constraints on the co-occurrence of tenses in the same sentence. We reserve the term backshift to refer to the more specific case of the complements of the class of verbs just mentioned. In this paper, we focus on backshift, in this narrow sense. This is because backshift is more constrained than the general co-occurrence of different tenses in the same sentence. For instance, Rodríguez (2004) points out that relative clauses are temporally independent, as illustrated by the example in (4).

(4) Felipe spoke last night with a girl that was crying this morning.

Here, two past tenses are found, and the verb of the relative clause refers to a situation that temporally follows the one denoted by the matrix verb. In turn, in backshift contexts involving two past tense forms, the embedded tense never signals a time that temporally follows the time associated with the embedding tense:

(5) * Debra said last night that she brought a bottle of wine this morning.

In this paper we present a novel account of backshift and formalize it in HPSG. We use Minimal Recursion Semantics (MRS; Copestake et al. (2005)), but our account is quite neutral with respect to the theory or format of semantic representation used. We treat backshift as the result of the combination of three dimensions. The first one is acknowledging that tense, as it is visible in morphology, is ambiguous. The second one consists in classifying the meanings of the tenses along a number of lines: direction (present vs. past vs. future), aspect (perfective vs. imperfective), relativity (relative vs. absolute). Direction and aspect determine which kinds of temporal relations are involved in the meaning of tenses (inclusion, overlap or precedence relations). Relativity is how the arguments in these relations are chosen: absolute tenses always take the speech time as one of the arguments of one of these relations; relative times look at a perspective point, which can be the speech time or the time of another event, depending on the syntactic context. The third dimension is that some tenses may appear only in restricted contexts: they may occur only in contexts where the perspective point is the utterance time, or in contexts where these two times are different, or in both of these contexts.

Our analysis contains novel aspects. It provides a very clean distinction between absolute and relative tenses, making it depend on the use of two features. It

correctly constrains the possible readings of past under past constructions depending on grammatical aspect, which no other theory of backshift explains.

The paper proceeds as follows. In Section 2 we present the semantic representations for some tenses, which we will need in order to treat backshift. The analysis of backshift we propose is explained in Section 3. In Section 4 we compare this analysis with the treatments of backshift found in the literature. We conclude the paper in Section 5 with a summary of our contributions.

2 A Simple Representation of Tense

In this section we present a representation of the meaning of tenses that will be used in the analysis of backshift developed in Section 3.

Ambiguity of Tense Tense presents ambiguity at two levels:

- The same surface form can correspond to more than one grammatical tense. An English example is the verb form *put*, which can, for instance, be present tense or past tense. Some languages show this ambiguity in productive conjugation patterns. For instance, Portuguese *corremos* is both a present and a past form of the regular verb *correr* "run".

- The same grammatical tense can locate a situation in time in different ways. An English sentence like *I leave tomorrow* shows that present tense can refer to the future. This tense can also locate an event in the present. Other languages show similar cases.

We make a distinction between grammatical tense and semantic tense: we will use the first expression to refer to the morphological category, and the second one to refer to the meaning of tenses, i.e. their semantic representation.

In order to account for this two-fold ambiguity, we assume a two-layer analysis. The first layer consists in a set of rules that map surface form to grammatical tense. The second layer consists in a set of rules that map grammatical tense to semantic representations of tense. Both sets of rules are made of lexical rules, i.e. unary rules that apply to lexical items (verb forms in this case).

Description of the Tenses We assume a Davidsonian (Davidson, 1967) representation of situations which employs event variables as the first argument of the predicates. We model tense via an at relation that relates this event variable with a temporal index. A temporal index can be viewed as a free time variable, in the spirit of Partee (1973). The temporal index in this at relation is the event time of Reichenbach (1947). Also drawing inspiration from Reichenbach, we describe tense by resorting to various temporal indices and temporal relations between them. Temporal indices have their own type *t*. We represent the speech or utterance time by a subtype *s* of *t*. The at relation and the temporal relations holding between the

temporal indices are all introduced at the second layer of the lexical rules for tense (the layer that maps grammatical tense to semantic tense).

For our purposes, we do not need full Reichenbachian representations (relying on the three times: event time E, reference time R and speech or utterance time S) for many of the tenses: in some cases we will represent the temporal relation between the event time and the speech time directly, and say nothing about the reference time. For instance, we assume semantic present to be a temporal relation between S and E, in particular a temporal overlap relation. We follow Discourse Representation Theory (DRT; Kamp and Reyle (1993)[p. 541]) in further assuming that the speech time is seen as punctual, which means that this overlap relation is more specific than just overlap, and it is an inclusion relation: the event time includes the utterance time.

We distinguish between imperfective and perfective tenses as they occur in e.g. Romance and Slavic languages or Greek. We assume that present cannot be perfective and, similarly to Michaelis (2011), that languages without perfective vs. imperfective distinctions show ambiguity in the other tenses. The examples in (6) are hers and support this last claim. The highlighted verb in the English sentence in (6a) is lexically telic, but the sentence nevertheless has an imperfective reading. In (6b) the highlighted verb is lexically stative, but the clause where it occurs has a perfective reading. Since these are cases of aspectual coercion similar to the ones found with the perfective and imperfective past tenses, the English past tense must be ambiguous between the two.

(6) a. At the time of the Second Vatican Council, they *recited* the mass in Latin.

b. He lied to me and I *believed* him.

Similarly, future tense (or future constructions) is ambiguous in English as well as Romance languages with respect to perfectivity, in contrast to languages like Greek and Russian, that show perfectivity distinctions also in the future tenses.

The examples in Table 1 show the sort of temporal representation that we have in mind, using the situation of John smoking. We leave future tense aside, as it adds nothing new to the discussion. We also leave perfect aspect, as exemplified by the English present perfect, outside the scope of this text.

These representations are inspired by Kamp and Reyle (1993) and Van Eynde (1998). In the case of the past tenses, these authors assume that the relation between the location time of a situation and a perspective point (that corresponds to the utterance time) is determined by aspectual class. For states this is one of overlap. For non-stative situations this is, more specifically, one of temporal inclusion. It follows from the event time being included in the location time and the location time preceding the utterance time (the past tense semantics) that the event time also precedes the utterance time. This is essentially the simplified representation that we use here for the perfective past. Unlike these pieces of work, we do not make this distinction depend on aspectual type but rather assume that it is the difference

Semantic imperfective present: $smoke'(e, john') \wedge at(e, t) \wedge includes(t, s)$	"John smokes"
Semantic imperfective past: $smoke'(e, john') \wedge at(e, t) \wedge overlap(t, t_2) \wedge before(t_2, s)$	"John smoked"
Semantic perfective past: $smoke'(e, john') \wedge at(e, t) \wedge before(t, s)$	"John smoked"

Table 1: The meaning of some tenses

between imperfective and perfective tenses. It just happens that perfective tenses constrain the whole clause to be telic whereas imperfective tenses constrain it to be stative or at least atelic (de Swart, 1998, 2000; Bonami, 2002; Flouraki, 2006), which means that imperfective tenses trigger no aspect shift when they combine with states, and neither do perfective tenses when they combine with culminations or culminated processes. The following Portuguese examples, based on those in (6) above, motivate our departure from their analysis:

(7) a. Na altura do Segundo Concelho do Vaticano, recitaram a missa em Latim. (perfective)
At the time of the Second Vatican Council, they recited the mass in Latin (they did that just once).

b. Na altura do Segundo Concelho do Vaticano, recitavam a missa em Latim. (imperfective)
At the time of the Second Vatican Council, they recited the mass in Latin (they used to do that).

(8) a. Ontem acreditei nele. (perfective)
Yesterday I believed him (I believed what he said yesterday).

b. Ontem acreditava nele. (imperfective)
Yesterday I believed him (I still believed him).

The examples in (7) both exhibit the phrase *recitar a missa* "recite the mass", which is a culminated process (i.e. a telic situation). The sentences in (8) contain the stative verb *acreditar* "believe". In all cases there is a PP or an adverb that locates the described situations in time. The examples with the perfective forms describe situations that happen only once and within the time interval referred to by these modifiers. The imperfective sentences describe situations that are more prolonged in time and may extend outside the boundaries of these intervals.

Not explicitly shown in these representations are these aspectual (i.e. *Aktionsart*) constraints associated with the different tenses: as just mentioned, imperfective tenses (including present tense) constrain the eventuality being temporally located to be a state (possible results of this coercion include habitual readings,

epistemic readings, etc.), whereas perfective ones constrain it to be a telic situation (which can force inchoative readings, among others). For instance, the semantic representation of *smoke*, which is an activity/process lexically, used in the perfective past could include an operator to convert this activity into an accomplishment/culminated process. In the imperfective tenses a stative operator, like the habitual operator, could be present, in the spirit of de Swart (1998). For our purposes, however, we can ignore these aspectual constraints as they do not affect our analysis.

3 Backshift

For the purpose of handling backshift phenomena, we separate semantic tenses into two groups: relative tenses and absolute tenses. The *absolute tenses* always refer to the utterance time directly: they introduce in the semantic representation a temporal relation with the utterance time as one of its arguments. In turn, the *relative tenses* introduce a relation with a perspective point as one of its arguments. This perspective point is the utterance time if the corresponding verb is the head of the main clause of a sentence.[1] This perspective point is instead the event time of a higher verb, if that higher verb is a verb like *say*, triggering backshift.

For the HPSG implementation of such an analysis, revolving around this distinctive constraint of the perspective point and the utterance time, three features are employed: UTTERANCE-TIME, which represents the utterance time, or speech time; PERSPECTIVE-POINT, for this perspective point; and EVENT-TIME, for the event time. As mentioned before we use the type *t* for these features. There is also a subtype *s* of *t* for the speech time or utterance time. The feature UTTERANCE-TIME is declared to be of this more specific type.

We put the UTTERANCE-TIME feature under SS|LOC|CTXT|C-INDICES, as suggested in Pollard and Sag (1994) and in line with Van Eynde (1998). The feature PERSPECTIVE-POINT must be under S(YN)S(EM), since lexical items can constrain the PERSPECTIVE-POINT of their complement. We assume the two features are grouped together under a feature TIMES, which is under SS|LOC|CONT|HOOK, because they are relevant for the composition of semantics. This feature TIMES must be percolated in the appropriate places (headed phrases, etc.).

[1]This perspective point is similar to the perspective point assumed by DRT. Assuming that, in the case of matrix clauses, the perspective point is always the utterance time is a simplification that we make here because we are only interested in describing backshift (i.e. embedded clauses). The following example, from Kamp and Reyle (1993), illustrates the issue:

(1) Mary got to the station at 9:45. Her train would arrive at 10:05.

The perspective point of the second sentence must be the event time of the first sentence, so that this example can be accounted for by saying that conditional verb forms and *would* + infinitive constructions convey a semantic future tense anchored in a past perspective point. More cases where the perspective point of a main clause does not coincide with the utterance time are presented in Kamp and Reyle (1993)[p.595 and following ones].

The event time is always the second argument of the at relation introduced in the MRS representations by the lexical rules responsible for the semantic tenses:

$$\left[\begin{array}{l}\textit{semantic-tense-rule} \\ \text{SS}|\text{LOC}|\text{CONT}\left[\begin{array}{ll}\text{HOOK} & \boxed{1}\left[\begin{array}{lll}\text{LTOP} & \boxed{h1} & h \\ \text{INDEX} & \boxed{e1} & e \\ \text{TIMES}|\text{EVENT-TIME} & \boxed{t1} & t\end{array}\right] \\ \text{RELS} & \left\{\left[\begin{array}{ll}\textit{at} & \\ \text{LBL} & \boxed{h1} \\ \text{ARG0} & \boxed{e1} \\ \text{ARG1} & \boxed{t1}\end{array}\right]\right\} \cup B \cup \boxed{A} \\ \text{HCONS} & \boxed{C}\end{array}\right] \\ \text{DTR}|\text{SS}|\text{LOC}|\text{CONT}\left[\begin{array}{ll}\text{HOOK} & \boxed{1} \\ \text{RELS} & \boxed{A} \\ \text{HCONS} & \boxed{C}\end{array}\right]\end{array}\right]$$

where B is the semantic contribution of specific tenses, i.e. subtypes of *semantic-tense-rule*.

The temporal semantics we assume in this paper do not use constraints on handles, since all elementary predications are conjoined. For this reason, the HCONS of the mother is simply the HCONS of the daughter for all tense rules. The HOOK feature of the mother is also token-identical to the HOOK of the daughter. On the one hand, the LTOP and INDEX of the verb have to be made available higher in the tree for the composition of semantics. On the other hand, the feature EVENT-TIME has to be visible by the daughter node of this rule, since verbs that trigger backshift in their complement constrain this feature, as shown below. Depending on how the semantics of temporal location adverbials (such as *today*, *next month*, etc.) is implemented, this feature EVENT-TIME may also have to be available higher in the syntax tree. Therefore it is also in the HOOK of the mother.

The utterance time must be accessible at any point in a sentence (as argued above), so this feature must be unified across all *sign*s present in a feature structure. Therefore, syntax rules must unify the UTTERANCE-TIME of the mother with that of each of their daughters:

$$\left[\begin{array}{l}\textit{phrase} \\ \text{SS}|\text{LOC}|\text{CTXT}|\text{C-INDICES}|\text{UTTERANCE-TIME}\ \boxed{1}\ s \\ \text{DTRS}\left\langle\left[\text{SS}|\text{LOC}|\text{CTXT}|\text{C-INDICES}|\text{UTTERANCE-TIME}\ \boxed{1}\right], \ldots, \left[\text{SS}|\text{LOC}|\text{CTXT}|\text{C-INDICES}|\text{UTTERANCE-TIME}\ \boxed{1}\right]\right\rangle\end{array}\right]$$

The types for lexical rules must be constrained in a similar fashion. Additionally, in the start symbol, the features UTTERANCE-TIME and PERSPECTIVE-POINT are unified: the perspective point is thus the utterance time in matrix clauses:

$$\left[\text{SS}|\text{LOC}\left[\begin{array}{ll}\text{CTXT}|\text{C-INDICES}|\text{UTTERANCE-TIME} & \boxed{1}\ s\\ \text{CONT}|\text{HOOK}|\text{TIMES}|\text{PERSPECTIVE-POINT} & \boxed{1}\end{array}\right]\right]$$

Because some verbs like *say* trigger backshift in their complement, but other elements do not, the relation between an item's perspective point and that of its complement is controlled lexically. For most items (the default case) they are unified, but in the case of backshift triggering elements, the P(ERSPECTIVE)-POINT of the complement is the EVENT-TIME of the head. This is encoded in the lexical types. For instance, lexical items that backshift the tense of their first complement include the constraint:

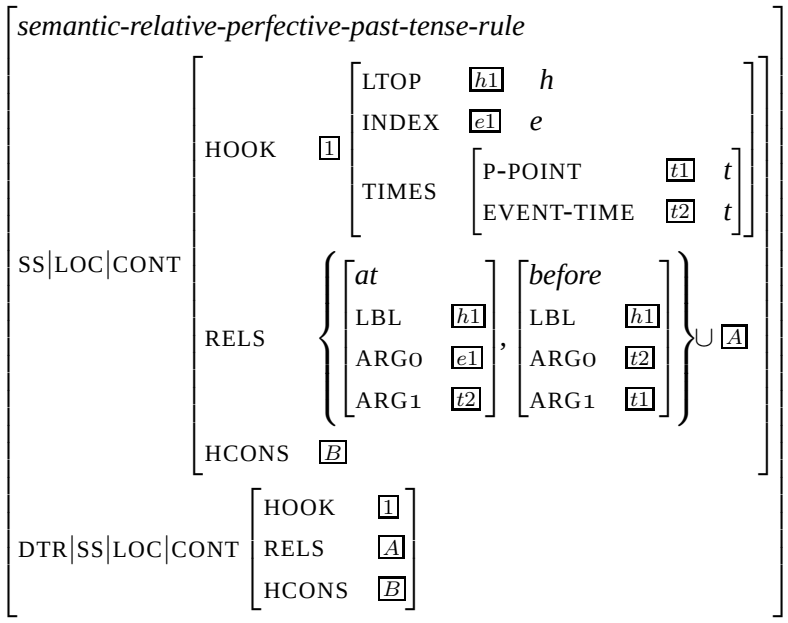
$$\left[\text{SS}|\text{LOC}\left[\begin{array}{l}\text{CAT}|\text{VAL}|\text{COMPS}\left\langle\left[\text{LOC}|\text{CONT}|\text{HOOK}|\text{TIMES}|\text{P-POINT}\quad\boxed{1}\quad t\right],\ldots\right\rangle\\ \text{CONT}|\text{HOOK}|\text{TIMES}|\text{EVENT-TIME}\ \boxed{1}\end{array}\right]\right]$$

The absolute tenses look at the feature UTTERANCE-TIME in order to find one of the arguments for the relevant temporal relation that they introduce in the semantics. The relative tenses look at the attribute PERSPECTIVE-POINT instead. As an example, the semantic perfective past tense is a relative tense. Consider:

(9) a. Kim lied.
$at(e_1, t_1) \wedge before(t_2, s) \wedge lie(e_1, kim')$

b. Kim said he lied.
$at(e_1, t_1) \wedge before(t_1, s) \wedge say'(e_1, kim', e_2) \wedge$
$at(e_2, t_2) \wedge before(t_2, t_1) \wedge lie(e_2, kim')$

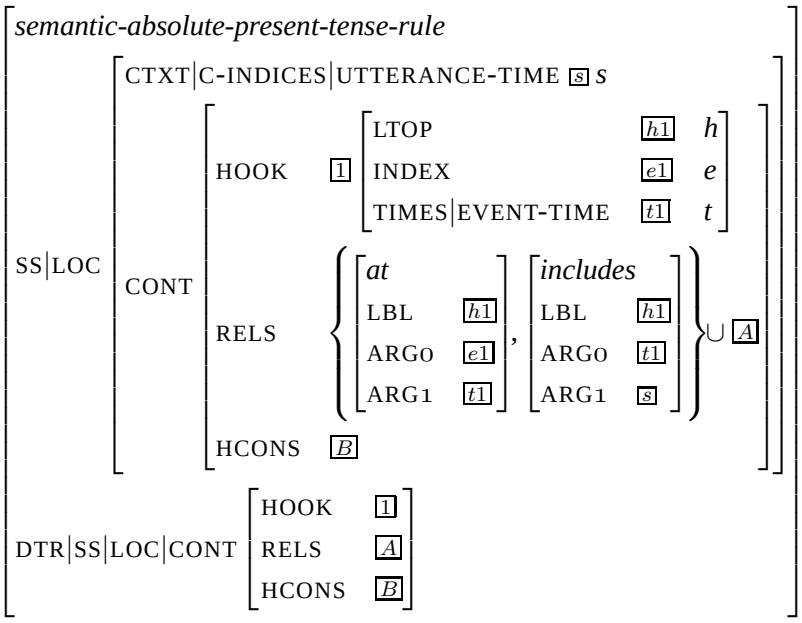
The second argument of the $before$ relation associated with semantic perfective past is not the utterance time (as has been presented so far) but rather the perspective point, because this tense is a relative tense. In the case of main clauses this perspective point is the utterance time—this is what happens in examples such as (9a), and it is also the case of the matrix verb in (9b). In the case of clauses occurring as the complement of verbs that trigger backshift, this perspective point is the event time of the higher verb. The example in (9b) is thus correctly analyzed as saying that the event of John lying precedes the saying event, as can be seen from the semantic representation provided in (9b). The AVM for the semantic perfective past tense rule thus includes the constraints:



By contrast, the semantic tense given by the English present tense, in examples like (1b) and (10) below, is an absolute tense.

(10) Kim said he is happy.
$at(e_1, t_1) \wedge before(t_1, s) \wedge say'(e_1, kim', e_2) \wedge$
$at(e_2, t_2) \wedge includes(t_2, s) \wedge happy'(e_2, kim')$

The semantic present carries an inclusion relation between the event time and another time. Because it is an absolute tense, this other time is always the utterance time, regardless of whether it occurs in backshifted contexts or regular ones.



English grammatical tenses	Semantic Tenses	Romance grammatical tenses
Simple present	Absolute (imperfective) present	Present
Simple past	Relative (imperfective) present	Imperfective past
Simple past	Relative imperfective past	Imperfective past
Simple past	Relative perfective past	Perfective past

Table 2: Mapping between some grammatical tenses and some semantic tenses, for English and Romance languages

We follow the strategy mentioned above in Section 2 of letting a grammatical tense be ambiguous between two or more semantic tenses. The relation between grammatical tense and semantic tense is language dependent, as shown in Table 2, where this mapping with semantic tense (middle column) is shown for some English grammatical tenses (left column) as well as some tenses in some Romance languages (right column).

The following examples illustrate each of the semantic tenses considered in this table under the influence of a higher past tense verb: the absolute present, denoting overlap with the utterance time, and represented by the English simple present in (11a);[2] the relative present, signaling overlap with the perspective point, and materialized in the English simple past in (11b); the relative imperfective past, marking precedence with respect to the perspective point, associated with a stative interpretation of the clause and realized by the English simple past in (11c); and the relative perfective past in (11d), similar to the relative imperfective past but associated with telic situations instead of stative ones.

(11) a. Kim said he is happy. (“I am happy”) *Absolute present*

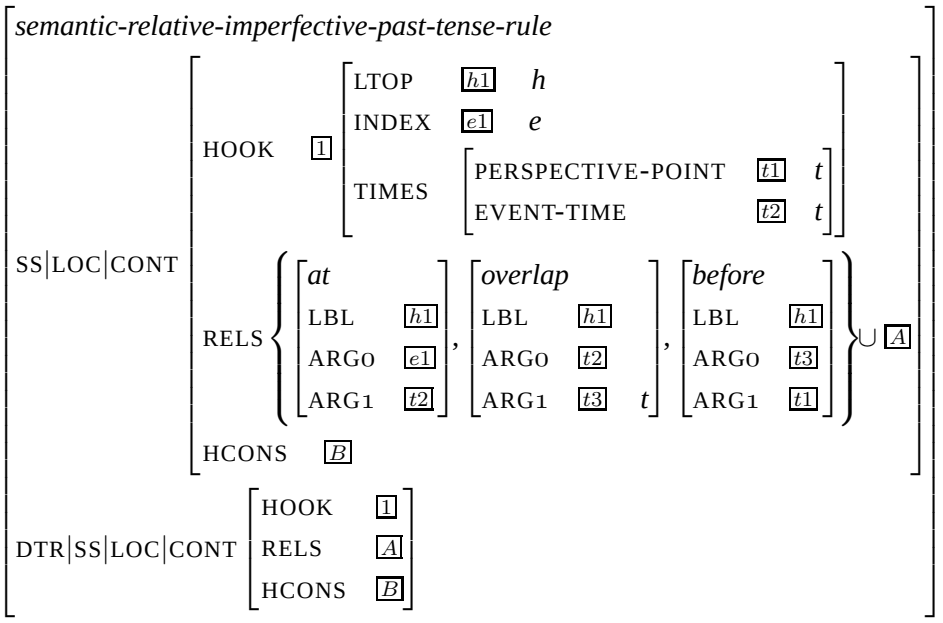
b. Kim said he was happy. (“I am happy”) *Relative present*

c. Yesterday Kim said he was happy when he was a child. (“I was happy when I was a child”) *Relative imperfective past*

d. Kim said he already had lunch. (“I already had lunch”) *Relative perfective past*

The constraints associated with the relative imperfective past are as expected from the discussion so far:

[2]The meaning of the “present under past” is not trivial (Manning, 1992), and we opt for a simplified view of it here.

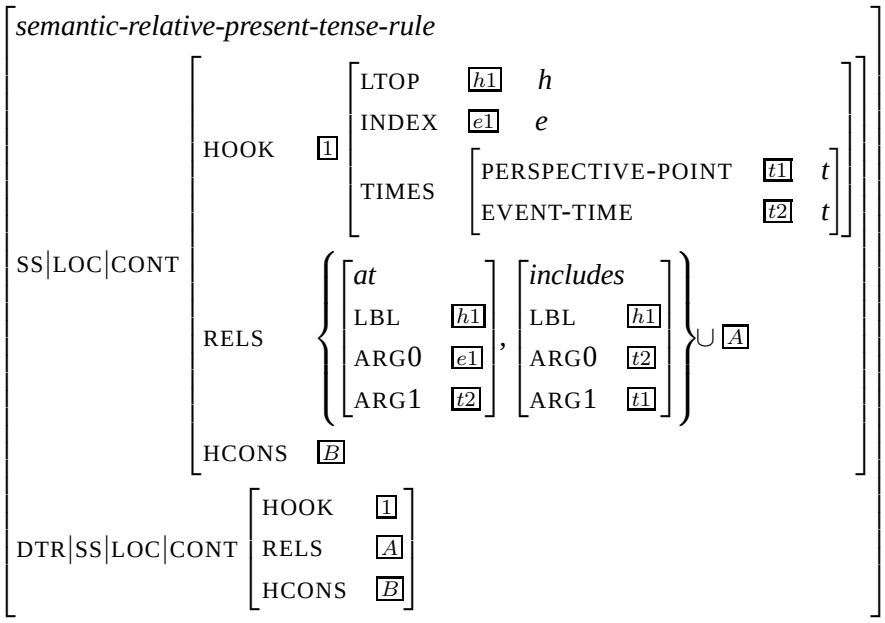


Both the English tense system and the Romance one show ambiguous past tenses. The English *simple past* can have the readings that the Romance grammatical perfective past has as well as those of the grammatical imperfective past. In the Romance case, the grammatical imperfective past is ambiguous between a semantic present (signaling temporal overlap) and a semantic past (marking precedence). In contexts with no tense shift, it is always a semantic imperfective past. However, in backshifted contexts it can also be a relative present tense. For instance, the Portuguese sentences that are translations of the examples (11b) and (11c) use the grammatical imperfective past. The direct speech equivalents can be the grammatical present or the grammatical imperfective past:

(12) a. O Kim disse que *era* feliz. (“Sou feliz”)

b. O Kim disse que *era* feliz quando era pequeno. (“Era feliz quando era pequeno”)

The relative present signals a temporal overlap relation between the time of the event denoted by the verb used in this tense and the perspective point: this is the reading for the examples in (11b) and (12a), where the two events overlap. We give this relative present tense (denoted by grammatical past in backshift contexts) a semantic representation similar to that assumed for the absolute present tense (denoted by grammatical present), the only difference is that the perspective point is used as the second argument of the $includes$ relation (it is a relative tense rather than an absolute one). These examples are thus analyzed as saying that the event time for the event described in the embedded clause includes the time of the event introduced by the matrix verb.



The only difference between the semantic relative present, given by the grammatical imperfective past, and the semantic absolute present, given by the grammatical present, is the second argument of the $includes$ relation that these two tenses introduce in the semantics. With the semantic relative present this is the perspective point, whereas with the semantic absolute present this is the utterance time.

Because the grammatical (imperfective) past cannot have a (relative) present reading in contexts with no tense shift, the lexical rule for this semantic tense (the relative present) must be constrained so that it only triggers in the appropriate syntactic context, namely in backshift contexts. There are a number of ways to do this. One may simply add the constraint that the perspective point has to be different from the utterance time. This solution is inadequate because it allows the grammatical (imperfective) past to have a semantic relative present reading in contexts where the perspective point is not the utterance time and is the event time of a verb that occurs in any tense that is not the present. Consider the following Portuguese example:

(13) A Maria dir-nos-á amanhã depois da festa que bebia demasiado. (imperfective past in the embedded clause)
Maria will tell us after the party tomorrow that she drank (i.e. used to drink) too much.

This sentence is similar to the one in (3) in that it contains a past tense clause embedded in a future tense clause. Whereas the past clause in (3) has a perfective reading (she drank too much at the party), the one in (13) displays an imperfective past. But despite being imperfective, the reading of temporal overlap with the main clause, of the sort that we find in (11b), is unavailable, and only the one of

temporal precedence is, as in (11c). For this reason, in cases such as this one, even though the perspective point is not the utterance time, the semantic relative present cannot be associated with the grammatical imperfective past. It is clear then that the semantic relative present can only occur in contexts where the perspective point is a past time.

An alternative that fixes this shortcoming is to use features to encode the temporal direction of temporal indices. This temporal direction can be first thought of as the location of the times denoted by temporal indices in the time line (*past*, *present*, *future*). As will be made clear shortly, this location is not absolute (i.e. it is not with respect to the speech time), so we use values like *backward*, *forward* and *no-dir(ection)* instead. We may think of a feature DIR(ECTION) appropriate for temporal indices, but instead we use two different features under TIMES: a feature P-DIR for the direction of the perspective point and a feature E-DIR for the direction of the event time. We do not use DIR features under temporal indices because the purpose of these features is to enforce a syntactic constraint (namely blocking semantic relative present tenses from occurring in the contexts where the perspective point is not a past time) and the temporal indices show up in the MRS representations produced by our analysis.

The possible values for these direction features are: *t(emporal)-dir(ection)* (the features P-DIR and E-DIR are declared to be of this type) and its three subtypes *no-dir*, *backward* and *forward*, which have no common subtypes.

The places where the PERSPECTIVE-POINT is constrained to be the utterance time also see the feature P-DIR to have the value *no-dir*. The revised constraints for the start symbols are thus:

$$\left[\begin{array}{l}\text{SS}|\text{LOC}\left[\begin{array}{ll}\text{CTXT}|\text{C-INDICES}|\text{UTTERANCE-TIME} & \boxed{1}\ s \\ \text{CONT}|\text{HOOK}|\text{TIMES}\left[\begin{array}{ll}\text{PERSPECTIVE-POINT} & \boxed{1} \\ \text{P-DIR} & \textit{no-dir}\end{array}\right]\end{array}\right]\end{array}\right]$$

As presented above, by default lexical items unify their complement's perspective point with their own perspective-point. These elements now additionally must unify their complement's P-DIR with their own P-DIR. The lexical items that trigger backshift on their complements identify their event time with their complement's perspective point. They now also identify their complement's P-DIR with their own E-DIR. For instance, verbs that backshift the tense of their first complement have the constraints:

$$\left[\begin{array}{l}\text{SS}|\text{LOC}\left[\begin{array}{ll}\text{CAT}|\text{VAL}|\text{COMPS}\left\langle\left[\text{LOC}|\text{CONT}|\text{HOOK}|\text{TIMES}\left[\begin{array}{ll}\text{P-POINT} & \boxed{1}\ t \\ \text{P-DIR} & \boxed{2}\ \textit{t-dir}\end{array}\right]\right], \ldots\right\rangle \\ \text{CONT}|\text{HOOK}|\text{TIMES}\left[\begin{array}{ll}\text{EVENT-TIME} & \boxed{1} \\ \text{E-DIR} & \boxed{2}\end{array}\right]\end{array}\right]\end{array}\right]$$

Finally, the lexical rules for the various semantic tenses constrain their E-DIR in the expected way: the semantic absolute present tense constrains it to take the value *no-dir*, past tenses with *backward* and future tenses with *forward*.

In the definition of the rule for the semantic relative present, the P-DIR feature has the value type *backward*. This means that this tense rule can only occur in contexts where the perspective point and the P-DIR feature have been constrained by a backshift triggering verb in the a past tense form. This constraint closely reflects the fact the the present tense reading (i.e. the temporal overlap reading) of the grammatical (imperfective) past tense only occurs in contexts where the perspective point is a past time, i.e. it is identical to the event time of another verb that is in a past tense:

$$\left[\begin{array}{l} \textit{semantic-relative-present-tense-rule} \\ \text{SS}|\text{LOC}|\text{CONT} \left[\begin{array}{ll} \text{HOOK} & \boxed{1} \left[\begin{array}{lll} \text{LTOP} & \boxed{h1} & h \\ \text{INDEX} & \boxed{e1} & e \\ \text{TIMES} & \left[\begin{array}{lll} \text{P-POINT} & \boxed{t1} & t \\ \text{P-DIR} & & \textit{backward} \\ \text{EVENT-TIME} & \boxed{t2} & t \\ \text{E-DIR} & & \textit{backward} \end{array}\right] \end{array}\right] \\ \text{RELS} & \left\{\left[\begin{array}{ll} \textit{at} & \\ \text{LBL} & \boxed{h1} \\ \text{ARG0} & \boxed{e1} \\ \text{ARG1} & \boxed{t2} \end{array}\right], \left[\begin{array}{ll} \textit{includes} & \\ \text{LBL} & \boxed{h1} \\ \text{ARG0} & \boxed{t2} \\ \text{ARG1} & \boxed{t1} \end{array}\right]\right\} \cup \boxed{A} \\ \text{HCONS} & \boxed{B} \end{array}\right] \\ \text{DTR}|\text{SS}|\text{LOC}|\text{CONT} \left[\begin{array}{ll} \text{HOOK} & \boxed{1} \\ \text{RELS} & \boxed{A} \\ \text{HCONS} & \boxed{B} \end{array}\right] \end{array}\right]$$

Note that for this tense the E-DIR is also constrained to be a *backward* looking one, just like for the past tenses. This is because of examples such as:

(14) O Kim disse que dizia que era feliz.
Kim said (perfective) that he said (imperfective; = "used to say") that he was happy.

This example shows that a clause in the semantic relative present can be embedded in another clause also in the semantic relative present. Since the semantic relative present needs a *backward* looking perspective point, it too needs to supply a *backward* E-DIR (which becomes the P-DIR of the complement clause due to the constraints just described), or at least leave it underspecified. It cannot constrain

its E-DIR to be *no-dir* even though it is semantically present in the sense that it denotes temporal overlap, as that would prevent this combination.

Furthermore, the values of these direction features are not absolute (i.e. relative to the utterance time), because of sentences like (3) and (13), and this is why we use the type names *backward*, *no-dir* and *backward* instead of *past*, *present* and *future*. Even though the embedded clauses in these examples will have a feature E-DIR with the *backward* value, they are not necessarily associated with past events (the preferred reading for (3) is arguably one according to which the drinking event is after the speech time).

Although this extra feature on the temporal indices may seem at first to make our temporal semantics redundant, as we now have two ways of describing the relation of an event time with a perspective point (the elementary predications describing various temporal relations between temporal indices and the direction features describing the temporal direction of temporal indices), it must be noted that they are in fact independently required, since they describe different things: as just mentioned for the example in (3), a *backward* looking event time does not necessarily mean the corresponding event is a past event.

4 Related Work

Many analyses of backshift and sequence of tense can be found in the literature, some of which we describe briefly. Reichenbach (1947), in his famous analysis of tense as involving temporal constraints between the speech time S and a reference time R on the one hand and between that reference point R and the event time E on the other, mentions the *permanence of the R-point*: a sentence like * *I had mailed the letter when John has come* is ungrammatical because the temporal constraints between R and S are incompatible in the two tenses involved (the past perfect constrains R to precede S while the present perfect constrains them to be simultaneous).

However, Reichenbach did not develop a full account of backshift. A Reichenbachian analysis of this phenomenon is that of Hornstein (1991), that posits a sequence of tense rule which associates the speech time S of an embedded clause with the event time E of the higher clause. In this analysis a conditional form of a verb is considered to be, underlyingly, a future form, which is transformed into a conditional form in backshift contexts. As pointed out by Gutiérrez and Fernández (1994), this fails to explain why the two tenses combine differently with adverbs like *yesterday*. If the conditional form in (15b) is a future form in deep structure, (15b) should be ungrammatical just like (15a) is:

(15) a. * Juan asegura que Pilar asistirá ayer a la fiesta.
Juan affirms that Pilar will attend the party yesterday.

b. Juan aseguró que Pilar asistiría ayer a la fiesta.
Juan affirmed that Pilar would attend the party yesterday.

The work of Comrie (1986) suffers from the same problem, as it also consists in a sequence of tense rule that transforms the tenses found in direct speech into the ones found in reported speech.

According to Declerck (1990), when two situations are located in time, there are two possibilities: either both of them are represented as related to the time of speech (absolute use of the tenses), or one situation is related to the time of speech while the second is related to the first (relative use, in the second case). In the second case, the simple past simply denotes overlap with a previous situation. This is very similar to our proposal, but we classify the different tenses as to whether they are relative or absolute, whereas Declerck (1990) assumes both possibilities for all tenses and lets pragmatics disambiguate, but these pragmatic conditions are never made explicit.

For Stowell (1993), past morphology is like a "past polarity" item that needs to be licensed by a Past operator (that in English is covert) outscoping it. The Past operator is what conveys the temporal precedence constraints present in the semantics. Past morphology can be bound by Past operators in different (higher) clauses, which explains sentences like (11b). The analysis of Abusch (1994) is similar in spirit, but it resorts to semantic rather than syntactic constraints.

Like us, Michaelis (2011) also assumes that the English simple past is ambiguous between two tenses (a perfective/eventive one and an imperfective/stative one). Because of this, and similarly to us, she is in a position where it is possible to account for the interplay between aspect and tense—i.e. perfective past clauses in backshift contexts are always anterior to the main clause event—, which the rest of the literature on backshift cannot explain.

However, the author fails to notice that and instead analyzes examples like (16), which is hers, as an example of an embedded imperfective/stative tense (when its translation to other languages shows that it should be viewed as an instance of a perfective tense). She then tries to obtain precedence effects from constraints coming from this imperfective tense, by deriving from it a semantic content similar to that of the English present perfect, which the grammatical imperfective past never has in languages like the Romance ones.

(16) He said that he paid $2000 for his property in 1933.

This relation between aspect and the possibility of the two past under past readings had been noticed by Enç (1986). The author mentions that statives allow two interpretations, one of simultaneity (17a) as well as one of precedence (17b) with respect to the event in the main clause. In the same context, non-statives do not exhibit the two readings that statives do. They only allow the precedence reading, as in (17c).

(17) a. John remembered that Jane was not even eighteen.
b. John remembered that Jane was not even eighteen when he met her.
c. John remembered that Jane flunked the test.

As the following examples in Portuguese show, this contrast is dependent not on the lexical aspect of the verb but on the aspectual type of the entire clause, i.e. whether a perfective or imperfective tense is used (as they constrain the aspectual type of the clause, as mentioned above).

(18) a. O John lembrou-se que a Jane tinha dezoito anos. (imperfective)
John remembered that Jane was eighteen.

b. O John lembrou-se que a Jane tinha dezoito anos quando a conheceu. (imperfective)
John remembered that Jane was eighteen when he met her.

c. O John lembrou-se que a Jane teve dezoito anos. (perfective)
John remembered that Jane was (once) eighteen.

d. O John lembrou-se que a Jane chumbou no teste. (perfective)
John remembered that Jane flunked the test.

e. O John lembrou-se que a Jane chumbava no teste. (imperfective)
John remembered that Jane flunked the test (e.g. she flunked it every time she tried).

f. O John lembrou-se que a Jane chumbava no teste quando a conheceu. (imperfective)
John remembered that Jane flunked the test when he met her (e.g. she flunked it every time she tried).

These examples show the combinations of perfectivity and the two lexical aspect classes considered by Enç (1986). The clauses with perfective past tense forms can only be interpreted as describing a situation that precedes the matrix one. The ones with imperfective forms are ambiguous and allow both simultaneity as well as precedence readings. The precedence readings are easier when the temporal location of the situation is mentioned explicitly, hence the *when* clauses. Our analysis correctly describes this generalization.

The collection of papers in Lo Cascio and Vet (1986) is about tense phenomena, including sequence of tense phenomena. Particularly relevant are those of Lo Cascio (1986), Rohrer (1986), Lo Cascio and Rohrer (1986) and Rigter (1986). Lo Cascio (1986) distinguishes between deictic tenses (those directly linked to the utterance time) and anaphoric tenses (those linked to the utterance time indirectly). This is similar to our distinction between absolute and relative tenses. Our use of a perspective point draws on the work of Rohrer (1986), which is an analysis of backshift for French in Discourse Representation Theory. Like us, the author uses it to relate embedded tenses to the time of matrix situations. More specifically, "the time denoted by the event of the matrix sentence becomes the temporal perspective point of the complement clause". The perspective point is necessary for those cases when the main verb shows future tense and the embedded one shows a past tense, like examples such as (3) illustrate. In such cases, past tense merely indicates precedence with respect to the perspective point, but not necessarily with the utterance time.

Van Eynde (1998) is a DRT-inspired analysis of English tenses in HPSG that also discusses transposition or sequence of tenses. Although he considers data such as the sentence in (19), rather than data involving the complement clauses of verbs like *say*, the data are nevertheless very similar. In the second sentence of (19) the simple past is a semantic present relative to a past perspective point introduced in the first sentence. However, the author does not discuss the use of simple past tenses to convey temporal precedence with the perspective point in transposition contexts, a possibility that is clearly available in backshift contexts, as examples like (1c) show.

(19) Mary had been unhappy in her new environment for more than a year. But now she felt at home.

More generally, the treatment of tense and aspect in HPSG includes the work of Van Eynde (1994, 2000), Bonami (2002), Goss-Grubbs (2005), and Flouraki (2006), among others.

5 Conclusions

In this paper we presented a cross-language account of backshift. We illustrated the problem with data from English and some Romance languages. Our approach relies on two levels of tense representation: the morphological one and the semantic one. The relation between these two levels is language dependent.

In this scenario, backshift is the result of the interaction of three key properties of tense: (i) grammatical tense can be ambiguous, (ii) the meaning of tense is the combination of three characteristics (direction, aspect, how the arguments of the temporal relations are chosen), and (iii) some of these combinations occur only in restricted contexts.

One strong point of our analysis is the clean distinction between the tenses that constrain the utterance time directly and the tenses that refer to an abstract perspective point, that needs to be resolved (as the utterance time or alternatively as the event time of a higher event). Another contribution is the correlation between perfectivity distinctions and the availability of temporal overlap readings in past under past constructions, which the remaining literature on the topic fails to explain.

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An a priori typology of sentential negation from an HPSG perspective

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Abstract

In this paper I explore the logical range of sentential negation types predicted by the theory of HPSG. I find that typological surveys confirm that attested simple negation strategies neatly line up with the types of lexical material given by assuming Lexical Integrity and standard Phrase Structure Grammar dependencies. I then extend the methodology to bipartite negation and derive a space of predicted sentential negation types. I present details of the analysis for each type and relevant examples where possible. Keywords: negation, grammatical exponence, typology, Grammar Matrix

1 Introduction

Every natural language exhibits sentential negation (Forest 1993; Miestamo 2005, *inter alia*)—the grammatical phenomenon whereby a linguistic construction is used to indicate that a sentence's semantic contribution is to be interpreted with a truth value opposite to that of its non-negated counterpart. This paper investigates and makes predictions about what particular constructions we should expect to find employed in the marking of negation across the world's languages.

HPSG theorists have provided analyses of negation for particular languages of interest[1] but this work attempts to generalize and make predictions about yet unseen negation types.

The methodology employed here is an *a priori* exploration. I look to syntactic theory for a model of lexical material and possible attachment mechanisms for morphs and I combine this with information about attested negation strategies reported in typological surveys of sentential negation to generate a family of negation analyses—a model of sentential negation from an HPSG perspective. Some of these negation types are familiar from HPSG literature, others are merely predicted by the methodology. Therefore, one purpose of this paper is to expose the predicted analyses to a wider audience of linguists, who may know of a language to which a particular analysis may apply.

1.1 Lexical Material in HPSG

Following Dryer (2005), this work assumes that negation must be indicated in a sentence by some lexical material, and that (at the level of syntactic analysis)

[†]This work would not have been possible without the assistance of my colleagues in the Grammar Matrix development group: Emily M. Bender, Antske Fokkens, Michael Goodman, Sanghoun Song and David Wax. Secondly, I wish to thank the anonymous reviewers and attendees at the HPSG conference (especially Michael Hahn and Berthold Crysmann), who discussed this work with me and pointed me toward new examples which I had not uncovered on my own.

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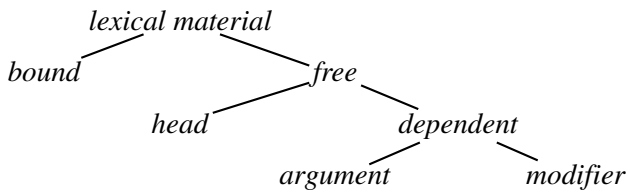
[1]For example, see Kim 2000 for Korean [kor], English [eng], French [fra] and Italian [ita].

lexical material is composed of morphemes. Therefore, the first question to ask regards the relevant dimensions of variation for morphemes in HPSG.

Assuming the Lexical Integrity Hypothesis (Bresnan and Mchombo, 1995) and standard phrase structure grammar dependencies, we can create a partial typology of lexical material for lexicalist phrase structure grammars which is shown in (1). This partial typology suggests that morphemes are strictly bound or free, that free morphemes are heads or dependents and that dependents are arguments or modifiers. Below, these properties will be integrated into a broader typology of predicted negation types.

(1)



1.2 Typological Survey

The broad categories of sentential negation as proposed in typological surveys partially overlap with the properties of morphemes in HPSG discussed above. I take Dahl's (1979) negation types as a representative example. That list is given in (2).

(2) a. morphological negation

b. uninflected negation particles

c. negative auxiliary

d. dummy auxiliary construction

e. double particle construction

In comparing Dahl's categories to the typology of lexical material given above (1), we can identify a notable amount of correlation—the theory of grammatical morphemes has already predicted a large number of Dahl's types. Morphological negation (2a) corresponds to the *bound* node of (1). Uninflected negative particles (2b) correspond to the *dependent* node of (1). Negative auxiliaries (2c) correspond to the *head* node of (1).

Furthermore, because a dummy auxiliary is not itself a negative word, Dahl's category "dummy auxiliary construction" (2d) can be seen as subsumed by his other categories, depending on the morphological status of the negator. That is, in a fleshed-out, implemented grammar, the presence of the dummy auxiliary can

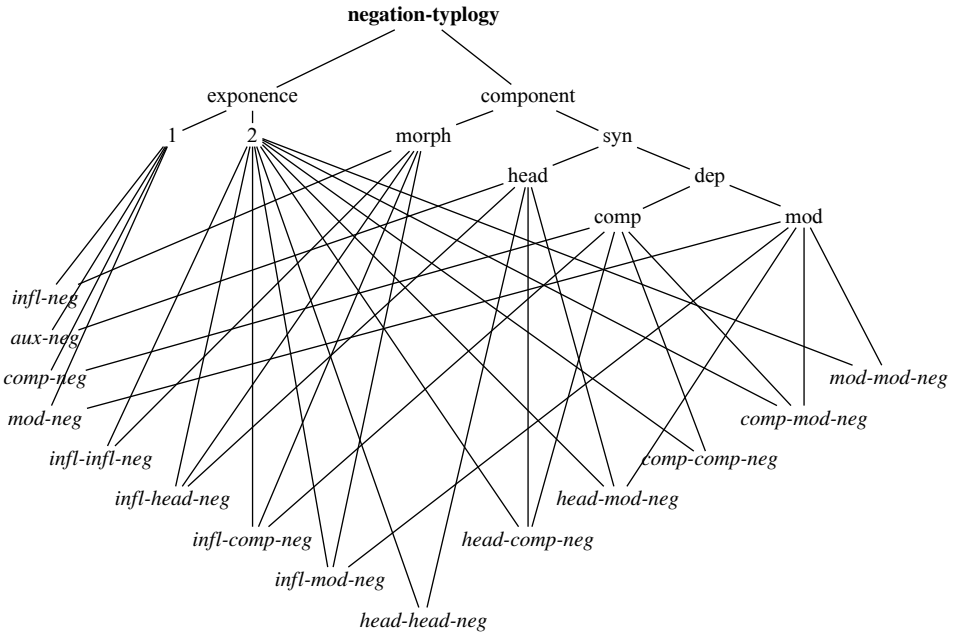


Figure 1: morpheme-type × exponence model of sentential negation

be seen as a side effect of subcategorization and constraints on finiteness, topics not particular to negation.

Given this caveat, we have reduced the first four of Dahl's categories to three types which were predicted by syntactic theory: morphological negation, negative auxiliaries (syntactic heads), uninflected negative particles (syntactic dependents), but still outstanding is the deceivingly monolithic category "double particle construction." Here, what served as a single category for Dahl in fact contains a lot of complexity when viewed from an HPSG perspective. In the next section, I propose a method to break this category out into a family of negation analyses for bipartite negation in HPSG.

1.3 Proposed Negation Typology

In this section I propose to unpack the category of "double negation" by adding a dimension of *exponence* to the typology of lexical material in (1) deriving the model in Figure 1. Typologists such as Dahl (ibid.) and Dryer (2005) have recognized that sentential negation is marked by single or multiple exponence, but this work promotes the notion of syntactic exponence to a primary dimension of analysis in the typology, deriving a family of subtypes for the henceforth unanalyzed category of double negation.

The main idea behind the model in Figure 1 is that both simple and bipartite negation constructions can be categorized in terms of the grammatical properties

of the morphemes involved. Simple negation types were found to be in a one-to-one correspondence with the types of grammatical material available. That is, for each morpheme type we know about (the leaves of the tree in (1)), typologists present examples of a language which encodes sentential negation using this type. This paper extends the approach to bipartite negation types, exploring each of the 10 predicted bipartite types[2] to develop fleshed-out syntactic analyses where feasible. The work presented here has also been implemented in the LinGO Grammar Matrix (Bender et al., 2002, 2010) as an extension to the downloadable options for sentential negation.[3] In this way, these analyses have been vetted by the development of grammatical test-suites for each type, which verify that the analyses work as expected. These test-suites and accompanying tests are part of the distribution of software available for download as the LinGO Grammar Matrix customization system.[4]

2 HPSG Analyses

2.1 Simple negation

Here I briefly review the analyses for simple types before going on to to the bipartite negation types.

infl-neg

(3) a. s-ă˙m-á
1SG-eat-FV
I eat. [acv]

b. tsé-s-ùw-í d-ámm-ì
NEG-1SG-be-FV NMLZ-eat-FV
I do not eat. [acv]

(3) is an example from Achumawi [acv] (Dryer, 2005; De Angulo and Freeland, 1930) of a bound morphological negator which attaches to an auxiliary verb.[5]

[2]Generally, a k-multicombination of elements from a set with n elements is given by $\binom{n+k-1}{k}$ where the notation $\binom{x}{y}$ indicates $\frac{x!}{y!(x-y)!}$. Here, $k = 2$ (bipartite negation) and $n = 4$ (there are four morpheme types under consideration), so $\frac{5!}{2!(5-2)!} = \frac{120}{2(6)} = 10$. Thanks to Sanjay Rao for pointing this out.

[3]The Grammar Matrix customization system allows users to fill out a questionnaire and download a machine-readable grammar, it is publically available for use on-line `http://www.deph-in.net/matrix/customize/`

[4]The Grammar Matrix and Customization System is distributed under the MIT license and available for download as a subversion repository at `svn://lemur.ling.washington.edu/shared/matrix/trunk/` with user account "guest".

[5]Parallel to the English construction, here we see a dummy auxiliary introduced as the host to the negator. But the auxiliary is not itself a negative word.

This type of morpheme can be modelled straightforwardly as an inflectional rule which attaches to auxiliary verbs and contributes the negation relation through C-CONT (Kim, 2000) as shown in (4).

(4)
$$\left[\begin{array}{ll} \textit{negpc-lex-rule} & \\ \text{INFLECTED}|\text{NEGPC-FLAG} & + \\ \text{C-CONT} & \left[\begin{array}{ll} \text{HOOK} & \left[\begin{array}{ll} \text{XARG} & \boxed{1} \\ \text{LTOP} & \boxed{2} \\ \text{INDEX} & \boxed{3} \end{array}\right] \\ \text{RELS} & \left\langle\, ! \left[\begin{array}{lll} \textit{event-relation} & & \\ \text{PRED} & & \text{"neg\_rel"} \\ \text{LBL} & & \boxed{2} \\ \text{ARG1} & & \boxed{4} \end{array}\right] ! \,\right\rangle \\ \text{HCONS} & \left\langle\, ! \left[\begin{array}{ll} \textit{qeq} & \\ \text{HARG} & \boxed{4} \\ \text{LARG} & \boxed{5} \end{array}\right] ! \,\right\rangle \end{array}\right] \\ \text{DTR} & \left[\begin{array}{ll} \textit{aux-verb-lex} & \\ \text{CONT}|\text{HOOK} & \left[\begin{array}{ll} \text{XARG} & \boxed{1} \\ \text{LTOP} & \boxed{5} \\ \text{INDEX} & \boxed{3} \end{array}\right] \end{array}\right] \end{array}\right]$$

head-neg

(5) e-n syö-nyt omena-a
neg-1sg eat-PTCP apple-PART
I didn't eat an apple. [fin]

(5) provides an example of a negator as a syntactic head in Finnish [fin] (Dryer, 2005; Sulkala and Karjalainen, 1992)—in this case an auxiliary verb which takes the lexical verb to be negated as a complement. This negative auxiliary verb can be modelled as contributing the negation relation through normal semantic composition of its own CONT value with that of its argument(s) via a head-complement rule. Assuming a grammar already has a model of semantically contentful auxiliaries, the idiosyncratic properties of the negative auxiliary are rather minimal, only a lexical instance with the spelling and predicate name must be specified.

comp-neg

(6) I do not care
1SG AUX NEG care
I do not care. [eng]

(6) shows a negated sentence of English [eng]. As mentioned above, (Kim, 2000; Kim and Sag, 2002) provide compelling arguments for treating the *not* of sentential negation as a selected complement of the auxiliary verb in the languages they analyze. For English(-like languages), a valence-changing, non-inflecting lexical rule creates a version of the auxiliary which requires *not*, along with any other complements.[6]

mod-neg

(7) Musa rok gik mwa duŋ-duŋ ka
NAME throw rock PL much NEG
Musa didn't throw many rocks. [anc]

(7) is an example from Ngas [anc] (Dryer, 2009; Burquest, 1973) , which is perhaps best treated as a modifier for two reasons. The first has to do with linguistic tradition and recursion. Kim and Sag (2002) treat finite (sentential) negation as a complement of the auxiliary after arguments based on the specific facts of English and French. They show that (in English) non-finite (VP) negation can recurse, but finite negation cannot. However, this argumentation is language specific. Without more facts about the syntactic structure of Ngas, we cannot apply their reasoning directly. The second reason comes from concerns of parsimony in a given implementation framework. In the formalism of Copestake (2002), VAL(ence) lists are implemented as linked-lists whose length is not externally visible (cf. difference lists used in semantic composition which support list-append operations). Thus, a monolithic lexical rule engineered to insert an additional complement at the end of the argument list of any verb is not possible. Instead, a specific lexical rule will have to be written for classes of verbs based on the length of their COMPS list. This approach leads to an unnecessary over-complication of the lexical rule system. But this complication is avoided if the negator is attached by a head-modifier rule.

This observation can be seen as a prediction of the formalism: we do not expect to find valence-changing lexical rules which target the last position of VAL lists across all verbs in a language. Should this prediction be falsified, it would provide motivation for modeling valence lists as the more articulated difference lists used in keeping track of semantic composition.

This prediction notwithstanding, the crux of this work is to provide a family of analyses which should be useful for the widest possible range of languages and grammar writers. These considerations have led me to include negation by modification alongside negation by complementation.

[6]As discussed in (Sag et al., 2003), this lexical rule treatment also parsimoniously sets up an analysis of a family of syntactic properties for English auxiliaries, the so-called NICE properties: Negation, Inversion, Contraction, Ellipsis.

2.2 Bipartite negation

There are 10 bipartite negation types predicted by the methodology described in the introduction. Here, I examine each of these types in more detail.

infl-infl-neg Bipartite negation may be marked by two bound negators. Here, we can imagine two subtypes: (a) both negators are bound to the same head; (b) the negators are bound to separate heads. The case of (a) is attested, for example, in Izi-Ezaa-Ikwo-Mgbo [izi] (Dryer, 2009; Meier et al., 1975) (8) and in Spoken Egyptian Arabic [arz] (Lucas and Lash, 2008) (9).

(8) ó tó-òmé-dú ré
3SG NEG-do-NEG well
He does not do well. [izi]

(9) ma-bəḥibb-^{i}š migiyy-u hina ktīr
NEG-like.IMPF.1SG-NEG coming-his here much
I don't like his coming here a lot. [arz]

The (a) cases are readily modelled with existing approaches to implemented HPSG morphotactics, such as the one described in (Goodman and Bender, 2010) for the LinGO Grammar Matrix. One lexical rule can require the presence of another—and only one of the lexical rules will contribute the semantic relation and constraints shown in (4).

In the case of (b), with bound negators on separate heads, the only plausible situation is that one negator is bound to an auxiliary verb and the other to a lexical verb.[7] I have yet to find a report of such a construction, but the methodology here predicts its existence. A schematic example of such a structure in a SVO language where auxiliaries precede their arguments (and raise the VP subject) would look as in (10).

(10) np aux-neg1 iverb-neg2.

In terms of feature structures, this sort of construction is readily captured through the selectional properties of the auxiliary and lexical rules. The lexical rule that attaches to the auxiliary introduces negative semantics through C-CONT as in simple inflectional negation described above, but with the additional requirement that its lexical verb complement also be inflected for negation. To achieve this, the lexical rule will also constrain its head's COMPS value to require a particular FORM value—one which the lexical rule attaching to the lexical verb will specify. Relevant aspects of these lexical rules are shown in (11).[8]

[7] If the putative second negator is bound to a nominal, it is best conceived of as a case of negative concord, a phenomenon distinct from bipartite negation, cf. De Swart and Sag 2002

[8] To achieve the mutual dependency of the two elements, auxiliary verbs must underlyingly select for lexical verbs with a FORM value incompatible with *negform*.

(11) a. $\begin{bmatrix} \textit{neg1-lex-rule} & \\ \text{DTR} & \begin{bmatrix} \textit{aux-verb-lex} \\ \text{COMPS}|\text{FIRST}|\text{FORM } \textit{negform} \end{bmatrix} \end{bmatrix}$

b. $\begin{bmatrix} \textit{neg2-lex-rule} & \\ \text{DTR} & \begin{bmatrix} \textit{lexical-verb-lex} \\ \text{HEAD}|\text{FORM } \textit{negform} \end{bmatrix} \end{bmatrix}$

infl-head-neg In this negation type, an inherently negative auxiliary verb is present and the lexical verb is marked with a required negative affix. I have not yet found a language with sentential negation of this type. Yet, schematically, such a construction looks like (12):

(12) np neg1.aux iverb-neg2.

The feature structures involved in this negation type are like ones we have already seen. The negative auxiliary will also have to require the presence of *-neg2* on its complement through the FORM feature, and the grammar will have to contain a rule such as (11b) to introduce the negative affix to the lexical verb and constrain its FORM value.

infl-comp-neg This type is widely attested, as for example in French [fra] (Dryer, 2005) (13) (as analyzed by Kim and Sag 2002).

(13) Je ne-vois pas la lune
1SG NEG1-see.1SG NEG2 the moon
I do not see the moon. [fra]

The facts of French suggest that the free negator, *pas*, carries negative force, so the lexical rule which attaches the inflection to the finite verb will place an element on the finite verb's complements list.[9] For French, the additional complement is placed at the front of the list, so we don't run into any problem finding the length of the list.[10] The complement-changing constraint necessary to create a French-like additional verbal complement is shown in (14).

[9]To simplify the range of choices presented to the user, the current policy of the negation library is to automatically choose for the user which element of a bipartite construction carries the negative predicate. Here, the example of French and the added computational cost of a semantically empty free element motivate placing negative force on the complement. In the case that the facts of a language suggest the opposite situation, users can always edit the output grammar to achieve this.

[10]Linked lists support push and pop operations (akin to stacks). Placing an item on top of the stack is trivial. Finding the depth of the stack takes extra computation, as discussed above.

(14)
$$\begin{bmatrix} \textit{neg1-lex-rule} & \\ \text{COMPS} & \begin{bmatrix} \text{FIRST} & \textit{neg-adv} \\ \text{REST} & \boxed{1} \end{bmatrix} \\ \text{DTR} & \begin{bmatrix} \text{COMPS} & \boxed{1} \end{bmatrix} \end{bmatrix}$$

infl-mod-neg In this type, sentential negation is marked by verbal inflection, and a modifier is also present.

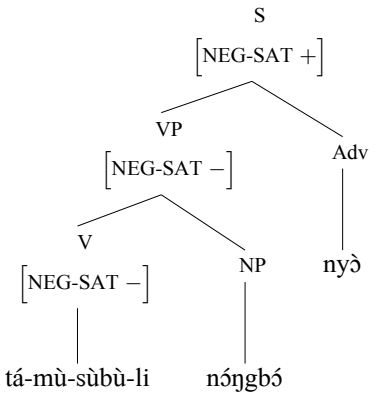
The case of Ma [msj] (Dryer, 2005; Tucker and Bryan, 1966, 130) (15) may present an example of such a construction. In Ma, the lexical verb is inflected by the prefix *tá-*, and an obligatory element which is inflected for agreement with the subject is placed at the end of the VP. Tucker and Byran refer to this element as a "postposition inflected for person". At first glance, the inflection on this element may suggest that it is in fact an auxiliary verb (thus an example of *infl-head-neg*). But in Ma, auxiliary verbs are placed before the lexical verb, a fact which suggests this is not the best analysis.

(15) tá-mù-sùbù-li nɔ́ŋgbɔ́ nyɔ̀
NEG-1SG-eat-PST meat NEG.1SG
I did not eat meat. [msj]

We can add the negative semantic relation via the inflectional lexical rule which attaches to the finite verb. To create the dependency between the inflectional marker of negation and the post VP modifier, an additional feature must be introduced. This *luk*-valued[11] feature is termed NEG-SAT and is defined on *synsems*. The root condition is amended to require that grammatical sentences are [NEG-SAT *na-or-*+] and most phrase structure rules are annotated such that the value of NEG-SAT is passed up via the head-path. The lexical rule which introduces negation on the finite verb sets NEG-SAT to −. Finally, a subtype of head-modifier rule is defined to attach the free negator to a VP which is [NEG-SAT −] and create a resulting phrase which is [NEG-SAT +]. In this way, the lexical rule which attaches negation to the finite verb can only appear in a grammatical sentence which also picks up the secondary marker of negation once the VP is completed (16). The approach of using a head-modifier rule avoids the complication of creating separate types of lexical rule for each verbal valence class.

[11] *luk* is a three-valued type named after Polish Logician Jan Łukasiewicz (Flickinger, 2000). It allows $\{+, -, na\}$, as well as *na-or-*+ and *na-or–*, but +*-or–* is inconsistent.

(16)



head-head-neg This predicted type has been set aside as unlikely and potentially grammatically incoherent. The predicted construction would only be possible as non-dependent multiple auxiliary verbs which mark simple negation and so would only be available in languages with serial auxiliary verb constructions.

head-comp-neg In this type of bipartite negation, an inherently negative auxiliary verb requires a grammatical complement. Schematically, such a construction looks like (17).

(17) np neg1.aux iverb neg2.

On the surface, this type is similar to others we've seen above. The choice to model the *neg2* dependency as a complement or modifier will be dependent upon language specific argumentation. The schematic example shown in (17) can be modelled using a negative auxiliary as in (9), with the added requirement on the COMPS list for the negative particle. Note that in the cases where the introducer of negative force is a head, we do not encounter the problem of finding the length of the argument list because it is simply specified in the lexical entry for this auxiliary verb type—there's no need to alter this list once it has been defined.[12]

head-mod-neg This type is similar to the *head-comp-neg* but the secondary negation marker is attached through head-modifier rather than head-complement rules. On the surface, the example looks identical to (17). To invoke this type language specific arguments about the grammatical system under consideration would have to be made. In general, considerations of parsimony go against this sort of analysis because the NEG-SAT approach described above for *infl-mod-neg* will have to be used. Given a negative head and a (free) negative dependent, the *head-comp-neg* approach is preferred. On the other hand, if syntactic tests for argument-hood fail, the NEG-SAT approach is still a viable way to handle these sorts of constructions.

[12] As pointed out to me by Emily M. Bender, this is only true of non-argument composing auxiliaries.

comp-comp-neg In this type, negation is marked by two obligatory complements of a verb. As with the *infl-infl-neg* type described above, we can imagine two subtypes: a) both complements are subcategorized by the same verb; b) one complement is selected by an auxiliary, the other by a lexical verb. The case of (a) can be modelled according to a lexical rule which applies to a verb and modifies its COMPS list. If one of the complements appears at the end of the list, this sort of analysis incurs the difficulty discussed above: subtypes of the lexical rule must be posited for each class of verbs based on length of COMPS list. I have not yet uncovered an example of the (a) type case. An example from Afrikaans [afr] (Bell, 2004; Oosthuizen, 1998) (18) presents a structure which could be analyzed as a (b)-type case. The auxiliary must place a requirement on its lexical verb complement that it also have undergone a complement-changing lexical rule. This can be encoded using the HEAD feature [NEGATED *luk*] proposed in Crowgey and Bender 2011.

(18) Hulle was nie betrokke nie
they were NEG1 involved NEG2
They were not involved. [afr]

This dependency can be achieved via the engineering of a feature which is passed up the head path when a verb is negated. A head feature [NEGATED *luk*] can be introduced by a lexical rule (in this case, the same rule which introduces the verbal complement). Then the finite auxiliary will also require that its lexical verb complement be [NEGATED +].

comp-mod-neg In particular examples, this negation type would look similar to *comp-comp-neg*. Syntactic tests for the treatment of the secondary negator as a modifier will have to be made. We can create an analysis of this type using a lexical rule to introduce the *neg1* complement, and the NEG-SAT analysis (as presented above) to create the requirement that *neg2* be attached through a head-modifier rule.

mod-mod-neg To create a construction with two required modifiers, we can adapt the NEG-SAT approach described above such that the attachment of the first negator (rather than a lexical rule) sets the phrase's NEG-SAT value to −, then the second negator will still go through a specialized rule which will set the value back to +. Because only clauses which unify with [NEG-SAT *na-or-*+] are licensed, this approach will require *neg2* to appear whenever *neg1* does and vice-versa (although there may be the intervention of other modifiers and complements, as expected for head-modifier constructions).

2.3 Summary of negation model

In figure 2, I show recapitulate figure 1 with annotations to indicate which constructions are potentially attested, which are implemented as a part of the negation

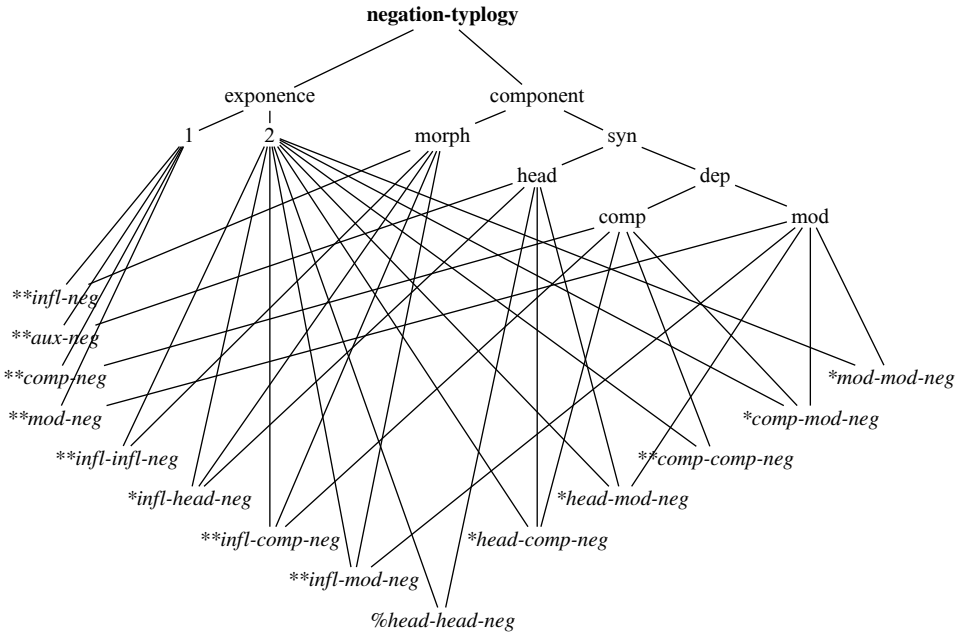


Figure 2: negation model annotated: **attested and implemented, *implemented, %discarded

library of the Grammar Matrix customization system and which are set aside.

3 Outlook and Conclusion

I have presented an *a priori* typology of sentential negation in HPSG. This approach makes predictions about what negation types we expect to find in the world's languages and provides accompanying analyses for these types. The typology's predictions for simple negation are fulfilled by numerous examples, whereas the results for the bipartite section are less clear, mostly for lack of data. Typologists have avoided the subclassification of bipartite negation constructions—treating them as a monolithic group.

One contribution of this work is the proposal to treat bipartite constructions where the secondary negator is free and occurring after other verbal complements as involving head-modifier rules and the feature-passing of [NEG-SAT *luk*]. This approach provides two immediate advantages. The first (as mentioned above) is that it avoids the opaque and baroque approach of creating subtypes of COMPS-changing rules for each class of verbs based on length of COMPS list. The second has to do with a reported phenomenon in a number of languages with bipartite negation: haplology of the secondary marker when multiple negations are embedded (for example, in Hausa [hau] Crysmann (2010) (19a)[13] , and Lubukusu [bxk]

[13] As Prof. Crysmann points out both in his paper on Hausa (ibid) and in personal communication

Bell (2004) (19b)). Haplology of the secondary marker follows automatically from the NEG-SAT approach because multiple negations do not create multiple NEG-SAT dependencies. After one (or many) negations have been attached to a clause, there is a single [NEG-SAT −] feature whose value will be + once the *neg2* marker is placed.

(19) a. Peter se-abolele John ali Sally
Peter NEG1-tell John COMP Sally
se-amala ekasi ta (*ta)
NEG1-finish work NEG2 NEG2
Peter did not tell John that Sally did not finish her work. [bxk]

b. bà̀ bà zā mù tàfi ba (*ba) nè
NEG NEG FUT.1.PL go NEG NEG COP
It is not that we are not going. [hau]

There are two important next steps in this research. The first regards another option for grammatical attachment in HPSG: EDGE-marking. Edge-marking is the phenomenon whereby inflection appears at the left or right boundary of phrases, and is the approach that Crysmann (2010) proposes for Hausa [hau]. Section 2 of Crysmann (ibid.) also provides a review of approaches to EDGE inflection in HPSG. To represent a more complete inventory of HPSG morpheme placement strategies, EDGE-marking must be integrated into the small typology of (1).

The other future step in this research is to take a closer look at even more descriptive grammars in order to ascertain whether the predicted types given here do occur in natural languages and to deal with interactions between these predicted negation types and other components of grammars. The question of how well these analyses scale in the face of complex, implemented systems must be addressed.

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with me, the NEG-SAT/modifier approach is not appropriate for the details of Hausa because of the interaction with coordination. Nonetheless, the facts of Hausa negation and coordination interaction are not necessarily indicative of what we expect across languages generally.

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Establishing order in type-based realisational morphology

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Abstract

Recent years have witnessed a renewal of interest in variable morph ordering, the situation where the position of a morph in the word is not constant. These situations present a challenge to extant inferential-realisational approaches to morphology (Stump, 2001), insofar as these adopt implicitly or explicitly an a-morphous approach to morphological composition (Anderson, 1992). In this paper we will first review the typology of known variable morph ordering phenomena in inflection. We then argue that the challenges can be met by making a distinction between *paradigmatic opposition classes* and *syntagmatic position classes*, and show that this distinction can readily be implemented in HPSG while keeping the amorphous assumption.

1 Introduction

Recent years have witnessed a renewal of interest in variable morph ordering, the situation where the position of a morph in the word is not constant. The following example from Moro (Rose, forthcoming) illustrates a typical such situation: object markers such as 2SG *ŋá* occur right before the stem in some tense/aspect/mood configurations (here in the proximal imperfective), and at the end of the word in other configurations (here in the perfective).[1]

(1) a. g-a-**ŋá**-ʧombəð-a
3SG.HUM-FIN-**2SG**-tickle-PROX.IPFV
'He is about to tickle you.'

b. g-a-ʧombəð-á-**ŋá**
3SG.HUM-FIN–tickle-PFV-**2SG**
'He tickled you.'

These situations can not be elegantly described under a 'templatic' view of morphotactics, where morphs are assumed to fall in a strictly ordered sequence of position classes. They also present a challenge to a-morphous approaches to morphological composition (Anderson, 1992) such as Paradigm Function Morphology (PFM; Stump, 2001), where morphotactic order is a direct consequence of the order of rule application; this leads proponents of PFM to relax strict ordering by means of metadescriptions and enrichments of the descriptive vocabulary for realisation rules.

This paper is an attempt to evaluate how we can maintain the basic insights of realisational approaches while capturing variable morph ordering at the description

[†]We are gratefully indebted to 3 anonymous reviewers, and to the audience of the 19th HPSG conference, for their comments, and in particular Greg Kobele and Frank Van Eynde. We also thank Greg Stump for stimulating comments and discussion. All remaining errors are of course ours.

Authors' names are listed in alphabetical order. We sometimes take liberty, though, to sort by first names rather than last names.

[1]As Rose (forthcoming) shows, object marker placement correlates strictly with the type of tone assignment associated with a TAM configuration.

level, using only simple rules of exponence. We will argue that the a-morphous hypothesis can be maintained if the traditional notion of position class is analysed as a cluster concept: by distinguishing PARADIGMATIC OPPOSITION CLASSES from SYNTAGMATIC POSITION CLASSES, exponents can be introduced in a single paradigmatic slot while getting realised in variable linear positions.

In section 2, we review the typology of variable morph ordering phenomena, and of current approaches to these phenomena within realisational morphology. Starting from canonical position class systems, we present the four types of deviation (portmanteau classes, parallel classes, ambifixal classes and reversible classes) discussed in (Stump, 1993), and the strategies developed by Stump to accomodate them within PFM. We then discuss two further types, affix clusters and freely ordered classes, that are not easily dealt with using the same kinds of strategies.

In section 3, we devise an inflectional component for HPSG grammars that shares most design features of PFM, a realisational framework for inflectional morphology that is renowned for striking a balance between conceptual soundness and formal explicitness. Previous research has assumed PFM to be broadly compatible with HPSG (Bonami and Samvelian, 2009; Bonami and Webelhuth, in press; Sag, in press); we will show here that the crucial properties of PFM, including its use of rule comparison for arbitrating the choice of exponents, can be implemented within a monotonous grammar formalism. In addition we show how the use of multiple inheritance hierarchies of realisation rules facilitates the flexible separation of morphotactics from exponence, with canonical position class systems corresponding to the limiting case where the two dimensions can be collapsed into one.

2 Aspects of a typology of variable morphotactics

2.1 Canonical position class morphology

We start with a canonical position class (or 'templatic') morphological system. French pronominal prefixes as used in e.g. indicative tenses provide a good example (Table 1). In such a system, affixes cluster in groups that (i) stand in paradigmatic opposition, and (ii) are rigidly ordered with respect to all other groups and to the stem. Such groups of affixes are called position classes.

1 'NOM'	2 'POL'	3 'REFL'	4 'ACC'	5 'DAT'	6 'LOC'	7 'GEN'
je	ne	me	le	lui	y	en
tu		te	la	leur		
il		se				
...	...					

Table 1: French prefixal pronominal affixes

Notice that French exhibits three well-known features of position class sys-

tems: (i) affixes that express different values for the same features may occur in different positions; for instance direct objects may be realised in positions 3 (if reflexive or non-third person), 4 (if definite, 3rd person and nonreflexive) or 7 (if indefinite); (ii) some feature combinations, such as positive polarity, have no affixal realisation; (iii) there sometimes are arbitrary gaps in the system: here positions 3 and 5 cannot be filled simultaneously. All of these properties except the last can readily be modelled, as Anderson (1992) shows, by assuming that inflection rules are organised in successive blocks of disjunctively ordered rules, each block corresponding to a position.

2.2 Classical challenges: Stump (1993)

Stump (1993) identifies four deviations from the situation illustrated by French that call for a more elaborate view of the organisation of inflection rules.

Portmanteau morphs span two position classes, typically expressing synthetically a combination of features that is otherwise expressed by two separate affixes. Swahili conjugation illustrates: negative forms use the portmanteau *si* to express subject marking and negation, where the sequence *ha-ni* is expected.

1 POL	2 SUBJ MRKR	3 TAM/ POL	4 REL. MRKR	5 OBJ MRKR	6 STEM	7 REL. MRKR	translation
	a	ta		ku	taka		'He will pay you'
ha	a	ta		ku	taka		'He won't pay you'
	ni	ta		ku	taka		'I will pay you'
	si	ta		ku	taka		'I won't pay you'
	a	na	ye		soma		'who is reading'
	a				soma	ye	'who reads'

Table 2: Swahili position classes

Parallel position classes are pairs of classes that contain the same affixes expressing different but related feature combinations in two different positions. Subject and object person markers in Swahili are a typical case: as Table 3b illustrates, most person-number-gender combinations are expressed by the same affixes in both functions, but occurring in the distinct positions 2 and 5.

Ambifixal position classes are pairs of positions that realise the same features through the same affixes but on either side of the stem. Swahili relative markers illustrate, as can be seen at the bottom of Table 2. These markers register on the verb agreement with a gap on that verb's argument structure. They are usually

PER	GEN	SUBJECT		OBJECT	
		SG	PL	SG	PL
1		ni	tu	ni	tu
2		u	m	ku	wa
3	M/WA	a	wa	m	wa
	M/MI	u	i	u	i
	KI/VI	ki	vi	ki	vi
	JI/MA	li	ya	li	ya
	N/N	i	zi	i	zi
	U	u	—	u	—
	U/N	u	zi	u	zi
	KU	ku	—	ku	—

Table 3: Swahili subject and object person markers

linearised in prefixal position 4, but do occur in position 7 if position 3 is empty, e.g. in the present tense.

Reversible position classes are classes that sometimes appear in one order and sometimes in the opposite order depending on some condition. Fula subject and object markers illustrate. Where the subject markers are suffixal, they normally immediately precede the object markers. If however the subject is 1SG and the object is SG, the order is reversed (subject markers are highlighted).

(2) a. mball-u-**ɗon**-mo
help-REL.PST-**2pl**-3sg
'You (pl.) helped him'

b. mball-u-**mi**-ɓe
help-REL.PST-**1sg**-3pl
'I helped them'

c. mball-u-moo-**mi**
help-REL.PST-2sg-**1sg**
'I helped him'

2.3 Paradigm Function Morphology and the classical challenges

We now show how Paradigm Function Morphology (PFM) deals with the classical challenges to morph ordering. PFM is an evolving framework, but has a core of design features that can be outlined as follows.

(3) a. Inflection is inferential (no lexical listing of morphological formatives) and realisational (exponents are partial realisations of the morphosyntactic features of the word).

b. The description of a language's inflection system is the statement of its PARADIGM FUNCTION, a function mapping pairs of a lexeme and a morphosyntactic property set to surface phonological forms.

c. Rules are organised in mutually exclusive and rigidly ordered BLOCKS; a word is well-formed only if its phonological makeup follows from using exactly one rule from each block.

d. Realisation rules are expressed under the assumption of Pāṇinian competition: within a block, rules expressing more specific property sets block the application of rules expressing less specific property sets.

e. Each block contains an instance of the IDENTITY FUNCTION DEFAULT (IFD) rule, making sure that in the absence of any rule explicitly expressing some features of the paradigm cell, the phonology of the input is not modified.

Under assumption (3c), if all realisation rules introduce a prefixal or suffixal exponent, the relationship between rule blocks and position classes will be as outlined in Fig. 1: successive blocks introduce exponents in positions that are more and more distant from the stem, on either side. Because there is no expectation that a rule block must contain only prefixal or suffixal rules, ambifixal exponents can be introduced in a single block; the postulation of two independent rules introducing the same exponent in different positions can be avoided by positing a metarule (Stump, 1993, 146–152).

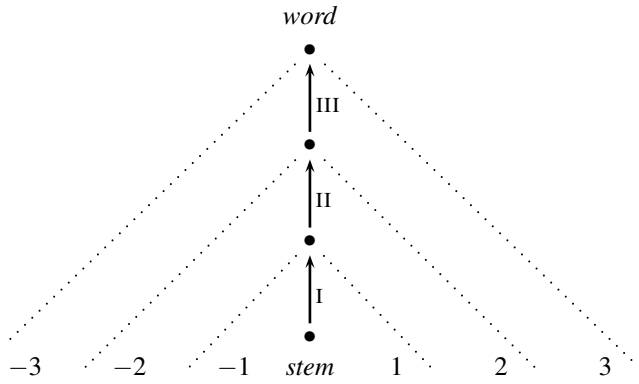
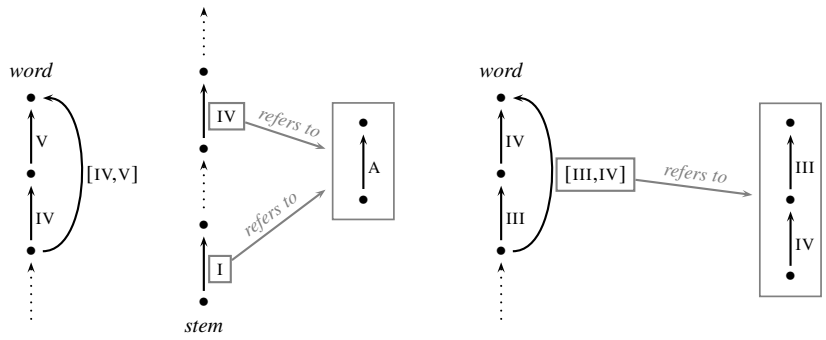


Figure 1: The relation between rule blocks and positions in PFM

Other deviations from a canonical position class system are captured in PFM by enrichments of the economy of rule blocks or the inventory of rule types. To account for portmanteau morphs in general, (Stump, 2001, 139–144) assumes that rules may be indexed for a sequence of successive blocks instead of an individual block (see Fig. 2(a)). Such PORTMANTEAU RULES entail the existence of a PORTMANTEAU BLOCK (here labeled [IV,V]) most of whose members are simply deduced by composition of the rules indexed for the successive blocks: thus in Swahili *si* is in paradigmatic opposition to sequences of prefixes such as *ha-a*.



(a) Portmanteau (b) Parallel (c) Reversible

Figure 2: Noncanonical rule blocks in PFM

Parallel position classes are dealt with using a different mechanism. In PFM, realisation rules come in two guises: RULES OF EXPONENCE introduce an exponent directly through some morphophonological operation, while RULES OF REFERRAL (Zwicky, 1985) state that some morphosyntactic property set σ in rule block α borrows its exponence from the expression of some (related) property set τ in block β. Rules of referral are central to the PFM theory of (directional) syncretism, but can also be used for other purposes. In the case of parallel classes, (Stump, 2001, 144–149) assumes that parallel exponents are introduced by rules in a special, unordered rule block, and that this block is accessed from two different rules in successive blocks through rules of referral. Fig. 2(b) provides a schematic view of the Swahili situation: assuming that block I introduces object markers and block IV introduces subject markers, both blocks contain a rule of referral (symbolised in gray) to unordered block A, where shared exponents are introduced.

Finally, (Stump, 2001, 149–156) models reversible position classes by combining the use of portmanteau rules and referrals, as illustrated in Fig. 2(c). The exceptional order is obtained by positing a portmanteau rule spanning two blocks, which then refers to the output of the composition of those same two blocks in the opposite order.

2.4 Combinations of variably positioned morphs

As the previous subsection showed, the analytic apparatus of (Stump, 2001) is flexible enough to deal with many, and probably most, types of variable morphotactics. However, the design of the theory embodies a disputable set of expectations about the markedness of different types of variable order.

One such expectation concerns the behaviour of combinations of morphs with variable order. Because of the relationship between rule blocks and linear position schematised in Fig. 1, if two affixes can appear simultaneously on either side of the stem, it is expected that their relative position on one side will be the mirror image

of their relative position on the other side. Such situations are not unheard of;[2] however, as Luís and Spencer (2005) note, the opposite situation, where sequences of affixes are linearised in the same order on either side of the stem, is well documented, and typical of Romance pronominal affix clusters. We illustrate here with Italian data (Monachesi, 1999).

(4) a. me-lo-dai
DAT.1SG-ACC.3SG.M-give.PRS.2SG
'You give it to me.'

b. dá-me-lo!
give.IMP.2SG-DAT.1SG-ACC.3SG
'Give it to me!'

Such data can be accomodated within PFM while maintaining the a-morphous assumption by a combination of reversible and ambifixal rule blocks; however their existence calls into question the validity of the expectation on marked orders embodied by the PFM view. In the absence of relevant typological evidence to the contrary, there is no reason to assume that some types of variable morphotactics are more natural than others.

A separate prediction of the PFM theory of morphotactics is that for any cell in the paradigm, there should be a single possible morph order. This is a consequence of the fact that inflection is a function generating phonological strings, and that no mechanism allows for underspecification of order in the description of these strings.

The recent literature clearly shows this prediction to be falsified. The neatest example[3] is found in Chintang conjugation (Bickel et al., 2007). In this language, prefixes on verbs realizing subject marking, object marking and negation can be freely reordered, with no semantic or sociolinguistic contrast. Crucially, this does not mean that the language has no morphotactics: these affixes are always prefixal, and suffixes occur in strictly ordered position classes.

(5) a. u-kha-ma-cop-yokt-e
3NS.A-1NS.P-NEG-see-NEG-PST
'They didn't see us.'

b. u-ma-kha-cop-yokt-e

c. kha-u-ma-cop-yokt-e

d. ma-u-kha-cop-yokt-e

e. kha-ma-u-cop-yokt-e

f. ma-kha-u-cop-yokt-e

[2] See (Stump, 1993) on Fula subject and preterite markers, and (Kim, 2010) on Huave subject and TAM markers.

[3] See also Luutonen (1997) on Mari declension.

2.5 Taking stock

In this section we have outlined the PFM theory of morphotactics and shown that while it fails to satisfactorily address all variable morph ordering phenomena. In recent but yet unpublished work, Stump (2012) amends the analytic apparatus of (Stump, 2001) by introducing CONDITIONAL AFFIXATION OPERATORS in the language of rule descriptions and CONDITIONAL COMPOSITION OPERATORS in the language of paradigm function descriptions; in addition he provides for the possibility of free ordering by redefining paradigm functions as outputting sets of forms rather than individual forms. While further work is needed to evaluate the merits of these changes, they do not affect the conception of morphotactics on which the previous proposals within PFM are grounded.

In this paper we defend a different approach, and contend that the existing PFM approach is based on an unwarranted presumption that some types of variable placement are more natural than others. This presumption is what motivates the use of a single device, rule blocks, to model paradigmatic opposition and syntagmatic placement. Because of this assumption, it is not possible for a single realisation rule to allow for the realisation of a morph in more than one position—hence the use of rules of referral or other devices to *modify* the placement of exponents. In the following section we develop a view of morphotactics that does away with presumptions on relative naturalness of variable morphotactic situations, and thus allows for a more uniform account of the phenomena at hand.

3 An HPSG architecture for morphotactics

3.1 Basic assumptions

We now turn to the description of an HPSG approach to variable morph ordering. Our intention is to implement within HPSG an approach to inflection that is as similar as possible to PFM except with regards to morphotactics. Thus we keep the assumptions in (3), except for (3c), and introduce those in (6).

(6) a. Realisation rules process phonological strings from left to right, rather than starting from the stem.

b. Realisation rules are classified separately for paradigmatic opposition and syntagmatic succession.

(6a) breaks with common assuptions in both morphology and neighbouring linguistic areas, like syntax, where the notion of the head plays a central role. Once we take into account,however, common practice in word and paradigm approaches to inflectional morphology, we find that stems are inserted by special stem introduction rules, in order to model stem allomorphy (Stump, 2001; Bonami and Boyé, 2006). Besides stem allomophy, introduction of discontinuous stems (Crysmann, 2002) will require dedicated rules for the introduction of the pieces. Finally, some languages feature zero stems, taking regular inflectional markings,

such as the Basque copula (Hippisley et al., 2004). Given the fact that stems do not come for granted but need to be introduced by rules anyway, it is a fairly modest extension to delay the point at which such introduction shall occur.

The main a priori reason for substituting stem-based composition with left-to-right composition is the fact that the latter, but not the former, can systematically avoid the potential for spurious ambiguity entailed by the mere possibility of having both prefixation and suffixation. For instance, in a system featuring 3 prefixal and 2 suffixal position classes, there are 10 different but equivalent ways of ordering the rule blocks that can be entertained (see Fig. 3). To avoid spurious ambiguity, one needs to make an arbitrary choice between these possibilities, since, under the hypotheses of realisational morphology, derivation trees in inflection have no theoretical interpretation (unlike what happens in syntax or lexeme formation). By contrast, strict left-to-right processing systematically avoids the spurious ambiguity problem at the simple (Fig. 4) and uncostly expense of likening stem selection to other rules of exponence by depriving it of the special status to apply first.

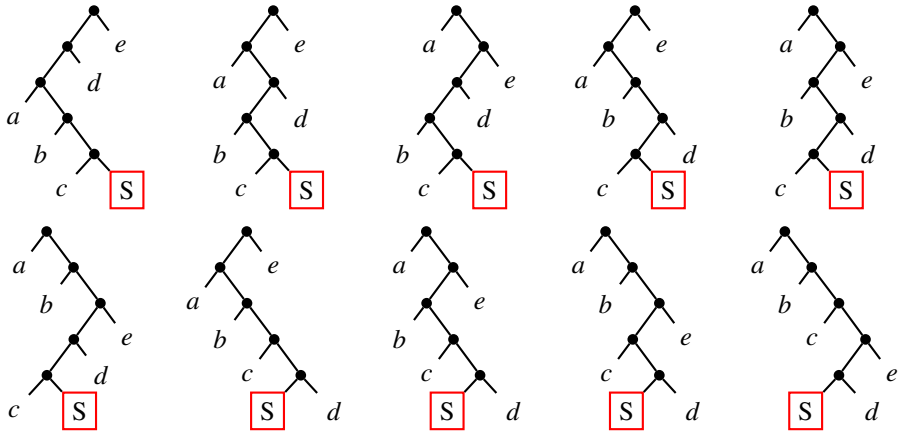


Figure 3: 10 possible composition orders under a stem-first strategy

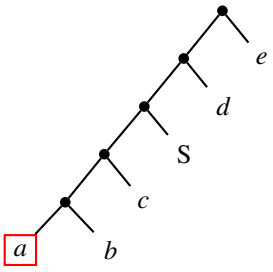


Figure 4: Single possible composition order under a left to right strategy

(6b) is the key to a more general approach to morph-ordering. To dissociate paradigmatic opposition from position class information, we substitute to the PFM notion of rule block two separate features, one indicating paradigmatic opposition (PARADIGMATIC OPPOSITION INDEX = POI), the other syntagmatic position (POSITION CLASS =PC). While POI will ensure that exactly one morphological rule has to be applied for every paradigmatic opposition, but underspecifies the order in which rules have to apply, PC constrains order of application.

Realisation rules will therefore be subject to the following constraint, requiring that at least one paradigmatic opposition be expressed and that rule application apply in the order of position class indices.[4] A morphological 'root condition' will specify, by means of the POI set, which paradigmatic choices have to be made for a word to be morphologically well-formed. This is sufficient to ensure that uninflected stems cannot serve to express just any morphosyntactic feature combination in the general case.

$$\begin{bmatrix} \textit{realisation-rule} & \\ \text{MORSYN} & \boxed{m}\left(\boxed{u} \cup \textit{set}\right) \\ \text{MUD} & \boxed{u} \\ \text{POI} & \left\{ [] , \ldots \right\} \uplus \boxed{p} \\ \text{PC} & \boxed{i} \oplus \left\langle \left[\ \right], \ldots \right\rangle \\ \text{DTR} & \begin{bmatrix} \text{MORSYN} & \boxed{m} \\ \text{POI} & \boxed{p} \\ \text{PC} & \boxed{i} \end{bmatrix} \end{bmatrix}$$

Figure 5: Realisation rule type

In order to describe aspects of exponence (selection of shapes) and morphotactics in the most general way, we suggest that realisation rules be modeled as types organised into the two cross-cutting dimensions of MORPHOTACTICS and EXPONENCE. Recall that according to Koenig's online type construction (Koenig and Jurafsky, 1994; Koenig, 1999), a well formed category (here: a realisational rule instance) must inherit from exactly one leaf type in every dimension. Synchronisation between exponence and morphotactic statements is facilitated by means of the feature MUD (="morphology under discussion"), which characterises the subset of the entire MORSYN a particular rule type is about.

The upper part of figure 6 illustrates this analytic setup through a partial type hierarchy for Swahili. The main task of rule types in the MORPHOTACTICS dimension is to define an association between classes of paradigmatic opposition (i.e. rule blocks) with position class information. In a system with completely fixed order, position classes and paradigmatic opposition will stand in a one-to-

[4] We use positive integers here for ease of exposition. Note, though, that underlyingly, position class information will be represented as lists.

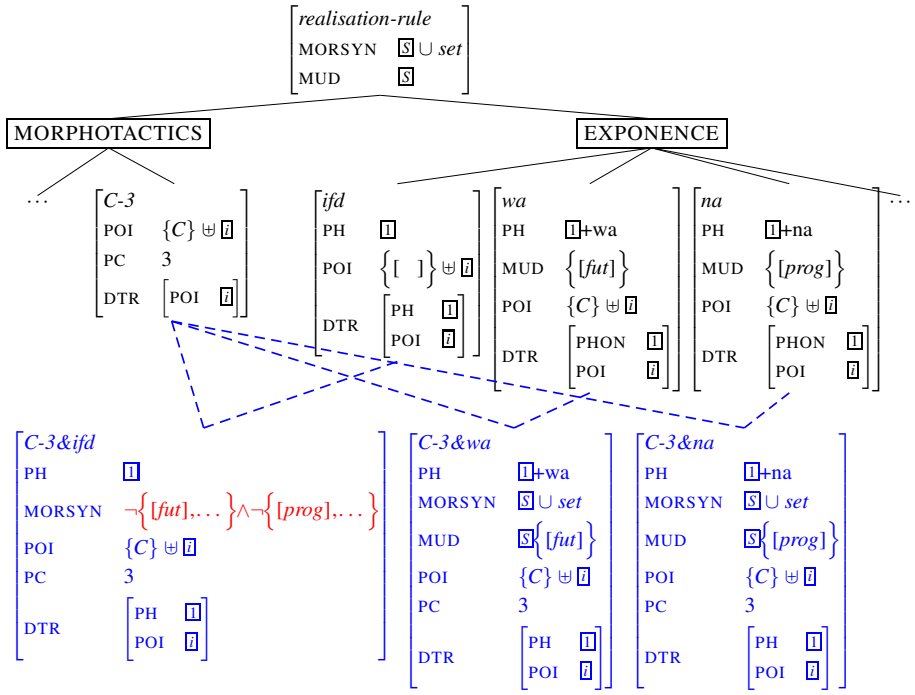


Figure 6: Pāṇini's principle

one correspondence. Types in the EXPONENCE dimension will typically specify phonological material to be added to the PHON list depending on the morphosyntactic properties to be expressed (described by the MUD value).

In addition to affixational rule types, there is exactly one additional type in the EXPONENCE dimension expressing Stump's (2001) Identity Function Default (IFD). This expresses the fact that in any rule block, in the absence of listed exponents, the default option is to just pass on the input phonology.

3.2 Pāṇini's Principle

Pāṇini's Principle (Stump, 2001), also known as Morphological Blocking (Andrews, 1990) or the Elsewhere Condition (Kiparsky, 1985), is generally regarded as a fundamental organising principle of morphological systems, by virtue of which more specific rules block the application of more general rules. Before we enter into the discussion of how Pāṇinian competition can be made formally precise within the confines of online type construction, we would like to briefly motivate why an HPSG theory of morphology cannot be considered complete, lest it provide a way to capture this basic insight shared amongst morphological theories as diverse as PFM, Network Morphology (Brown and Hippisley, 2012), Lexical Phonology (Kiparsky, 1985), and Distributed Morphology (Halle, 1997). The central aim of a theory of inflectional morphology is to explain the organisation of

morphological paradigms: it is a pertinent observation regarding morphological systems that there is typically a stark contrast between non-default and default realisations: as witnessed e.g. by English regular subject-verb agreement, non-default present tense 3rd person marking can be conjunctively describe as a natural class, whereas default zero realisation cannot. Similar arguments can be made for German 2$^{\text{nd}}$ declension, where *-s* is used in the genitive singular, *-n* in the dative plural, and the identity function elsewhere. The concept of default realisation can also provide a natural explanation of zero exponence: the fact that many languages can make do without much inflection or that even highly articulate morphological system of the fusional or polysynthetic types feature meaningful zero realisations can easily be captured once we grant the possibility of an identity function default. Stump (2001) even claims that featural coherence in position class systems can be partially explained on the basis of Pāṇini's Principle. Related to its ability to account for what constitutes a natural inflectional system, Pāṇini's Principle, if implemented in the theory of morphology, provides for highly concise morphological descriptions.

Following Koenig (1999), there are two possible interpretations of the Morphological Blocking Principle: a grammar-internal or static perspective pertaining to knowledge representation, and a dynamic interpretation based on knowledge use where competition is established at run time. In what follows we shall adopt the grammar-based view, since it integrates more readily with the monotonic perspective on constraint satisfaction employed elsewhere in HPSG grammars.

The central assumption behind Pāṇinian competition is that narrower descriptions block the application of broader descriptions. When applied to the and/or hierarchies given above, sister types are always interpreted as disjoint, even if the descriptions stand in a subsumption relation.

Thus, by combining the information contained with the feature structure descriptions themselves with information about sisterhood in a type hierarchy, competition can be made explicit by means of compilation. The line we are taking hare is akin to that of Malouf (2005) who developed an analogous proposal for encoding Pāṇinian competition in the context of a Finite-State Morphology, combining *Ordered Disjunction* (Erjavec, 1994) or *Priority Union* (Karttunen, 1998) with a topological sort on feature structure descriptions.

Consider two sister types τ and τ' whose MUD values stand in a subsumption relation, e.g., ϕ and $\phi \wedge \psi$. Since Pāṇinian competition entails disjointness, we can make this explicit in the feature structure descriptions by conjoining the more general description ϕ of τ with the negation of the more narrow description $\phi \wedge \psi$ of τ', giving us the expanded description $\phi \wedge \neg(\phi \wedge \psi)$ which simplifies to $\phi \wedge \neg\psi$ by the laws of statement logic. This generalises to n types by sorting the types on the basis of subsumption relations of MUD values and then adding to the description of each type the negation of the conjuction of the description of all more specific types. Performing this expansion as part of a closure on the underspecifed type hierarchy not only frees us from stating these negations manually over and over again in the type hierarchy but it also establishes Pāṇinian competition as an organising

principle of inflectional morphology.

So far, we have made the simplifying assumption that sisterhood alone is sufficient in establishing competition between types. While this may be true in case there is only a single dimension of paradigmatic opposition, it does not hold for more complex inflectional systems where a word inflects along different independent dimensions: to give a simple example from Swahili, the interpretation of the identity function default depends on whether it is in competition with relative marking or negative marking. Thus, morphological competition must apply between sister rule types that stand in paradigmatic opposition, i.e., that add a compatible index to the POI set. Since constraints on MUD are actually existential statements on the MORSYN set, translating competition between rules whose MUD, and therefore, MORSYN descriptions stand in a proper subsumption relation amounts to the introduction of negative existential constraints on the MORSYN of the more "general" rule type. As a result, a Morphological Blocking Principle that establishes competition on the basis of POI values and subsumption of MORSYN descriptions will be as expressive as Pāṇinian competition in morphological theories such as PFM, while still maintaining compatibility with the general monotonic nature of HPSG. Figure 6 illustrates the effect of Pāṇinian competition in a concrete example.

3.3 Noncanonical morphotactics

3.3.1 Reanalysing Stump's classical challenges in type-based realisational morphology

In canonical situations such as the one illustrated in Fig. 6, each POI is in a one-to-one correspondence with a position class; hence the MORPHOTACTICS dimension plays very little role. In less canonical morphological situations, the correspondence is looser. These cases can be modeled by complementing the MORPHOTACTICS subhierarchy with additional types, either horizontally (providing alternative associations), or vertically (refining the conditions on position class assignment).

Swahili **ambifixal position classes**, as witnessed by relative agreement markers, constitute the first deviation from a canonical templatic system that militates strongly for a separation of aspects of form (exponence) from position (morphotactics). In order to capture the fact that exponents of relative number and gender agreement are identical independently of how they are linearised, we use partial descriptions of rules of exponence that are crucially underspecified with respect to the position class (PC) index, as illustrated in Figure 7. Systematic alternation between pre-stem and post-stem order is captured by stating two morphosyntactic types with the same POI that restrict the exponents to different position classes: while linearisation in position class 7 is restricted to untensed affirmative verbs, relative markers will be realised in position class 4 in the elsewhere case, by virtue of Pāṇinian competition. Cross-classification with EXPONENCE types will then

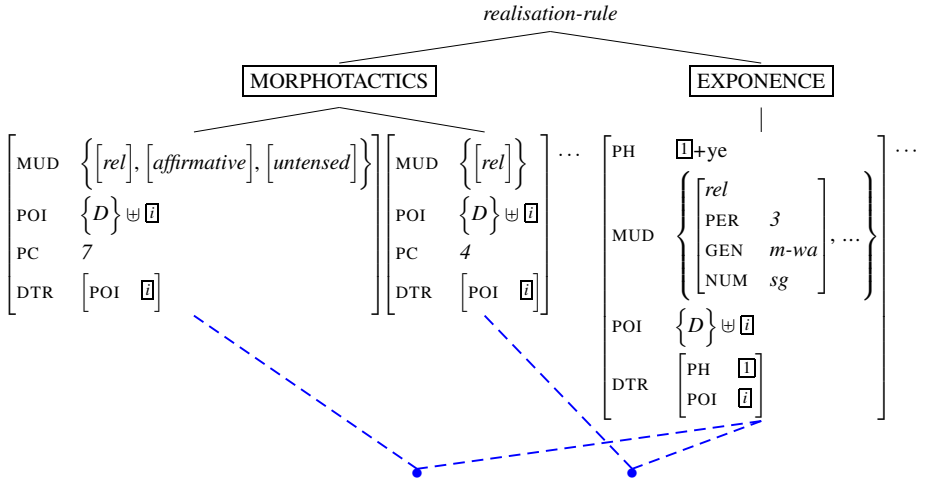


Figure 7: Swahili ambifixal position classes

allow for a single exponent to be realized in two different positions.

The second deviation from the canonical situation we shall address are **reversible position classes**, as witnessed in Fula. Given that rules apply canonically from left to right, there is no significant difference between situations where variable placement targets different sides of the the stem (ambifixals) or affects the relative order of exponents on the same side of the stem. As a consequence, we can invoke the exact same mechanism we used in our analysis of ambifixals to account for reversible position classes.

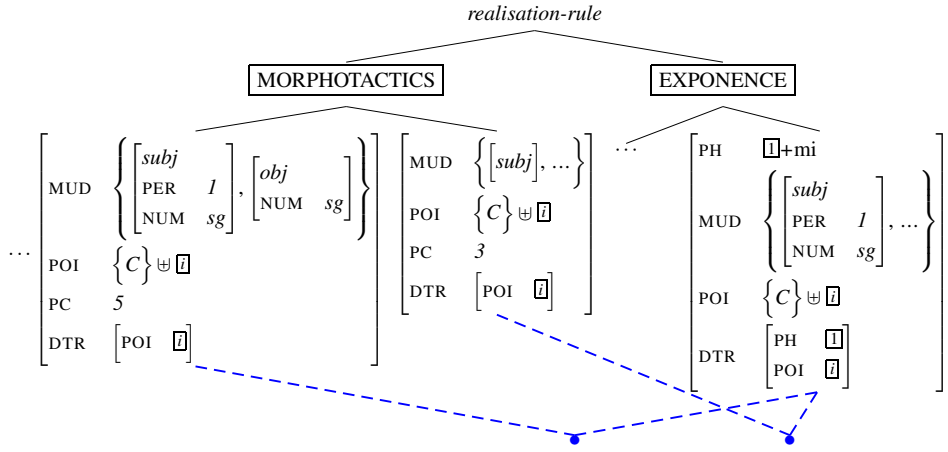


Figure 8: Fula reversible position classes

Specifically, we shall assume that the Fula rules of exponence for subject markers are underspecified with respect to position class. The MORPHOTACTICS dimension provides two alternative schemata for their position: a canonical associ-

ation with position class 3, and an exceptional assignment to class 5, conditioned by the featural combination for subject (1SG) and object (SG). Object markers will always be assigned to position 4. Since both canonical and non-canonical position class assignments for subject markers bear the same paradigmatic opposition index, they are in paradigmatic competition, subject to morphological blocking (see section 3.2 above). Observe that this analysis also aligns neatly the more narrow morphological description with non-canonical position class assignment.

The third departure from the canonical system, which pertains to **parallel position classes**, is of a slightly different nature: in order to express the massive parallelism between exponents of subject and object agreement, rules of exponence should be underspecified not only with respect to grammatical function, but also with respect to paradigmatic opposition and position class. Yet, interpretation of grammatical function is intimately linked to positional realisation. Thus, by introducing specialised subtypes of our canonical morphotactic supertype, we can establish the link between grammatical function and position class within the MORPHOTACTICS dimension.

The majority of rules of exponence for subject and object agreement will then be underspecified with respect to paradigm opposition and position class: interpretation of grammatical function is solely imposed by morphotactics, yielding positional disambiguation. In those cases (2nd and 3rd person MA/WA gender) where grammatical function is also distinguished by the choice of exponent schemata in the EXPONENCE dimension will have a determinate POI.

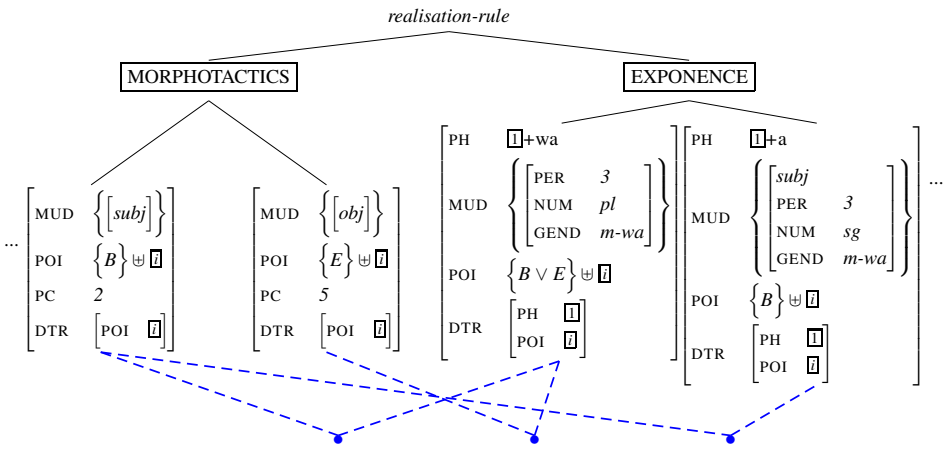


Figure 9: Swahili parallel position classes

The last classical departure from a canonical system is required by **portmanteau position classes**: since affixation with a single morph may simultaneously satisfy inflectional requirements along two dimensions (in Swahili: negation and subject agreement), adding a morphotactic type for this situation will permit portmanteau position classes to be included into otherwise canonical systems without losing any generality. Figure 10 illustrates schematically the analysis of the Swahili

1st person negative marker.

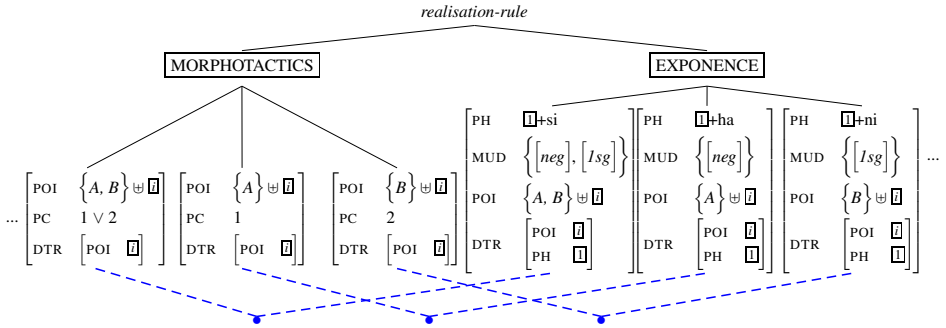


Figure 10: Swahili Portmanteau position classes

3.3.2 Extending the analysis to non-classical cases of variable order: Italian and Chintang

The type-based realisational approach to variable morph order we have sketched in the previous sections can be straightforwardly extended to phenomena which have hitherto not yet received a fully satisfactory formal treatment in standard realisational morphological theories, such as Paradigm Function Morphology, namely ambifixal clusters and freely ordered position classes.

Affix clusters The crucial observation regarding Italian mobile clusters pertains to the fact that relative order within the cluster is maintained regardless of the cluster's position relative to the stem, a situation not well handled by theories that apply rules of exponence from the stem outward. Under our perspective, where rule application canonically applies from left to right and stems can be inserted at any point, this is not an issue.

When confronted with mobile clusters of the type witnessed by Italian, there are two possible perspectives on the data: either, we assume that the stem (and associated non-mobile affixes) are assigned to fixed positions and the cluster elements are variable (="ambifixal clusters"), or else, the cluster elements are in a fixed position and the stem (and associated non-mobile affixes) are assigned to variable positions.

To encode the idea of an "ambifixal cluster" without positing that it forms a morphological constituent (unlike Luís and Spencer, 2005), one may underspecify in parallel the position of each element in the cluster. Although such an analysis will certainly be able to derive the facts, it amounts to treating consistent ordering of the cluster on either side of the stem as a mere coincidence. Nothing would distinguish, in terms of complexity, an order-preserving mobile clusters from some hypothetical system where only odd-numbered slots preserve relative order, yet even-numbered slots invert their order.

This situation can be improved by changing the perspective from "ambifixal clusters" to "ambifixal stems": not only is the number of affected position classes considerably smaller in the case of mobile stems and TAM/agreement affixes, but also is there less overlap between TAM/agreement affixes that can appear on either side of the cluster, given the fact that only non-finite, and imperative stems can appear in pre-cluster position, and that the number of TAM/agreement exponents found attached to these stems is greatly reduced. Furthermore, under the assumption of mobile stems, the properties conditioning the alternation are actually properties relevant to the selection of exponence as well, e.g. stem selection, whereas under the assumption of mobile affixes, variable placement is conditioned on properties that otherwise play no role for these elements. Still, with our current indexing scheme in terms of alternation between absolute position, even the mobile stem approach cannot avoid picturing remnant cases of order preservation as merely accidental, since we do observe systematic syncretism between agreement markers in the imperative and finite verb forms, suggesting that without a more refined indexing scheme, we will miss an important generalisation: TAM and agreement markers are always linearised at some fixed distance from the stem.

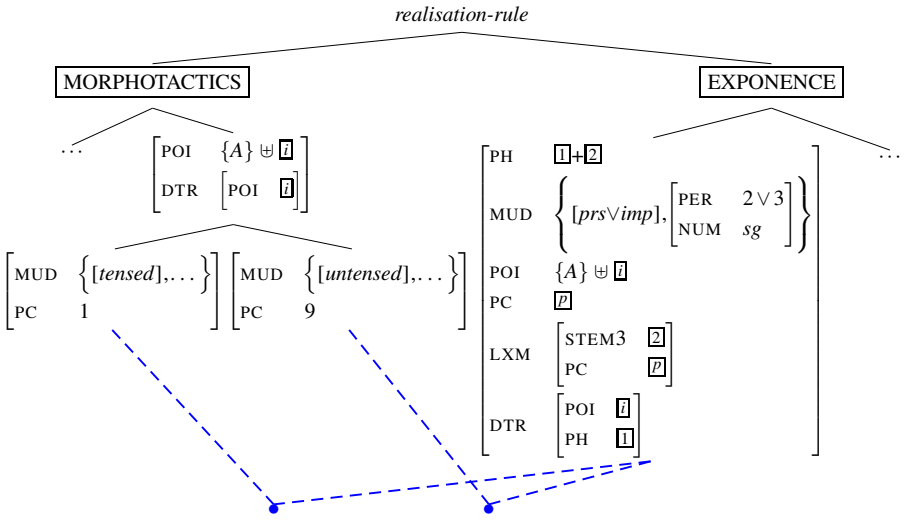


Figure 11: Mobile stems in Italian

To provide a fully satisfactory account of the Italian data we shall take serious the above-made observation that some inflectional markers appear in positions relative to the stem, whereas others are linearised in a stem-independent fashion. This observation regarding position correlates nicely with observations regarding exponence: since stem selection and rules of exponence for TAM/agreement markers already draw on lexeme properties (e.g. inflection class), while rules of exponence for pronominal affixes do not, it is a straightforward extension to record the positional index of the stem as a property of lexemic information. As illustrated in Figure 11, exponence rules of stem selection will redundantly record the position

of the stem as a property of LXM. Intersecting with one of the types in the MORPHOTACTICS dimension will then instantiate this index accordingly.

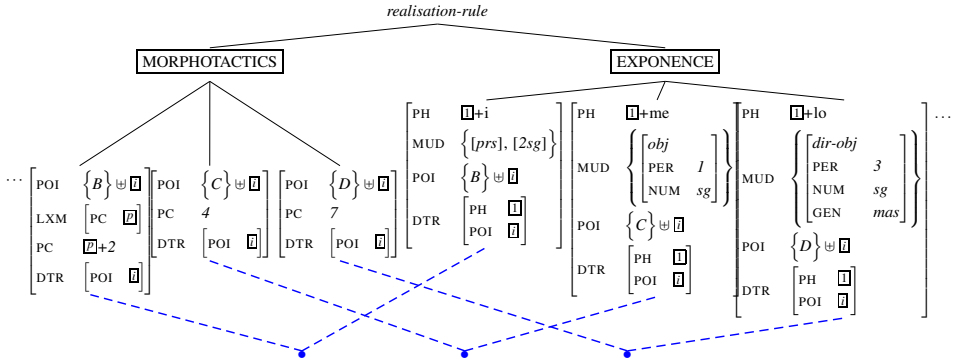


Figure 12: Absolute and relative positioning in Italian

Once the position of the stem is recorded, rules of exponence for TAM and agreement markers can easily specify their position relative to the stem (cf. Figure 12), independently of where that stem happens to be linearised.

As shown in Figure 12, members of the pronominal affix cluster are assigned to fixed positions: depending on the position the stem is realised in, TAM/agreement markers will "move" along, ultimately giving the effect of an "ambifixal cluster".

Thus, at the expense of a single reentrancy in stem introduction rules, we are able to integrate two independent indexing schemes, enabling us to give a redundancy-free and principled account of Italian mobile affix clusters in terms of variable stem placement.

Freely ordered position classes The second non-classical deviation from canonical strict ordering concerns Chintang freely ordered position classes, which constitute the ultimate reason for distinguishing between paradigmatic opposition and position class. In Chintang, since any of the three prefixes can appear at most once, and every verb must be inflected according to all three dimensions (positives and intransitives with null affixation, by virtue of the identity function default), it is clear that the classes of paradigmatic opposition must be clearly distinguished, as capture by the POI values in Figure 13, while only position class is relaxed.

4 Conclusion

In this paper, we have investigated properties of position class systems and argued for a treatment of inflectional morphology that combines basic insights from Paradigm Function Morphology with mulitple inheritance hierarchies, as used in HPSG. We have shown in particular that a dissociation of linear position and paradigmatic opposition paves the way for a highly general account of canonical and non-canonical properties of position class systems, based on the cross-

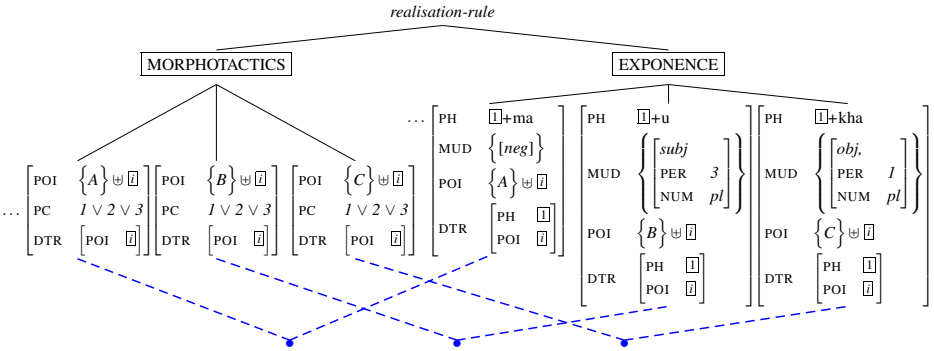


Figure 13: Chintang freely ordered position classes

classification of underspecified rule type schemata from the orthogonal dimensions of EXPONENCE and MORPHOTACTICS.

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Arabic relativization patterns: A unified HPSG analysis

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Abstract

Classical Arabic and Modern Standard Arabic have several relativization patterns, including relative clauses with and without relativizers and adjectival modification patterns. Previous generative work has targeted several phenomena, but there is no analysis which covers all relativization patterns in any generative framework. We present an HPSG analysis that covers these phenomena in a uniform manner. Based on Doron and Reintges (2005), we show that the crosslinguistically unusual syntax of adjectival modifiers is a language-internally expected variant of participial modifiers as found in English. We also present the first HPSG analysis of Arabic broad subjects and argue that they are selected as specifiers, accounting for the similarities between broad subjects and ordinary subjects.

1 Introduction

Classical Arabic (CA) and Modern Standard Arabic (MSA) (henceforth together 'Arabic')[1] have several relativization patterns, including relative clauses with and without relativizers and adjectival modification patterns. Previous generative work has targeted several areas, but there is no analysis which covers all relativization patterns in any generative framework. Previous work includes Suaieh (1980), Ouhalla (2004), and Aoun et al. (2010) in transformational frameworks and HPSG analyses by Melnik (2006), Haddar et al. (2009), Alqurashi and Borsley (2012), and Alqurashi (2012). The goal of this paper is to provide a unified analysis covering all relativization patterns. The analysis will include an HPSG account of the broad-subject construction (Doron and Heycock, 1999).

1.1 Relative Clauses

Arabic relative clauses can be classified into *marked clauses* introduced by special relative marker and *unmarked clauses* without such a marker. Unmarked relative clauses always modify an indefinite NP:

(1) risaalat-u-n$_i$ [ḥammala=nii=haa$_i$ Maḥmuud-un]
letter.SG.F-NOM-INDEF gave=me=it.SG.F Mahmud-NOM
'a letter Mahmud gave me'

†I want to thank Berthold Crysmann, Abdulrahman Alqurashi, Stefan Müller, Armin Buch, the participants of HPSG 2012, and three anonymous reviewers for helpful comments, discussion, and pointers. Of course, I alone am responsible for any errors or inaccuracies.

[1]Classical Arabic (CA) in the narrow sense was the spoken and written language of the Arab tribes roughly from the seventh to the ninth century. It forms the basis for Modern Standard Arabic (MSA), which is the (mainly) written language of the Arab world today. Especially in morphology and syntax, these two languages are extremely similar, and they are often treated as having the same syntax in generative work. This paper follows this approach and attempts to develop a syntactic analysis for both languages.

Relative clauses may employ resumptives or gaps, with different but overlapping distributions. Nominal and adjectival predicates in verbless relative clauses show nominative case marking, as in independent clauses:

(2) ra'aytu mra'at-a-n [Zayd-un 'abuu=haa]
I.saw woman-ACC-INDEF Zayd-NOM father-NOM=her
'I saw a woman whose father is Zayd'

For marked relative clauses, two sets of markers have to be distinguished. As demonstrated by Alqurashi and Borsley (2012), they are relativizers, not relative pronouns. The Inflected Relativizers (singular masculine *lladhii*, feminine *llatii*, etc.) mark definite relative clauses which may be free or modifying. They agree with the antecent in case, number and gender (3a). The Uninflected Relativizers *man* 'who' and *maa* 'what' mark free relative clauses and do not show case marking, nor agreement in any feature other than animacy (3b).

(3) a. l-mar'at-ayni$_i$ [llatayni ra'ayta=(humaa)$_i$]
DEF-woman-DU.ACC RELTV.FDU.ACC you.saw=them
'the two women that you saw'

b. [maa ra'ayta=(hu)$_i$ fii l-bayti]$_i$
RELTVZR.INANIM you.saw=(it) in the-house
'what you saw in the house'

1.2 Adjectival Modifiers

The second type of relativization patterns is adjectival modification. The simpler pattern, the *Direct Attribute* (*na'ت ḥaqiiqiyy*), is similar to ordinary adjectival modification in English, but the adjective agrees with the modified NP in number, gender, animacy, case and definiteness (4). Adjectival phrases can also be used as independent NPs:

(4) a. ra'aytu (buyuut-a-n) [jadiid-at-a-n]
I.saw house.PL-ACC-INDEF new-PL.INANIM-ACC-INDEF
'I saw new (houses)'

b. ra'aytu (l-buyuut-a) [l-jadiid-at-a]
I.saw DEF-house.PL-ACC DEF-new-PL.INANIM-ACC
'I saw the new (houses)'

In the *Indirect Attribute* (term from Polotsky (1978), traditional term: *na'ت sababiyy*) construction, the adjective has a subject that may be distinct from the modified NP, which is linked to a resumptive pronoun inside the adjectival phrase. The adjective agrees with the head only in the morphosyntactic features case and definiteness, while agreeing with its subject with respect to the index features number, animacy, and gender. The phrase may be attributive (5a) or free (5b).

(5) a. fii l-buyuut-i_i [l-ḥaaṣil-i fii=haa$_i$ l-ḥariiq-u]
in DEF-houses.GEN DEF-starting.SG-GEN in=them DEF-fire
'in the houses in which the fire broke out'

b. ma'a [l-munkasirat-i quluub-u=hum$_i$]$_i$
with DEF-broken-GEN hearts-NOM=their.ANIM
'with those whose hearts are broken'

The adjective always stands at the beginning:

(6) a. ra'aytu rajul-an [kariim-an 'abuu=hu]
I.saw man-ACC.INDEF kind-ACC.INDEF father=his

b. * ra'aytu rajul-an ['abuu=hu kariim-an]
I.saw man-ACC.INDEF father=his kind-ACC.INDEF

'I saw a man (acc.) whose father is kind'

The resumptive can be embedded in arbitrary depth, hence, the structure presumably involves a genuine UDC:

(7) l-baraamij-u$_i$ t-talafizyuuniyyat-u [l-mumkin-u
DEF-programmes.PL-NOM DEF-television-nom DEF-possible.M.SG-NOM
li=l-mushaahid-i ['an yaxtaara bayna=haa$_i$]]
for=DEF-viewer-GEN COMP.M.SG he.chooses between=them
'the television programmes the viewer can choose between, lit 'the television programs such that it is possible for the viewer to choose between them' (Fischer, 1987)'

2 The Structure of Adjectival Modifiers

The question that arises is what the structure of these four relativization patterns is and whether they can be reduced to more general patterns. In traditional and modern Arabic linguistics, the two adjectival modification patterns are usually discussed as distinct and apparently unrelated structures. The HPSG analysis by Melnik (2006) introduces two phrasal types for the two structures, but expresses some properties that both types share on a more general level. In the direct attribute, represented by *subject-non-fin-rel-cl*, the modified NP controls the unrealized subject argument of the adjective. The type of the indirect attribute, *non-subject-non-fin-rel-cl*, establishes the coindexation of the modified NP and a resumptive pronoun via the nonlocal feature RESUMP(TIVE), which is similar to SLASH. The first type coresponds to the analysis of English reduced relatives by Sag (1997) (*red-rel-cl*), while the second type corresponds to Sag's analysis of English non-wh relative clauses (*non-wh-rel-cl*).

Doron and Reintges (2005) argue that the indirect attribute is a language-specific variant of the direct attribute whose presence is explained by the notion of *broad subjects*, introduced by Doron and Heycock (1999). In Arabic, broad

subjects are NPs which are extracted and appear in a subject-like position, often in a higher clause, leaving a resumptive pronoun. This construction can result in simple preposing (8) similar to English topicalization, but the broad subject can also participate in raising and equi. In (9), *Hind* is the broad subject of the clause *ra'aa=haa 'Amrun* and is coreferent with the resumptive pronoun *=haa* contained in it. The subject-to-object raising verb *ẓananta* takes *Hind* and the clause as its complements. (10) show examples of subject-to-subject raising. While subject-to-subject raising of broad subjects is rare[2] and considered ungrammatical by many MSA speakers, subject-to-object raising of broad subjects is more common.

(8) a. Hindun$_i$ ra'aa=haa$_i$ 'Amr-u-n
Hind-NOM he.saw=her Amr-NOM
'Hind (f), Amr (m) saw'

b. Hind-un$_i$ [yaẓunnu 'Amr-un ['anna=ka ra'ayta=haa$_i$]]
Hind(f) thinks Amr(m) that=you saw=her
'Hind$_i$ (f), Amr (m) thinks that you saw t_i'

(9) ẓananta Hind-an [ra'aa=haa$_i$ 'Amr-un]
you.thought Hind(f)-ACC he.saw=her Amr(m)-NOM
'You thought that Amr (m) saw Hind (f)'

(10) a. kaan-at l-mar'atu$_i$ [yu-qaalu la-haa$_i$ Ḥanḍalatu]
used.to-3FS DEF-woman 3MS-is.said to-her Ḥanḍala
'They used to say 'Ḥanḍala' to the woman. (more literally: the woman used to be said to 'Handala') (Reckendorf, 1921, 368)'

b. kid-tu [ta-qṭa'u nafs-ii]
was.almost-1S 3FS-break soul.F-my
'my heart almost broke (Reckendorf, 1921, 369)'

Doron and Reintges (2005) argue that, given this phenomenon, the direct attribute, and an analysis which assimilates broad subjects to normal (narrow) subjects, the existence of the indirect attribute is expected: While the modified NP is coindexed with the lexically required ('narrow') subject in the direct attribute, it is coindexed with a broad subject in the indirect attribute. In (5a), for instance, *buyuut* and *haa* are coreferent with an (unrealized) broad subject of *ḥaaṣil-i-n fii-haa*. This treatment is supported by the distribution of resumptives and gaps: Like the indirect attribute, broad subjects do not leave gaps[3], and their resumptives are not subject to island constraints.

[2]Corpus data from CA is given by Reckendorf (1895-1898, 789), Reckendorf (1921, 368–369).

[3]Arabic as a pro-drop language has zero resumptives. The distribution of zero elements in the canonical position of a broad subject is the same as the distribution of pro-drop, i.e. they can always be analyzed as empty resumptives.

Thus, we analyze the indirect attribute using the broad subject construction, following Doron and Reintges (2005).

One might go one step further and derive all relative clauses with resumptives using the broad subject construction. However, extraction of the highest subject is not possible in unmarked nonfinite relative clauses without a resumptive:

(11) buyuut-a-n [*(hiya) jadiid-at-u-n]
house.PL-ACC-INDEF they new-F.SG-NOM-INDEF
'houses that are new'

We therefore only analyze adjectival modifiers using the broad subject construction, while marked and unmarked relative clauses are analyzed as unbounded dependency constructions.

3 An HPSG Analysis

In this section, we present an HPSG analysis of Arabic relative clauses and adjectival modifiers. Since the analysis of adjectival modifiers is based on the broad subject phenomenon, we will first discuss how this phenomenon can be accounted for.

3.1 Broad Subjects

UDCs in Arabic We follow Taghvaipour (2005) in assuming a uniform treatment of resumptives and gaps using the SLASH list, whose elements are objects of type *ud-object* with the features LOCAL and UD-TYPE, for which the type *ud-type* with subtypes *resumptive* and *gap* is appropriate. Broad subjects are connected to the resumptive by a nonlocal dependency with UD-TYPE *resumptive*. The advantage over using separate features SLASH and RESUMPTIVE (Vaillette, 2001, Vaillette, 2002) is that constructions allowing gaps also allow resumptives in Arabic. Analyses under which resumptives cannot be distinguished non-locally from gaps (Taghvaipour, 2004; Borsley, 2010) face the problem that island constraints only apply to gaps in Arabic. Another approach, under which island constraints only apply to slashed non-pronouns, suggested by an anonymous reviewer, faces the problem that accusative interrogative pronouns can leave gaps, to which island constraints apply. However, it seems plausible that the approach of Crysmann (2012), which simplifies the analysis of ATB extraction and eliminates spurious ambiguities between resumptive and gap analyses, can be applied to Arabic. We leave this to future research.

Valence In examples like (8a), the broad subjects could be analyzed using the *filler-head-construction*. However, the participation in control would be unexpected under such a treatment. This can be accounted for more naturally by selecting broad subjects using valence lists similar to the selection of narrow subjects.

The question arises which valence lists are appropriate for Arabic and where the place of broad subjects is.

Borsley (1995) proposes that subjects are always selected via SUBJ, while complements are selected via COMPS. It seems straightforward to use SUBJ also for broad subjects and controlled subjects. However, this leads to some complications.

There has to be some way of indicating whether a member of SUBJ will be realized pre- or postverbally to account for a well-known agreement asymmetry: there is no number agreement with postverbal nominal subjects. One possibility is to have such a head feature on the verb, such as INV, but this causes problems if there is both a postverbal narrow subject and one or more (preverbal) broad subjects. An alternative is to indicate the position by a feature of the subject, but then raised subjects must be marked somehow, as their position feature will be relevant only for the verb with which they are realized, while embedded verbs will necessarily show full agreement.

These problems could be solved by introducing additional machinery such as the RAISED feature introduced by Meurers (2000), but there is little, if any, independent motivation for such features in Arabic. Thus, we will use SUBJ only for postverbal subjects, while preverbal subjects, broad subjects, and controlled subjects are selected via SPR.

Another possibility is to realize postverbal arguments via COMPS, as suggested by Beller (2007). However, postverbal subjects differ from postverbal complements with respect to a second CLLD-like pattern which we will refer to as *accusative fronting*, found only in Classical Arabic (Siibawayh, 1988, I 80, Reckendorf, 1895-1898, 791, Ayoub, 1981, 219). Here, the verb is preceded by an accusative NP which is coindexed with a genitive or accusative resumptive pronoun (12a). While the resumptive can be embedded inside a complement (12b), it is never embedded inside a subject (12c).

(12) a. wa=l-qamar-a qaddarnaa=hu manaazil-a
and=DEF-moon-ACC we.defined=it phases-ACC
'and we have determined phases for the moon (Qur'an 36:39)'

b. 'amr-an$_i$ laqiitu 'ax-aa=hu$_i$
Amr-ACC I.met brother-ACC-his
'Amr$_i$, I met his$_i$ brother (Al-Zamakhshari, 1879, 24)'

c. * 'abda-llaahi$_i$ ḍaraba 'ax-uu=hu$_i$ zaydan
Abdullah.ACC hit brother-NOM-his Zayd-ACC
'Abdullah$_i$, his$_i$ brother hit Zayd (Ayoub, 1981, 220)'

Another problem that occurs if postverbal subjects are treated as complements while preverbal subjects are treated as specifiers is that it is hard to prohibit subjects on COMPS from appearing in a preverbal position, while allowing this for other members of COMPS. Unless additional mechanisms for controlling raising

are used, it is not possible to put preverbal complements into the same valence list as preverbal subjects, as complements cannot be controlled.

Therefore, we use SUBJ for postverbal subjects, SPR for preverbal subjects, broad subjects, and controlled subjects, and COMPS for complements. We adopt Borsley (1995)'s proposal that all arguments of a verb, except for preverbal subjects, are realized in a *head-subj-comp-phrase*. Our constraint differs from Borsley's in that the relative order of subjects and complements is not fixed; the only constraint being that the subject be realized postverbally. This accounts for the possibility of VSO, OVS, and VOS:

(13) *head-subj-comp-phrase* →

$$\left[\begin{array}{ll} \text{SS}|\text{L}|\text{C} & \left[\begin{array}{ll} \text{HEAD} & \textit{verb} \\ \text{COMPS} & \langle\rangle \\ \text{SUBJ} & \langle\rangle \end{array}\right] \\ \text{HD-DTR} & \boxed{1}\left[\begin{array}{ll} \text{COMPS} & \boxed{3} \\ \text{SUBJ} & \boxed{2} \oplus \text{list}(\textit{non-canonical-ss}) \end{array}\right] \\ \text{DTRS} & \texttt{ss-to-sign}(\boxed{3}) \circ \left(\left\langle \boxed{1} \right\rangle \oplus \texttt{ss-to-sign}(\boxed{2})\right) \end{array}\right]$$

where `ss-to-sign` is defined as follows:

(14) $\texttt{ss-to-sign}(\langle\rangle) = \langle\rangle$

$\texttt{ss-to-sign}(\langle \boxed{1} \mid \boxed{2} \rangle) = \langle [\ \text{SYNSEM}\ \boxed{1}\ ] \mid \texttt{ss-to-sign}(\boxed{2})\rangle$

Note that the constraint also accounts for verbs without subjects and verbs with empty subjects. Without an additional mechanism for adjuncts, such a treatment requires an Adjuncts-as-Complements approach, as adjuncts can occupy essentially any position after the verb. As an alternative, one could define a binary branching structure or use discontinuous constituents.

Members of SPR are realized in a *spr-head-phrase*:

(15) *spr-head-phrase* →

$$\left[\begin{array}{ll} \textit{clause} \ \& \ \textit{head-final-phrase} & \\ \text{SS}|\text{L}|\text{C}|\text{SPR} & \boxed{1} \\ \text{HD-DTR}|\text{SS}|\text{L}|\text{C} & \left[\begin{array}{ll} \text{SPR} & \left\langle \boxed{2} \right\rangle \oplus \boxed{1} \\ \text{COMPS} & \langle\rangle \\ \text{SUBJ} & \text{list(noncanical-ss)} \end{array}\right] \\ \text{NON-HEAD-DTRS} & \left\langle \text{SYNSEM}\ \ \boxed{2} \right\rangle \end{array}\right]$$

We now define the linking between ARG(UMENT)-ST(RUCTURE) and the valence lists (Manning and Sag, 1998). We assume that preverbal subjects correspond to a *pro* on SUBJ. This allows a very simple analysis of the agreement asymmetry:

a verb always agrees with the (single) element of SUBJ, which is also the first element of ARG-ST. Agreement is complete if and only if this element is pronominal or a gap. Following Manning and Sag, we state the following principle:

(16) Argument Realization Principle (adapted)

$$\textit{word} \rightarrow \left[\text{SS|L|C} \left[\begin{array}{ll} \text{SUBJ} & \boxed{1} \\ \text{SPR} & \texttt{to-specifier}(\boxed{1}) \\ \text{COMPS} & \boxed{2} \ominus \text{list(non-canonical-ss)} \\ \text{DEPS} & \boxed{1} \oplus \boxed{2} \end{array} \right] \right]$$

The non-deterministic function `to-specifier` is defined in Prolog notation as follows (the first argument denotes the input, the second one the output):

(17) `to-specifier(`*list*, $\langle\ \rangle$`).`
`to-specifier(`$\langle$ *non-canonical-ss*$_i$ $\rangle$, $\langle$ *synsem*$_i$ $\rangle$`).`

The first clause accounts for empty subjects and for postverbal subjects. The second clause accounts for overt preverbal and for controlled subjects, including controlled empty subjects.

This analysis is similar to the traditional account, according to which a preverbal subject (at least in clauses headed by a finite verb) is actually a *mubtada'*, i.e. a broad subjects linked to an empty resumptive subject pronoun (Wright, 1896-98, II 255). A direct implementation of this approach would make it possible to eliminate the reference to SPR from the Argument Realization Principle entirely, but there is evidence that the position of preverbal subjects is ambiguous and that they can be either broad subjects or genuine preverbal narrow subjects (Doron, 1996, 16).

Broad Subjects One possibility to introduce the broad subject to SPR is to introduce all broad subjects into SPR lexically. For every broad subject introduced to SPR, a corresponding requirement is added to TO-BIND (Pollard and Sag, 1994, Bouma et al., 2001). Under this account, the SPR list, which is usually assumed to contain at most one element, can contain an unbounded number of elements. This account, which is similar to the analysis of English missing object constructions by Grover (1995), the analysis of the Korean double nominative construction by Choi (2012) and the analysis of Danish object shift by Müller and Ørsnes (2012), explains why broad subjects behave very much like ordinary, lexically required subjects and allows a straightforward analysis of the data in (8–9).

It also correctly predicts that the resumptive belonging to a broad subject may be located inside any of the verb's dependents, even another broad subject (18a; corpus examples are given in Reckendorf, 1895-1898, 784). However, the analysis fails to predict that a broad subject always precedes (and c-commands) the coreferent resumptive (18b).

(18) a. Hindun$_i$ ṣadiiqu ’abii$_j$-haa$_i$ ra’ay-tu=hu$_j$
Hind-NOM friend-NOM father-GEN-her I.saw-him
‘Hind$_i$, the friend$_j$ of her$_i$ father, I saw him$_j$’

b. * ṣadiiqu ’abii$_j$-haa$_i$ Hindun$_i$ ra’ay-tu=hu$_j$
friend-NOM father-GEN-her Hind-NOM I.saw-him
‘The friend$_j$ of her$_i$ father, Hind$_i$, I saw him$_j$’

In fact, the analysis does not even ensure that a pronominal broad subject cannot be its own resumptive. This is not trivial to rule out under the Pollard and Sag (1994) mechanism.[4] However, these cases can be ruled out by modifying the SLASH Amalgamation Principle (Bouma et al., 2001) so that for each broad subject, an element of the SLASH value of a preceding element of DEPS is removed. Apart from the problem that it seems hard to formalize this constraint without relations or quantifiers, there is the more general issue that lexical introduction of the broad subject does not readily extend to predicative NP, which should probably be introduced phrasally (Müller, 2009), and which can head clauses including broad subjects without a copula. Unless an empty copula head is used[5], it is necessary to also stipulate the possibility of broad subjects for phrasally introduced predicates.

An alternative that avoids this drawback and that predicts that broad subjects c-command their resumptive uses a unary projection that takes an element from SLASH and adds a broad subject to SPR:

(19) *broad-subj-intro-phrase* →

$$\left[\begin{array}{l}\textit{headed-phrase}\\ \text{SYNSEM}\left[\begin{array}{ll}\text{L}|\text{C} & \left[\begin{array}{ll}\text{HEAD} & \textit{verb}\\ \text{COMPS} & \boxed{1}\langle\rangle\\ \text{SPR} & \left\langle\left[\text{LOC}\ \ \boxed{2}\right]\right\rangle\end{array}\right]\\ \text{N}|\text{SLASH} & \boxed{3}\end{array}\right]\\ \text{HEAD-DTR}|\text{SYNSEM}\left[\begin{array}{ll}\text{L}|\text{C} & \left[\begin{array}{ll}\text{COMPS} & \boxed{1}\\ \text{SPR} & \langle\rangle\end{array}\right]\\ \text{N}|\text{SLASH} & \left\langle\left[\begin{array}{ll}\text{UD-T} & \textit{resu}\\ \text{LOC} & \boxed{2}\end{array}\right]\right\rangle\circ\boxed{3}\end{array}\right]\end{array}\right]$$

To avoid spurious ambiguities, it only applies to saturated projections. We will adopt this account. Note that, unlike a DEPS-based analysis, it does not rely on

[4]Stipulating that no coreferential element is on SLASH when a broad subject is realized is insufficient, as there might be several coreferential broad subjects, as in (?) *Zaydun huwa ra’aytu=hu* ‘Zayd, he, I saw him’.

[5]For arguments against empty copulas in Arabic, cf. Al-Horais (2006) and Benmamoun (2008). The arguments by Bender (2001) for a copula head in an HPSG analysis of verbless clauses in AAVE apparently do not apply to Arabic.

an adjuncts-as-complement analysis. It is also independent of the particular choice of the theory of extraction; it is compatible with both Pollard and Sag (1994)'s analysis and head-driven lexicalized analyses (Bouma et al., 2001, Ginzburg and Sag, 2001).

Figure 1 shows an analysis of (8b).

Another possibility is to introduce only controlled broad subjects to SPR and to realize other broad subjects immediately. Clearly, this analysis leads to smaller syntactic trees for sentences with a broad subject that is not controlled, but it requires an additional construction and controlled elements of SPR must somehow be marked.

A second alternative is to treat all raising constructions as UDC constructions. Hence, ordinary raising of (narrow) subjects would be treated as extraction leaving an empty resumptive. However, nonfinite predicates do not allow empty subject pronouns, as can be seen in unmarked relative clauses (20a). Thus, it is unexpected under such an analysis that the subject of a nonfinite predicate can be raised, as in (20b).

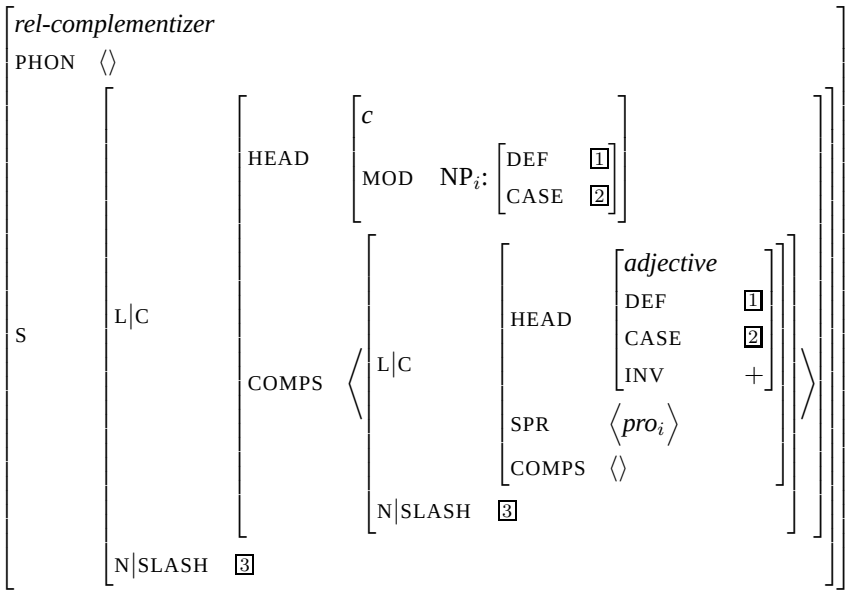
(20) a. ra'aytu rajul-a-n yaquumu/*qaa'im-u-n
I.saw man-ACC-INDEF he.stands/standing-NOM-ACC
'I saw a man who was standing'

b. Zayd-un kaana qaa'im-a-n
Zayd-NOM was.3MS standing-ACC-INDEF
'Zayd was standing'

3.2 Previous Work on Arabic Relative Clauses

Haddar et al. (2009) present an HPSG analysis of Arabic marked relative clauses under which the relativizer is a marker in the sense of Pollard and Sag (1994) which selects a VP. While the analysis accounts for marked relative clauses where the extracted element is the highest subject, it is not obvious how it can be extended to cover cases like (3), where the extracted element is not the highest subject. Unmarked relative clauses and free marked clauses are not included in the analysis.

Alqurashi and Borsley (2012) and Alqurashi (2012) argue for a uniform analysis of marked and unmarked relative clauses under which they are headed by a (potentially empty) relativizer. It selects a saturated clause and establishes coindexation between an element of the clause's SLASH list with its own MOD value. Free relatives are accounted for by a unary projection. This analysis can be extended to cover adjectival modifiers by adding another empty element (the feature geometry is the same as in Alqurashi and Borsley, 2012):

(21)


The relativizer selects a head-initial projection of an adjective with an unrealized *pro* element on SPR, which is coindexed with the relativizer's MOD value. The element on SPR is a broad or narrow subject of the adjective. Furthermore, the relativizer establishes concord in DEFINITENESS and CASE between the adjective and the modified NP. The SLASH value of the adjective is taken over unchanged, since adjectival modifiers are not UDC constructions.

Alqurashi and Borsley (2012) also consider surface-oriented constructional analyses and reject these. Their main argument is based on the fact that Sag (1997)'s constructional analysis requires a new type *head-relative-phrase* to account for the correct semantic composition. Whether this argument is convincing depends on whether an additional type in a completely surface-oriented account is seen as more 'expensive' than the stipulation of an empty word. Different researchers will presumably differ on this issue. We will therefore present a different, surface-oriented account that uses both constructional and lexical elements in the next section. In section 3.4, we will outline a second constructional analysis, which does not require a special rule for the semantic composition of NPs containing a modifying relative clause.

3.3 A Surface-Oriented Account

In this section, we present a surface-oriented analysis of relative clauses and adjectival modifiers. We assume that the head of an Arabic relative clause is the relativizer in marked clauses and the highest predicate in unmarked clauses and adjectival modifiers. Both assumptions are justified by the case-marking of the putative heads visible on case-marked relativizers and adjectival predicates.

In the surface-oriented account of Sag (1997), English relatives are analyzed as clauses with a nominal synsem object as MOD value. Following Sag (1997), we

get the following constraint for *relative-clause*:

(22) *rel-cl* $\rightarrow$ $\begin{bmatrix} \text{MOD}|\ldots|\text{HEAD} & \textit{noun} \\ \text{CONT} & \textit{proposition} \end{bmatrix}$

This analysis faces the difficulty that in the semantic architecture of Pollard and Sag (1994), the semantics of a relative clause is of type *proposition*, while an NP composed of a noun and a relative clause has a restricted index as its CONT value. The standard HPSG principles for semantic composition (Pollard and Sag, 1994) assume that the CONT value of the NP should be token-identical with the CONT value of the adjunct, i.e. the relative clause. Sag solves this problem by defining a special constraint for the semantic composition of phrases composed of a head and a relative clause. We will adopt this solution.

Alqurashi and Borsley (2012) view the necessity of assuming a different rule for semantic compositionality as a major argument against a constructional analysis. Whether this argument is convincing depends on whether an additional type in a completely surface-oriented account is seen as more 'expensive' than the stipulation of an empty word. In section (3.4), we will outline a constructional analysis that avoids this drawback of Sag's analysis.

For relative clauses involving a UDC, Sag (1997) establishes a link between SLASH and MOD on the level of the *relative-clause* by removing an element from the SLASH list of its head. In a surface-oriented analysis, this does not work for Arabic, as relative clauses can consist of finite verb without any overt dependents, i.e. there is not even always a head-daughter. We will establish the link between MOD and SLASH on the lexical level using the feature TO-BIND (Pollard and Sag, 1994, Bouma et al., 2001). Heads of relative clauses involving a UDC satisfy the following description:

(23) $\begin{bmatrix} \text{S} & \begin{bmatrix} \text{L}|\text{C} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{reltvzr-or-verb} \\ \text{MOD} \quad \text{NP}_i \end{bmatrix} \end{bmatrix} \\ \text{NONLOC} & \begin{bmatrix} \text{TO-BIND} & \left\langle \left[\text{L } \textit{local}_i \right] \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$

We then have the following two subtypes of *rel-cl*:

(24) *ordinary-rel-clause* $\rightarrow$ $\begin{bmatrix} \text{S} & \begin{bmatrix} \text{L}|\text{C} & \begin{bmatrix} \text{HD} & \begin{bmatrix} \textit{reltvzr-or-verb} \\ \text{MOD} \quad \text{NP} \end{bmatrix} \\ \text{SPR} & \langle\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$

(25) *adjective-rel-clause* →

$$\begin{bmatrix} \text{S} & \begin{bmatrix} \text{L|C} & \begin{bmatrix} \text{HD} & \begin{bmatrix} \textit{adjective} \\ \text{PRED} \quad + \\ \text{MOD} \quad \text{NP}_i \end{bmatrix} \\ \text{SPR} & \left\langle \textit{pro-ss}_i \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The second constraint is only slightly more specific than the constraint on *red-rel-cl* in Sag (1997) and stipulates none of the specific properties of the Arabic indirect attribute, all of which are accounted for by independently needed machinery for broad subjects and subject-predicate agreement.

An analysis for (4a), an instance of the direct attribute, is shown in figure 2. Figure 3 shows an analysis of (5a), an instance of the indirect attribute.

The apparent possibility of pro-drop with adjectival modifiers (Polotsky, 1978, 162–168), which is not attested in CA and not accepted by all MSA speakers, can be stipulated on the lexical level for adjectives with MOD *synsem*.

Free relatives are introduced via a unary projection, as suggested by Müller (1999) for German. Whether a relative clause can or has to be free can be stipulated by restricting the MOD value. Following Müller (1999), free relative clauses are specified as modifying an element with a *synsem* object that intuitively represents an empty head and which cannot be realized in any sign. The free-relative clause projection construction takes as its daughters only relative clauses with such a requirement. This ensures that the head of the relative clause, which is the highest predicate or the relativizer, can control whether the clause is free or modifying.

Restrictions on Marked Clauses and Adjectival Modifiers Marked relative clauses and adjectival modifiers require agreement with the modified NP in case and definiteness. Furthermore, they are always head-initial (6).[6] These facts are captured by the following constraint:

(26) $\begin{bmatrix} \ldots\text{HD} & \begin{bmatrix} \textit{reltvzr} \vee \textit{adjective} \\ \text{MOD} \quad \text{NP} \end{bmatrix} \end{bmatrix} \rightarrow \begin{bmatrix} \ldots\text{HD} & \begin{bmatrix} \text{INI} & + \\ \text{CASE} & \boxed{1} \\ \text{DEF} & \boxed{2} \\ \text{MOD} & \begin{bmatrix} \ldots\text{CASE} & \boxed{1} \\ \ldots\text{DEF} & \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix}$

Sharing DEF is compatible with cases where definiteness agreement with adjectival modifiers fails. In general, nouns with a genitive dependent are not marked for definiteness. This rule may prohibit the use of definiteness marker on adjectives with a genitive dependent. This depends on several factors, all of which are accessible on the level of the adjective: In 'unreal annexation' (*l-mar'atu l-jamiilatu*

[6] It is not clear how examples like *la=ka maa 'amilnaa baaṭil-un* for=you RELTVZR we.have.done void-NOM 'what we have done for you is void' (Reckendorf, 1921, 447, with similar examples), where the relativizer is preceded by material belonging to the relative clause, should be analyzed.

l-wajhi DEF-woman-NOM DEF-beautiful-NOM DEF-face-GEN ‘the woman whose face is beautiful’), the definiteness marker is obligatory. If the adjective is a participle and the genitive dependent an argument, the presence of the definiteness marker is influenced by tense/aspect (Reckendorf, 1895-1898, 155–156, 185–188, Reckendorf, 1921, 186). With certain words like *ghayr* ‘other than’, the definiteness marker was forbidden in CA and is optional in MSA. Such a treatment allows a simple account of the fact that the definiteness of the genitive complement is identical with that of the head if it is also an adjective (Badawi et al., 2004, 234–235).

The agreement of adjectival modifiers with their subject in number and gender can be accounted for by a general agreement mechanism, which is independently required in order to account for subject-predicate agreement in independent clauses and which is similar to Melnik’s constraint 22. This is confirmed by the fact that adjectives seem to show the same agreement patterns in the indirect attribute as in independent clauses in which the subject follows the predicate; in particular, number may be neutralized in both cases (Hasan, 1968-1971, III 453; Reckendorf, 1921, 29). An additional constraint enforcing total agreement in the direct attribute, as constraint 24 in Melnik (2006), is not needed, since adjectives used as direct attribute have a nonempty SUBJ list under our analysis, as shown in Figure 2.

Thus, while we follow Melnik (2006) in basing our analysis on the general approach of Sag (1997), our analysis of adjectival modifiers is significantly simpler, since it capitalizes on independently required mechanisms for broad subjects and subject-predicate agreement.

Restrictions on Unmarked Clauses Unmarked relative clauses always modify in indefinite NP. This is captured by the following constraint:

(27) $$\begin{bmatrix} \ldots\text{HD} & \begin{bmatrix} \textit{verb} & \\ \text{MOD} & \text{NP} \end{bmatrix} \end{bmatrix} \rightarrow \begin{bmatrix} \ldots\text{HD} & \begin{bmatrix} \begin{pmatrix} \textit{not-case-marked-head} \\ \vee\ \text{CASE} \quad \textit{nom} \end{pmatrix} \\ \text{MOD} \quad \begin{bmatrix} \ldots\text{DEF} & - \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Not-case-marked-head subsumes finite verbs, prepositions and other heads without morphological case marking. Other heads, i.e. nominal and adjectival predicates, are constrained to show nominative case marking, which accounts for (2). The restriction on definiteness was not valid for all CA speakers, as definite unmarked relative clauses are attested. An account of this obsolete and rare phenomenon is given in Hahn (2012).

3.4 A (Second) Constructional Alternative

Alqurashi and Borsley (2012) see the necessity of assuming a different type of semantic compositionality as an argument against a constructional analysis. In this section, we outline a constructional analysis that does not require a separate

head-relative-phrase type to account for the correct composition of the semantics. The basic ingredient is a unary projection which introduces an NP with a restricted index as its CONT value over a clause:

(28) *rel-phrase* →

$$\begin{bmatrix} \text{N-HD-DTRS} & \left\langle \begin{bmatrix} \textit{clause} \vee \textit{relativizer-with-clause} \\ \text{CONT} \quad \boxed{1}\,\textit{proposition} \end{bmatrix} \right\rangle \\ \text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{noun} \\ \text{COMPS} & \langle\rangle \\ \text{SUBJ} & \langle\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{RESTR} & \left\{\boxed{1}\right\} \cup \textit{set} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Modifying relative clauses are instances of *relative-phrase* with MOD value of type *synsem*, while free relatives specify MOD as *none*. A constraint enforcing coindexation and agreement of modifying relative clauses with the modified NP value can be stated easily. Thus, both free and modifying relatives are analyzed as NPs.

By defining a hierarchy of subtypes and expressing some of the properties expressed on the lexical level there by constraints on these phrasal types, the analysis presented in the previous section can be reconstruced. The analysis is described in more detail in Hahn (2012).

While leading to more complex syntactic structures for modifying relative clauses, this treatment simplifies the analysis of free relative clauses. More importantly, since the phrasally introduced NP has a restricted index as its CONT value, there are no difficulties with the semantic composition. This shows that the prinicples of semantic compositionality stated in Pollard and Sag (1994) are compatible with a constructional surface-oriented analysis of Arabic relative clauses. In principle, similar analyses are also possible in other semantic frameworks formalized in HPSG that allow semantic material to be introduced phrasally.

4 Conclusion

We have presented an HPSG analysis of NP relativization in Arabic that covers significantly more phenomena than previous analyses. Based on Doron and Reintges (2005), we showed that the crosslinguistically unusual syntax of adjectival modifiers is a language-internally expected variant of reduced relatives as found in English and requires no additional stipulations or phrasal types. Its syntactic peculiarities follow from independently established properties of Arabic syntax, in particular the existence of *broad subjects*, clause-initial NPs that bind off a UDC and that can be controlled (Doron and Heycock, 1999). We showed that their syntactic behaviour suggests that they are selected via SPR and that this requirement is

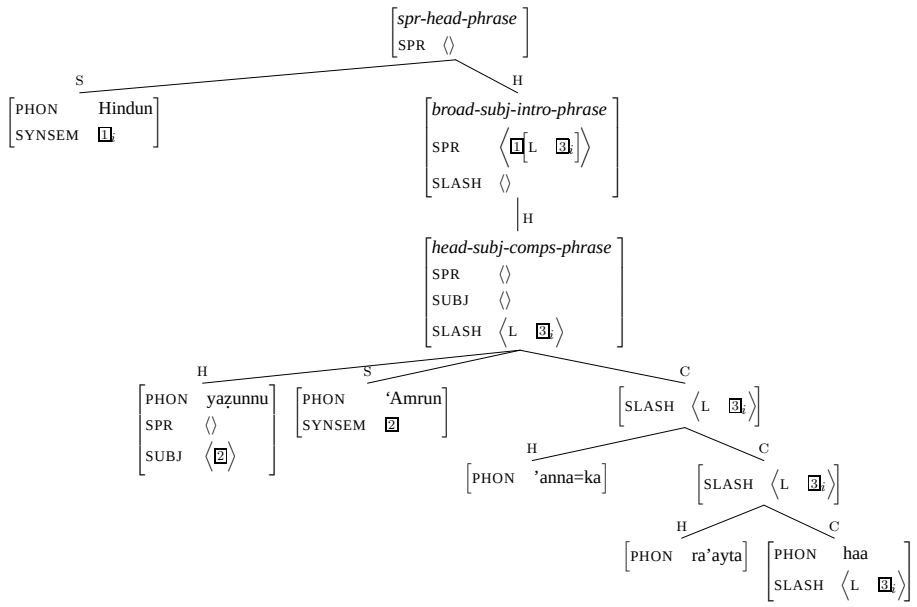


Figure 1: Analysis of (8b)

introduced phrasally by a unary projection. We then presented an analysis of relative clauses and adjectival modifiers that combines constructional with lexicalist elements and does not require empty elements. Because of the use of independently required mechanisms, the analysis of adjectival modifiers is significantly simpler than the previous analysis by Melnik (2006).

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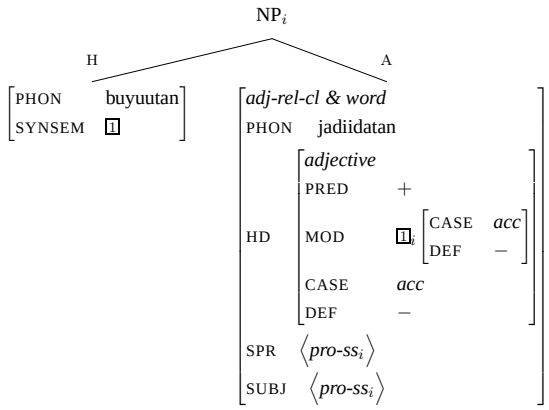

Figure 2: Analysis of example (4a) (Direct Attribute)

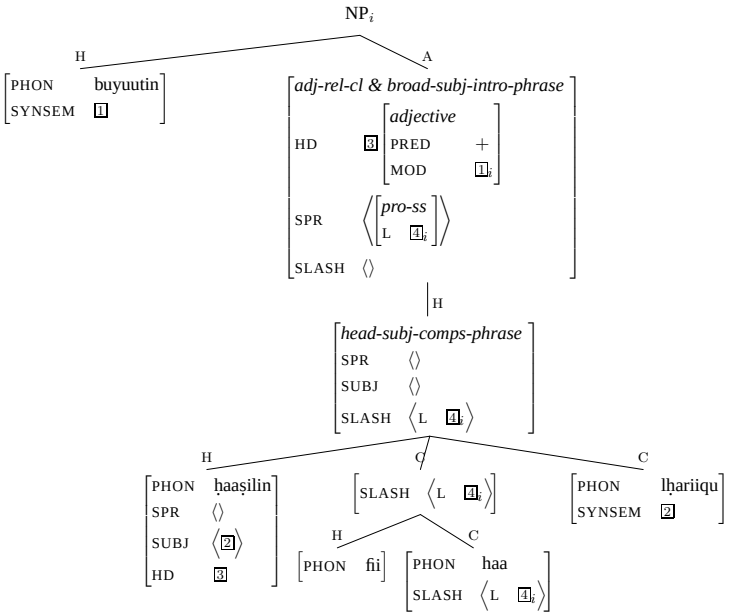

Figure 3: Analysis of example (5a) (Indirect Attribute)

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The adverb argument intersection field in a left-branching grammar of Norwegian

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Abstract

This paper presents an account of the position of sentence adverbials in Norwegian within a left-branching HPSG-like grammar design. The assumed left-branching structures open for a treatment of Object Shift in Norwegian as part of a wider phenomenon referred to as the *Adverb Argument Intersection Field*. The approach is compared to the standard P&P analysis of Object Shift and it is shown that the two approaches make similar predictions regarding basic clause structures with full NP arguments. However, while one in P&P is forced to assume a secondary phonological movement in order to account for the position of unstressed pronoun objects with regard to sentence adverbials, no extra assumptions need to be made in the proposed account.

1 Introduction

A central topic in Scandinavian syntax is the notion of "Object Shift" (see Diderichsen (1946); Hellan (1971); Fretheim and Halvorsen (1975); Holmberg (1986, 1999); Holmberg and Platzack (1995); Hellan and Platzack (1995); Vikner (1994, 1995)). Object Shift applies when a pronoun "shifts" from its "normal" position behind the sentence adverb to the position preceding it, after the main verb. This is illustrated in (1). In (1a) the two objects appear after the sentence adverbial *ikke*. In (1b) the indirect object pronoun *henne* is "shifted" to the position before *ikke*, and in (1c), both objects (*henne* and *den*) have "shifted".

(1) a. Jon ga ikke Marit en blomst.
Jon gave not Marit a flower
Jon didn't give Marit a flower.

b. Jon ga henne ikke en blomst.
Jon gave her not a flower
Jon didn't give her a flower.

c. Jon ga henne den ikke.
Jon gave her it not
Jon didn't give it to her.

The arguments that undergo Object Shift are usually unstressed pronouns.[1] In this paper, I will show how Object Shift can be seen as a part of a wider phenomenon, involving what will be referred to as the 'Adverb-Argument Intersection Field.' The analysis that will be presented has been implemented in a grammar for

[†]I would like to thank the audience at HPSG 2012, Daejeon, South Korea, and three anonymous reviewers for their valuable comments.

[1]In Icelandic, full NPs can undergo Object Shift. This is also possible in Norwegian, but it then requires a marked intonation on the verb, and the reference of the NPs must be as salient as that of an unstressed pronoun.

Norwegian, Norsyg. It does not involve movements, just a field with certain ordering constraints. In addition, the analysis does not restrict itself to the position of sentence adverbials with regard to the objects, but also with regard to the subject.

In section 2, I will give a description of the Adverb-Argument Intersection Field. In section 3, I will present two accounts of basic clause structures in Norwegian; Diderichsen's Sentence Model, and Holmberg's P&P account. In section 4, I will give an outline of the proposed left-branching grammar formalism. In section 5, I will show how the phenomenon is treated in the Norsyg grammar. Finally, in section 6 I will compare the P&P account with my HPSG account.

2 The Adverb-Argument Intersection Field (AAIF)

An informal definition of the Adverb-Argument Intersection Field (AAIF) is given in (2).

(2) The Adverb-Argument Intersection Field is the field after the first verb or complementizer and before the following verb (if there is one).

The sentence adverbials and arguments in the AAIF obey the following ordering constraint:

(3) Unstressed pronominal arguments cannot appear in the position following a sentence adverbial.

In a main clause with a finite main verb, the clause has only one verb (and no complementizer) so the AAIF includes the sentence adverbs and arguments that appear after the verb. Since the clause has only one verb, the AAIF does not have a boundary to the right, other than the clause boundary. An example of an AAIF of a main clause with a finite main verb was given in (1), where it includes all constituents after the verb *ga* ('gave'). Given the constraint in (3), the position of the sentence adverbial with regard to the arguments is accounted for.

If a non-subject constituent is topicalized in a sentence with a finite main verb, the subject becomes a part of the AAIF. This is illustrated in (4), where the AAIF includes the sentence adverbial *ikke*, the subject, and the two objects. In (4a), the subject *Jon* is a full NP and appears after *ikke*. In (4b), the subject is the pronoun *han* ('he'), and it now appears before *ikke*. In (4c), all the arguments are pronouns, and they all precede *ikke*.

(4) a. I dag ga ikke Jon Marit en blomst.
today gave not Jon Marit a flower
Today, Jon didn't give Marit a flower.

b. I dag ga han ikke Marit en blomst.
today, gave he not Marit a flower
Today, he didn't give Marit a flower.

c. I dag ga han henne den ikke.
today gave he her it not
Today, he didn't give it to her.

Also in yes-no questions, the subject becomes a part of the AAIF, given that the main verb is finite. This is shown in (5). As in (4), the subject appears after the sentence adverbial when it is a full NP (see (5a)), and before the sentence adverbial when it is a pronoun (see (5b) and (5c)).

(5) a. Ga ikke Jon Marit en blomst?
gave not Jon Marit a flower
Didn't Jon give Marit a flower?

b. Ga han ikke Marit en blomst?
gave he not Marit a flower
Didn't he give Marit a flower?

c. Ga han henne den ikke?
gave he her it not
Didn't he give it to her?

In addition to main clauses with a main verb, also subordinate clauses and main clauses with an auxiliary (and a non-subject constituent in the first position) have an AAIF. The field then consists only of the sentence adverbial and the subject. This is illustrated in (6) and (7). In (6a) and (7a), the subject follows the sentence adverbial. This position is only possible if the subject is a full NP (*Jon*), and not an (unstressed) pronoun (*han* ('he')). In (6b) and (7b), the subject precedes the sentence adverbial. In this position, the subject can be either an unstressed pronoun or a full NP.

(6) a. at ikke Jon/*han ga Marit en blomst
that not Jon/he gave Marit a flower
that Jon didn't give Marit a flower

b. at Jon/han ikke ga Marit en blomst
that Jon/he not gave Marit a flower
that Jon/he didn't give Marit a flower

(7) a. Marit har ikke Jon/*han gitt en blomst.
Marit has not Jon/he given a flower
Marit, Jon has not given a flower.

b. Marit har Jon/han ikke gitt en blomst.
Marit has Jon/he not given a flower
Marit, Jon/he has not given a flower.

	Nexus field			Content field		
Fund.	Fin verb	Subject	Sentence adv	Inf verb	Objects	Pred adv
Jon	ga		ikke		Marit en blomst	
Jon	ga	henne	ikke		en blomst	
Jon	ga	henne den	ikke			

Figure 1: Main clause in Diderichsen's Sentence Model

	Nexus field				Content field		
Fund.	Finite verb	Subject	Sentence adv	Subject	Inf verb	Objects	Pred adv
I dag	ga		ikke	Jon		Marit en blomst	
I dag	ga	han	ikke			Marit en blomst	
I dag	ga	han henne den	ikke				

Figure 2: Main clause with topicalized predicate adverbial in Diderichsen's Sentence Model

3 Earlier accounts of Object Shift

3.1 Diderichsen's Sentence Model

The assumption that Scandinavian has a canonical position for the object and that the object under certain circumstances moves to a position preceding the sentence adverbial, with the presupposition that the position of the sentence adverbial is stable, can be traced back to Diderichsen (1946). Although the non-P&P literature does not necessarily use the term movement, two slots are made available for the realization of the objects. According to the Diderichsen Sentence Model, the canonical position of the objects is after the verb, in the Content field, as shown in Figure 1. However, unstressed pronouns can appear in the Subject slot in the Nexus field, as Figure 1 also illustrates. The sentences analyzed in Figure 1 are the examples in (1). Note that the Nexus field does not correspond to the AAIF field, as the AAIF field includes also the Content field in case the slot for infinite verbs is not filled (and the clause is not a subordinate clause).

If the Fundament slot is held by another constituent than the subject (see (4)), or if the sentence is a yes-no question (see (5)), the subject is realized in the Subject slot. However, if the subject is a full NP, as it is in (4) and (5), a secondary Subject slot is needed in the position following the sentence adverbial. This is illustrated for (4) in Figure 2. If all the arguments are unstressed pronouns, they all appear in the first Subject field.

Subordinate clauses are analyzed with a separate sentence scheme illustrated in Figure 3. The positions in the Nexus field are altered so that the slot for the finite verb comes after the subject and the sentence adverbial. Given the assumption that unstressed pronouns cannot move past the verb, they are realized in the same position as the full NPs.

	Nexus field			Content field		
Compl	Subject	Sentence adv	Fin verb	Inf verb	Objects	Pred adv
at	Jon	ikke	ga		Marit en blomst	
at	Jon	ikke	ga		henne den	

Figure 3: Subordinate clause in Diderichsen's Sentence Model

3.2 Object Shift in P&P

In P&P, the basic clause structure is accounted for by means of verb movement. While the position of the sentence adverbial is assumed to be relatively constant (attaching to T' or TP),[2] verbs can be realized in V, T or C. A verb originates in V and moves to T in order to receive Tense. As shown in Figure 4, this position is preceded by the position of the sentence adverbial. If the C position is not taken by a complementizer, the finite verb moves to a position preceding the sentence adverbial (C). Figure 4 shows the structure of a main clause where the verb *ser* has moved from V via T to C, and where the subject *Kari* has moved from the specifier position of V via the specifier position of T to the specifier position of C.

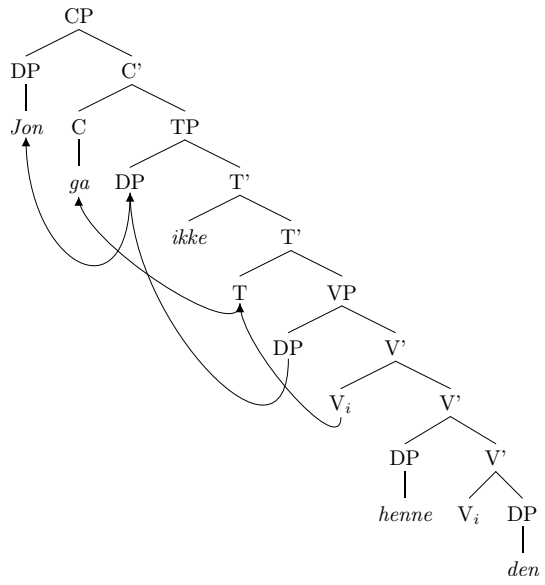

Figure 4: Main clause in P&P, before Object Shift

As shown in (1b) and (1c), it is possible for DP objects to appear in the position after a finite main verb and before the sentence adverbial. As mentioned, this is

[2]For the comparison with the left-branching grammar, I will use a P&P analysis where sentence adverbials attach to T'. This assumption is often made in the Scandinavian P&P literature. See e.g. Holmberg and Platzack (1995).

referred to as 'Object Shift', and is according to Holmberg (1999), an operation that happens after the other movements. It lets objects move to the position to the right of the next main category element to their left. A 'main category' here does not include sentence adverbials. This means that an object is allowed to move past a sentence adverbial and find its position to the right of a verb after the verb has moved. This is shown in the tree in Figure 5, where the objects attach to the verb after the verb has moved to C.[3]

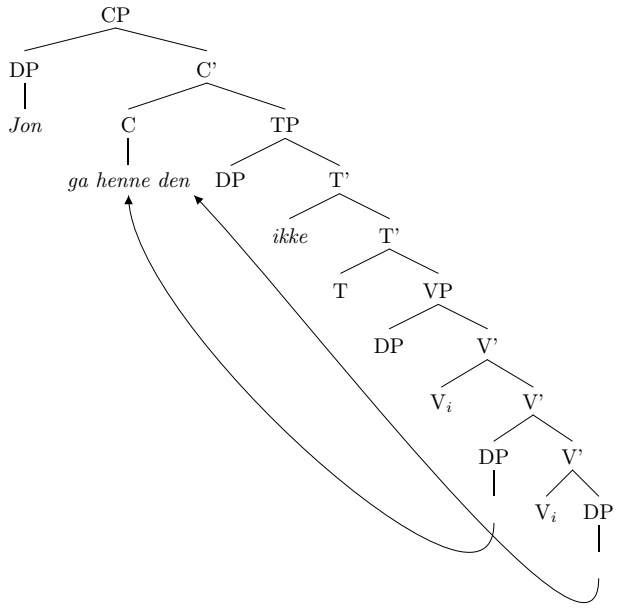

Figure 5: Object Shift in P&P

If a non-subject is topicalized, the subject will be prevented from moving to the specifier position of C and stay in the specifier position of T, with the effect that it also can undergo the same phonological movement as the objects, accounting for the data in (4). The possibility for the subject to appear after the sentence adverbial is accounted for by allowing the sentence adverbial to attach to T' or TP, and hence there is only one position for the subject (specifier of T), and not two as in the Diderichsen's Sentence Model.

In subordinate clauses, a complementizer is assumed to occupy the C position, with the result that the finite verb does not move higher than T. This means that there is no Object Shift in subordinate clauses since the verb is realized after the position of the sentence adverbial. The account of the difference in clause structure by means of verb movement is appealing since it explains why the finite verb appears before the sentence adverbial in main clauses and after the sentence adverbial

[3]The observation that Object Shift depends on the main verb moving to C is referred to as 'Holmbergs Generalization' in the P&P literature and stems from Holmberg (1986).

in subordinate clauses. The C projection also accounts for the fact that the finite verb always comes second in main clauses.

3.3 Other non-movement approaches

Sells (2001) and Börjars *et al.* (2003) account for Object Shift in Swedish by assuming a flat structure under I', where unstressed pronouns and sentence adverbials are realized. The main problem associated with the assumption of a flat structure is the number of phrase structure rules required. Given the fact that there is no upper limit to the number of possible adverbs that can appear in this field, there is no theoretical upper limit to the number of phrase structure rules required.[4]

4 A left-branching grammar of Norwegian

The assumption of the I and C projections on top of VP in P&P and the assumption of A-bar movement to the specifier position of C in main clauses, give a compelling explanation of basic clause structures in Norwegian. In this section, I will introduce a grammar fragment of Norwegian and argue that the explanatory force of verb movement and A-bar movement can be attained within the monostratal architecture of HPSG.

The grammar fragment is based on a grammar of Norwegian, Norsyg,[5] which was originally developed from the HPSG Matrix Grammar (Bender *et al.*, 2002).[6] It is a part of the DELPH-IN effort.[7] The grammar is a constructionalist grammar with a different account of the syntax-semantics interface than a regular lexicalist HPSG grammar, (see Haugereid (2007, 2009, 2012)), and a different approach to syntactic structures. The analysis presented is implemented, and is a part of the Norsyg grammar.

4.1 Overview

The grammar fragment consists of some basic phrase structure rules and function words accounting for basic syntactic structures in Norwegian. I will here focus on four types of rules:[8]

[4] See Müller (2006) for a convincing argument against flat structures.

[5] `http://moin.delph-in.net/NorsygTop`

[6] The Matrix Grammar is a language independent HPSG core grammar, and serves as the basis of several implemented HPSG grammars. Many of the types and features of the Matrix Grammar have been kept, but much has been changed, added or deleted.

[7] `http://www.delph-in.net/`

[8] The feature geometry in the implemented grammar is richer and more embedded than the one shown here. For expository reasons, I have omitted features that are not relevant for the present discussion. I have also overgeneralized with regard to what information is reentered in the SLASH list in the filler and extraction rules. In reality, only the HEAD, VAL(ENCE), CONT(ENT), and CASE features are copied across. Finally, I have not included the *force* rules that come on top of all parsed sentences in the implemented grammar. See Haugereid (2009, 151–208) for a more detailed and

1. Valence rules: These rules combine the argument with the head projection. There are two kinds of valence rules; the binary valence rules, which realize arguments in their canonical position, and the valence extraction rules, which enter arguments on a SLASH list.

2. Modifier rules:

   (a) Predicative modifier rules: There are two types of predicative modifier rules; the binary modifier rule, which combines the modifier with the head projection, and the modifier extraction rule, which enters the modifier onto the SLASH list.

   (b) Sentence adverbial rules: As with the predicative modifier rules, there are two types of sentence adverbial rules, one binary and one for extraction.

3. Verbal predicate rule: The verbal predicate rule combines verbs with the head projection.

4. Filler rule: This rule fills in the element on the SLASH list.

Some of the rule types like the rule types for valence rules have subtypes, and other rule types are omitted. The implemented grammar has a total of 69 rules.

5 Analysis

5.1 Subordinate Clauses

As mentioned, the analysis presented in this paper makes certain assumptions that differ from a standard HPSG analysis. Most importantly, it is a constructionalist approach, and the structure is not built up around the main verb. Rather, a verb may be selected by a structure headed by a complementizer or an auxiliary. This constructionalist approach allows binary left-branching structures to be built, as shown in Figure 6.[9] In this analysis, the complementizer *at* ('that') forms a fundament upon which the rest of the constituents are attached. A complementizer has the constraints shown in (8). The complementizer selects for an argument with subject case via the feature ARG(UMENT),[10] and a finite auxiliary or main verb via the feature VBL(VERBAL).[11]

precise account for Norwegian.

[9]The motivation behind the left-branching structures is given in Haugereid and Morey (2012).

[10]The function of the ARG(UMENT) feature is to allow a word or phrase to constrain the next argument that it attaches to. It can be seen as a pivot for the arguments of the clause. The grammar has an account of how the individual arguments are linked, but that will not be a topic in this paper. (See Haugereid (2007, 2009))

[11]The function of the VBL(VERBAL) feature is to let words or phrases constrain the verb following them.

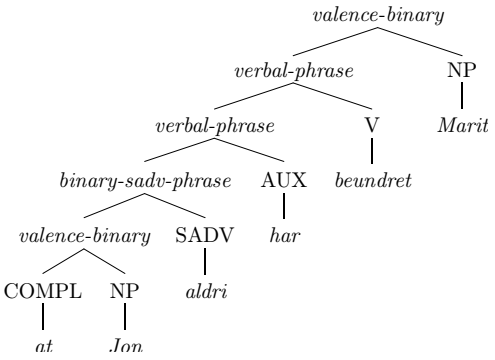

Figure 6: Analysis of *at Jon aldri har beundret Marit* ('that Jon never has admired Marit')

(8)
$$\begin{bmatrix} \textit{complementizer-word} & \\ \text{HEAD} & \textit{compl} \\ \text{ARG|CASE} & \textit{subj-case} \\ \text{VBL} & \begin{bmatrix} \text{HEAD} & \textit{aux-verb} \\ \text{TENSE} & \textit{finite} \end{bmatrix} \end{bmatrix}$$

Arguments are combined with the valence rule shown in (9), where the value of ARG of the first daughter is the second daughter.

(9)
$$\begin{bmatrix} \textit{valence-binary} & \\ \text{HEAD} & \boxed{1} \\ \text{ARG|CASE} & \textit{non-subj-case} \\ \text{ARGS} & \left\langle \begin{bmatrix} \text{HEAD} & \boxed{1} \\ \text{ARG} & \boxed{2} \end{bmatrix}, \boxed{2} \right\rangle \end{bmatrix}$$

Verbs and auxiliaries are combined with the verbal rule shown in (10). The rule, which is head-initial, unifies the value of VBL of its first daughter with the second daughter. It also unifies the VBL value of its second daughter with that of its mother, which means that a verb can constrain the following verb (if there is any). The rule also has the feature AAIF –, which expresses that the verbal rule has triggered, and that the AAIF is finished. The motivation behind this feature is that the verbal rule functions as a delimiter of the AAIF.[12]

[12]The rule is also constrained to apply after the valence rule that links the subject, and before the rules that link the objects, but this is not shown in the present analysis.

(10)
$$\begin{bmatrix} \textit{verbal-phrase} \\ \text{HEAD} \quad \boxed{1} \\ \text{ARG} \quad \boxed{3}\begin{bmatrix}\text{CASE} & \textit{non-subj-case}\end{bmatrix} \\ \text{AAIF} \quad - \\ \text{VBL} \quad \boxed{2} \\ \text{ARGS} \quad \left\langle \begin{bmatrix}\text{HEAD} & \boxed{1} \\ \text{VBL} & \boxed{4} \\ \text{ARG} & \boxed{3}\end{bmatrix}, \boxed{4}\begin{bmatrix}\textit{synsem} & \\ \text{HEAD} & \textit{aux-verb} \\ \text{VBL} & \boxed{2} \\ \text{ARG} & \boxed{3}\end{bmatrix} \right\rangle \end{bmatrix}$$

The rule for sentence adverbials is given in (11). It is a head-final rule which combines a word or phrase with a sentence adverbial. The constraint AAIF + means that it cannot apply after the verbal rule has applied.

(11)
$$\begin{bmatrix} \textit{binary-sadv-phrase} \\ \text{HEAD} \quad \boxed{1} \\ \text{AAIF} \quad \boxed{2} + \\ \text{ARGS} \quad \left\langle \begin{bmatrix}\text{HEAD} & \boxed{1} \\ \text{AAIF} & \boxed{2}\end{bmatrix}, \begin{bmatrix}\text{HEAD} & \textit{sadv}\end{bmatrix} \right\rangle \end{bmatrix}$$

The position of the AAIF of a subordinate clause is shown in Figure 7. The feature AAIF reflects where the order of arguments and sentence adverbials is not fixed, namely after the complementizer and before the finite verb, and so it is only the subject *Jon* and the sentence adverbial *aldri* which appear in the AAIF.

5.2 Main clauses

In declarative main clauses, it is assumed that the first constituent, including the subject, is extracted. This is a common assumption in the literature on Scandinavian syntax (see Holmberg and Platzack (1995)), and it has also been hinted at in Pollard and Sag (1994, 381). The idea can be traced back to Diderichsen (1946, 185).

The extraction of the first constituent is accounted for by means of a set of extraction rules, which trigger in the canonical position of the extracted element, and a filler rule, which fills in the extracted element in the position before the first verb. The dependency between the filler rule and the extraction rule is accounted for by means of a SLASH feature. An analysis of a transitive main clause with a sentence adverbial is given in Figure 8.[13]

The filler rule and the extraction rule employed in the analysis in Figure 8 are illustrated in (12) and (13). While the filler rule realizes the extracted element as its first daughter, the extraction rule links the extracted element to its ARG value and ensures that it is linked in its canonical position.

[13]The dependency between the extracted element and its trace is shown with the index *i*.

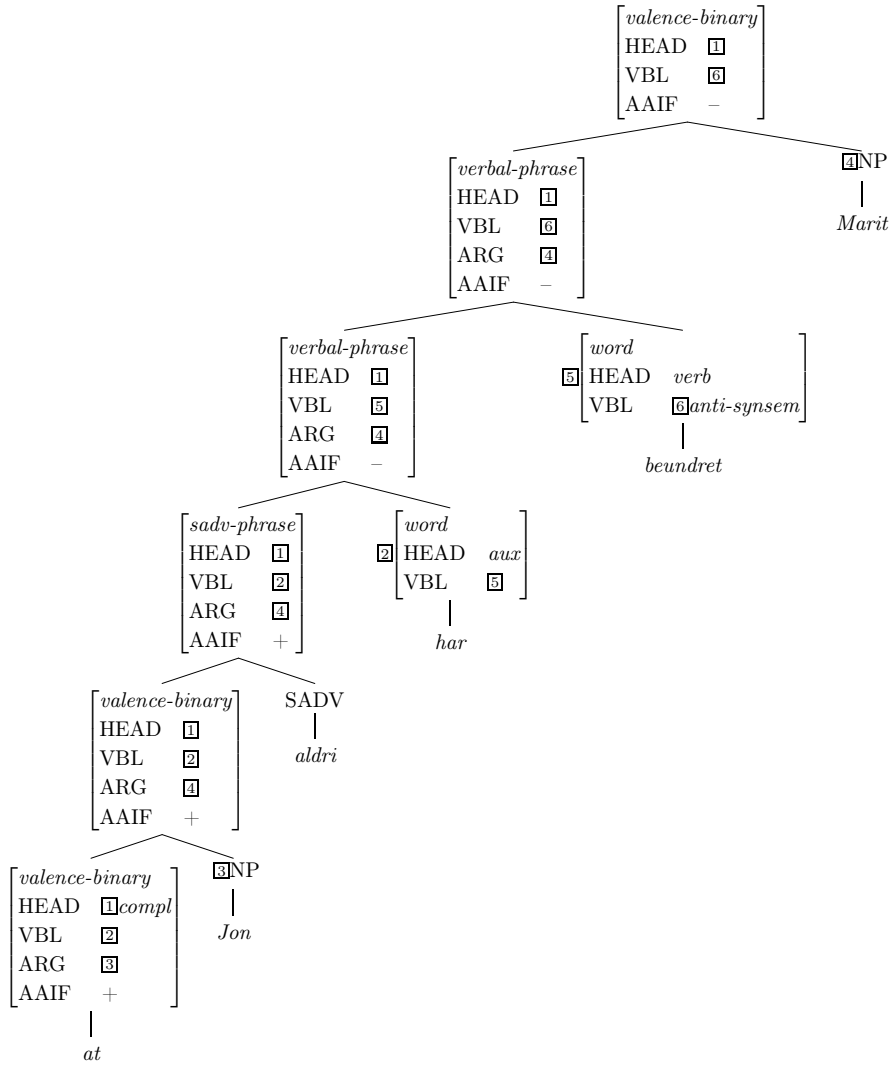

Figure 7: Analysis of *at Jon aldri har beundret Marit* ('that Jon never has admired Marit')

(12)
$$\begin{bmatrix} \textit{filler-binary} & \\ \text{HEAD} & \boxed{1}\ \textit{aux-verb} \\ \text{ARG}|\text{CASE} & \textit{subj-case} \\ \text{VBL} & \boxed{2} \\ \text{SLASH} & \langle \boxed{3} \rangle \\ \text{ARGS} & \left\langle \boxed{3}, \begin{bmatrix} \text{HEAD} & \boxed{1} \\ \text{VBL} & \boxed{2} \\ \text{SLASH} & \langle\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

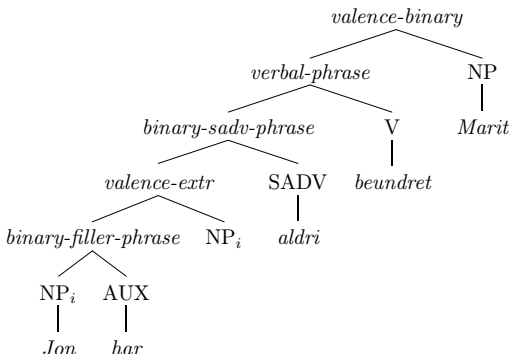

Figure 8: Analysis of *Jon har aldri beundret Marit* ('John never has admired Marit')

(13)
$$\begin{bmatrix} \textit{valence-extr} & \\ \text{HEAD} & \boxed{1} \\ \text{ARG}|\text{CASE} & \textit{non-subj-case} \\ \text{SLASH} & \langle\rangle \\ \text{ARGS} & \left\langle \begin{bmatrix} \text{HEAD} & \boxed{1} \\ \text{ARG} & \boxed{2} \\ \text{SLASH} & \langle \boxed{2} \rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

A declarative main clause with a topicalized adverbial is given the analysis in Figure 9. As the tree shows, the AAIF includes all the constituents after the main verb. This means that a sentence adverbial is allowed to attach before, in between, or after the arguments.

Given the analysis presented in this section, the AAIF can be given a more formal definition than the one in (2):

(14) The Adverb-Argument Intersection Field of a clause includes the constituents attaching to the head projection before the first verbal rule.

Some additional constraints are be needed in order to prevent unstressed pronouns from appearing in the position after a sentence adverbial. This has however not been implemented since it is possible for *stressed* pronouns to appear in this position, and the grammar presented only parses text, which does not differentiate between stressed and unstressed pronouns.

6 Comparison with P&P

Although the Norsyg grammar design appears very different from the P&P approach, I would like to point out how the two approaches make similar predictions.

The fact that Norwegian is a V2 language, is in P&P accounted for by means of the C projection. The finite verb moves to C and there is space for one constituent

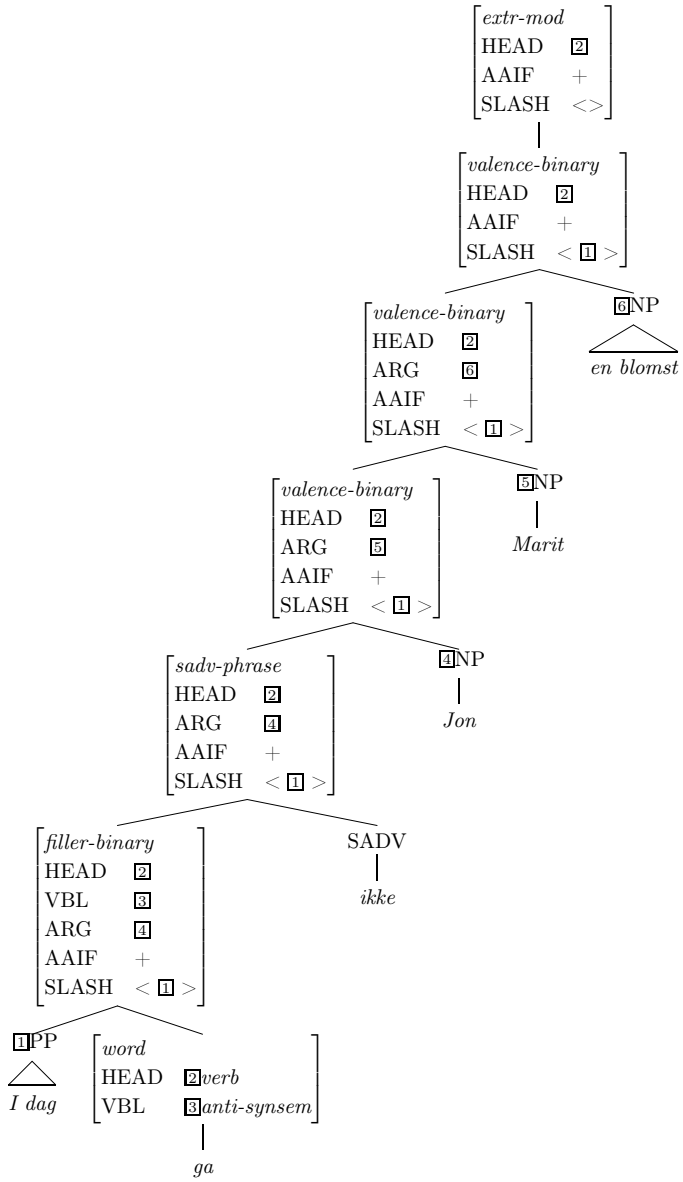

Figure 9: Analysis of *I dag ga ikke Jon Marit en blomst* ('Today, John didn't give Marit a flower')

in the specifier position of C. In Norsyg, V2 is accounted for by the filler rule (see (12)), which realizes the element on the SLASH list as its first daughter and the finite verb as the second daughter.

The syntax of subordinate clauses are in P&P accounted for by letting the complementizer block the finite verb from moving from I to C. In Norsyg, a clause initiated by a complementizer requires that the finite verb is realized by the verbal rule (see (8)). And the verbal rule will only apply after the subject has been realized

(see (10)), so the order *complementizer*, *subject*, *verb* is accounted for. The realization of the finite verb by the verbal rule in Norsyg corresponds to the realization of the finite verb in I in P&P.

The syntax of yes-no questions in P&P are accounted for by letting the finite verb move to C, but blocking constituents from moving to the specifier position of C. In Norsyg, the finite verb is simply the first daughter of the first valence or modifier rule. The realization of the verb in this position corresponds to the realization of the verb in C in P&P. Since there is no constituent preceding the verb, the SLASH list is empty.

The two approaches can be said to be similar at a certain level of abstraction. Both approaches assume that the first constituent of a main clause is not realized in its canonical position, even if it is a subject. This is also assumed in the Diderichsen's Sentence Model.

Both P&P and Norsyg account for the basic clause structure by means of the position of the finite verb, P&P by realizing it in I (subordinate clauses) or moving it to C (main clauses), Norsyg by realizing it with the verbal rule (subordinate clauses) or realizing it with the filler rule (main clauses) or as the first daughter of a valence or modifier rule (yes-no clauses).

The main difference, as I see it, is that the design in Norsyg does not require verb movement. And it is exactly verb movement that makes the P&P account of Object Shift less attractive. Since the positions of the objects are assigned before the verb moves, one is forced to assume a phonological movement that takes place after the other movements in order to account for the position of unstressed object pronouns preceding the sentence adverbial. The Norsyg approach on the other hand simply assumes a field before the application of the verbal rule (if it applies) with certain ordering constraints.

7 Conclusion

An account of the position of sentence adverbials with regard to the arguments in a clause has been presented. A field called the Adverb Argument Intersection Field was introduced. This field includes all constituents that attaches to the projection of the first verb or complementizer before the next verb is attached. In subordinate clauses and clauses with auxiliaries, the field may include only the subject and the sentence adverbial, while in main clauses, the field may include the subject as well as the indirect and direct object and the sentence adverbial. By assuming that verbs that follow an auxiliary or complementizer are attached to the projection of the initial auxiliary or complementizer by means of a particular rule, the verbal rule, it was possible to constrain the elements applying after the verbal rule to be outside the Adverb Argument Intersection Field.

The approach was compared to the treatment of nominal constituents in Diderichsen's Sentence Model and to the account of Object Shift in P&P. It was shown that while these two approaches were forced to make amendments to their theories in

order to account for the position of unstressed pronouns with regard to sentence adverbials, this is not possible with the assumption of an Adverb Argument Intersection Field.

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A left-branching grammar design for incremental parsing

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Abstract

This paper presents a left-branching constructionalist grammar design where the phrase structure tree does not correspond to the conventional constituent structure. The constituent structure is rather reflected by embeddings on a feature STACK. The design is compatible with incremental processing, as words are combined from left to right, one by one, and it gives a simple account of long distance dependencies, where the extracted element is assumed to be dominated by the extraction site. It is motivated by psycholinguistic findings.

1 Introduction

Until recently natural language parsing was commonly conceived as a chart-based, head-driven process, in particular among the HPSG community (Ninomiya *et al.*, 2009; Ytrestøl, 2011). This conception has had a significant impact on the design of implemented HPSG grammars and even more so when parsing efficiency was desired. Psycholinguistic studies however suggest that human sentence processing is not head-driven nor chart-based but incremental and deterministic. Such findings are of wide relevance as they suggest different means of achieving efficient parsing, that, in turn, call for different grammar designs.

The notion of incremental parsing/processing is well established in the psycholinguistic literature, and refers to the notion of words being added to an overall syntactic structure one by one. This is evidenced by studies showing that sentences in head-final languages do not require a higher processing effort than a head-initial sentence, even though the head, which according to traditional constituent analysis is required to form a constituent, appears after several of its arguments. The example in (1) taken from Swets *et al.* (2008) shows how as many as 7 arguments and adjuncts may appear before the first verb in Japanese.

(1) John-ga denwa-de Mary-ni Tom-ga asa rokuji-ni inu-ni
John-NOM phone-by Mary-DAT Tom-NOM morning six-at dog-DAT
esa-o ageta ka kiita.
food-ACC gave if asked
John asked Mary by phone if Tom gave his dog food at six in the morning.

The notion of deterministic parsing refers to the aim of producing a unique analysis for a sentence, which, in an incremental setting, usually implies to make decisions at each step (Ytrestøl, 2011). This is suggested by evidence that humans parse structurally ambiguous sentences more efficiently than structurally unambiguous sentences. The examples in (2) are taken from Van Gompel *et al.* (2001).

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Experiments show that the ambiguous sentence in (2a) is processed faster than the unambiguous sentences in (2b) and (2c). This is contrary to what one would expect from a deep non-deterministic parser, which generally requires a higher processing effort to process ambiguous sentences than unambiguous sentences.

(2) a. The maid of the princess who scratched herself in public was terribly humiliated.

b. The son of the princess who scratched himself in public was terribly humiliated.

c. The son of the princess who scratched herself in public was terribly humiliated.

Much of the linguistic analysis in the psycholinguistic literature is conducted within the framework of GB/Minimalism. For example, Phillips (2003) shows that given a Government and Binding analysis involving Larsonian shells (Larson, 1988; Culicover, 1997), it is possible to parse a tree incrementally, from left-to-right, with a right-corner parser. The aim of this paper is to show that it is possible to achieve a similar analysis by means of an appropriately designed HPSG grammar that retains full compatibility with a standard bottom-up HPSG parser. This grammar design characteristically provides an analysis of long-distance dependencies where it is assumed that the fronted element is realized at the bottom left corner of the tree, rather than as the first daughter of the top node.

A grammar fragment for English will be introduced, which on the one hand makes comparable generalisations about syntactic structures as the Principles and Parameters theory, but which on the other hand is radically different in that it employs left-branching trees, rather than right-branching trees. The account does not assume verb movement. The grammar fragment is implemented with the LKB system (Copestake, 2002), which is a grammar development environment mainly used to implement HPSG grammars. It is a bottom up parser that employs phrase structure rules. All grammatical objects are expressed as typed feature structures (Carpenter, 1992). The implemented grammar has much of the feature geometry in common with HPSG grammars, but some central assumptions are different. Most importantly, the grammar is a constructionalist grammar, and not a lexicalist grammar. This implies that open lexical items in principle do not constrain their syntactic context, and do not carry information about their argument structure. Instead, it is assumed that the syntactic structure is determined by functional signs like inflections, function words and phrase structure rules. The argument structure is determined by sub-constructions, which are syntactic realisations of Davidsonian sub-events.[1]

[1]The grammar fragment presented is a modified version of a grammar for Norwegian, Norsyg, (`http://moin.delph-in.net/NorsygTop`) and is a part of the DELPH-IN effort (`http://www.delph-in.net/`)

2 A Left-branching grammar design

The grammar fragment presented in this paper has a left-branching grammar design, which allows for words to be incorporated into the overall structure one by one. The design can be compared to Left-Associative Grammar (LAG) (Hausser, 1989), which also combines words to the overall structure one by one, resulting in a binary left-branching tree. But where LAG does not construct anything corresponding to a conventional constituent tree, but rather makes the step directly from the binary left-branching syntactic tree to a semantic representation, our approach employs a feature STACK in order to represent the constituent structure. Similarly to LAG the semantic representation is constructed "on the fly," as the sentence is processed from left to right. In section 4 we will return to how the constituent structure is reflected by the STACK feature. In this section, however, we will give an introduction to a couple of the features involved in the left-branching grammar design.

The tree in Figure 1 shows how a subordinate clause is analysed with the left-branching grammar design.[2] The head of the clause is the complementizer. The verbs and arguments attach to the complementizer projection from the right. Arguments are selected via the ARG(UMENT) feature with the valence rules. The ARG(UMENT) feature is a pivot for four different argument features, C-ARG1, C-ARG2, C-ARG3, and C-ARG4, corresponding to what in Government and Binding would refer to the 'external argument', 'direct object internal argument', 'indirect object internal argument', and 'goal/locative oblique', respectively. The grammar design has a mechanism that allows the grammar writer to constrain what combination(s) of arguments a verb can have. The rules that combine the arguments with the head projection (the valence rules) link the argument to the main predicate of the clause. Until the main verb is selected, the main predicate is left underspecified. This makes it possible to integrate the semantic linking of arguments before the main verb is encountered. The mechanism for constraining what combination(s) of arguments that can appear in a clause will not be a topic of this paper. (See Haugereid (2007, 2009, 2012) for detailed accounts of how arguments are linked, and how verbs are allowed to appear with different constellations of arguments.)

Verbs are selected via the VBL (VERBAL) feature with the verbal rule. As shown in Figure 1, a complementizer constrains the verb it selects to have the HEAD value *aux-verb*, which means that it is either an auxiliary or a main verb, and it also requires the TENSE value to be *finite*. When a verb is realized by the verbal phrase, the VBL value of the selected verb becomes the VBL value of the phrase. This allows a verb to constrain whether it will be followed by another verb and what kind of verb it is. The auxiliary in Figure 1 constrains the following verb to be a main verb past participle, while the main verb has the VBL constraint

[2]The feature geometry in the implemented grammar is richer and more embedded than the one shown here. For expository reasons, features that are not relevant for the present discussion have been omitted. Also, the *force* rules that come on top of all parsed sentences in the implemented grammar have not been included.

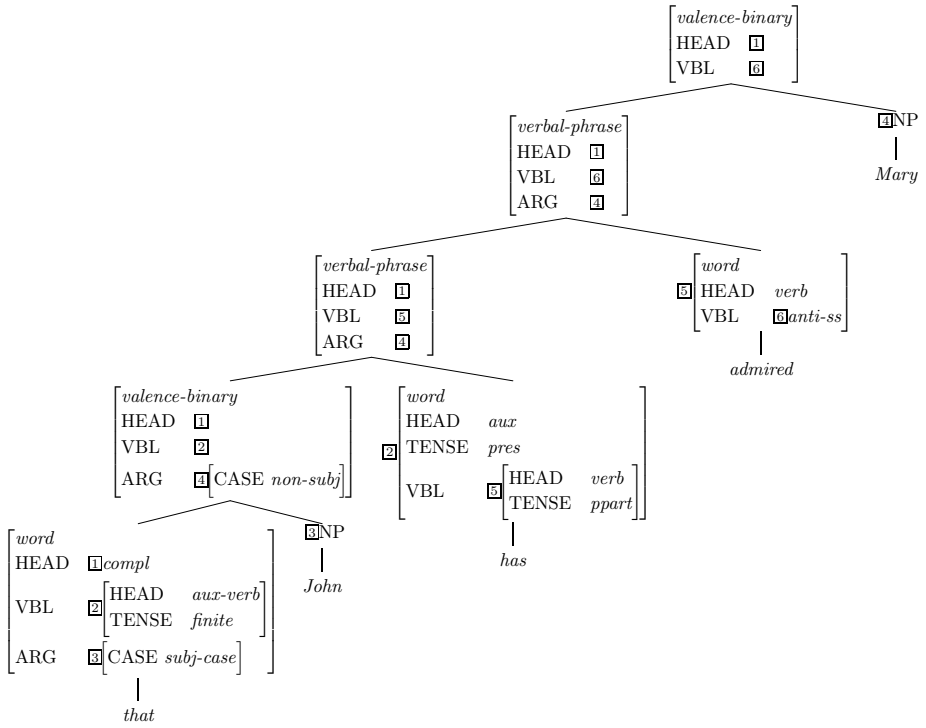

Figure 1: Selection of arguments and verbs in a subordinate clause

anti-synsem, which means that no more verbs can be selected.

The fact that the main verb is selected by the overall structure, and that arguments can be linked before the main verb is encountered, is due to constructionalist design of the grammar. The underlying assumption is that the syntactic rules together with function words and inflections provide a skeleton that the open class words fit into. By splitting a construction up into *sub-constructions*, which are realized as single syntactic rules, function words, or inflections, the overall construction can be build incrementally, and the open class words are fitted into this construction as they appear.

3 Long Distance Dependencies

Contrary to the analysis of subordinate clauses just presented, the analysis of English main clauses assumed in the proposed grammar design implies the use of the HPSG SLASH feature.

The use of a slash to account for long-distance dependencies in a monostratal account was introduced by Gerald Gazdar (1981), where a trace of the extracted item was assumed in the extraction site, and the slash feature would establish a link between the trace and the filler. The slash feature would "percolate up" the tree with the information about the trace.

The mechanism behind the more recent trace-less account of long distance dependencies in Bouma *et al.* (2001) involves entering all arguments and modifiers of a verb onto a separate DEPS (DEPENDENTS) list and retrieving the slash from this list. The DEPS list is created by means of the Argument Structure Extension constraint shown in (3).

(3) **Argument Structure Extension:**

$$verb \Rightarrow \begin{bmatrix} \text{ARG-ST} & \boxed{1} \\ \text{DEPS} & \boxed{1} \oplus list\Big(adverbial\Big) \end{bmatrix}$$

Since there is no limit to the potential number of adjuncts added to the DEPS list by the Argument Structure Extension constraint, the number of possible lexical descriptions of a verb is infinite. This is problematic from a psycholinguistic perspective, since it means that the DEPS list cannot be fixed before the parsing of the sentence has reached a state where the number of adjuncts is determined (or possible to determine), and the SLASH mechanism ends up as a potential post-parsing process. This problem is acknowledged by the authors:

> The infinity which is a consequence of Argument Structure Extension is also similar to the infinity which arises as a consequence of recursive lexical rules (i.e. rules which may apply to their own output). For example, the Adjunct Lexical Rule allows a single lexical item to give rise to an infinite number of derived items. As argued in van Noord and Bouma (1994), the computational problem posed by this kind of recursion can be solved by reformulating lexical rules as recursive constraints on lexical entries, whose evaluation can be delayed to a point where only a finite number of solutions remain (typically, after some syntactic processing has taken place). (Bouma *et al.*, 2001, 15)

The account of long distance dependencies in this paper is similar to the Gazdar (1981) "trace" account, apart from the fact that the SLASH feature "percolates down" the tree, rather than "up". The tree in Figure 2 is an analysis of the Wh-question *Who does John admire?*[3]

At the bottom of the tree, the head filler rule combines the fronted element (the NP *Who*) with the auxiliary (*does*). The NP is entered onto the SLASH list. The binary filler rule is illustrated in (4). The next two rules, the binary valence rule and the verbal predicate rule, combine the NP *John* and the verb *admire* with the head projection. (Both these rules are head-initial.) The SLASH feature of the daughter is reentered in the mother in both rules. And finally, at the top of the tree, the valence extraction rule unifies the element on the SLASH list of its daughter with the extracted argument. This rule is illustrated in (5).

[3]There has been some overgeneralization with regard to what information is reentered in the SLASH list in the filler and extraction rules. In reality, only the HEAD, VAL(ENCE), CONT(ENT), and CASE features are copied across.

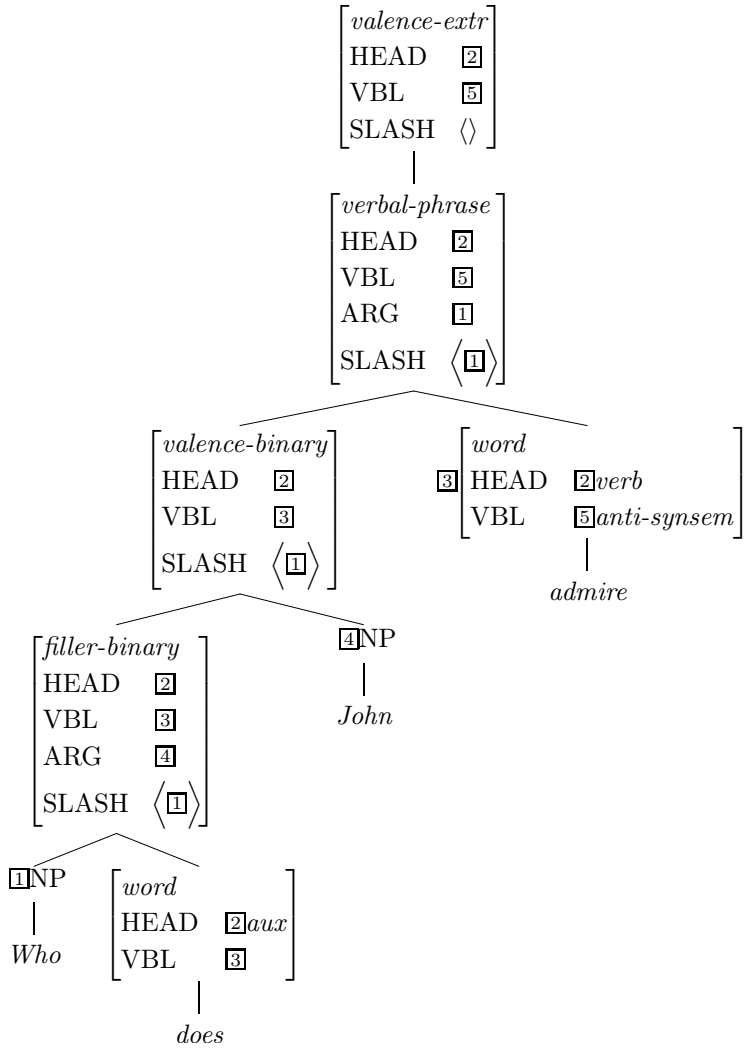

Figure 2: The SLASH feature: Fronted object.

(4)
$$\begin{bmatrix} \textit{filler-binary} \\ \text{SLASH} \quad \langle \boxed{1} \rangle \\ \text{ARGS} \quad \left\langle \boxed{1}, \begin{bmatrix} \text{SLASH} \quad \langle\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

(5)
$$\begin{bmatrix} \textit{valence-extr} \\ \text{SLASH} \quad \langle\rangle \\ \text{ARGS} \quad \left\langle \begin{bmatrix} \text{ARG} \quad \boxed{2} \\ \text{SLASH} \quad \langle \boxed{2} \rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

It is assumed that also subjects undergo the SLASH mechanism when they appear as the first constituent in the clause. The sentence *John admires Mary* is given the analysis in Figure 3. Here, the subject, *John*, is filled in by the unary head-filler rule, and subsequently entered onto the SLASH list by the unary extraction rule. The unary filler rule is shown in (6). The rule can be seen as the combination of the filled-in constituent and an empty auxiliary.

(6)
$$\begin{bmatrix} \textit{filler-unary} & \\ \text{HEAD} & \textit{aux} \\ \text{SLASH} & \langle \boxed{1} \rangle \\ \text{ARGS} & \langle \boxed{1} \rangle \end{bmatrix}$$

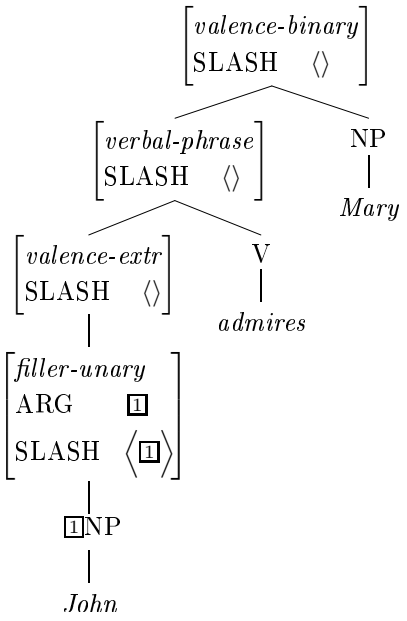

Figure 3: The SLASH feature: Fronted subject.

4 Parsing with the left-branching grammar design

The left-branching grammar design does not represent constituents in the syntactic tree, as is common in most other frameworks.[4] In this section, it will be shown how the constituent structure of an utterance is reflected, and then how the design opens for incremental processing in a way which is compatible with psycholinguistic findings.

[4]As mentioned, Hausser's Left-Associative Grammar is an exception.

4.1 Constituency

The left-branching grammar design represents constituents by means of a stacking/popping mechanism. This mechanism allows the parser to enter embedded structures by entering selected syntactic and semantic features of the matrix constituent on a stack while taking on features of the embedded structure. When the embedded structure has been processed, the matrix features are popped from the stack, and the processing of the matrix constituent proceeds. Examples of constituents where this mechanism is employed are NPs, PPs, CPs, and IPs. The mechanism allows for multiple embeddings.

The STACK mechanism is motivated by the fact that gaps can appear inside embedded constituents. The SLASH feature is not affected by the STACK mechanism, in the sense that while the syntactic HEAD and VAL features and the semantic HOOK features are entered onto the stack, the SLASH feature is passed up from the (first) daughter to the mother.[5] Since the SLASH feature in this way is passed on to the embedded structure, rather than the stack, the mechanism allows us to keep the assumption that the extraction rule dominates the filler rule, also when the extraction site is in an embedded structure.[6]

The STACK mechanism consists of two types of rules: i) the embedding rules, which enter selected features of the matrix constituent on the STACK list, and ii) the popping rule, which pops the features of the matrix constituent from the stack and takes them on. The stacking/popping mechanism is illustrated for the CP *that he slept* in (7) in Figure 4.[7]

(7) John says that he slept.

The use of the stack reflects the constituent structure of a parsed string. In (7), there is one embedding, the subordinate clause. The embedding rule and the popping rule marks the beginning and the end of the embedded constituent. The constituent structure of this clause is given in Figure 5.

The ambiguous sentence in (8) has up to three levels of embedding (CP, PP, and DP). The two possible constituent structures of the sentence are given in Figure 6 and Figure 7. The different PP attachment is accounted for by letting the rule that pops the complementizer projection apply either after the PP embedding rule (low PP attachment) or before the PP embedding rule (high PP attachment).

(8) John says that he slept in the garden.

[5] An exception to this principle is when the embedded constituent is an NP. (See discussion in Section 5.)

[6] The percolation of the SLASH feature from mother to (initial) daughter in the left-branching structures makes the presence of a gap accessible to all constituents appearing between the filler and the gap, and hence offers a straightforward account of the registering of the extraction path that is reflected on verbs and complementizers in languages like Chamorro (Chung, 1998) and Irish (McCloskey, 1979), one of the motivations behind the no-trace account of long distance dependencies in Bouma *et al.* (2001).

[7] Only the reentrancies of the HEAD feature is displayed in this analysis. As mentioned, also the VAL features and the semantic HOOK are entered into the STACK.

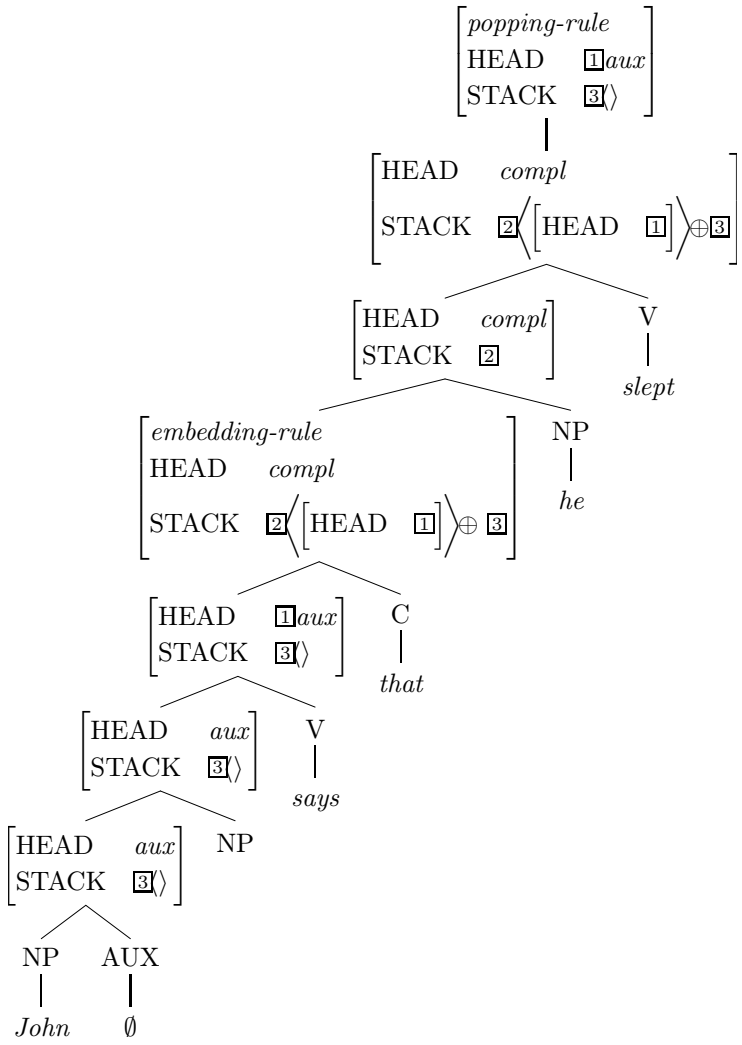

Figure 4: STACK mechanism in embedded clause

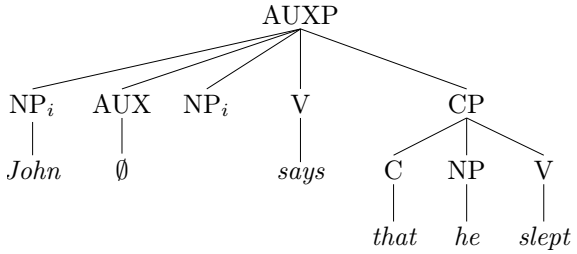

Figure 5: Constituent structure of sentence with subordinate clause

The fact that the left-branching grammar design operates with a stack, should normally make it non-incremental. It is however not so that constituents are put

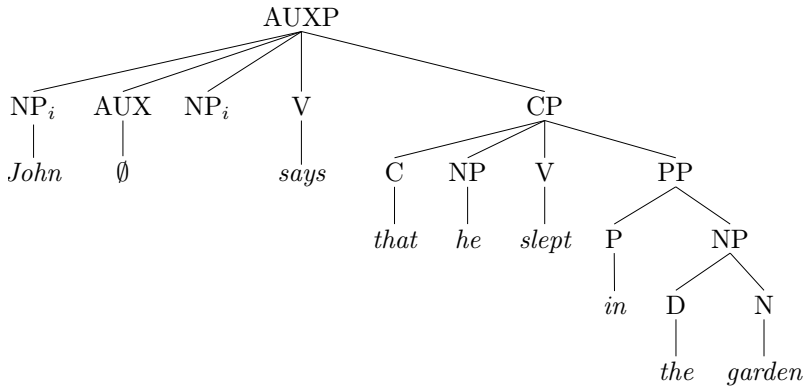

Figure 6: Constituent structure of sentence with subordinate clause. Low PP attachment.

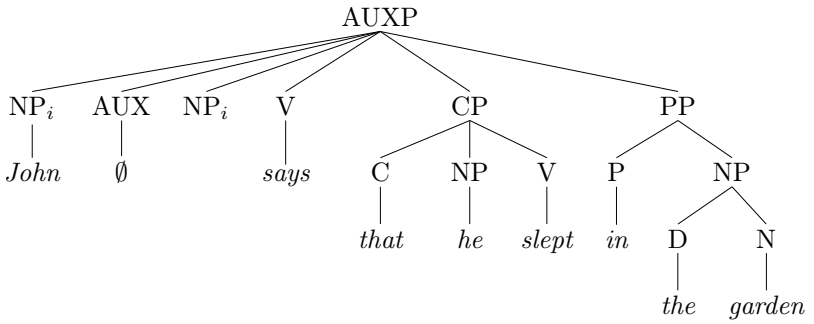

Figure 7: Constituent structure of sentence with subordinate clause. High PP attachment

on a stack for later processing. It is rather a way to keep track of what level of embedding the parser is operating on, and only a few selected features of the matrix structure are entered. It is comparable to the use of SLASH in HPSG, which function is to make sure that the values of certain features are reentered in another part of the structure in order to account for long-distance dependencies.

4.2 Efficient processing of ambiguous structures

Even though the left-branching grammar design is incremental, it expresses the same ambiguities as other constraint-based grammars. In traditional chart-based parsing, ambiguities always add complexity, thus the more ambiguous an utterance is, the bigger is the processing effort for the parser. This contrasts with a psycholinguistic study by Swets *et al.* (2008) which shows that processing of ambiguous syntactic structures actually can be more efficient than that of corresponding unambiguous structures.

The left-branching grammar design however naturally lends itself to incremental processing and is thus inherently compatible with deterministic parsing strate-

gies. Instead of conducting a full analysis of all possible readings of an ambiguous utterance and performing a parse ranking after all the analyses are finished, an alternative strategy consists in having the parser make local decisions after each word is processed given the information available at that stage, that is, the structure that has been built so far and the word that is added to the structure. Assuming that at each step, a default analysis is available, parsing an ambiguous structure can in fact turn out to be more efficient on average than an unambiguous structure.

Unambiguous sentences can lead a parser using a deterministic incremental strategy into garden paths where it has to backtrack and do parts of the analysis over. Incremental deterministic parsers have been proposed for HPSG by Ninomiya *et al.* (2009) and Ytrestøl (2011), in the form of shift-reduce parsers with backtracking mechanisms.

5 Discussion

In the presentation of long distance dependencies in Section 3, the SLASH feature is "detached" from the constituent tree. This makes it possible to give a very simple account of long distance dependencies, namely one where the gap dominates the filler. The dependency between the gap and the filler is accounted for by the SLASH feature, which goes from mother to the first daughter.

The presentation did not include the treatment of NP constituents. Like the subordinate clause constituents and the PP constituents, NP constituents are also analyzed as embedded structures, but in contrast to the other embedded structures mentioned, the SLASH value will here be transferred to the STACK, rather than directly to the mother (and hence the embedded constituent). This accounts for island effects of complex NPs, where elements cannot be extracted from complex NPs (Ross, 1967, 118–158).

All elements that are represented as constituents in the constituent trees in (5) and (6) can be coordinated. Coordination can be accounted for by means of coordination rules, which, when one conjunct is parsed, will initiate another conjunct, which will be coordinated with the first.[8] Each conjunct will get the same SLASH list from the matrix constituent, and so coordination island effects are accounted for.

As in other HPSG grammars, the semantics is composed in parallel with the syntax. This means that there will be a (partial) semantic representation for each word added to the structure. The constructionalist design of the grammar allows arguments to be linked as they appear. So even if the language is verb final, like Japanese, the arguments will be linked instantly. With a lexicalist design on the other hand, the arguments of a verb cannot be linked before the verb itself has been parsed. So given a verb-final sentence, the whole sentence must be parsed before the arguments can be linked (given that the parsing is done from left to right).

[8]For the moment, the grammar has special rules to account for coordination of VPs which in the analysis presented does not have a designated constituent.

6 Conclusion

The grammar design that has been presented is radically different from standard HPSG. The most striking difference is probably the fact that the syntactic structure is not reflecting the constituent structure, but rather the parsing strategy. This is a result both of providing a simple account of long distance dependencies as well as making the grammar compatible with deterministic incremental processing in line with psycholinguistic findings.

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A hybrid type of ellipsis in Romanian

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Abstract

The paper presents a type of ellipsis similar to stripping and split conjuncts, yet irreducible to either of them. One aim of the analysis is to document the existence of this distinct ellipsis type within the class of constructions where the elided constituent is a verb or a verb phrase. It is argued that the main generative strategies, namely, deletion and null anaphora cannot be applied to this ellipsis type in order to account for it. Instead, the study shows that an approach which takes the asymmetry syntax-semantics of this construction as basic is much more successful in explaining the nature of this type of ellipsis. This alternative approach is the one offered by the HPSG framework[†].

1 Introduction

The present paper documents the existence of a hybrid type of ellipsis that mainly occurs in coordinate structures, as the second conjunct:

(1) John talked to the principal *and nobody else*.

The structure can be attested cross-linguistically. Here, though, I will examine its properties with respect to only one language, Romanian. In Romanian, this kind of ellipsis obligatorily contains a N(egative)-word followed by a non-identity pronoun or adverb. For this reason, it will be called here a *N-word elliptical construction* (N-wdEC). The equivalent in Romanian of (1) is (2), where the N-word is *nimeni* ('nobody' 'no one') and the non-identity item is *altcineva* ('...else'):

(2) Ion a vorbit cu directorul *şi cu nimeni altcineva*.

[†] My deepest thanks go to Ana-Maria Barbu and Gianina Iordăchioaia who made substantive remarks on the previous versions of this paper. I am also grateful to the anonymous reviewers, whose suggestions and comments helped me a lot to improve the analysis. Many thanks also to Gabriela Bîlbîie and the audience of the conference "Topics in the Typology of Elliptical Constructions." held in Paris (Université Denis Diderot), on June, 27, 2012. And to Bogdan Ştefănescu, who improved the present English version.

Last but not (at all) least, all my gratitude to the editor of this volume, Stefan Mueller and the members of the program commitee of the HPSG 2012 Conference, who manifested human understanding for the motives which prevented me to be present at the HPSG Conference in Daejeong, South Korea.

Any undetected errors in this paper are mine.

The paper has two main aims: to show that this construction shares features with two other ellipsis types (namely, stripping and split conjuncts), without being, though, identical to either of them; and to prove that a 'structural approach' to N-wdECs (Merchant 2009) copes with numerous and significant problems, which may avoided, if one chooses a non-structural explanation. By structural approaches I mean here PF deletion (Grinder and Postal 1971, Hankamer and Sag 1976 etc.) and the anaphora-based explanation (Lobeck 1995). By a non-structural explanation I am referring to an HPSG approach.

The structure of the paper is as follows. It is firstly shown that N-wdECs share properties with stripping constructions and split conjuncts. Then, I present features of N-wdECs which raise problems for a structural explanation. Finally, it will be shown that an analysis which does not rely on hidden structure or empty categories (the HPSG one) does not cope with the difficulties of the structural approaches. As a side consequence, it is pointed out that in the recent dispute about the status of the N-words (N-words: a kind of NPIs or negative quantifiers) the HPSG analysis independently supplies an argument that N-words are negative quantifiers.

2 N-wdEC: Structure and Typological Membership

Just like other elliptical structures, N-wdECs contain a visible part (the *remnant*, R) and an 'invisible' part (the term is metaphorical), the *elided material* (EM). EM is identified through its *antecedent* A (which lies in the first conjunct) - the antecedent being a sequence that allows for the interpretation of what is intuitively 'missing' in the second conjunct. R, in turn, is identified as the opposite pair of the *correlate* C, (which also lies in the first conjunct). For example in (2), rewritten below as (3), A is the verb-subject sequence *Ion a vorbit*, ('John talked'), EM is the silent 'sequence' that corresponds to A in the elliptical clause, R is *cu nimeni altcineva* ('to nobody else'), and C is *cu directorul* ('to the principal'):

(3) $_{A}$[Ion a vorbit] $_{C}$[cu directorul] şi $_{EM}$[ ] $_{R}$[cu nimeni altcineva]
$_{A}$[John has talked] $_{C}$[with principal-the] and $_{EM}$[ ] $_{R}$[with nobody other one]
'John talked to the principal and nobody else'

From a typological point of view, N-wdECs are ellipsis in which EM is equivalent to the head verb. In this respect, they belong to same family with gapping, sluicing, stripping and split conjuncts. On the other hand, just like sluicing, stripping and split conjuncts, but unlike gapping, N-wdECs currently display only one remnant (but see below, the end of this section).

When compared to sluicing, stripping and split conjuncts, N-wdECs mostly resemble stripping, with which they share a number of general features (for stripping features, see Lobeck 1995: 27-28). Here are two of them:

(i) N-wdECs cannot have a subordinating conjunction in the initial position:

(4) Am vorbit cu directorul **deşi cu nimeni altcineva*
I talked to principal-the *although with nobody else*

(ii) EM cannot precede its antecedent:

(5) **Şi cu nimeni altcineva* a vorbit Ion cu directorul
Intended: '*And nobody else* John talked to the principal'

The conclusion that N-wdECs are stripping structures, though, is rather hasty. Recent studies (Abeillé 2005, 2006) have convincingly argued that stripping constructions are in fact a heterogeneous family of structures, very close to split conjuncts but not identical to them. The features that allow for a distinction between the two families are constituency, syntactic function, distribution and prosody. I will enumerate them below and I will show that N-wdECs cannot be identified with either of them.

Stripping constructions have a specific constituent pattern, which is *Conj (XP) Propositional Adverb* (for example *Are you coming **or not**?*). This pattern plays the syntactic role of a coordinate member in a coordination structure. The construction does not have multiple distribution, which means that the structure only occupies the final position in the coordination (compare *John will come **but Mary certainly not*** with **John **but Mary certainly not** will come*). Finally, the structure displays an intonation boundary before the propositional adverb (*John will come **but Mary # certainly not***).

Split conjuncts, on the other hand, have a distinct constituent pattern: *Conj (Adv) XP* (for example, *John will come **but not Mary***). They play the syntactic function of *adjunct* in a conjoined structure and they may have multiple distribution (*John **but not Mary** will come*).
Also, split conjuncts have incidental prosody (that is, an intonation independent of the intonation of the first conjunct, for example *John will come # **but not Mary***).

A N-wdEC is distinct from stripping and split conjuncts, because it has properties that neither stripping nor split conjuncts have, and also it shows common properties with stripping and split conjuncts. Its constituency is completely different from stripping or split conjuncts, because it consists of an N-word plus a non-identity adverb/pronoun obligatorily. Nevertheless, N-

wdECs share with split conjuncts the properties of multiple distribution (6) and incidental prosody (7):

(6) Am adus bomboane copiilor *şi nimic altceva*/Am adus bomboane, *şi nimic altceva*, copiilor
I have brought candies to children-the and nothing other/ I have brought candies and nothing other to children-the
'I brought candies to the children and nothing else'

(7) Ion a vorbit cu directorul # *şi cu nimeni altcineva*
'John talked to the principal # and nobody else'

Unlike split conjuncts and similar to stripping, N-wdECs observe the Coordination Structure Constraint (CSC), a diagnostic test for coordinate constructions. Extraction out of a single constituent fails ((8) b, c). The only allowed extraction is out of both conjoined constituents, concomitantly (8) (d):

(8) (a) Lenin voia puterea *şi nimic altceva*
'Lenin wanted the power and nothing else'

(b) ?? Ce voia _ Lenin *şi nimic altceva ?* (extraction out of the first conjunct)
What wanted _ Lenin and nothing else?

(c) *Ce voia puterea Lenin *şi*_ ? (extraction out of the second conjunct)
What wanted power-the Lenin and _ ?

(d) Ce voia_ Lenin ? (parallel extraction)
'What did Lenin want ?'

In face of this set of data, it is appropriate to conclude that N-wdECs cannot be assimilated either to stripping or split conjuncts. Nor may an N-wdEC be considered a supertype for these ellipsis types, because this would amount to saying that stripping and split conjuncts each inherits the N-word feature of their supertype (which is utterly false). So, it is obvious that N-wdECs rather represent a distinct type of ellipsis which is a mix of stripping or split conjuncts.

The last fact of ellipsis typology discussed here is that N-wdECs may also have variants with *two remnants*, which makes them similar to gapping[1]. In the example below, the second conjunct contains two remnant annotated R_1 and R_2:

(9) Am adus $_{C1}$[copiilor] $_{C2}$[bomboane] şi $_{R1}$[nimănui] $_{R2}$[nimic altceva]

[1] I owe this type of examples to Ana-Maria Barbu.

I brought $_{C1}$[to children-the] $_{C2}$[candies] and $_{R1}$[to nobody] $_{R2}$[nothing else]

The structure is emphatic, with the emphatic accent on the first N-word *nimănui* ('to nobody'). The constraint observed by the pair C2-R2 is one of linearization: if R1 immediately precedes R2, the existence of the pair C2-R2 is legitimated. On the contrary, if R1 is not adjacent to R2, the structure is bad:

(10) *Am adus $_{C1}$[copiilor] şi $_{R1}$[nimănui] $_{C2}$[bomboane] şi $_{R2}$[nimic altceva]
I brought $_{C1}$[to children-the] and $_{R1}$[to nobody] $_{C2}$[candies] and $_{R2}$[nothing else]

Another constraint regards the pair C_1-R_1 and more precisely, the NP containing R1: unlike the pair C2-R2, in the pair C1-R1 (i. e. < *copiilor, nimănui*>) the non-identity item is not allowed (but it is understood):

(11) Am adus $_{C1}$[copiilor] $_{C2}$[bomboane] şi $_{R1}$*[nimănui altcuiva] $_{R2}$[nimic altceva]
I brought $_{C1}$[to children-the] $_{C2}$[candies] and $_{R1}$[to nobody else] $_{R2}$[nothing else]

N-wdECs with two remnants are closer to gapping, and this strengthens their distinct position on the typological map of verb head ellipsis, if compared with stripping or split conjuncts: indeed, 'canonical' stripping or split conjuncts cannot have 'gapped counter-parts'.

3 Analysis

The analysis of N-wdECs concentrates upon two aspects: the phrasal nature of the construction and the elided material.

3.1 N-wdECs: a Non-finite Clause

Despite iteration of case or prepositional marking between C and R (which seems to suggest that we deal with *nonclausal* constituents) N-wdECs are *clauses*. An argument in this respect comes from the semantics of the construction: the content of a N-wdEC is a proposition, and the proposition is also the semantic type of the first conjunct. For example, in the sentence *Ion o iubeşte pe Ioana şi pe nimeni altcineva* the entailment is that John loves nobody but Joanna. This entailment is in fact the content of the second conjunct (i.e. the elliptical phrase).

N-wdECs are *non-finite clauses*. This is shown by their distribution in coordinate structures. N-wdEC cannot combine with a clausal marker specific to finiteness (*că* 'that'):

(12) Ion zice că a cumpărat legume şi * că nimic altceva
John says that (he) bought vegetables and that nothing else

3.2 EM: how to (syntactically) approach it?

The position defended in this paper is that a structural approach to the syntax of the 'silent sequence' fails. To show that, I will put to work the representatives of this type of approach and I will argue that neither of them is satisfactory. The structural approaches under examination are the Phonological Form (PF) deletion strategy and the anaphora-based explanation.

3.2.1 The PF deletion strategy

Three arguments will be used to show that PF deletion is not a satisfactory explanation for N-wdECs: the argument of the missing antecedent, the argument of the differences between C and R and, also, between EM and A; and the argument of the syntactic differences between the elliptical phrase and its non-elliptical counterpart. The force of these arguments is variable. Nevertheless, they all converge towards the conclusion that deletion is not the right explanatory device for the type of ellipsis examined here.

3.2.1.1 *The missing antecedent argument*

Grinder and Postal (1971) showed that there are ellipses exclusively explained by means of deletion. According to these authors, VP ellipsis is one of them[2]. With Grinder and Postal, deletion ellipsis is characterized by the missing antecedent phenomenon. The missing antecedent is instantiated below in (13)(b) (examples are borrowed from Hankamer and Sag 1976:403-404):

(13) (a) I've never ridden a camel but Ivan's ridden a camel $_i$ and he says it $_i$ stank horribly.
(b) I've never ridden a camel but Ivan has ~~ridden a camel~~ and he says it $_i$ stank horribly.

In (13) (b), the clause *it stank horribly* contains the pronoun *it* which has no visible antecedent in the elliptical clause *Ivan has ~~ridden a camel~~*. Despite

[2] VP ellipses are also subsumed by Hankamer and Sag (1976) to the class of 'deletion (or surface) anaphora'

that, the pronoun *it* is correctly used, which means that *it*, though, has an antecedent. According to Grinder and Postal, the antecedent is the NP *a camel* in the clause *Ivan's ridden a camel* from the sentence (13) (a). However, as the NP *a camel* does not also occur in the elliptical clause of (13) (b), it follows that the antecedent of the pronoun *it* in (13) (b) is simply missing (or deleted). Grinder and Postal's argument in this sense is that the antecedent of *it* in (13) (b) cannot be the overt NP *a camel* (in the first conjunct of the coordination, *I've never ridden a camel*); this NP cannot be the antecedent of *it,* because, if the first conjunct and the third are put together in a sentence (14, below), the pronoun *it* is left with no antecedent:

(14) *I've never ridden a camel, and it stank horribly.

So, Grinder and Postal's conclusion is that the anaphoric link is in fact achieved in (13) (a) and inherited by (13) (b). This means that (13) (a) has to be considered an intermediary between the surface structure (13) (b) and the deep structure of (13) (b). The move from (13) (a) to (13) (b) is just deletion. With Grinder and Postal, no other operation or deep structure representation is able to account for this anaphoric link.

From the point of view of this test, N-wdECs *cannot* be considered an ellipsis obtained by deletion, because N-wdECs fail to exhibit the missing antecedent phenomenon. Let the following parallel examples be:

(15) (a) Am pus o carte $_i$ în raft şi nu am pus o carte nicăieri altundeva, dar acum nu o $_i$ mai găsesc.
'I put a book $_i$ on the shelf and I put a book nowhere else but now I do not find it any more.'[3]

(b) Am pus o carte $_i$ în raft şi ~~nu am pus o carte~~ nicăieri altundeva, dar acum nu o $_i$ mai găsesc.
'I put a book $_i$ on the shelf and ~~I put a book~~ nowhere else but now I do not find it $_i$ any more.'

Notice that (15) (a)-(b) differ in one semantic respect from (13) (a)-(b). The entailment allowed by (13) (a)-(b) is something like this: *no camel is such that the speaker has ridden but there is (at least) one camel that Ivan has ridden*.

The entailment of (15) (a)-(b), is different: *there is a book that I put on the shelf and I didn't put anywhere else*. This time, the NP *o carte* ("a book") in

[3] Notice that even if (15) (a) sounds strange this is not ruling it out, because, according to the framework in which Grinder and Postal work, (15) (a) is merely an intermediary structure between the surface structure (15) (b) and the deep structure of (15)(b). And after all, (15) (a) is pragmatically weird but not grammatically ill-formed.

the first conjunct necessarily denotes the book denoted by the same NP in the second conjunct.

These semantic details turn out to be crucial for the anaphoric link between the pronoun *o* ("it-FEMININE") and its antecedent: for, unlike (13) (b), the antecedent of *o* in (15) (b) is the NP *o carte* ('a book') in the first clause (i. e. *am pus o carte în raft* - "I put a book on the shelf") of the sentence. The proof for it is that if the first and the third clause are put together in a sentence (16, below) the pronoun *o* ("it-FEMININE") has as antecedent the NP *o carte* ("a book") in the first clausal conjunct:

(16) Am pus o carte $_i$ în raft dar acum nu o $_i$ mai găsesc.
'I put a book $_i$ on the shelf but now I do not find it $_i$ any more.'

This shows that in (15) (b), the situation is the same: the antecedent does not need to be considered as occurring in the deleted sequence but in the first conjunct:

(15) (b) Am pus o carte $_i$ în raft şi nicăieri altundeva, dar acum nu o $_i$ mai găsesc.
'I put a book $_i$ on the shelf and nowhere else but now I do not find it $_i$ any more.'

Deletion, therefore, does not appear to be the device required to explain the ellipsis in N-wdECs.

3.2.1.2 *Connectivity effects and morpho-syntactic reconstruction in the ellipsis site*

A chief hypothesis of the PF deletion is that EM is syntactically structured but unpronounced. In essence, this amounts to say that an elliptical phrase has to have a non-elliptical counter-part. This hypothesis has clearly emerged in the previous discussion on the missing antecedent phenomenon.

Under this hypothesis, the non-elliptical phrase is not directly accessible. Its existence has to be inferred (and hence reconstructed) from other data in the linguistic surroundings of the EM. In the case of N-wdECs, the existence of the non-elliptical phrase is firstly inferred from the identity of case or prepositional marking between C (in the first conjunct) and R in the second conjunct. This is what Merchant (2009) calls a 'connectivity effect':

(17) $_A$[Ion a vorbit] $_C$[*cu* directorul] şi $_{EM}$[ ] $_R$[*(*cu*) nimeni altcineva]
John has talked with principal-the and with nobody else

Connectivity effects are generally used to argue that syntactic reconstruction in the ellipsis site *is* possible. Nevertheless, in our case this

argument is not so relevant. Uniform preposition marking of C and R, that is, another instance of connectivity effect, may not take place, if C is an adjunct or a locative complement (18):

(18) Ion era în bar şi (* în) nicăieri altundeva.
John was in pub and in nowhere else.

As Bîlbîie (2011) notices, even if this type of non-identity is explained, the cost of the explanation is expensive and *ad-hoc*, given the identity of preposition marking between correlate and remnant in other cases (see above, (17)).

Valence, lexeme realization and voice of the antecedent and the reconstructed verb in the ellipsis site must also be identical. If these identities are violated, the reconstruction of EM fails; here is a violation of the subject identity and its consequence:

(19) * $_{A}$[*Lenin* voia] puterea şi $_{EM}$[*Trotzky* nu voia] nimic altceva.
Intended: '*Lenin* wanted the power and *Trotzky* wanted nothing else.'

Nevertheless, even with respect to these parameters there are again problematic exceptions for the reconstruction. Consider the following example:

(20) În vacanţă am dormit şi nimic altceva.
'In vacation I slept and nothing else.'

(20) contains a N-wdEC in which the reconstruction of the elided material in accordance with the lexeme realization of the antecedent *is not* allowed. The antecedent is the verb *a dormi* ("to sleep"), but this verb cannot be reconstructed in the ellipsis site:

(21) În vacanţă am dormit şi * nu am dormit nimic altceva.
In vacation (I) slept and (I) slept nothing else.

The only verb allowed to fill the gap in N-wdEC is the 'lite' verb *a face* ("to do"):

(22) În vacanţă am dormit şi nu am făcut nimic altceva.
'In vacation I slept and I did nothing else.'

So, even the strong requirement of the lexeme identity between A and the reconstructed verb in EM may be sometimes violated without consequences, in the case of N-wdECs[4].

Other differences between A and the reconstruction of EM occur, as well, and deletion must be able to deal with them. These differences regard the person, number, tense, mood and the verb 'extended morphology' (that is, affixes and clitics incorporated by the lexical verb[5]). For example, in (23) the verb in A is in the first person, whereas the reconstructed verb is in the third:

(23) Eu $_{A}$[*am spus* asta] şi nimeni altcineva $_{EM}$[**nu am spus* asta/*nu a spus* asta]
I $_{A}$[have said-1stSG that] and nobody else $_{EM}$[not have said-1stSG/not has said3rdSG that]

Also, in (24), the verb in A incorporates a pronominal affix which is responsible for the direct object clitic doubling (a phenomenon well illustrated in Romanian). Nevertheless, the reconstructed verb is not allowed to incorporate the same affix:

(24) $_{A}$[Ion *o* iubeşte] pe Ioana şi $_{EM}$[Ion **nu o* iubeşte] pe nimeni altcineva
$_{A}$[John PRON-AFF$_{i}$ loves] PE Joanna$_{i}$ and $_{EM}$[John not PRON-AFF$_{i}$ loves] PE nobody else

Finally, non-identical mood and tense may also appear whenever N-wdEC occur in pseudo-cleft constructions. Here is an example (25) a, along with its annotation (25) b:

(25) (a) Ceea ce a făcut Ion în vacanţă a fost să doarmă şi nimic altceva.
'What John has done in vacation was to sleep and nothing else.'

(b) $_{C}$[Ceea ce] $_{i}$ $_{A}$[*a făcut* Ion] în vacanţă a fost [să doarmă] $_{i}$ şi $_{EM}$[*să nu facă*] $_{R}$[nimic altceva].
'$_{C}$[What] $_{i}$ $_{A}$[John has done] in vacation was [to sleep] $_{i}$ and $_{EM}$[to do] $_{R}$[nothing else].'

In this type of examples, the antecedent of EM does not lie, as usual, in the previous conjunct (which is *să doarmă* - SUBJUNCTIVE-sleep). It lies higher in the structure, in the subject clause of the pseudo-cleft structure *ceea ce a făcut Ion în vacanţă* ('what John has done in the vacation'). Consequently, A and the reconstruction in the ellipsis site necessarily differ

[4] The relevance of this phenomenon has been pointed out to me by Gabriela Bîlbîie (p.c.).
[5] See Miller and Sag (1997) for French and Barbu (1999) and Monachesi (2000) for Romanian.

with respect to mood and tense: the verb in A is in the perfect indicative (*a făcut* 'has done'), whereas the reconstructed verb is in the present subjunctive (*să nu facă* 'SUBJUNCTIVE not done').

One may debate whether morphological differences between A and the reconstructed verb in the ellipsis site are problematic for PF deletion. For instance, one may accept that the reconstruction can also exploit relevant data coming from the remnants. Two examples: the reconstructed form in (9) above *nu a spus* 'not said3rdSG ' (which is different in person from the form in A *am spus* 'said-1stSG') may be explained not only by the verb in A, but also by the remnant *nimeni altul* 'nobody else': the remnant may be seen as the subject argument of the reconstructed verb, and, due to subject-verb agreement the reconstructed verb must have the person of the remnant. Likewise, since, in the same sentence, the subject argument *nimeni altul* 'nobody else' is a N(egative)-phrase the reconstructed verb has to carry, thanks to Negative Concord, the negation affix *nu*. As a matter of fact, some versions of the PF Deletion hypothesis (for instance, Sag 1976) do accommodate this kind of recalcitrant data.

3.2.1.3 *The syntactic relationship between the elliptical phrase and its non-elliptical counter-part*

A consequence of the reconstruction hypothesis is that the non-elliptical (reconstructed) phrase and the elliptical one have to have the same syntactic properties[6]. It turns out, though, that in the case of N-wdECs this does not occur[7]. Syntactic differences between the two phrases may be ascertained with respect to embedding and relativization.

Consider, firstly, embedding. Example (26) contains in its second conjunct a N-wdEC (*...nimic altceva*, 'nothing else'), whereas the second conjunct of (27) contains the non-elliptical counter-part of the N-wdEC *...nu voia nimic altceva* ('(he) wanted nothing else'):

(26) Lenin voia puterea şi ~~*nu voia*~~ nimic altceva.

[6] I owe the form of the argument described below to Cullicover and Jackendoff (2005). The argument has been also used in connection with gapping in Bîlbîie (2011).

[7] This is especially visible in the implementation of the deletion strategy into the G&B framework: the non-elliptical clause which is the basis of the elliptical one has an S-structure and a PF-representation (for the relationship between S-structure, PF and LF, see Chomsky 1986:68). The PF representation undergoes a deletion operation which yields an elliptical clause. Since deletion is purely phonetical it cannot affect the S-representation of the non-elliptical clause. So, the elliptical clause obtained by phonetic deletion inherits the S-representation of its 'matrix', the non-elliptical clause. Notice that *phonetic deletion* is distinct from *syntactic deletion*, the latter one being an operation assumed to take place in the passage from D-structure to S-structure, that is to say, before the phonetic realization of the S-structure.

'Lenin wanted the power and nothing else.'

(27) Lenin voia puterea şi *nu voia* nimic altceva.
'Lenin wanted the power and wanted nothing else.'

If one attempts to embed (26) as a *că* ('that') clausal complement of a verb, the attempt fails, because the elliptical clause is not compatible with the complementizer *că*:

(28) Istoricii sunt de acord *că* [Lenin voia puterea] şi * *că [~~nu voia~~ nimic altceva]*.
Historians agree *that* [Lenin wanted the power] and *that [~~not~~ ~~wanted~~ nothing else]*.

Nevertheless, the embedding of (27), which is the full counter-part of (26) succeeds, because (27) *is* compatible with this complementizer:

(29) Istoricii sunt de acord *că* [Lenin voia puterea] şi *că* [nu voia nimic altceva].
Historians agree *that* [Lenin wanted power-the] and *that* [not wanted nothing else].
'Historians agree that Lenin wanted the power and that he did not want anything else.'

This difference should not exist under the hypothesis that the elliptical clause is structured and follows from its non-elliptical counter-part by phonetic deletion of some part of it.

A similar asymmetry may be ascertained in the case of the relativization of the subjects in the two conjuncts: the relativization of the unexpressed subject in the non-elliptical conjunct is allowed (30), while the relativization of the same subject in its elliptical variant N-wdEC fails (31):

(30) Politicianul *care* voia puterea şi *care* [nu voia nimic altceva].
The politician *who* wanted power-the and *who* not wanted nobody else.
'The politician who wanted the power and wanted nothing else.'

(31) Politicianul *care* voia puterea şi * *care [~~nu voia~~ nimic altceva]*.
The politician *who* wanted power-the and *who* [~~not wanted~~ *nobody else]*.

These facts render the PF deletion analysis of the N-wdECs inapplicable, because deletion may only be used if the elliptical phrase has the same

structure and obeys the same rules as its reconstructed non-elliptical counterpart[8].

3.2.2 The anaphora-based strategy

The syntactic analysis of the EM is not improved, if, instead PF deletion, one adopts the hypothesis that EM is an empty pronoun. This is the anaphora-based explanation. It has usually been applied to NP ellipsis[9].

The null anaphora strategy relies on a parallelism assumed to hold between ordinary pronouns and EMs (Lobeck 1995:28-30). It is thus said that both EM and pronouns observe the Backwards Anaphora Constraint (BAC), they both freely violate the Complex Noun Phrase Constraint (CNC), they may occur both in coordinate and subordinate clauses and, finally, they may have a split or pragmatic antecedent.

As EM in N-wdECs is not an NP ellipsis, it is not surprising that none of these properties characterizes it. More precisely, either the tests give negative results, or they are simply irrelevant to N-wdECs. As already noticed, EM in N-wdECs may not occur in a subordinate clause and this is one difference from pronouns:

(32) $_{A}$[Lui Ion îi place] tenisul *chiar dacă $_{EM}$[**e**] nimic altceva.
$_{A}$[To John likes] tennis even though $_{EM}$[**e**] nothing else.

Because of this, the subordinate clause that contains an N-wdEC is not allowed to precede the antecedent. So, EM does not obey BAC, either. In addition, unlike pronouns, EM in an N-wdEC cannot have a split antecedent:

(33) $_{A1}$[Am vorbit] $_{i}$ cu directorul şi $_{A2}$[m-am salutat] $_{j}$ cu paznicul şi *$_{EM}$[**e**] $_{i+j}$/ $_{EM}$[**e**] $_{j}$ cu nimeni altcineva.
$_{A1}$[I have talked] $_{i}$ to principal-the and $_{A2}$[I sent greetings] $_{j}$ to guardian-the and $_{EM}$[**e**] $_{i+j}$/ $_{EM}$[**e**] $_{j}$ nobody else.

Finally, the syntactic organization of the N-wdECs does not allow the placement of its EM in a configuration where the EM behaviour could be

[8] There are also technical difficulties in implementing some versions of the deletion strategy (like the version proposed in Sag 1977) into the G&B framework. I will not insist on them (but see Lobeck 1995: 31-32).

[9] If the (null) anaphora strategy explained EM in N-wdECs this would show that EM was what Hankamer and Sag (1976) call 'deep anaphora'. Nevertheless, one cannot assimilate N-wdECs to deep anaphora: unlike deep anaphora, EM in N-wdECs cannot be pragmatically controlled (for details concerning pragmatic control, see Hankamer and Sag 1976: 391-392).

checked with respect to CNC. An EM (the [**e**] below) embedded in a NP, like in (16), is therefore impossible in the case of an N-wdEC:

(34) Mary enjoyed Clinton's **speech** but $_{NP}$[a man who liked Perrot's [**e**]] hated it. (Lobeck 1995:25).

So, an account of EM in N-wdECs through empty pronouns fails, too. And the more general moral is that structural assumptions about EM, even if apparently legitimate, lack empirical justification.

3.3 EM: how to (semantically) approach it?

No difficulty similar to those previously noticed arise in reconstructing the content of EM. The EM content may be recovered through semantic reconstruction based on λ-notation. The leading idea of the reconstruction is the equational strategy proposed in Dalrymple, Pereira and Shieber (1991). Consider then the sentence *Ion citeşte ziare şi nimic altceva* ('John reads newspapers and nothing else')[10]. The question is how is it that we assign the meaning that John reads nothing else to the second conjunct, as long as no expression of the predicate *read* occurs in the sentence? The answer supplied by the equational strategy is that the access to the meaning of the incomplete clause comes from recovering a property of the remnant in the second conjunct. Let us term this property *P*. As Dalrymple, Pereira and Shieber notice, *P* is not arbitrary. In fact, *P* is the property which, if applied to the correlate in the source clause supplies the interpretation of the clause as a whole (Dalrymple, Pereira and Shieber 1991: 400-402) . This means that the following equation holds:

(35) *P*(ziare) = A citi (ion, ziare)
P(newspapers) = Read (john, newspapers)

The equation (35) may now be solved if the value of P is determined, that is, if one finds the expression whose denotation makes the equation true.

The expression in question is a λ-expression: it is *λx. Read (john, x)* (in words, *the class of those x that John reads*). If *P* is replaced with its value in (35) the result is exactly the true equality (36):

(36) λx. Read (john, x) (newspapers) = Read (john, newspapers)

This last step allows us now to consider the expression *λx. Read (john, x)* as also being the predicate of the remnant *newspapers* in the second conjunct

[10] What follows represents just a basic and informal application of the equational approach to the case at hand.

(the remnant being *things different from newspapers*). In this way, the meaning of the second conjunct is also determined:

(37) λx. Read (john, x) (things different from newspapers) = Read (john, things different from newspapers)

(37) does not represent the full meaning of EC. There is also a meaning in EC, contributed by the N-word. It will be commented in the section below.[11]

3.3.1 N-words

N-words are items usually occurring in negative contexts. The contribution of a N-word to the content of the elliptical clause is that of a quantifier. It binds a variable ranging over the set of the alternatives introduced by the non-identity item. The set of alternatives, therefore, is the restrictor of the quantifier. Its nuclear scope is the predication reconstructed in the elliptical clause. So, if the sentence is *Ion citeşte ziare şi nimic altcineva* ('John reads newspapers and nothing else'), the quantifier *nimic* ('nothing') binds a variable with values in the domain of the things that are different from newspapers (and that exist in the universe where John lives), to the effect that the intersection between the set of these alternatives and the set of things read by John are empty.

4 Retrospect

There is an obvious asymmetry between the syntactic and the semantic structure of N-wdECs: syntactically, N-wdECs are less than a canonical clause: they lack the verb. From a semantic point of view, though, they *are* canonical clauses, because they express a proposition. As already shown, this asymmetry cannot be solved, through structural assumptions, such as PF Deletion or the anaphora-based account. Therefore, the asymmetry syntax-

[11] One of the reviewers points out a drawback of this approach: λ-abstraction on C cannot be uniform, as long as it operates on both complements *and* adjuncts. In particular, the access to adjuncts presupposes some non-local mechanism. Assimilating adjuncts to complements in order to avoid this non-uniformity of treatment is debatable, so this strategy is not a real way out, says the reviewer. Unfortunately I do not have for the moment a sound solution to the problem. I was not aware of these consequences of my proposal, because my main aim was to prove that the semantic reconstruction of the fragment does not cope with the kind of the difficulties the syntactic reconstruction does. Probably, an approach expressed in the M(inimal) R(ecursion) S(emantics) framework might be better and avoid the drawback. But of course this guess is not a real answer to the problem.

semantics ought to be approached *as such*. As in the case of other elliptical constructions (sluicing - Ginzburg and Sag 2000, gapping - Bîlbîie 2011), a HPSG analysis is able to deal with asymmetry, thanks to the concept of fragment.

5 HPSG Representation[12]

The concept of fragment deals with the main aspects of an N-wdEC, the remnant phrase R and the missing sequence EM.

We saw that an N-wdEC is an incomplete phrase and, also, that it expresses more content than its constituency allows. Both these properties may be captured through the concept of *fragment*. In the HPSG hierarchy of phrases, a fragment phrase (*hd-frag-ph*) is a subtype of phrase with only one daughter (*hd-only-ph*). Its contextual dependencies are expressed by means of two features, MAX(imal)-Q(uestion)U(nder)D(iscussion) and SAL(ient)-UTT(erance) (Ginzburg and Sag 2000:304). The former permits the access to the content of the source clause, that is, in our case, the first conjunct (which is the very value of MAX-QUD). The latter identifies the correlate and thus establishes the link between C and R. One may reformulate MAX-QUD as MAX-Me(ssage)UD, which results in the possibility of having as value the semantic type needed in the case of N-wdEC, a proposition.

The constraint on *hd-frag-ph* looks as follows:

(38)

$$\left[\begin{array}{l} hd-frag-ph \\ HEAD: v \\ CTXT: \left[\begin{array}{l} MAX-MeUD: proposition \\ SAL-UTT: \left\{ synsem\left[CONT|IND: |2|\right] \right\} \end{array}\right] \end{array}\right] \rightarrow \left[\begin{array}{l} HEAD: noun \vee adv \vee prep \\ CONT|IND: |2| \end{array}\right]$$

(38) says that there must be a nonempty value for the feature MAX-MeUD, as well as a nonempty value for the feature SAL-UTT. The referential index of the value of SAL-UTT (= C) must be identical with the one of the head-daughter. The mother-phrase and the daughter have different

[12] This section owes much to the comments and suggestions of Ana-Maria Barbu and the anonymous reviewers.

values for the feature HEAD[13]. This accounts for the fact that a NP, an AdvP or a PP may have the distribution of a verb, without actually being one.

We saw that N-wdECs have incidental prosody. This is encoded in the Boolean feature INCID. (Abeillé 2006). Due to this feature the fragment phrase analysed here becomes a subtype of the type *hd-frag-ph*, called *incid-hd-frag-ph*:

(39) $\textit{incid-hd-frag-ph} \rightarrow \left[HEAD : v \left[INCID : + \right] \right]$

An N-wdEC expresses a proposition and this is the property of a particular phrase, the clause. A clause that is declarative is represented in HPSG by the type *decl-cl* and it is defined as follows (Ginzburg and Sag 2000:42):

(40) $\begin{bmatrix} \textit{decl-cl} \\ CONT : \begin{bmatrix} \textit{austinian} \\ SOA : /\boxed{1} \end{bmatrix} \end{bmatrix} \rightarrow \left[CONT : /\boxed{1} \right]$

In (40) the type *austinian* refers to *propositions* and *outcomes*. By default, the SOA value of the mother phrase is identical to the CONT value of the daughter.

The feature structure of an *incid-hd-frag-ph* unifies with the feature structure of the *decl-cl*, the result being the maximal type *incid-hd-frag-cl*. Thus, an *incid-hd-frag-cl* gathers all the information of its two supertypes.

One now needs a type that identifies N-wdECs itself. This is *NwdE-cl*, a subtype of *incid-hd-frag-cl*. It specifies two things: that the value of its HEAD feature is the *synsem* of a non-identity item; and that the quantifier stored on the head-daughter must be retrieved (this latter stipulation ensures that the quantifier introduced by the N-word is properly treated):

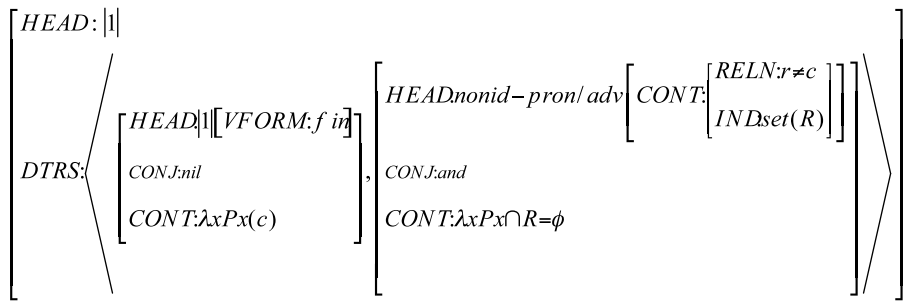
(41) $\begin{bmatrix} \textit{NwdE-cl} \\ CONT|QUANTS : \boxed{1} \end{bmatrix} \rightarrow \begin{bmatrix} HEAD : \textit{nonid} - \textit{pron} / \textit{adv} \\ STORE : \{\boxed{1}\} \end{bmatrix}$

An *NwdE-cl* must also show that it has essential dependencies on the linguistic surroundings. The placement of the *NwdE-cl* in the appropriate linguistic surroundings is given in (42), a constraint on a structure with a conjunct N-wdEC as its second member. (42) establishes the link between N-wdEC and the preceding clause (in the representation below, *c* is the correlate and *r* are the alternatives to *c*; the set of these alternatives is R). The whole

[13] In Ginzburg and Sag (2000):360,362, *v* is a (part of speech) subtype of *verbal*.

structure is a headed phrase (with the head-daughter the first conjunct, and the *şi*-('and')N-wdEC as the non-head daughter):

(42)



6 The status of N-words in N-wdECs

N-words in Romanian are generally known as occurring under licensing conditions supplied by sentence negation. In this regard, they are close to NPIs (e.g. *any*) in English. For example, in *Ion *(nu) citeşte nimic* ('John reads nothing') the N-word presence is illicit in the absence of the negative marker. Nevertheless, the present analysis obligatorily worked with independent occurrences of N-words.

Being based on this type of evidence**,** recent studies on Romanian (Iordăchioaia 2010, Bîlbîie 2011) consider that the independent occurrence of N-words in elliptical structures proves that they are negative quantifiers. Negative quantifiers (for example, *nobody, no one*, in English) contribute negation to the sentence in which they appear and have to be distinguished from NPIs. The latter ones cannot have independent occurrence.

A different stance, though, is expressed in Giannakidou (2002), where it is argued that, since an elliptical construction is licensed by an antecedent, the occurrence of an N-word in such a construction cannot be really independent. Consequently, it is claimed that even in such environments an N-word is still licensed by negation (the N-word thus being a universal quantifier, obligatorily outscoping negation). The licensing negation, this time, comes from the content of the antecedent and *may not have* syntactic expression. This is the case with question-answer pairs, where the N-word that is the fragment-answer is said to be licensed by the denotation of its antecedent - the interrogation[14]; it is also claimed that this is the case with structures involving alternatives - N-wdECs being just such a structure.

[14] The denotation of the interrogative sentence is defined as the set of its possible answers; for example, in the pair Speaker A: *Who came*? Speaker B: *Nobody*, the denotation of the interrogation is the set of answers {*John came*,..., *Nobody came*}.

The procedure used here to determine the content of the N-wdECs gives justice to the hypothesis that N-words in N-wdECs are negative quantifiers. Indeed, the denotation of the antecedent does not contain negation. So, a licensing phenomenon, by means of the antecedent cannot be documented. Notice also that one cannot invoke the existence of a licensing negation occurring *on the reconstructed verb*, either. Licensing cannot be invoked, because, under the HPSG analysis, *there is no morpho-syntactic reconstruction of the verb, hence no host of the verbal negation marker*. In sum, then, the way the HPSG analysis is designed independently leads to the conclusion that the negative polarity of the elliptical clause originates in the N-word itself.

7 Conclusions

N-wdECs represent a new type of ellipsis which shows that an approach based on the syntactic licensing is not satisfactory. If one takes a look at the set of phenomena which resist this approach (gapping, sluicing, stripping, split conjuncts, sprouting and now N-wdECs) one may see that the theory of ellipsis tends to undergo a significant modification of its explanatory basis, in the direction of the non-structural approach. The HPSG theory of the ellipsis-as-a-fragment is a major illustration of this option.

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Syntactic types of *as*-parentheticals in Korean

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Abstract

This paper is intended to investigate the linguistic behaviors of the Korean as-parenthetical constructions with the aim of devoting to distinguishing universal properties of as-parentheticals. This paper shows three prominent behaviors in Korean as-parenthetical constructions. First, the Korean as-clause displays that the syntactic gap in as-clauses must be realized as CP, through the variations on case marker. Secondly, the Korean as-parentheticals tend to have two types of as-clauses; CP or VP as-clause types. In addition, they are sensitive to the syntactic restrictions which can be noticed in as-parenthetical constructions: the sisterhood restriction and the Island boundary. Thirdly, the Korean as-parenthetical constructions reveal that they would require some pragmatic information which is combined with semantic meaning, in the process of getting the interpretation of as-clauses.[1]

1 Introduction

As-parentheticals are considered as a type of parenthetical insertions in English which include nonrestrictive relative clauses, appositions, adverbial clauses, etc., and whose functions are highly controversial issue. A lot of researches on these expressions have tried to describe their linguistic characteristics, focusing on their syntax and semantics. They have made an attempt to clarify their syntactic structures, under the consideration of how closely they are related to their host structure (Haegeman 1991, Emonds 1979, McCawley 1982, Corver & Thiersch 2002, Potts 2002, 2005, Ackema & Neeleman 2004, D'Avis 2005, Burton-Roberts 2006, etc.).

This paper endeavors to investigate the linguistic behaviors of as-parentheticals in Korean and to provide an opportunity to contribute effectually toward identifying their universal characteristics. In order to achieve this goal, this paper focuses on searching for grammatical phenomena of Korean as-parentheticals, basically in terms of corpus data[2], and describing their syntactic types. The main issues which this paper brings

[1] I want to thank the anonymous reviewers for helpful comments, discussion, and pointers. Of course, I alone am responsible for any errors or inaccuracies.

[2] The Korean data sources that I used in this paper are Sejong corpus and the Google corpus engine.

up will be how many as-parenthetical constructions there are in Korean and which factors trigger their differences. This research is not intended to provide any analysis within a theoretical framework.

2 '*As*' morphemes

The first element which consists of an as-parenthetical clause is '*as*' morpheme in English. Through the corpus data, this paper could identify three different morphemes, which lead the Korean as-clauses. They are –(*kek*) *chelem, -taylo, -tusi*, which correspond to '*as*' morpheme of English. They exhibit the same (morpho-)syntactic behaviors and their different morphemes do not carry any change of meaning at least under the context of as-parenthetical clauses in Korean. They can all be attached to the same verbal expressions. For instance, the verb verb '*yesanghata* (to expect)' in (1) can freely be combined with these three morphemes without any change in meaning.

(1) a. Kutul-i yesangha-*tusi*
they-Nom expect as
'As they expect ,'

b. Kutul-i yesanghankek–*chelem*

c. Kutul-i yesanghan-*taylo*

3 Syntactic Properties

This section will be examined the syntactic aspects of Korean as-parentheticals. First, we will explore the syntactic distribution of as-clauses and the gap in as-clauses. We will also consider how many syntactic types can be realized in the Korean as-clauses.

3.1 Distribution

In order to understand the syntax of the Korean as-clauses, it is meaningful to survey their syntactic distribution in a sentence. We find the as-clause in the initial or after the subject positions. The as-clause '*ap-eyse-to kangsa-ka*

enkuphayss-tusi' ('as an instructor mentioned previously') in (2) occurs in a sentence-initial position or is inserted after the subject in a sentence, like (2b). Unlike English, the sentence-final position is not allowed in Korean, as in (2c)

(2) a. [ap-eyse-to kangsa-ka enkuphayss-**tusi**], tokhay-uy picung-un
previously lecturer-Nom mentioned-**as**, reading portion-Nom
kalsulok nopacikoiss-ta.
more and more increasing.
'As an instructor mentioned, the portion of reading is more and more increasing'

b. tokhay-uy picung-un, [ap-eyse-to kangsa-ka enkuphayss-**tusi**],
kalsulok nopacikoiss-ta.

c. *tokhay-uy picung-un kalsulok nopacikoiss-ta, [ap-eyse-to kangsa-ka
enkuphayss-**tusi**]

3.2 Syntactic Gaps in As-Clauses

In order to clarify the syntactic types of as-clauses, it is important to look into the characteristics of syntactic gaps within the as-clauses. First, we can consider the possible syntactic categories of syntactic gaps in as-clauses. One of the typical properties in English as-clauses is that the as-clause has the syntactic gap which is expected to be realized as CP or VP. Although the verb can lexically take CP or NP as the complement, the CP should be realized under the environment of as-parenthetical constructions. This property can also be found in Korean as-clauses.

The Korean language takes different case markers, depending on which types of complements a verb takes; a CP or NP complement in this topic here. When a verb takes a NP complement, the accusative case marker '*-ul*' is attached, whereas the clausal marker '*(ta)ko*' is attached when the verb takes a CP complement. The verb '*alko-iss-ta* (to be aware of)' in (3a) can usually take two types of category, CP or NP as the complement. Especially when the verb takes CP complement, the case marker '*-(ta)ko'* is preferred, whereas the case marker '*-ul*'' is allowed in NP complement.

(3) a. Wuli-nun ciku-ka tungkulta-**ko**/*-**ul** alko-iss-ta.
We-Top earth round know
We know that the earth is round.

b. Wuli-ka alko-iss-**tusi**, ciku-nun tungkulda.
We-Nom know-as, earth-Top round
As we know, the earth is round.

c. Ciku-nun, Wuli-ka alko-iss-**tusi**, tungkulda.
Earth-Top We-Nom know-as, round
The earth is, as we know, round.

From the declarative sentence (3a), which has the clausal maker '*-tako'*, the as-parentheticals can be derived, as in (3b) and (3c). Thus, we can claim that the syntactic gap in as-clauses is CP, not NP.

Second, we can think of how many different syntactic gaps in as-clauses we have. The Korean as-parentheticals can be classified into two types[3]: CP as-clause type and VP as-clause type, depending on the syntactic gaps in as-clauses: their gaps are clausal gaps or VP gaps, as in (4) and (5). A prominent feature of both VP and CP type As-clauses is their missing constituents (gaps). We can see the CP As-clause type in (4). The verb '*unkuphayss-ta* (to mention)' can take CP complement, which is realized as a syntactic gap in as-clause, in (4a). The antecedent of this CP gap would be the same to a whole main clause. So the As-clause gap in (4a) can get its interpretation from the whole main clause, as in (4a').

(4) a. [Ap-eyseto kangsa-ka enkuphayss-**tusi**], [tokhay-uy picung-un
previously also lecturer-Nom mentioned-as, reading portion-Top
kalsulok nopacikoiss-ta.]

[3] Potts (2002) provides two types of as-parentheticals, CP-as type and Predicate-as clauses. These two terms are somewhat ambiguous or overlapped. The first term, CP in CP-as clause type, is used to refer to the grammatical form (categories), whereas the second one, 'predicate' in Predicate-as clause type, is used as the grammatical function. Thus CP can sometimes function as a predicate in a sentence. This paper avoids borrowing these terms.

more and more increasing.

'As an instructor mentioned, the portion of reading is more and more increasing'

a'. As-clause = [[Ap-eyse-to kangsa-ka [tokhay-uy picung-un kalsulok nopacikoiss-ta-ko]] enkuphayss-ta]

b. [[kunye-ka yeysanghayssten-**taylo**], [ku-nun sanglyucung kaceng-ey

She-Nom expected as, he-Top wealthy family

ipyangtoyess- ta]].

adopted

'As she expected, he was adopted by a wealthy family.'

The syntactic gaps of as-clauses in (5) are all VPs and the antecedents of these gaps can be found within the VP of main clause. The as-clause in (5b) has a VP gap, which corresponds to the part of the VP in main clause. Thus, the aspect (present perfect) of verb in (5b), does not exactly match (equal to) with that of the main clause (future tense). So we can get the interpretation of the gap in a VP as-clause from part of VP in the main clause.

Here we can see that unlike those of the first CP type of as-parentheticals, the gaps in the VP type are not easy to identify in main clauses, in the sense that the antecedent of the gap can be parts of the verbal expressions in main clause. That is, in VP as-clause type, the information on tense and aspect, negation from the main clause can easily be ignored in as-clauses.

(5) a. [nukulato kuleha-**tus**], [tu salam-un ches tanchu-lul cal

Anyone did as, two persons first button-Gen well

kkiuko sipul kes-ita.]

fasten want-tense

'As anyone does, two persons will want to fasten their first button well.'

b. [kutongan haywassten-**taylo**], [kincang-uy kkun-ul

during the time have done as, (he)tension-Gen loose
nohci anhko mokpyo-lul talsengha-keysstako kangcohayss-ta.]]
not goal-Acc achieve-future tense emphasized
'(He) emphasized that as he has done, he would achieve his goal
without loosening it up.'

b'. as-clause = [kutongan kincang-uy kkun-ul nohci anhko mokpyo-lul talsenghaywass-ta]

3.3 The Syntactic Characteristics of As-clauses

In this section, we will examine the syntactic properties of two types of as-clauses which discussed in the above section. We need to investigate two syntactic properties: sisterhood restriction and extraction boundary. First, the sisterhood restriction says that the constituent to be extracted as the gap's meaning in the as-clause must be the most local phrase within the appropriate type: Williams (1977), Kennedy (1998), Potts (2002).

Here we can closely look at this sisterhood behavior of the Korean as-clauses in the examples (7) and (8). First of all, the sentence (7) is ambiguous. The gap in as-clauses should be able to find its antecedent in a local phrase. In the sentence (7a) with as-clause in initial position of a sentence, the main clause has an embedded clause. The main verb takes CP complement within the main clause. This structure causes ambiguous meanings. It can either assert that Suci said that Chelsu claimed that his secretary is not guilty, as in (7b), or that Suci said that his secretary is not guilty, as in (7c).

(7) a. Suci-ka malhan-**taylo**, Chelsu-nun pise-ka mucoyla-ko
Suci-Nom said-as, Chelsu-Top his secretary-Nom not guilty
cucang-hayss-ta.
claimed
"As Suci said, Chelsu claimed that his secretary is not guilty."

b. Suci-ka Chelsu-nun pise-ka mucoyla-ko cucang-hayss-ta-
Suci-Nom Chelsu-Top his secretary-Acc not guilty claimed

ko malhaess-ta.

said

= Suci said that Chelsu claimed that his secretary is not guilty.

c. Suci-ka Chelsu-nun pise-ka mucoyla-ko malhaess-ta.

Suci-Nom Chelsu-Top his secretary-Acc not guilty said

= Suci said that his secretary is not guilty.

Meanwhile, the sentence (8) is unambiguous. This sentence (8a) has the as-clause after the subject position. The sentence (8) asserts only that Suci said that his secretary is not guilty, as in (8c). This sentence (8a) is hard to get the interpretation of (8b). This behavior in Korean as-clauses supports the sisterhood requirement of as-clauses, like English.

(8) a. Chelsu-nun Suci-ka malha-taylo, pise-ka mucoyla-ko

Chelsu-Top Suci-Nom said-as, his secretary-Acc not guilty

cucang-hayss-ta.

claimed

"Chelsu claimed that his secretary, as Suci said, is not guilty."

b. Suci-ka Chelsu-nun pise-ka mucoyla-ko cucang-hayss-

Suci-Nom Chelsu-Top his secretary-Acc not guilty claimed

ta-ko malhayss-ta.

said.

≠ Suci said that Chelsu claimed that his secretary is not guilty.

c. Suci-ka pise-ka mucoyla-ko malhayss-ta.

Suci-Nom his secretary-Acc not guilty said

= Suci said that his secretary is not guilty.

Thus, we can conclude that Korean As-clauses must structurally adjoin to the constituent from which they obtain their meaning.

The second syntactic property is about extraction boundary. This

syntactic property on extraction boundary displays that though rare, we can find the situations where ***as*** is separated from the gap beyond the boundary of one or more clause: long CP as-clause: Ross (1967), McCloskey (1989), Lapointe (1991), Postal (1997), Potts (2002).

As-clauses (especially, CP) are sensitive to Island boundaries. The sentence (9) shows that the gap of the as-clause cannot be extracted across the *wh*-boundary. Thus from the sentence (9a) with the *wh*-complement, the as-clause cannot be derived across the *wh*-boundary, as in (9b).

(9) a. Kyengchal-i ellon-un Chelsu-ka supai-eyss-tanun-kekul alko issess-
Police-Nom press-Top Chelsu-Nom spy knew
nunci mulepoass-ta.
whether asked
"The police asked whether the press knew that Chelsu was a spy."

b. *Kyengchal-i ellon-un ____ alko issess-nunci mulepon-kek-chelum,
Police-Nom press-Top ___ knew whether asked as,
Chelsu-ka supai-eyss-ta.
Chelsu-Nom was spy
"As the police asked whether the press knew, Chelsu was a spy."

As for the as-clause with the relative clause gap, we can see that the as-clause with the relative clause gap is not allowed, as in (10).

(10) * ___Cucang-hayss-tun sangin-kwa iyaki-lul nanu-ess-ten kek-chelum
t claimed grocer-with talk to as
sakwa-num masiss-ta.
apple-Top delicious.
"An apple is delicious, as Chelsu spoke with a grocer who claimed t."

4 Semantic Interpretations

In this section, we will consider the elements to be contributed to the proper interpretations of as-parenthetical constructions (especially, of as-clauses). In the process of doing this, two factors will be reviewed: the relationship between as-clause and main clause in negative scope, and the semantic function of as-clause in the whole sentence.

4.1 Negation Scope

In the semantics of Korean as-clauses, we can discover the behaviors of the negations of main clause and as-clause. The sentences in (11) display that there is a kind of semantic relation between main clauses and As-clauses. The positive declarative sentence (11a) is grammatical. Meanwhile, if the As-clause has a negative meaning and the main clause is positive meaning, the whole meaning of the sentence is ungrammatical, as in (11b). The sentence in (11c) is also ungrammatical, even though it has negative as-clause and negative main clause. Lastly, we can deduct the negative main clause with a positive as-clause in the same way, as in (11d). It is interesting that the last case triggers ambiguity in the process of semantic interpretation. We can derive two meanings as the gap's meaning in as-clause; first, the whole main clause can be the gap's meaning, and secondly, only the main clause without the negative meaning can also be the complement of the verb 'claim'.

(11) a. Suci-ka cucangha-tusi, Chelsu-nun wuliu yengung-ita.
Suci-Nom claim as, Chelsu our hero.
"As Suci claims, Chelsu is our hero."

b. *Suci-ka pucengha-tusi, Chelsu-nun wuliu yengung-ita.
Suci-Nom deny as, Chelsu our hero.
"As Suci denies, Chelsu is our hero."

c. ?##*Suci-ka pucengha-tusi, Chelsu-nun wuliu yengung-i ani-ta.
Suci-Nom deny as, Chelsu our hero not.
"As Suci denies, Chelsu is not our hero."

d. Suci-ka cucangha-tusi, Chelsu-nun wuliu yengung-i ani-ta.
Suci-Nom claim as, Chelsu our hero not.
"As Suci claims, Chelsu is not our hero."

From these data, we can see that the negative meaning in as-clauses does not produce the natural sentences. Thus as the claim of Potts (2002), the as-clauses might implicate that their complement is true.

4.2 Meaning of As-clauses

According to the semantic analysis of English as-clauses in Potts (2002), the lexical denotations for as-morphemes are semantically that they implicate that conventionally their complement is true. Thus, the semantic contribution of as-clauses is said to be a conventional implicature, not a presupposition, because as-clauses can be used to create new information without any need for accommodation of the sort associated with presuppositional predicates. That is, they carry out the function of expressing kind of the speaker's attitudes, like other modal adverbials, *probably*, etc., and thus their presence does not have influence over the truth value of the whole sentence.

If we apply this claim to Korean as-clauses, we can judge whether Korean As-clauses should also behave similarly with respect to basic truth conditional meaning: both the whole sentence and the simple assertion denote the same proposition. That is, the sentences in (12a) and (12b) all denote the same proposition. This research is not intended to provide the semantic analysis here.

(12) a. [[Kunye-ka yeysanghayssten-taylo], [ku-nun sanglyucung kaceng-
She-Nom expected as, he-Top wealthy family
ey ipyangtoyess- ta]].
adopted
'As she expected, he was adopted by the wealthy family.'

b. [Ku-nun sanglyucung kaceng-ey ipyangtoyess- ta]
he-Top wealthy family adopted

'He was adopted by the wealthy family'

(13) a. It conventionally implicates that she expected that he was adopted by the wealthy family.

b. It asserts only that he was adopted by the wealthy family.

As we have witnessed in the previous section, under the environ-ment where the as-clause is positive and the main clause is negative, the as-clauses cause ambiguities in interpretation of both CP and VP As-clauses. As in (14), the as-clause appears to ignore the negation in the main clause. The sentence (14) with negated main clause can give ambiguous interpretations, which can be shown in (15a) and (15b).

(14) [Wi-eyse poass-tusi, Mayngca-ka mucoken totekman-ul
Above saw as, Mencius-Nom flatly morality-Acc
kangcohankek-un ani-ess-ta.]
emphasized
'As seen in the above, Mencius did not flatly emphasize the morality.'

(15) a. As-clause = It is seen that Mencius flatly emphasized the morality.

b. As-clause = It is seen that Mencius did not flatly emphasize the morality.

Some information on tense and aspect can also be ignorable, especially in the interpretation of VP as-clause type. The reading of sentence (16) is expected as (17a), not (17b). In this reading, tense and modality information is ignored.

(16) [Uli-nun cikumkkaci haywassten-taylo, ancengcekin kyengki-lul We-
To up to now have done as, reliable game-Acc will play
halkekila-ko malhayss-ta.]
said
'As we have done up to now, (it is said that) we will play a reliable

game.'

(17) a. As-clause = As we have played a reliable game up to now.

b. *As-clause = As we will play a reliable game up to now.

5. Other Factors

In addition to syntactic and semantic aspects of as-parentheticals that we have examined so far, we can calculate other factors on getting more exact interpretation of the gaps in as-clauses.

From the syntactic and semantic properties of as-parentheticals which we have examined, we can easily see that it is not easy to identify the syntactic gaps in as-clauses, because the as-parentheticals can show ambiguous meanings, which are triggered by negation and tense and aspect, etc. This research has reviewed that the sisterhood requirement and semantic aspects have to be considered, in order to get the desirable interpretation of as-clauses in Korean.

In addition to these factors, we will discover that we have to consider other factors, for example, the contextual information on the knowledge of the world in some society. That is, the crucial meaning of As-clauses can sometimes be determined by the world knowledge in some communities. These behaviors can be seen in the following example (18a), which has a negative main clause. So even though this sentence structurally has ambiguous meaning, we do not get the ambiguous meaning. That is, the as-clause in this sentence does not give non-negated interpretation. This phenomenon makes us look at other kinds of factors that are involved in this interpretation.

Generally in our society, the fund manager is regarded as one of the highest payers. From our knowledge on this, we judge that the antecedent of this gap never contain the negated meaning of the main clause.

(18) a. [pendu maynice-nun potong salam-tuli sayngkakhanun-kes-chelum,
fund manager-Top people-pl-Nom think as,
koayk-uy posu- lul paknun-kes-un anita.
higher salary-Acc is paid not

'The fund manager, as the people think, is not highly paid.'

b. [seysang-uy motun halmeni-ka uleha-tus(i), uli halmeni-to
world-Gen every grandmother-Nom do as, our
na-yekye hana te chayngkyecusilye hasyessta.
grandmother also me-Gen one more to give tried.
'As every grandmother in this world does, my grandmother tried to give me more.'

Interestingly, the verb in the main clause '*cu-ta'* (to give) take as the complement two NPs, and the referring individual who are realized as the genitive NP appeared as a different syntactic element: the person in as-clause will be her grandson and that of the antecedent will be 'me', the grandson of our grandmother, even though it should be realized as her grandson, separately.

Therefore, we can conclude that the essential factors for tracing back the antecedents of the gap are the syntactic sisterhood and more crucially the contextual factors including the knowledge on the world.

6 Conclusion

This paper focused on observing the linguistic behaviors of the Korean as-parenthetical constructions with the aim of devoting to distinguishing universal properties of as-parentheticals. This paper showed three prominent behaviors which could be observed in Korean as-parenthetical constructions. First, the Korean as-clause displayed through the variations on case marker that the syntactic gap in as-clauses must realize as CP (more exactly, verbal predicates), not NP. Secondly, the Korean as-parentheticals, at least, tend to have two types of as-clauses; CP or VP as-clause types. In addition, they obey (or sensitive to) the syntactic restrictions which can be noticed in as-parenthetical constructions: the sisterhood restriction and the Island boundary. Thirdly, the Korean as-parenthetical constructions revealed that they would require some pragmatic information which is combined with semantic meaning, in the process of getting the interpretation of as-clauses.

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Past affix' selection of verbal stems

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Head-Driven Phrase Structure Grammar

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Abstract

We will observe which stem allomorph the affixes, the so-called 'non-past' affix, the past affix, the imperative affix, the negative affix and the voice affix-like verbs, select between the longer and the shorter in Japanese-Yanagawa dialect on the assumption that verbal lexemes may be associated with more than one stem. Observing the phenomenon more closely, we found that the verbal stem forms entertain default implicative relations in the stem dependency hierarchy. We will propose i) an implemented analysis of the past affix and ii) an implementation of the allomorph selections by the 'non-past' affix in Koga and Ono, 2010 as two examples.

1 Introduction

It has been believed that there are 'many morphological groups' of verbs with apparently 'irregular conjugations' in the dialects and old languages of Japanese, differently from standard Japanese (except for the strong base verbs /k(o)/ 'come' and /s/ 'do' with 'irregular conjugations'). One of them is those of the so-called 'vowel /e/-final' base verbs in Japanese-Yanagawa dialect, as you will see in the two top-most lines of Table 2 in contrast with their standard counterparts, as given in Table 1.

Table 1: Verbal forms in standard Japanese

stems 'meaning'	'-Non-past' 'if'	'-Past'	'Imper'	'-not'	'-cause'
n(e) 'sleep'	ne-ru	ne-ta	ne-ro	ne-nai	ne-sas(e)
tab(e) 'eat'	tabe-ru	tabe-ta	tabe-ro	tabe-nai	tabe-sas(e)

The verbal stems of the 'non-past' forms and the /(r)eba/-conditional forms of the verbs in this group in the dialect are not the same as those of the past, imperative,

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negative and causative forms. The latter are the stem forms with vowel /e/ at its final like /ne/ ‘sleep’, as are in standard, and the former are the stem forms with the final vowel /e/ absent and vowel /u/ present in the place like /n-u/ ‘sleep’. If we see this phenomenon more closely, it will turn out that the ‘irregular conjugations’ of the strong base verbs /k(o)/ ‘come’ and /s/ ‘do’ in standard as well as Japanese-Yanagawa dialect are similar to some extent to those of the ‘vowel /e/-final’ base verbs in the dialect. The phenomenon ‘irregular conjugations’ in standard Japanese has been ignored in the literature maybe because it has been supposed that there cannot be any scientific research of them and that they are a vexing but minor problem. As mentioned at the beginning of this section, if we expand the scope of our morphological research to dialects and old languages of Japanese, it will be more important to have a scientific research of the selections of verbal stem allomorphs of the so-called ‘vowel /e/-final’ base verbs and the strong base verbs /k(o)/ ‘come’ and /s(e)/ ‘do’ in Japanese-Yanagawa dialect.

We will observe the phenomenon of Japanese-Yanagawa on this paper, and will show an implemented analysis of the past affix and an implementation of the allomorph selections by the ‘non-past’ affix as two examples. The framework is an HPSG-like morpho-syntax in conjunction with Optimality Theoretic morphological accounts with the uses of surface constraints.

The current study is presented on this paper in such an order as follows: After quickly seeing Koga and Ono’s, 2010 observation and their assumption in section 2.1, we will argue for Koga and Ono’s, 2010 plural stem assumption, using the data from an old Japanese and from another Japanese dialect in section 2.2. Then, we will observe the phenomenon of the selections of verbal stem allomorphs by affixes in Japanese-Yanagawa dialect in section 2.3. We observe the phenomenon more closely on further specific assumptions, and will show a finding that the stems selected by affixes in the paradigm of each verb are dependent in section 2.4. In section 3, we first confirm an assumption in morphology for the agglutinative language Japanese in section 3.1, and then will present an implemented analysis of the past affix in section 3.2 and an implementation of stem selections by the ‘non-past’ affix in section 3.3.

2 The phenomenon

2.1 Koga and Ono’s, 2010 assumption of plural stem allomorphs

Koga and Ono, 2010 observed that both the so-called ‘non-past’ tense morpheme and the conditional /(r)eba/ select the shorter stem allomorph of each verbal lexeme if it is associated with two in Japanese-Yanagawa dialect, as given in the left-most column of Table 2.

The plural stem allomorph assumption was proposed in Aronoff, 1994, and has been assumed since then in the literature, for example, in Bonami and Boyé, 2002 and Bonami and Boyé, 2006. Each lexeme of the strong base verbal lexemes /k(o)/ ‘come’ and /s(e)/ ‘do’ and the so-called ‘vowel /e/-final’ base verbal lexemes like

Table 2: Verbal forms in Japanese-Yanagawa dialect

stems 'meaning'	'-Non-past' 'if'	'-Past'	'Imper'	'-not'	'-cause'
n(e) 'sleep'	*ne-ru *ne-reba *n-u *n-eba n-u-ru n-u-reba	ne-ta *n-ta *[nda] *n-ita	ne-ro *n-e	ne-N *n-aN	ne-sas(e) *n-as(e)
tab(e) 'eat'	*tabe-ru *tabe-reba *tab-u *tab-eba tab-u-ru tab-u-reba	tabe-ta *tab-ta *[tanda] *tab-ita	tabe-ro *tab-e	tabe-N *tab-aN	tabe-sas(e) *tab-as(e)
ki 'wear' oki 'wake'	ki-ru ki-reba oki-ru oki-reba	ki-ta oki-ta	ki-ro oki-ro	*ki-N ki-raN ?oki-N oki-raN	ki-sas(e) oki-sas(e)
k(o) 'come'	*ko-ru *ko-reba *k-u *k-eba k-u-ru k-u-reba	*ko-ta k-ita	*ko-ro /k-e/ [ke:]	ko-N *k-aN	ko-sas(e) *k-as(e)
s(e) 'do'	*se-ru *se-reba *s-u *s-eba s-u-ru s-u-reba	*se-ta s-ita	se-ro *s-e	se-N *s-aN	?se-sas(e) s-as(e)
sin 'die'	sin-u sin-eba	/sin-ta/ [sinda]	sin-e	sin-aN	sin-as(e)
yob 'call'	yob-u yob-eba	/yob-ta/ [yonda]	yob-e	yob-aN	yob-as(e)
kak 'write'	kak-u kak-eba	/kak-ita/ [kaita]	kak-e	kak-aN	kak-as(e)
hanas 'talk'	hanas-u hanas-eba	hanas-ita	hanas-e	hanas-aN	hanas-as(e)

/n(e)/ and /tab(e)/ in Japanese-Yanagawa dialect is assumed to be associated with two stem allomorphs, as here written with parentheses for the verbal lexemes.

2.2 An argument for the assumption of two allomorphs for the so-called 'vowel-/e/ final' base verbs and the strong base verbs

Before we observe the phenomena in question, we will argue for Koga and Ono's, 2010 assumption of plural stem allomorphs in this section since the assumption is crucial to the current study.

If we assume that general grammar of Japanese, maybe with different surface constraints added for particular dialects and old Japanese, should be the core of all the possible particular grammars of Japanese, the grammar of Saga western dialect to propose here, if it is deep enough, should at least suggest an idea to a crucial phenomenon of stem selections in another dialect or an old Japanese if there is any. There is such a crucial phenomenon found in Old Japanese. The so-called 'vowel /e/-final' base verbs and the strong base verbs have two kinds of 'non-past' forms, differing in whether they occur prenominally or not, as in (a) examples non-prenominally and in (b) examples prenominally from (1a) to (4b) in contrast with those having only one kind of 'non-past' forms, as in (5a) and (5b).

(1) a. onna nageki **nu** to te, ... [Ise]
woman crying sleep [Non-past] Comp [*fin*] saying, ...
'The woman ..., saying that she will sleep, crying.'

b. hitori **nuru** yo [Noun Phrase] [Shui]
alone sleep [Non-past] night
'a night when I sleep alone'

(2) a. ringo **tabu** wakaki haoto wa tooki koto
apple eat [Non-past] young tooth sound Top distant event
'Now the sound of biting an apple at my teeth was far away in the past.'[1]

b. sake-nado **taburu** tsuide ni, ... [Noun Phrase] [Fukisho]
rice wine-etc. eat [Non-past] next one for
'... in addition to having rice wine, for example.'

(3) a. kumo i tachi **ku** mo, ... [ki chuu]
clouds staying standing come [Non-past] even if, ...
'Even if clouds come staying and standing, ...'

b. kari nakite **kuru** koro, ... [Tsurezure]
geese crying come [Non-past] time, ...
'... when geese come (here) singing.'

[1]This is a haiku, which is a 5-7-5 syllabled-verse, taken from Asahi-Haidan, 2007. Old Japanese is often used in haiku.

(4) a. kaze fukamu to **su**. [ki tyuu]
wind is going to blow Comp [*fin*] do [Non-past]
'Wind is going to blow.'

b. onna mo shite mimu to te **suru** nari [Tosa]
woman too doing try Comp [*fin*] saying do [Non-past] is.
'It is the case that she will do it saying that she, who is a woman, also tries to do that.'

(5) a. ... mazushiki hito wo tomeru hito to **nasu**.
... poor people Acc rich people as make [Non-past],
[Tsurezure]
...
'(He) makes poor people to become rich one.'

b. {**nasu**, ***nasuru**} sube mo nashi
do [Non-past] way too is not
'There is no way to do.'

The verb in the examples (5a) and (5b) /nas/ 'do' is a consonant-final base verb. The non-prenominal 'non-past' forms of the so-called 'vowel /e/-final' base verbs and the strong base verbs take the pattern of the shorter verbal allomorph (like /n/ 'sleep', /tab/ 'eat', /k/ 'come' and /s/ 'do') plus the 'non-past' affix /(r)u/, as in the (a) examples. Koga and Ono, 2010 analyze the 'non-past' affix as the tense expletive. The shorter allomorphs of these kinds of verbs like /n/ 'sleep', /tab/ 'eat', /k/ 'come' and /s/ 'do' are thus motivated at least in the old Japanese. Their prenominal counterparts, on the other hand, take the pattern of the shorter verbal allomorph plus /u/ + /ru/. Koga and Ono, 2010 propose an analysis of the former part of this sequence, /u/, as an allomorph of the tense expletive /u/ and the latter part /ru/ as another occurrence of the tense expletive /ru/. See section 3.3 for an implemented analysis of the tense expletive /(r)u/ in Japanese-Yanagawa dialect. My speculation to the doubled occurrences of the tense expletive is that the prenominal verbal tensed forms are the longer if there are two in order for their audibility immediately before the matrix head noun in the middle of sentences, whereas their clause-final counterparts are the shorter because of the easy detectability at the finals of sentences.

Such a natural question may occur to the doubled tense expletive analysis by Koga and Ono, 2010 as follows. May the doubled occurrences of the tense expletive contract into lighter ones in another dialect with a smaller prosodic minimality since a repetition of the same expletive, or one with least contribution in meaning, may be too much in the dialect? Actually, this prediction is born out in Saga western dialect. Yanagawa and the western part of Saga are distant only 40km. The dialects of the two communities are mutually intelligible to each other. The second occurrence of the doubled tense expletive /u/+/ru/ in the so-called 'vowel /e/-final' base verbs and the strong base verbs only obligatorily contracts into the glottal stop

or the beginning part of the consonant geminate in Saga western dialect, whereas the rest of the underlying final /ru/ contract into the latter part of the immediately preceding vowel lengthened, as given in Table 3.[2]

Table 3: 'Non-past' forms ending underlyingly with /ru/ in Japanese-Saga western dialect

stems meaning	'-Non-past' [s-final]	'-Non-past'-time	Japanese- Yanagawa
n(e) 'sleep'	nuʔ	nuttoki	nuru
tab(e)	tabuʔ	tabuttoki	taburu
ki 'wear'	kiː	kiːtoki	kiru
oki 'wear'	okiː	okiːtoki	okiru
k(o) 'come'	kuʔ	kuttoki	kuru
s(e) 'do'	suʔ	suttoki	suru
ir 'need'	iː	iːtoki	iru
ur 'sell'	uː	uːtoki	uru
er 'choose'	eː	eːtoki	eru
or 'break'	oː	oːtoki	oru
ar 'is'	aː	aːtoki	aru

If the glottal stop or the first half of a consonant geminate is weaker than the second half of a lengthened vowel, then such a speculation will be possible to Koga and Ono's, 2010 analysis as follows: The second occurrence of the doubled tense expletive in Saga western dialect is obligatorily the least sound of the three possible sounds deriving from the underlying form of the final occurrence of the tense expletive /ru/, i) the glottal stop ʔ or the first half of a consonant geminate (CC), ii) the second half of the lengthened vowel, (V)ː, and iii) the syllabic nasal N. Here the prosodic minimality of the tensed verbal forms in Japanese-Saga western dialect is one heavy syllable [σ_{heavy}] (in contrast with that in Japanese-Yanagawa dialect, two syllables [σ σ]). That is, in order for the prosodic minimality, the morpho-syntactic component of grammar is motivated to 'generate' those 'non-past' forms with the doubled tense expletive. And yet, the verbal forms exceed the prosodic minimality. Here economy works, and the verbal forms contract to the minimum of one heavy syllable with the glottal stop or the first half of a consonant geminate filling its coda least to satisfy the prosodic minimality. The first occurrence of the tense expletive of /u/-/ru/ is enough to obtain the semantic function of the tense expletive. Note that this explanatory-adequate explanation to the obligatory occurrence of the consonant geminate or the glottal stop in Saga western dialect is made possible by Koga and Ono's, 2010 analysis of the doubled occurrences of the tense expletive. See Koga and Ono, 2010 for arguments against analyses of the

[2] You can find a native speaker's utterances of 266 'non-past' verbal forms of Saga western dialect at the URL of http://theoreticallinglab.isc.saga-u.ac.jp/research_topics.html.

intermediary /u/ i) as the phonological insertion, ii) as a part of the stems or iii) as the phonological alternation from /e/ to /u/.

2.3 Selections of stem allomorphs by affixes

Now we provide a further phenomenon on which stem each of the other affixes (or the past tense morpheme, the imperative morpheme, the voice morphemes and the negative morpheme) selects, the shorter or the longer, as was given in the 2nd left most column to the right most column in Table 2. For example, the past tense affix selects the longer ones for the so-called standard vowel /e/-final base verbal lexemes and the shorter ones for the strong /k/ and /s/ base verbal lexemes. The negative affix selects the longer ones for all the verbal lexemes as well as the voice verbal affixes, for example, the causative affix, do. Here we regard ?/se-sas(e)/ 'do-cause' as grammatical, sounding a little bit odd, as in (6a), as supported by the fact that the sequence ?/nes-se-sas(e)/ [heat-do-cause] 'cause (him) to heat (it)' is preferred to the shorter one */nes-s-as(e)/, if the verbal stem, consisting of one Chinese character ending with /tsu/ plus the light verb /s/ 'do' like /netsu-s-u-ru/(phonetically realizing as [ness-u-ru]), as in (6b).[3]

(6) a. si-taka koto ba {?se-sase, s-ase}-ta
do [prp]-want thing Acc {do [base]-cause, do [base]-cause}-Past
'(We) let (him) do things that (he) wants to do.'

b. {?[nes-se-sase-ta], *[ness-ase-ta] [fast speech]}
{?/netsu-se-sase-ta/, */netsu-s-ase-ta/ [slow speech]}
{heat [base]-cause-Past}
'(We) let (him) heat it.'

2.4 A closer observation on further specific assumptions

If we look closer at the phenomenon in Section 2.3 on such assumptions as will be given in the paragraphs following this paragraph, a novel description will be found that the verbal stems entertain default implicative relations in a stem dependency hierarchy, as will be specified below.

We assume that the verbal lexemes of the so-called 'vowel /e/-final' base verbs and the strong base verbs are associated with two stem allomorphs. One allomorph is the basic stem, and the other allomorph is the stem derived from the basic one. The two allomorphs of each verbal lexeme are classified into four with the specifications of two dimensions: i) derivationhood and ii) length. The specifications of the dimensions of derivationhood and length determine whether the affix in question is able to select the stem allomorph. This idea is formalized as follows:

[3]The fact that the voice affixes prefer to select the shorter allomorph for the verbal lexeme /s(e)/ 'do' may be relevant to the fact that the strong base verb /s(e)/ is also the light verb syntactically combining with the verbal noun, as in /benkyou s-ase-ru/ (or benkyou s-as-u-ru in Japanese-Yanagawa dialect) 'study do-cause-Non-past'.

Each stem has a morphological feature of STEMS, consisting of two features, 1) SFORM and 2) LENGTH as well as the features of syntax and semantics. The SFORM specification indicates whether the stem is the basic form, *basic*, or the form adjusted with a vowel eliminated from the basic form or added to the basic form, *vwl_adjstd*. The LENGTH specification indicates whether the stem is the longer or the shorter. For the so-called 'vowel /e/-final' base verbal lexemes, the longer are the basic ones and the shorter are the derived ones, which are the same as the basic ones except with the final vowel /e/ absent. For example, the allomorph /ne/ of the verbal lexeme /n(e)/ 'sleep' is analyzed as in Figure 1.

$$\begin{bmatrix} \textit{morpheme} \\ \text{PHON} \quad \langle \text{NE} \rangle \\ \text{STEMS} \quad \begin{bmatrix} \textit{stems} \\ \text{SFORM} \quad \textit{basic} \\ \text{LENGTH} \quad \textit{longer} \end{bmatrix} \\ \text{SYNSEM} \quad \begin{bmatrix} \textit{synsem} \\ \text{CATEGORY} \quad \begin{bmatrix} \textit{cat} \\ \text{HEAD} \quad \begin{bmatrix} \textit{v} \\ \text{VFORM} \quad \textit{bse} \end{bmatrix} \\ \text{COMPS} \quad \langle\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Figure 1: An analysis of the allomorph of the verbal lexeme, /ne/ 'sleep'

The other stem /n/ is analyzed as having the same feature specifications as the basic one except for [PHON <*n*>] and [STEMS [SFORM *vwl_adjstd*] [LENGTH *shorter*]]. For the strong base verbal lexemes, the shorter /k/ 'come' and /s/ 'do' are the basic ones and the longer are the derived ones, specifically the former with the vowel /o/ occurring at the final and the latter with the vowel /e/ occurring there. For example, the allomorph /ko/ of the verbal lexeme /k(o)/ 'come' is analyzed as in Figure 2.

$$\begin{bmatrix} \textit{morpheme} \\ \text{PHON} \quad \langle \text{KO} \rangle \\ \text{STEMS} \quad \begin{bmatrix} \textit{stems} \\ \text{SFORM} \quad \textit{vwl\_adjstd} \\ \text{LENGTH} \quad \textit{longer} \end{bmatrix} \\ \text{SYNSEM} \quad \begin{bmatrix} \textit{synsem} \\ \text{CATEGORY} \quad \begin{bmatrix} \textit{cat} \\ \text{HEAD} \quad \begin{bmatrix} \textit{v} \\ \text{VFORM} \quad \textit{bse} \end{bmatrix} \\ \text{COMPS} \quad \langle\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Figure 2: An analysis of the allomorph of the verbal lexeme, /ko/ 'come'

We could assume a morphological rule associating basic stem forms to their vowel-adjusted ones with the use of relevant thematic vowels added or with the final vowel

absent. We leave it for a future research. We stipulate the two stem forms for each verbal lexeme in our current proposal. We can develop our analysis of different allomorphs stated in different signs, following Bonami and Boyé, 2006 to make lexemes containing their associated allomorphs.

On the basic-and-derived plural stem assumption in our proposal, if we look closer at the phenomenon in Table 2, it will turn out that the verbal stems entertain default implicative relations in such a stem dependency hierarchy as given in Figure 3.

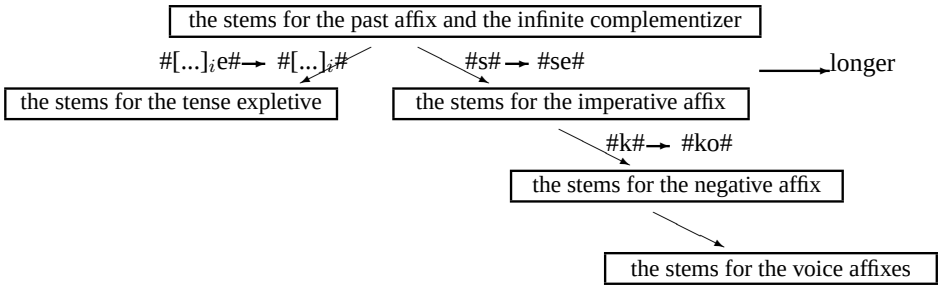

Figure 3: The verbal stem dependency of Japanese-Yanagawa dialect

The stems for the marked tense, or the past tense, and for the infinitival complementizer, or the tense interpretation dependent on that of the matrix clause, are placed at the top node. The stems for the unmarked tense, or the tense expletive, are placed at the node immediately lower than the top. In parallel, a tree of the stems for the relation-argument relations is placed immediately lower than the top. Each local relation between the affix at a node and the affix at its immediately lower node can describe either 1) one between a relation (R) for the higher node and its argument (A) for the lower node like one between negation for R and causative for A, as in /ne-sase-N/ ([$_{Negative}$ [$_{Voice}$ [$_{Verb}$ ne] sase] N]) [sleep-cause-not] 'do not let (him) sleep', or 2) one between a marked element (M) for a higher note and its unmarked element (UM) for the lower node like one between the past tense for M and the tense expletive for UM.

With an affix and a verbal lexeme given, the verbal stem allomorph to be selected is the same as that for the affix at the immediately higher node unless otherwise specified at the node in the given hierarchical structure. Even for the apparent 'irregularity' of the strong base verbal lexeme /k(o)/ 'come', the hierarchy discovers its implicative relation, i.e., the fact that the shorter stem /k/ 'come', which is the basic stem, is selected by the past affix, the 'non-past' affix and the imperative affix, as in [kee] (underlyingly /k-e/) 'Come', whereas the longer stem /ko/ 'come' is selected by the negative affix and the voice affixes. Note that if an affix A describes a relation or an unmarked element and another affix B describes its argument of the relation or its marked element for the unmarked element, then the stems for the affix B will be equal to or longer than those for the affix A. My

speculation for an agglutinative language like Japanese is that the more deeply embedded or marked the affix is, the longer or at least equally lengthened verbal stem allomorph will be selected in order for the audibility of the verbal stem.

The vowel /e/ deletion for the so-called vowel /e/-final base verbs and the additions of the vowels /o/ and /e/ for the strong base verbs in the proposal are well motivated. In other words, we can find explanations to how the verbal forms with basic stems plus affixes are avoided. We can find an explanation to why the imperative form */s-e/ 'do-Imperative' is avoided as follows: Assume that the imperative form /...-e∼i∼ro/ '...Imperative' will be inappropriate without distinct audibility between the verbal stem and the affix in question, for example, if the verbal stem consists of one consonant, and the POA (place of articulation) of the final consonant and the tongue position of the initial vowel of the imperative affix /e∼i∼ro/ are not far away. On this assumption, the imperative form */s-e/ 'do-Imperative' will be correctly predicted NOT to have distinct audibility between its verbal stem and the affix and to be inappropriate since the POA of the consonant /s/ and the tongue position of the vowel /e/ are close. Thus, the imperative form */s-e/ 'do-Imperative' is avoided.[4] Similarly, we can find an explanation to why the negative form */k-aN/ 'come-not' is avoided. The negative affix, which is a derivational (adjectival) affix in Japanese, is the deepest embedded except for the voice affixes, and start selecting the longer allomorph for the verbal lexeme /k(o)/ 'come' at this embedded level.

Furthermore, we can easily explain how the other stem of each of the strong base verbal lexemes derives from the one-consonant stem by assuming that the thematic vowels (or the vowels added to produce stem forms) are /e/ and /o/ in the dialect (and also Japanese) as well as usual in the linguistics of India-European languages. As pointed out by Koji Ono (personal communication), the thematic vowel close to the final consonant will be added at its final in the stem formations. The tongue position of the vowel /o/, [back +, high -], is close to that of the consonant /k/. The tongue position of the vowel /e/, [back -, high -], is close to that of the consonant /s/. Thus, it is very natural to assume that the verbal stem allomorphs of the verb lexeme 'come' are the basic /k/ and the derived /ko/, and the verbal stem allomorphs of the verbal lexeme 'do' are the basic /s/ and the derived /se/.

There is also a plausible speculation found to why the stems for the past affix and the complementizer affix are at the top of the stem dependence hierarchy, i.e., are analyzed as the most implicative stems. The past affix and the infinitive complementizer affix are more basic in the grammar of the family of Japanese and its dialects than any other stem-selecting affix among the 'non-past' affix, the conditional affix, the imperative affix, the negative affix and the voice affixes. This is supported by the fact that phrases of the past affix and the infinitive complementizer are selected as the morphological complement by the biggest number of other

[4]On the other hand, the imperative form /k-e/ 'come-Imperative', phonetically realizing as [ke:], is correctly predicted to have distinct audibility since the POA of the consonant /k/ and the tongue position of the vowel /e/ are far away.

lexemes, for example, the conditional affix /ra/, the benefactory verb /moraw/ 'receive' than phrases of the other affixes are. This is also supported by the highest frequency of the stems for the past affix and the complementizer affix in language use.

Suppose another hierarchical structure as in Figure 4, which is the opposite hierarchy of Figure 3, is assumed, which will be rejected soon.

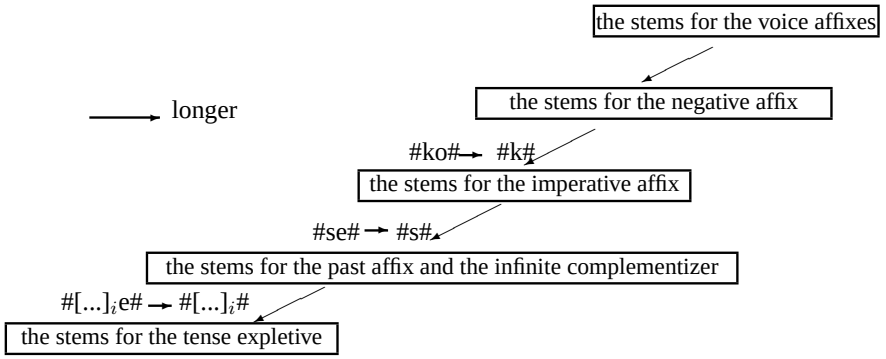

Figure 4: The verbal stem dependency of Japanese-Yanagawa dialect: undesirable one

The stems for the voice affixes, the most predicative verbal stems, were analyzed as the top of the hierarchy. On this assumption, the deletions of the vowels /o/ and /e/ for the strong base verbs cannot be well motivated. In other words, we cannot find explanations for why and how the verbal forms with basic stems plus affixes are avoided. We will not be able to find any explanation to the fact that */ko-i/ (*/ko-ro/), including the hypothesized basic stem form, was not preferred to /k-e/ [ke:], including the hypothesized derived stem form, in the dialect, and to the fact that */se-ta/ 'do-Past', including the hypothesized basic stem form, was not preferred to /s-ita/ 'do-Past', including the hypothesized derived stem form. This undesirable situation would not occur if the basic stems of the strong base verbs were analyzed as the shorter ones, /k/ and /s/, as assumed in our proposal.

3 Analyses of affixes

3.1 Derivational and inflectional affixes of the agglutinative language

We assume that every morphological phrase is identified with a morpheme or a morphological phrase for its non-head daughter and another morpheme for its head daughter. The head feature principle in syntax in HPSG with the morphological feature STEMS included holds true in Japanese.[5] In other words, morphemes in

[5]One difference is that the PHON value of a morphological phrase is not only a list of two PHON values of the non-head daughter and the head daughter, but a concatenation of them.

our proposal are words in HPSG. The assumption is motivated in the agglutinative language Japanese and its dialects since affixes and affix-like verbs, which are mostly historical remnants of verbs, are distinct from lexemes, and attach to lexemes always at their finals, differently from inflections in India-European languages. For example, Sag, 2012 uses the morphological function of the preterite (past) tense for its inflection in English as follows:

F(unction)$_{preteritie}$(take) = took,

F$_{preterite}$(buy) = bought, ...,

F$_{preterite}$(x) = x-ed, where x is otherwise.

On the other hand, Japanese has a distinctive past affix (i)ta. For every morpheme, including allomorphs of a verbal lexeme x, F$_{past}$(x) = x-(i)ta in Japanese, where phonological changes occurring over the morpheme boundary are left to phonology and stem selections are left to morphology. Since this analysis does not distinguish the derivational affixes (or the affix-like voice verbs) from the inflectional affixes, e.g., /(i)ta/ 'Past', the grammar of Japanese and its dialects will be much simpler, as will be clarified in the research of the voice affixes of Japanese and its dialects.

3.2 An implemented analysis of the past affix

The analyses of affixes' selections may or may not be the same from dialects to dialects. Take an example of the past affix /(i)ta/. Since the past affix selects the identical morphemes of identical verbal lexemes from standard Japanese to its dialects in general, the selection by the past affix should be stated in the core components of grammar. The analysis we propose is stated in the COMPS specification of the past affix. The stem forms that the past affix selects are those of [STEMS [SFORM *basic*] [LENGTH *longer*]] if the verbal stem is the so-called vowel /e/-final verb and those of [STEMS [SFORM *basic*] [LENGTH *shorter*]] if the verbal stem is either of the strong base verbs /k/ 'come' and /s/ 'do'. The largest common feature specifications of the stem forms that the past affix selects are [STEMS [SFORM *basic*]]. The past affix is thus analyzed as specifying its morphological complement as having the morphological specification of [STEMS [SFORM *basic*]] as well as the specifications in syntax and semantics, as formalized in Figure 5.

The feature COMPS in our proposal is the morphological one. The past affix /(i)ta/ can select, for example, /ne/ for the verbal lexeme /n(e)/ 'sleep', as in Figure 6, but NOT /n/, which has the morphological specification of [STEMS [SFORM *vwl_adjstd*], as supported by the ungrammaticality of */n-ta/ or *[nda] 'sleep-Past'.[6]

[6]The boundaries of verbal stems and affixes in Japanese-Yanagawa dialect as well as standard are basically either C#V or V#C, but NOT C#C or V#V. The concatenations of the 'vowel /e/-final' base verbs and the strong base verbs are like /ne-ta/ 'sleep-Past', /k-ita/ 'come-Past' and /s-ita/ 'do-Past' in the dialect. There is one difference between the dialect and standard. The past verbal form of the verbal lexeme /s(i)/ is /si-ta/ in standard Japanese since the negative form in the dialect is /se-N/, whereas that in standard is /si-nai/. See Nakamichi, 1999 for the so-called 'sound convention' of Japanese, as in the phonetic form /oyoida/ of the underlying sequence /oyog/ plus /(i)ta/, which is an exception of affixation.

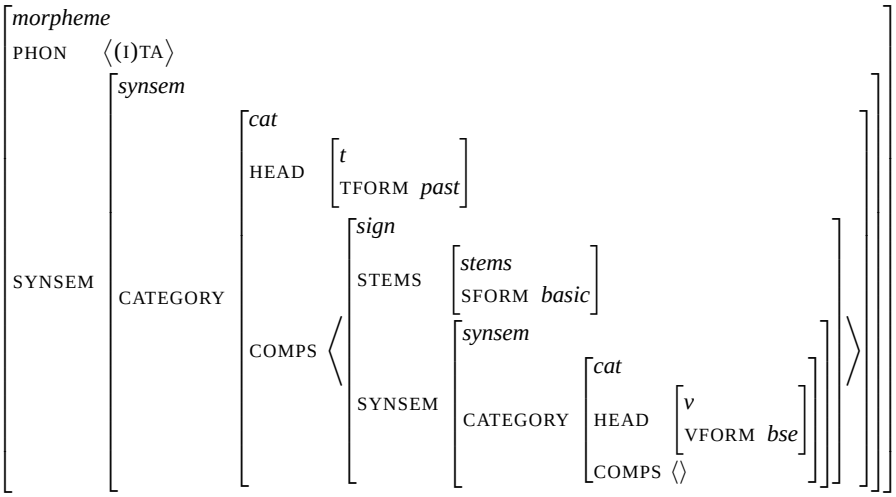

Figure 5: An analysis of the past affix /(i)ta/

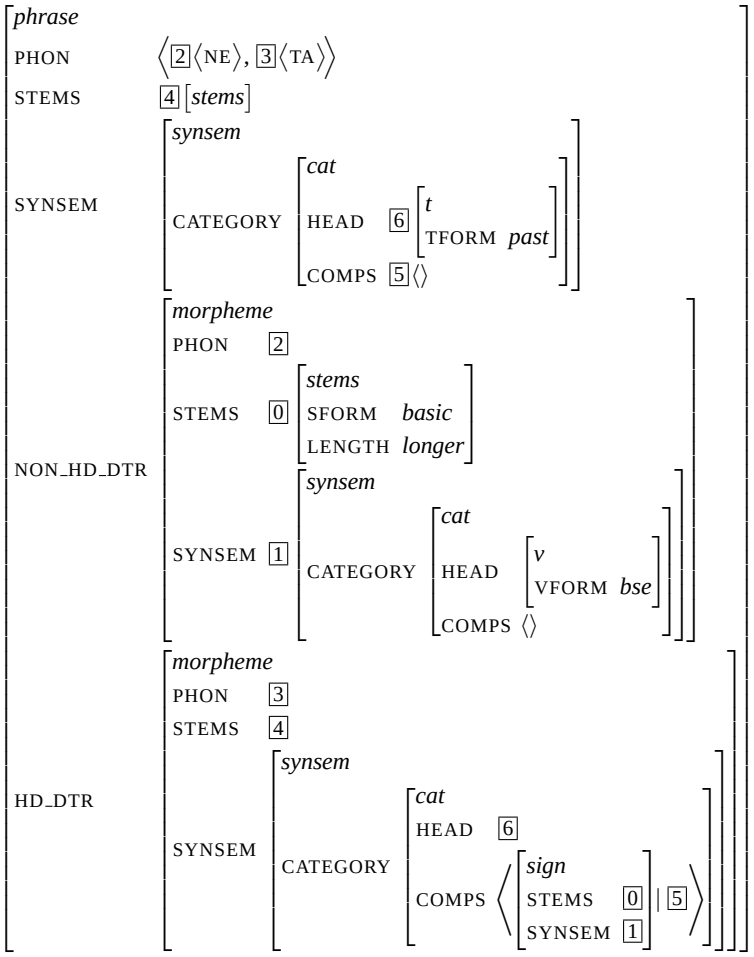

Figure 6: An analysis of the past form /ne-ta/ ‘sleep-Past’

3.3 An implementation of the allomorph selections by the 'non-past' affix in Koga and Ono, 2010

Take another example of the 'non-past' affix, or the tense expletive. There are dialectal or historical variations for the so-called 'non-past' verbal forms. The stem forms that the tense expletive selects in the dialect will be those of [STEMS [SFORM *vwl_adjstd*] [LENGTH *shorter*]], as in /tab-u-ru/ 'eat-Non-past-Non-past', if the verbal stem is the so-called vowel /e/-final verb and those of [STEMS [SFORM *basic*] [LENGTH *shorter*]] if the verbal stem is either of the strong base verbs /k/ 'come' and /s/ 'do'. The largest common feature specifications of the stem forms that the tense expletive selects are [STEMS [SFORM *shorter*]]. This is the same in standard and other dialects, and the selection should thus be stated in the core components of grammar.

Differently from that in the dialect and standard, the non-prenominal and prenominal 'non-past' forms in Old Japanese are the shorter stem form plus one occurrence of the tense expletive and the shorter stem from plus two occurrences of the tense expletive, as exemplified in /tab-u/, as in (2a), and /tab-u-ru/, as in (2b) for the example of /tab(e)/ 'eat'. We can implement Koga and Ono's, 2010 selectional analysis of the tense expletive affix /(r)u/ as selecting a verbal base form with its stem [STEMS [LENGTH *shorter*]] or a tense [expletive] phrase in the core components of grammar, as formalized as in Figure 7.

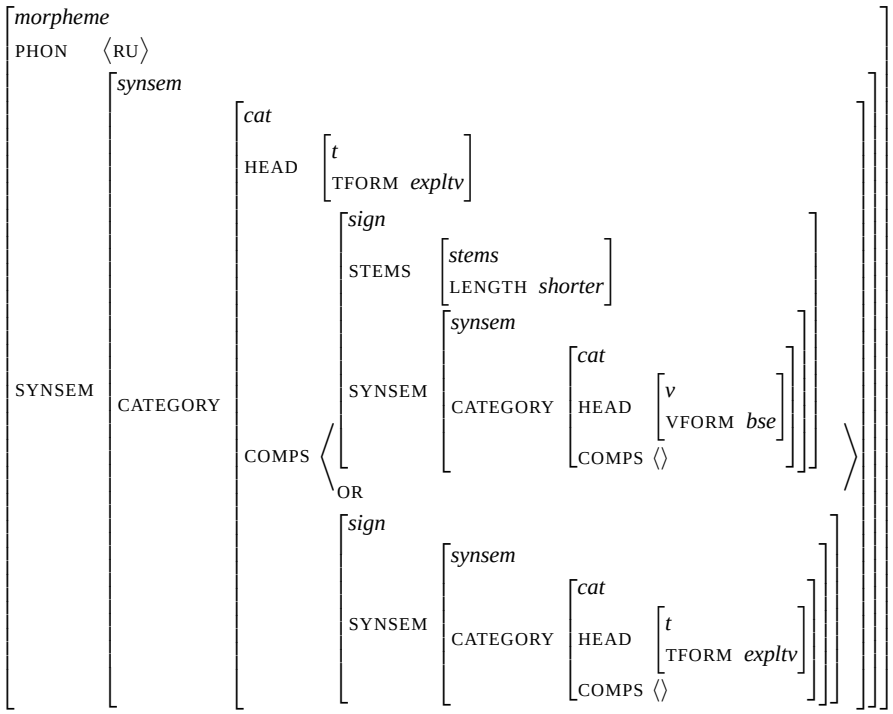

Figure 7: An analysis of /ru/ 'Tense expletive'

The core components of grammar, then, allow candidates */tab#u/, as in Figure 8, and /tab#u#ru/, as in Figure 9, disallowing */tabe#ru/ since the stem /tabe/ is [STEMS [LENGTH *longer*]] for 'eat [Non-past]' in the dialect.

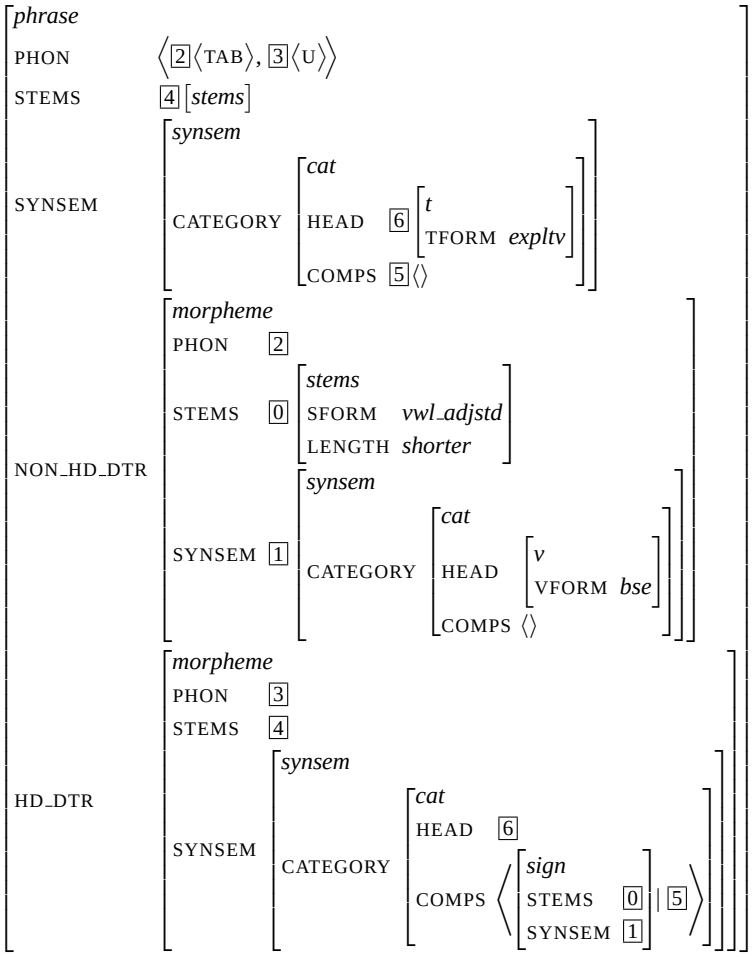

Figure 8: An analysis of */tab#u/ 'eat-Tense Expletive'

An Optimality Theoretic (OT)-constraint-based syntax framework (in which syntax is the 'generator' to map a set of candidates from a given meaning), including violable constraints outside of the core components, similarly to Lee 2004, will be in order. We assume a division of labor among morpho-syntax, phonology and semantics.[7] Here leaving the implementations of the surface constraints for a

[7]Our implementation does not include semantics, and the implementation of the semantics is left for a future research. Since the meaning of the tense expletive is analyzed as being inherently the identity function, if the 'non-past' tense is cost-free, the meaning of the 'non-past' will be conventionally implicated (Koga and Ono, 2010). The meaning of */tab-u/ 'eat-Tense Expletive', for example, would be $\lambda X \lambda e \lambda t[X(e)(t)\ \&\ t \in Non-past](\lambda X \lambda e \lambda t[X(e)(t)]\ (\lambda e \lambda t[eat'(e)(t)]))$, equivalently $\lambda e \lambda t[eat'(e)(t)\ \&\ t \in Non-Past]$. The semantics of the tense expletive is $\lambda X \lambda e \lambda t[X(e)(t)]$.

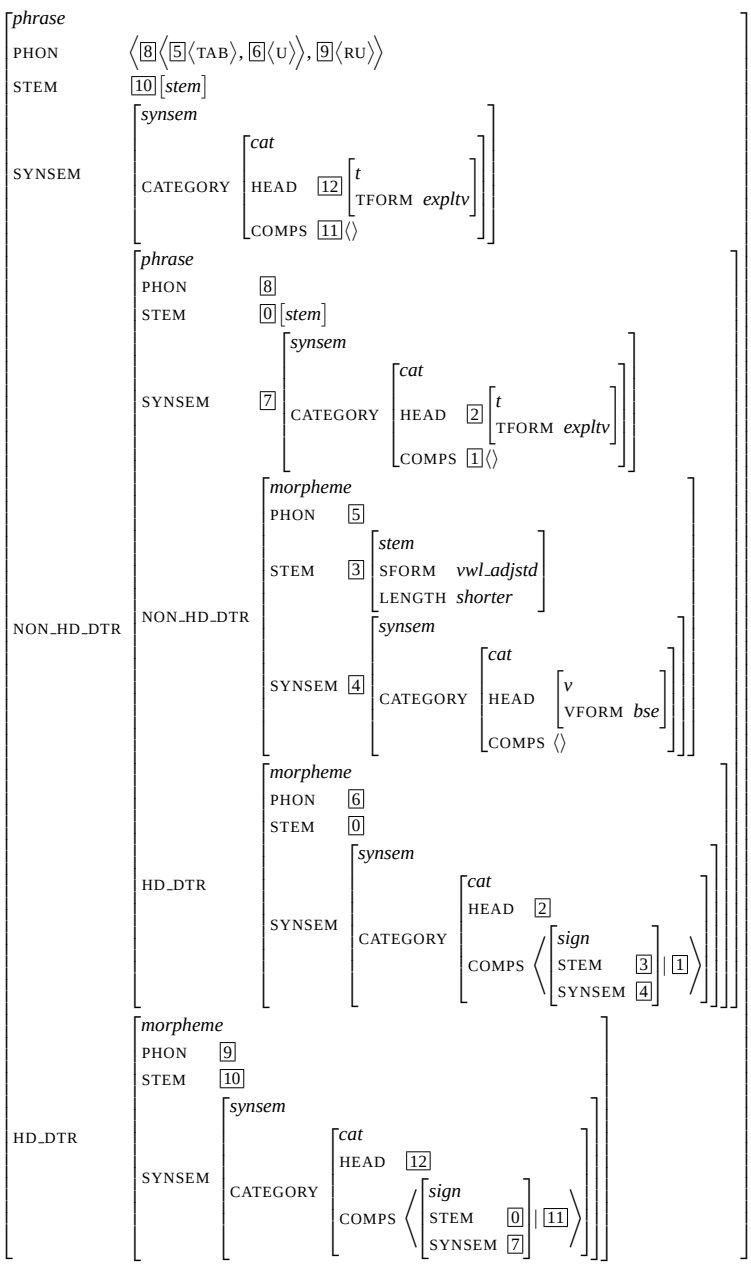

Figure 9: An analysis of /tab#u#ru/ ‘eat-Tense Expletive-Tense Expletive’

future research, we repeat Koga and Ono's, 2010 surface constraints. Grammatical but inappropriate candidates like */tab#u/ 'eat-Tense [Expletive]' in Figure 8 in the dialect are excluded by surface constraints (SCs) (Koga and Ono, 2010). The characteristic of the surface constraints is that they may use notions of various components, thus suggesting a requirement of heavier loads on computations in brain and resulting in children's errors in the later period of their acquisitions. SC1: The prosodic structure of every tensed form is at smallest bimoraic. This is similar to Ito, 1990. For example, /n#u/ 'sleep-Tense [expletive]', violates this. SC2: Given a subconstituent C of a candidate expression characterized by a set of syntactic specifications, C stands in correspondence to every other listed form that is characterized by the same set of syntactic values within its immediate morphological class (Steriade, 2008). Constraint SC2 with the subconstituent C being the rest of the verbal stem excludes */tab#u/ 'eat-Tense [Expletive]', which contains only /u/ in the rest of the verbal stem, since some lexeme within its morphological class whose stem consists only of one consonant, e.g., /n/ 'sleep', leads to a violation of the surface constraint 1 (SC1). The lexemes /tab(e)/ and /n(e)/ are two of the morphological class with the basic stem endings with the vowel /e/. Thus, the grammar, which is the core components plus the surface constraints, allows /tab#u#ru/ for 'eat [Non-past]'. See Koga and Ono, 2010 for another constraint of the economy for the number of repeated occurrences of the tense expletive. The well-known apparently-irregular 'conjugations' of the strong base verbs /k(o)/ 'come' and /s(e)/ 'do' left unexplained until now are thus explained with an explanatory adequacy similarly.

4 Conclusion and implications

We found stem dependency in Japanese-Yanagawa dialect. The stem dependency forms a hierarchical structure with the stem forms of the past affix at the top node and with each local relation describing a *either* relation-argument *or* marked-unmarked relation. It is revealed that the more deeply embedded or marked the affix is, the longer or at least equally lengthened verbal stem will be selected. We argued for Koga and Ono's, 2010 analysis of /u/-/ru/ in the 'non-past' forms of the so-called vowel /e/-final base verbs and the strong base verbs as the doubled occurrences of the tense expletive, using the data of the old Japanese and Saga western dialect, which is crucial to the current study. When we examined the two descriptive-adequate stem dependency hierarchies, we used a criterion, whether we can find an explanation for why and how the basic (or more basic) one plus the affix, which would be implicated from the hierarchy if it were not for the specification there, would be avoided for every specification of another allomorph in the hierarchy (either by a suppletion or an allomorph derivational rule). This is considered an explanatory-adequate criterion for stem dependency hierarchies. As two examples from among the affixes, we presented implementations of the past affix and Koga and Ono's, 2010 selectional analysis by the tense expletive in the

core components of the grammar, which both include the morphological selectional specifications as well as syntactic and semantic ones. The current study implies that the morphological selectional specifications are independently necessary, and are analyzed with the use of the dimensions of derivationhood and length in the agglutinative language Japanese.

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The direct evidential *-te* in Korean: Its interaction with person and experiencer predicates

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Abstract

This paper discusses the complex relations among the direct evidential *-te*, *person*, and experiencer predicates in Korean. The questions of the paper are: (i) how the three components are related with each other in the evidential sentences, and (ii) how the interactions of the three components can be formally analyzed to correctly license only the well-formed evidential sentences. I show that in direct evidential construction with a non-private predicate (e.g. *pwutulep-* 'soft'), the asserter/epistemic authority (i.e. the speaker *na* 'I' in declarative or the addressee *ne* 'you' in question) must be the experiencer of the predicate, but there is no such constraint in direct evidential construction with a private predicate (e.g. *aphu-* 'sick'). I also show that the direct evidential construction with a non-private predicate is an instance of self-ascription. Then I propose an analysis of the experiencer predicates and associated lexical rules in the Minimal Recursion Semantics (MRS) (Copestake, *et al*., 2005) of Head-driven Phrase Structure Grammar (HPSG) (Pollard and Sag, 1994; Sag, *et al*., 2003).

1 Introduction

The direct evidential *-te* in Korean has been much studied (see e.g. Sohn, 1994; Cinque, 1999; Chung, 2006; Lim, 2011; Lee, 2011, and also see Japanese evidentials in Kuno, 1973; Kuroda, 1973; Tenny, 2006; McCready and Ogata, 2007; and evidentials in various languages in Aikhenvald, 2004, among others). For example, in the following constrast between the non-evidential sentence and the direct evidential sentence in (1), only the latter has the direct evidential implication that the assertion of the proposition is based on relevant direct evidence.

(1) Mary-ka ku sakwa-lul **mek**-ess-ta/ **mek-te**-la.
Mary-Nom the apple-Acc eat-Past-Dec/ eat-Te-Dec[1]
'Mary ate the apple.'/
'Mary ate the apple.' Implication: the speaker has relevant direct evidence (e.g. the speaker *saw* the scene) for the asserted proposition that Mary ate the apple.

In addition to actions denoted by verbs, states of adjectives (e.g. experiencer predicates) can also be asserted based on relevant direct evidence, as

· I would like to thank Stephen Wechsler for his valuable comments on this paper. The helpful comments of the anonymous reviewers and the audiences at the HPSG 2012 Conference are also gratefully acknowledged. Any remaining errors are mine.

[1] Abbreviations: Acc = Accusative, Comp = Complementizer, Cop = Copula, Dec = Declarative, Nom = Nominative, Past = Past, Pres = Present, Prog = Progressive, Que = Question, Rel = Relativizer, Te = *te*, Top = Topicalization.

illustrated in (2) and (3) below. However, as shown in (3b), it is not the case that the direct evidential constructions are always grammatical in Korean, which is less discussed in the literature (the empirical basis of the acceptability of the examples in (2) and (3) is discussed more in the next section).

(2) a. **na/ ne/ ku**-nun simcang-i **aphu-ta**.
I/ you/ he-Top heart-Nom sick-Dec
'My/ Your/ His heart is sick.'

b. **na/ ne/ ku**-nun simcang-i **aphu-te-la**.
I/ you/ he-Top heart-Nom sick-Te-Dec
'My/ Your/ His heart was sick (based on relevant direct evidence).'

(3) a. **na/ ne/ ku**-nun i peykay-ka **pwutulep-ta**.
I/ you/ he-Top this pillow-Nom soft-Dec
'This pillow felt soft to me/ you/ him.'

b. **na/ *ne/ *ku**-nun i peykay-ka **pwutulep-te-la**.
I/ you/ he-Top this pillow-Nom soft-Te-Dec
'This pillow felt soft to me/ *you/ *him (based on relevant direct evidence).'

In (2) and (3), the contrasts show the complex interactions between the direct evidential *-te*, *person*, and experiencer predicates: from the minimal pairs in (3b), the type of the personal pronoun subject is a factor of the grammaticality, from the contrasts between (2b) and (3b), the type of the experiencer predicate is also important, and finally, the minimal pairs between (3a) and (3b) show that the existence of the direct evidential *-te* is also involved in the grammaticality (or acceptability) of the constructions.

The two main questions which I aim to answer are: (i) how exactly the three components are related with each other in the evidential sentences, and (ii) how the interactions of the three components can be formally analyzed to correctly license only the well-formed evidential sentences.

Regarding these two issues, I show that in Korean direct evidential construction with a non-private predicate (e.g. *pwutulep-* 'soft'), the asserter (i.e. the speaker *na* 'I' in declarative or the addressee *ne* 'you' in question) must be the experiencer (i.e. the subject) of the predicate, but there is no such constraint in direct evidential construction with a private predicate (e.g. *aphu-* 'sick'). I also argue that the direct evidential construction with a non-private predicate is an instance of self-ascription (see e.g. Wechsler, 2010, 2012 for self-ascription). Then, based on the grammatical properties of the constructions, I propose an analysis of the experiencer predicates and related inflectional lexical rules in the framework of the Minimal Recursion Semantics (MRS) (Copestake, *et al*., 2005) of Head-driven Phrase Structure Grammar (HPSG) (Pollard and Sag, 1994; Sag, *et al*., 2003).

2 Grammaticality vs. awkwardness of experiencer predicates

In this section, I look into the grammaticality and acceptability of experiencer predicates, and argue that some Korean experiencer predicate constructions which were previously considered ungrammatical are actually not ungrammatical, but awkward due to some pragmatic factors.

Direct experiencer predicates denote some feelings, sensations, or experiences of subjects.[2] In the Japanese declarative sentences (4a) (from Tenny, 2006: 247), the predicate of direct experience (i.e. *samui* 'cold') restricts its subject to the first-person pronoun (i.e. *watashi* 'I'). However, when the same predicate of direct experience is used in a question, as in (4b), the predicate restricts its subject to the second-person pronoun (i.e. *anata* 'you') (Kuno, 1973 cited in Tenny, 2006: 247).

(4) a. **Watashi**/ *anata/ *kare wa samui desu.
I/ you/ he Top cold Cop
'I am cold.' / *'You are cold.' / *'He is cold.'

b. *Watashi/ **anata**/ *kare wa samui desu-ka?
I/ you/ he Top cold Cop-Que
*'Am I cold?' / 'Are you cold?' / *'Is he cold?'

According to Tenny (2006: 248), the starred sentences in (4) are clearly *ungrammatical* while some corresponding English sentences may appear somewhat *odd*. The ungrammaticality or oddness of the starred sentences appears to be based on the fact that it is generally hard for a person to get access to another person's sensations or feelings. For example, in the question (4b) with the third-person subject, the addressee is expected to have access to another person's sensation.

In the footnote 3 of Tenny (2006), the author says, "Chungmin Lee informs me that these facts in Japanese are largely parallel to the facts in Korean." However, in the footnote 4 of Tenny (2006), the author also says, "Some speakers have informed me that among younger Japanese, sentences like *Kare wa samui desu* are not as bad; the phenomenon may be disappearing in the language."

Similarly, the Korean sentences corresponding to (4a) with the second- or third-person subject seem to be *not as bad*, even though they sound somewhat *awkward* (like English) without a plausible context. According to No (1989), the non-occurrence of third-person with an emotion verb in Korean is

[2] There are different names for experiencer predicates: for instance, sensation verbs (e.g. Kuroda, 1973; Talmy 1985), emotion verbs (e.g. No, 1989) or psychological verbs (e.g. Lee, 1976; Yang, 1994). They appear to be equivalent to each other. In this paper, I use the term, experiencer predicates.

subject to register variation: i.e. in a certain register, the combination is possible. We can find empirical data supporting it; the subject of a direct experiencer predicate can be second-person, as in (5b), or third-person, as in (5c), although the first-person subject in (5a) sounds most natural (data from the web).

(5) a. **na**-nun nemwu **sulphu-ta**.[3]
I-Top very sad-Dec
'I am very sad.'

b. twi tol-a po-nun **ne**-nun **pwulanha-ta**.[4]
back turn-Comp see-Rel you-Top anxious-Dec
'You, turning and looking back, are anxious.'

c. nwun-ey teph-i-myen **ku**-nun **chwup-ta**.[5]
snow-in cover-Pass-if he-Top cold-Dec
'If covered in snow, he is cold.'

Thus there seems to be less person restriction related with the experiencer predicates in Korean. If a context (e.g. which is associated with evidence about the state of the experiencer) is explicitly given, as in (5b,c), the experiencer predicate sentences sound better.

Also, in a Korean question, the first- or third-person pronoun can be the subject of an experiencer predicate (unlike the Japanese questions in (4b)), as shown in (6a,c), respectively, even though the second-person subject in (6b) is most natural (data from the web).

(6) a. **na**-nun **chwuwun-ka**?
I-Top cold-Que
son-ul po-ni kwayen ttelli-ko iss-ess-ta.[6]
hand-Acc see-when indeed shiver-Comp Prog-Past-Dec
'Am I cold? When I saw my hand, it was shivering indeed.'

b. **ne**-nun **oylowun-ka**?[7]
you-Top lonely-Que
'Are you lonely?'

c. **ku**-nun **oylowun-ka**?[8]
he-Top lonely-Que
'Is he lonely?'

[3] http://blog.daum.net/yea-an/16877065
[4] http://blog.eduhope.net/edustory/?d=2010-03-19
[5] http://softdrink.egloos.com/196996
[6] http://www.munpia.com/bbs/view.php?id=cn_173&no=201
[7] http://cafe.daum.net/tnehdka/DZhE/1248?docid=qTVADZhE124820100927101713
[8] http://serrana.egloos.com/m/3596217

The empirical data in (5) and (6) suggest that the restriction on the personal pronoun subject in declarative and interrogative with experiencer predicate is a matter of *the degree of awkwardness*, rather than a matter of *grammaticality* (at least in Korean).

Another piece of evidence in favor of *the degree of awkwardness* comes from the fact that the experiencer predicate declarative sentences with the second-person subject sound more awkward than the comparable sentences with the third-person subject. In both cases, the speaker has the difficulty of getting access to another person's sensation. However, in terms of *epistemic authority* (the person who has primary authority for the truth or knowledge of the proposition expressed, see Wechsler, 2012 for the concept), the two sentences are different: i.e. in the former, the addressee is the epistemic authority for her sensation, but in the latter, the addressee is not the epistemic authority for a third person's sensation. In other words, it can be weird for the speaker to inform the addressee of the addressee's sensation since generally the addressee knows about her sensation much better than the speaker (i.e. the addressee is the epistemic authority here). However, this kind of awkwardness is not found in the experiencer predicate declarative sentences with the third-person subject.

If the speaker has a clear reason to tell the addressee's sensation to the addressee, then the relevant sentence should sound less awkward (or more natural). This is shown in the following sentences which are augmented with a plausible context:

(7) a. **ne**-nun i peykay-ka **pwutulep**-ciman
you-Top this pillow-Nom soft-but
aninchek-ha-ko iss-ta.
pretend.not-do-Comp Prog-Dec
'This pillow feels soft to you,
but you are pretending that it does not feel soft.'

b. **ne**-nun ku koki-ka **masiss**-ciman
you-Top the meat-Acc tasty-but
aninchek-ha-ko iss-ta.
pretend.not-do-Comp Prog-Dec
'The meat tastes good to you,
but you are pretending that it does not taste good.'

In (7), while the speaker may be considered to be aggressive, the sentences sound better than the corresponding sentences without such a context.

Also, in the experiencer predicate interrogatives (6) above, the sentence with the first-person subject sounds more odd than the sentences with the third-person subjects. Both cases have the addressee's problem of getting access to another person's feeling, but the former has another pragmatic pro-

blem: i.e. it is normally not natural for a person not to know her own feelings and so ask others about them. However, it is not that people always have access to their own sensations perfectly. So if the speaker is not sure about her sensations, and wants to verify them by asking the addressee, then the interrogative sentences with the first-person subject become better:

(8) a. **na**-nun **chwuwun-ka**?
I-Top cold-Que?
ne-ka poki-ey-to kulay?
you-Top seeing-at-also so.Que
'Am I cold? Do you also see that I am cold?'

b. **na**-nun **oylowun-ka**?
I-Top lonely-Que?
ne-ka poki-ey-to kulay?
you-Top seeing-at-also so.Que
'Am I lonely? Do you also see that I am lonely?'

Now let us consider direct evidential constructions headed by an experiencer predicate. In a certain type of direct evidential constructions, even the context cannot save the evidential sentences with the second- or third-person subject. Although in (9a), the context (i.e. the medical examination results) makes the direct evidential constructions (with *aphu-* 'sick') more natural, the context in (9b) does not have such an effect: the direct evidential constructions (with *masiss-* 'tasty') still sound very bad.

(9) a. kemsakyelkwa-lul po-nikka
examination.result-Acc see-since
ne/ ku-nun simcang-i manhi **aphu-te-la**.
you/ he-Top heart-Nom very sick-Te-Dec
'Your/ His heart was very sick
according to the medical examination results.'

b. *mek-nun mosup-ul po-nikka
eat-Rel scene-Acc see-since
ne/ ku-nun ku koki-ka cengmal **masiss-te-la**.
you/ he-Top the meat-Nom really tasty-Te-Dec
*'The meat tastes really good to you/ him
according to my observation.'

If the subjects in (9b) are replaced with the first-person subject, the sentence is well-formed even without a context. Thus in (9b) the three componenets (i.e. personal pronoun subject, experiencer predicate, and the direct evidential *-te*) are responsible for the ungrammaticality. Each component is discussed in the three sections that follow.

3 Personal pronouns in Korean

In this section, I present the basic paradigm of Korean personal pronouns and their properties as a type of indexicals. In the following table, Korean personal pronouns are presented:

Table 1: Personal Pronouns in Korean

Person	Singular	Plural
First	*na* 'I'	*wuli*(-*tul*) 'we'
Second	*ne* 'you.SG'	*nehuy*(-*tul*) 'you.PL'
Third	*ku* 'he', *kunye* 'she'	*ku-tul* 'they', *kunye-tul* 'they.FEM'

Korean has some honorific or humble forms of the personal pronouns, but they are not included in the table; only basic personal pronouns are given in the table. For the first- or second-person plural pronoun, the plural marker -*tul* is optional since they already have the distinguished forms from the singular counterparts (i.e. *na* vs. *wuli*, *ne* vs. *nehuy*). However, in case of the third-person plural pronouns, the plural marker -*tul* is required. In this paper, I focus on the singular personal pronouns (i.e. *na* 'I', *ne* 'you', *ku* 'he', *kunye* 'she').

The main point of the person indexicals is that the first- and second-person pronouns (i.e. speech act participant indexicals) are speaker-dependent: their interpretations vary depending on who the speaker or addressee is (see e.g. Kaplan, 1977; Wechsler, 2010). For instance, in Korean, *na* 'I' always refers to the speaker (i.e. whoever says *na* 'I' is the speaker), and *ne* 'you' always refers to the addressee. However, the referents of the third-person pronouns normally exclude speaker and addressee (see e.g. Wechsler, 2010).

In interrogatives, the first- and second-person pronouns are also anchored to the speaker and addressee, respectively. This is a crucial difference from evidentials. In declarative evidential constructions, the evidential is anchored to the speaker (i.e. the speaker has evidence), but in interrogative evidential constructions, it is anchored to the addressee (i.e. the addressee is expected to have evidence) (see more on the direct evidential -*te* in Section 5 below).

4 Two types of experiencer predicates

In this section, I argue that the experiencer predicates in Korean can be broadly classified into two types based on their semantic and syntactic properties (cf. English experiencer predicates in Pesetsky, 1987): (i) private predicate (e.g. *aphu*- 'sick', *oylop*- 'lonely', *chup*- 'cold', *tep*- 'hot' representing the mental state of the subject) and (ii) non-private predicate (e.g. *pwutulep*- 'soft', *kkachilkkachilha*- 'rough', *masiss*- 'tasty', *ttakttakha*- 'hard' denoting the state of a stimulus that the subject experiences).

First, experiencer predicates can be identified by a test: if and only if a predicate can be combined with the verb *ha* 'do', the predicate is an emotion verb (i.e. experiencer predicate) (No, 1989):

(10) a. Tom-i **oylo-we** **hay**-ss-ta.
Tom-Nom lonely-Comp do-Past-Dec
'Tom was feeling lonely.'

b. Tom-i ku koki-lul **masiss-e** **hay**-ss-ta.
Tom-Nom the meat-Acc tasty-Comp do-Past-Dec
'The meat was tasty to Tom.'

c. *Tom-i hanul-ul **phalay** **hay**-ss-ta.
Tom-Nom sky-Acc blue.Comp do-Past-Dec

d. *Tom-i ku koki-lul **mek-e** **hay**-ss-ta.
Tom-Nom the meat-Acc eat-Comp do-Past-Dec

In (10), the combination of an experiencer predicate and the verb *ha* 'do' denotes an activity, not a state anymore. One piece of evidence is that the present tense morpheme *-n* can be attached to the verb *ha* (e.g. *Tom-i* o*ylo-we ha-n-ta* 'Tom feels/is feeling lonely.') (see more e.g. in Park, 1974; Yang, 1994).

Equipped with the identification of experiencer predicates, I show several differences of the two types (i.e. private- and non-private) of experiencer predicates. In (11a), the sentence has only one interpretation (i.e. the speaker is the experiencer), but in (11b), the sentence is ambiguous: the speaker is either the experiencer or the stimulus which brings about the sensation to an unexpressed experiencer. Note that Korean is a pro-drop language.

(11) a. na-nun **oylop**-ta.
I-Top lonely-Dec
'I am lonely.'

b. na-nun **masiss**-ta.
I-Top tasty-Dec
'Something is tasty to me.'
'I am tasty e.g. to a monster.'

c. sokoki-nun **masiss**-ta.
beef-Top tasty-Dec
'Beef is tasty.'

In (11c), if a specific experiencer is not inferred from the context, *masiss-* 'tasty' is used as a predicative adjective denoting the generic meaning.

If a second nominative phrase (i.e. a stimulus) appears in a sentence headed by *masiss-* 'tasty', the subject is interpreted as experiencer, but not as

stimulus, as in (12b). However, in (12a) with *oylop*- 'lonely', the subject remains the experiencer.

(12) a. na-nun **kaul** **nalssi-ka** nemwu **oylop**-ta.
I-Top autumn weather-Nom very lonely-Dec
'I am very lonely due to the autumn weather.'

b. na-nun **ku** **koki-ka** nemwu **masiss**-ta.
I-Top the meat-Nom very tasty-Dec
'The meat is very tasty to me'

In (13), the pronoun *na* 'I' comes with a relative clause. In (13a), the speaker is the experiencer, but in (13b), the speaker is not experiencer, but stimulus.

(13) a. **oylo**-wun na
lonely-Rel I
'I, who am lonely'

b. **masiss**-nun na
tasty-Rel I
'I, who am tasty e.g. to a monster'

In short, *masiss*- 'tasty' is ambiguous between experiencer predicate and predicative adjective, but *oylop*- 'lonely' is simply an experiencer predicate. A stimulus complement (i.e. the second nominative NP) is required for the *masiss*-type experiencer predicates.

5 The direct evidential -*te*

In this section, I present the two main properties of the direct evidential -*te*: indexicality and presupposition.

First, evidentials have a property of indexicality (i.e. speaker-dependent): *the speaker* has evidence for an asserted proposition (see e.g. Garrett, 2001; McCready and Ogata, 2007; Lim, 2010). In other words, whoever says a declarative evidential sentence has relevant evidence for the proposition denoted by a predicate. However, evidential is shifted in interrogatives (unlike *you* and *I*). The evidential -*te* in declaratives is anchored to the speaker, but in interrogatives, it is anchored to the addressee (see e.g. Lim, 2010). That is, whoever is being asked an evidential question is expected to have relevant evidence for the proposition expressed by a predicate. So, we can say that in declaratives, the speaker is the utterer and asserter (or epistemic authority), but in interrogatives, the speaker is the utterer and the addressee is induced to assert (i.e. epistemic authority). In short, evidentials are always anchored to the asserter/epistemic authority (cf. Lim, 2010).

Second, I adopt the idea that evidentials are like presupposition (e.g. Mathewson, *et al*., 2007; Lim, 2010): the evidential implication of *-te* cannot be negated or questioned.[9] The following shows the negative counterparts of the examples in (2b) and (3b):

(14) a. na/ne/ku-nun simcang-i **an aphu-te-la**.
I/ you/ he-Top heart-Nom Neg sick-Te-Dec
'My/ Your/ His heart was not sick
(based on relevant direct evidence).'

b. na/*ne/*ku-nun i peykay-ka **an pwutulep-te-la**.
I/you/he-Top this pillow-Nom Neg soft-Te-Dec
'This pillow did not feel soft to me/ *you/ *him
(based on relevant direct evidence).'

In (14), the direct evidential implications are not negated, but are still included in the meanings of the constructions.

In the interrogatives (15), the implications of the direct evidential *-te* are not questioned, either.

(15) a. ne-nun **chup-te-nya**?
you-Top cold-te-Que
'Were you cold?' Implication: the addressee is expected to answer
based on relevant direct evidence.

b. ne-nun i uyca-ka **ttakttakha-te-nya**?
you-Top this chair-Nom hard-Te-Que
'Did this chair feel hard to you?' Implication: the addressee is
expected to answer based on relevant direct evidence.

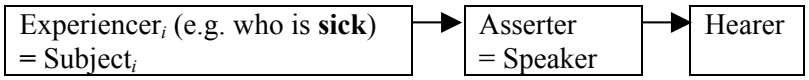
These two key facts indicate that the meaning (i.e. the implication) conveyed by the direct evidential *-te* is a presupposition.

6 The direct evidential *-te*, *person* and experiencer predicates

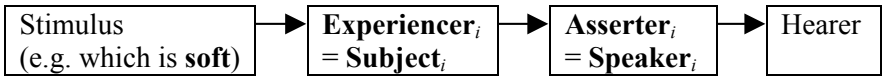
Based on the properties of the three componenets, we can see that in direct evidential construction with a private predicate (e.g. *aphu-* 'sick'), the asserter does not need to be the experiencer (i.e. subject), but in direct evidential sentence with a non-private predicate (e.g. *pwutulep-* 'soft'), the asserter must be the experiencer. These facts can be explained by considering the flow of information in an utterance:

[9] I do not here discuss the status of presupposition in terms of semantic value.

(16) a. Information flow in declarative direct evidential construction with private predicate:



b. Information flow in declarative direct evidential construction with non-private predicate:



In (16a), the asserter can directly observe the psychological state of the experiencer, which is denoted by a private predicate: i.e. the asserter can have access to direct evidence on the state of the experiencer. So whatever *person* the subject is, the construction satisfies the requirement of the direct evidential *-te* (i.e. the asserter's direct observation). But in (16b), the asserter cannot directly observe the property of the stimulus, which is described by a non-private predicate since it is the experiencer who directly observes (i.e. experiences) it. Thus in order to have access to direct evidence on the property of the stimulus, the asserter must be co-indexed with the experiencer. That is, only under the co-indexation, the construction can satisfy the requirement of the direct evidential *-te* (i.e. the asserter's direct observation).

7 Predictions in interrogatives

From the general constraint in (16) (i.e. the asserter's direct observation of the state or property denoted by an experiencer predicate), we can predict that in interrogative direct evidential construction with a private predicate (e.g. *oylop-* 'lonely'), any personal pronoun can be the subject, but in interrogative direct evidential construction with a non-private predicate (e.g. *pwutulep-* 'soft'), only the second-person pronoun *ne* 'you' (i.e. the asserter/epistemic authority in questions) can be the subject. This is confirmed as below:

(17) a. **na**/ **ne**/ **ku**-nun manhi **oylop-te-nya**?
I/you/he-Top very lonely-te-Que
'Was I/ Were you/ Was he very lonely?' Implication: the addressee is expected to answer based on relevant direct evidence.

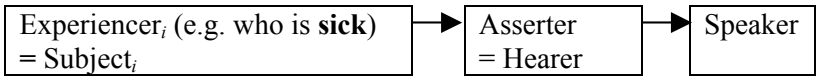
b. ***na**/ **ne**/ ***ku**-nun i peykay-ka manhi **pwutulep-te-nya**?
I/you/he-Top this pillow-Nom very soft-Te-Que
'Did this pillow feel very soft to *me/ you/ *him?' Implication: the addressee is expected to answer based on relevant direct evidence.

In (17a), when the subject is *na* 'I', it sounds somewhat awkward. However, we can find situations in which it sounds more natural: e.g. a patient may ask

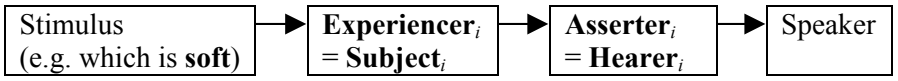
a psychiatrist about her states.

Then, the information flow of the interrogative direct evidential constructions can be represented with the following diagrams:

(18) a. Information flow in interrogative direct evidential construction with private predicate:



b. Information flow in interrogative direct evidential construction with non-private predicate:



In (18a), the asserter/hearer can have access to direct evidence for the proposition denoted by a private predicate. So, this interrogative construction satisfies the requirement of the direct evidential *-te* (i.e. the asserter's direct observation). In (18b), however, the experiencer has access to direct evidence for the proposition about the stimulus; so the asserter/hearer (i.e. epistemic authority in interrogatives) can have access to direct evidence for the state of the stimulus only through its co-indexation with the experiencer/subject. Then the interrogative construction can satisfy the requirement of the direct evidential *-te* (i.e. the asserter's direct observation).

8 Self-ascription

This section shows that direct evidential constructions with a non-private predicate belong to self-ascription.

In a self-ascription (or *reference de se*), "someone ascribes a property, she ascribes the property to herself: she believes that she has the property" (Wechsler, 2012: 11). For instance, if John says *I drank too much*, he self-ascribes the property 'drank too much': i.e. John has a *de se* belief (see more about *de se* belief in Lewis, 1979). However, if a friend shows John a photo in which someone in the photo is wearing a lampshade on his head, John does not know it is himself in the picture, and John says, *he drank too much*, then John does not self-ascribe the property of drinking too much: i.e. John has a *de re* belief (a belief about a real thing, but not about identity) (Wechsler, 2012: 12).

Based on the self-ascription, Wechsler (2012) accounts for the distribution of conjunct verb form in Kathmandu Newar.[10] In the following declaratives (from Hargreaves 2005, cited in Wechsler, 2012: 3), the conjunct form (CJ) appears only on the verb whose subject is first-person:

[10] See alternative accounts compared with self-ascription in Wechsler (2012).

(19) a. jī: a:pwa twan-**ā**.
1.ERG much drink-PST.**CJ**
'I drank a lot/too much.'

b. chā a:pwa twan-a.
2.ERG much drink-PST.DJ
'You drank a lot/too much.'

c. wā: a:pwa twan-a.
3.ERG much drink-PST.DJ
'S/he drank a lot/too much.'

In (19a), the subject (i.e. the speaker) self-ascribes the VP-denoted property (i.e. drinking too much). The conjunct form is specialized for encoding of self-ascription.

In interrogatives, however, the addressee is being asked whether the addressee would self-ascribe the VP-denoted property 'drink too much'. So the conjunct form appears on the verb whose subject is second-person (Wechsler, 2012):

(20) a. jī: a:pwa twan-alā?
1.ERG much drink-PST.DJ Q
'Did I drank a lot/too much?'

b. chā a:pwa twan-**ā** lā?
2.ERG much drink-PST.**CJ** Q
'Did you drank a lot/too much?'

c. wā: a:pwa twan-alā?
3.ERG much drink-PST.DJ Q
'Did s/he drank a lot/too much?'

The Japanese experiencer predicates in (4) can also be accounted for with the self-ascription: the Japanese experiencer predicates are specified for self-ascription, or at least favor it (Wechsler, 2012). So self-ascription can be encoded with different grammatical categories: a morphological category is used for Kathmandu Newar, but the lexical class of experiencer predicates is used for Japanese.

In much the same way, the combination of the direct evidential *-te* (i.e. morphological level) and a non-private predicate (i.e. lexical level) is an instance of self-ascription. The direct evidential *-te* requires that the asserter have direct evidence on an asserted proposition, but the proposition denoted by a non-private predicate is basically about a stimulus (unlike proposition of private predicate), which is not next to the asserter in terms of the information flow, as illustrated in (16b) and (18b). So in order for the asserter to get

access to direct evidence on an asserted proposition about the stimulus, the asserter must be the subject/experiencer (i.e. the speaker *na* 'I' in declarative or the addressee *ne* 'you' in interrogative). This combination of the properties of *-te* and a non-private predicate has the effect of inducing the meaning of a self-ascription.

In the following table, the relations between experiencer predicates, the direct evidential *-te* and self-ascription are represented:

Table 2: Grammatical encoding of self-ascription in Korean

Grammatical encoding	Self-ascription
Private predicate	favor self-ascription (specified for or favor it in Japanese)
Non-private predicate	favor self-ascription
Direct evidential with private predicate	favor self-ascription
Direct evidential with non-private predicate	**specified for self-ascription**

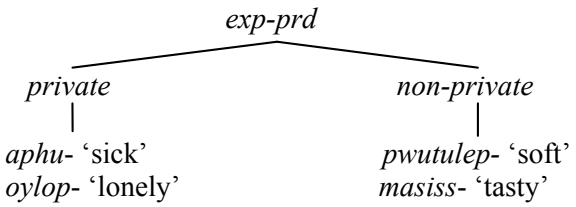
In Table 2, the direct evidential construction with a non-private predicate has the meaning of self-ascription in Korean. Other constructions only favor self-ascription since the first-person subject in declaratives or the second-person subject in interrogatives is favored due to some pragmatic factors presented in Section 2.

9 An analysis of the direct evidential constructions

Here I propose an analysis of the Korean experiencer predicates and four inflectional lexical rules that systematically generate evidential experiencer predicates which can be used in declaratives or interrogatives.

In the following type hierarchy, the type of experiencer predicate (i.e. *exp-prd*) is claimed to have two subtypes (i.e. *private* and *non-private*):

(21) Local type hierarchy of experiencer predicate:



Then relevant constraints are declared on the types in the hierarchy, as repre-

sented in (22).

(22) a. Constraints on *exp-prd*:

$$\begin{bmatrix} exp\text{-}prd \\ \text{SUBJ} < \text{NP}[nom] > \end{bmatrix}$$

b. Constraints on *private*:[11]

$$\begin{bmatrix} private \\ \text{SUBJ} < \text{NP}_{\boxed{1}} > \\ \\ \text{CONT} \begin{bmatrix} \text{RELS} < \begin{bmatrix} \text{LBL h1} \\ \text{ARG0 e1} \\ \text{ARG1 } \boxed{1} \end{bmatrix} > \end{bmatrix} \end{bmatrix}$$

c. Constraints on *non-private*:

$$\begin{bmatrix} non\text{-}private \\ \text{SUBJ} < \text{NP} > \\ \text{COMPS} < \text{NP}_{\boxed{1}}[nom] > \\ \\ \text{CONT} \begin{bmatrix} \text{RELS} < \begin{bmatrix} \text{LBL h1} \\ \text{ARG0 e1} \\ \text{ARG1 } \boxed{1} \end{bmatrix} > \end{bmatrix} \end{bmatrix}$$

Due to (22a), all the experiencer predicates have a subject. In (22b), the subject of a private predicate is co-indexed with the ARG1 of its semantic relation. In (22c), however, the complement nominative NP (i.e. the stimulus which has the property denoted by the predicate) is co-indexed with the ARG1 of the semantic relation.

The following lexemes have phonological and relational specifications in their feature structures:

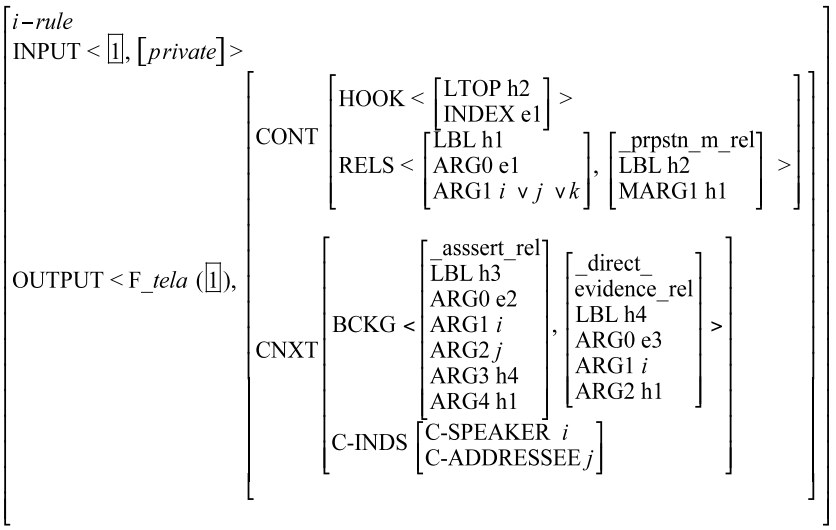
(23) a. constraints on *aphu-* 'sick': b. constraints on *pwutulep-* 'soft':

$$\begin{bmatrix} \text{PHON} < aphu\text{–} > \\ \text{CONT} \begin{bmatrix} \text{RELS} < \begin{bmatrix} \text{\_sick\_rel} \end{bmatrix} > \end{bmatrix} \end{bmatrix} \qquad \begin{bmatrix} \text{PHON} < pwutulep\text{–} > \\ \text{CONT} \begin{bmatrix} \text{RELS} < \begin{bmatrix} \text{\_soft\_rel} \end{bmatrix} > \end{bmatrix} \end{bmatrix}$$

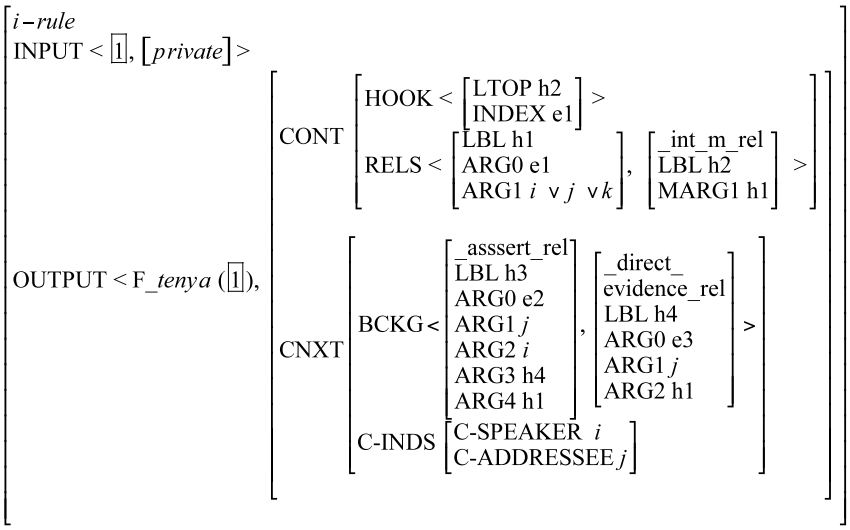
The following two inflectional lexical rules are posited to generate private evidential declarative words and private evidential interrogative words (i.e. from the private predicate lexemes to the words). Since no dependent morpheme is inserted in between the direct evidential *-te* and the declarative marker (*-la*) or interrogative marker (*-nya*), the inflectional lexical rules combine a private predicate lexeme with the combination, *-tela* or *-tenya*:

[11] Exact paths are omitted for the sake of concise representations of feature structures.

(24) a. Private Evidential Declarative Lexical Rule:



b. Private Evidential Interrogative Lexical Rule:

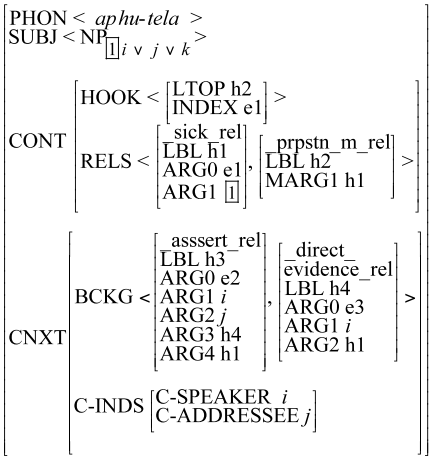


In BCKG (Background) of CNXT (Context) of the output, [_assert_rel] and [_direct_evidnece_rel] are included. In the declarative rule, [_prpstn_m_rel_] is added to the RELS, and C(ontext)-SPEAKER (indexed with *i*) is co-indexed with the asserter, but in the interrogative rule, [_int_m_rel_] is added to the RELS, and C-ADDRESSEE (indexed with *j*) is co-indexed with the asserter. Since direct evidence is obtained by observations (e.g. seeing, hearing, touching), the [_direct_evidence_rel] is interpreted as an event (marked

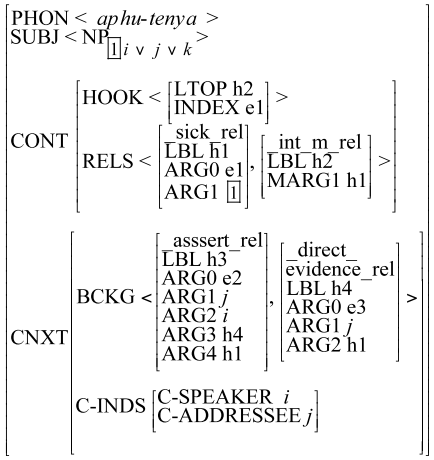
with e3) whose agent is co-indexed with the asserter.

Now the following words can be licensed from the private predicate lexemes through the lexical rules:

(25) a. *aphu-tela*:



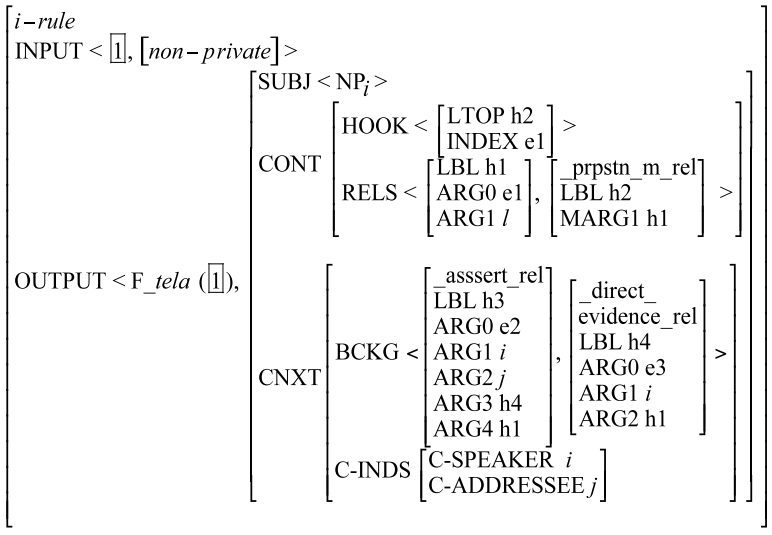
b. *aphu-tenya*:



In (25), subject NP whose index is marked with 1 can be interpreted as the speaker or the addressee or someone else.

As for non-private evidential predicates, the asserter must be the experiencer (i.e. subject). This is reflected in the following two inflectional lexical rules for declaratives and interrogatives:

(26) a. Non-Private Evidential Declarative Lexical Rule:



b. Non-Private Evidential Interrogative Lexical Rule:

$$\begin{bmatrix} i\text{-}rule \\ \text{INPUT} < \boxed{1}, [non\text{-}private] > \\ \text{OUTPUT} < \text{F}\_tenya\ (\boxed{1}), \begin{bmatrix} \text{SUBJ} < \text{NP}_j > \\ \text{CONT} \begin{bmatrix} \text{HOOK} < \begin{bmatrix} \text{LTOP h2} \\ \text{INDEX e1} \end{bmatrix} > \\ \text{RELS} < \begin{bmatrix} \text{LBL h1} \\ \text{ARG0 e1} \\ \text{ARG1 } l \end{bmatrix}, \begin{bmatrix} \text{\_int\_m\_rel} \\ \text{LBL h2} \\ \text{MARG1 h1} \end{bmatrix} > \end{bmatrix} \\ \text{CNXT} \begin{bmatrix} \text{BCKG} < \begin{bmatrix} \text{\_asssert\_rel} \\ \text{LBL h3} \\ \text{ARG0 e2} \\ \text{ARG1 } j \\ \text{ARG2 } i \\ \text{ARG3 h4} \\ \text{ARG4 h1} \end{bmatrix}, \begin{bmatrix} \text{\_direct\_} \\ \text{evidence\_rel} \\ \text{LBL h4} \\ \text{ARG0 e3} \\ \text{ARG1 } j \\ \text{ARG2 h1} \end{bmatrix} > \\ \text{C-INDS} \begin{bmatrix} \text{C-SPEAKER } i \\ \text{C-ADDRESSEE } j \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Equipped with the inflectional lexical rules in (26) and the non-private predicate lexemes, the following evidential words can be licensed:

(27) a. *pwutulep-tela*:

$$\begin{bmatrix} \text{PHON} < pwutulep\text{-}tela > \\ \text{SUBJ} < \text{NP}_i > \\ \text{COMPS} < \text{NP}_l [nom] > \\ \text{CONT} \begin{bmatrix} \text{HOOK} < \begin{bmatrix} \text{LTOP h2} \\ \text{INDEX e1} \end{bmatrix} > \\ \text{RELS} < \begin{bmatrix} \text{\_soft\_rel} \\ \text{LBL h1} \\ \text{ARG0 e1} \\ \text{ARG1 } l \end{bmatrix}, \begin{bmatrix} \text{\_prpstn\_m\_rel} \\ \text{LBL h2} \\ \text{MARG1 h1} \end{bmatrix} > \end{bmatrix} \\ \text{CNXT} \begin{bmatrix} \text{BCKG} < \begin{bmatrix} \text{\_asssert\_rel} \\ \text{LBL h3} \\ \text{ARG0 e2} \\ \text{ARG1 } i \\ \text{ARG2 } j \\ \text{ARG3 h4} \\ \text{ARG4 h1} \end{bmatrix}, \begin{bmatrix} \text{\_direct\_} \\ \text{evidence\_rel} \\ \text{LBL h4} \\ \text{ARG0 e3} \\ \text{ARG1 } i \\ \text{ARG2 h1} \end{bmatrix} > \\ \text{C-INDS} \begin{bmatrix} \text{C-SPEAKER } i \\ \text{C-ADDRESSEE } j \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

b. *pwutulep-tenya*:

$$\begin{bmatrix} \text{PHON} < pwutulep\text{-}tenya > \\ \text{SUBJ} < \text{NP}_j > \\ \text{COMPS} < \text{NP}_l [nom] > \\ \text{CONT} \begin{bmatrix} \text{HOOK} < \begin{bmatrix} \text{LTOP h2} \\ \text{INDEX e1} \end{bmatrix} > \\ \text{RELS} < \begin{bmatrix} \text{\_soft\_rel} \\ \text{LBL h1} \\ \text{ARG0 e1} \\ \text{ARG1 } l \end{bmatrix}, \begin{bmatrix} \text{\_int\_m\_rel} \\ \text{LBL h2} \\ \text{MARG1 h1} \end{bmatrix} > \end{bmatrix} \\ \text{CNXT} \begin{bmatrix} \text{BCKG} < \begin{bmatrix} \text{\_asssert\_rel} \\ \text{LBL h3} \\ \text{ARG0 e2} \\ \text{ARG1 } j \\ \text{ARG2 } i \\ \text{ARG3 h4} \\ \text{ARG4 h1} \end{bmatrix}, \begin{bmatrix} \text{\_direct\_} \\ \text{evidence\_rel} \\ \text{LBL h4} \\ \text{ARG0 e3} \\ \text{ARG1 } j \\ \text{ARG2 h1} \end{bmatrix} > \\ \text{C-INDS} \begin{bmatrix} \text{C-SPEAKER } i \\ \text{C-ADDRESSEE } j \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The experiencer evidential words in (25) and (27) can combine with their complement and subject by the Head-Complement Rule and Head-Subject Rule, respectively (see the phrase structure rules in Sag *et al*., 2003; Kim, 2004).

10 Conclusion

In Korean direct evidential construction with a non-private predicate (e.g. *pwutulep*- 'soft'), the asserter/epistemic authority (i.e. the speaker *na* 'I' in declarative or the addressee *ne* 'you' in question) must be the experiencer (i.e. subject) of the predicate. This construction is an instance of grammatically-encoded self-ascription. There is, however, no such constraint in direct evidential construction with a private predicate (e.g. *aphu*- 'sick'). Although this construction is not specified for self-ascription, it favors self-ascription due to some pragmatic factors. An analysis of the experiencer predicates and the associated inflectional lexical rules are suggested in the HPSG framework.

The next question that can be pursed is whether the semantic, pragmatic and syntactic interactions between direct evidentiality, *person* and experiencer predicates can be applied to other languages (e.g. Japanese).

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A unified approach to VP-ellipsis and VP-anaphora

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Abstract

It is known that VP-ellipsis and VP-anaphora are typologically different phenomena. English has VP-ellipses whereas Korean has VP-anaphora. The goals of this paper are (i) to develop a unified algorithm which can analyze these two different phenomena and (ii) to explain them using the developed resolution algorithm. In order to analyze these phenomena, this paper incorporates Jäger (2010)'s anaphora resolution mechanism into the typed feature structure formalism of Head-driven Phrase Structure Grammar (HPSG). In this paper, VP-ellipsis and VP-anaphora are analyzed as follows. First, English *do* and Korean *kuleha-ta* are introduced with the Geach value, and this value is changed with a *slash-elimination* rule. Then, one constituent combines with another by ordinary syntactic rules, while the information on the target predicate is percolated up. When a potential source appears, a *slash-introduction* rule is applied. Then, the source predicate activates the *VP-resolution* rule, and the target predicate is connected with the source in the semantic representations.

1 Introduction

Ellipsis is one of the interesting topics in syntax and semantics, since syntactically elided parts have to be recovered in the semantic interpretation. It is also an interesting area in computational linguistics where the syntax and semantics of words and sentences are computationally implemented.

As the sentences in (1) illustrates, English has VP-ellipsis phenomena.

(1) a. John came, and Mary [$_{VP}$ came], too.
b. John came, and Mary did [$_{VP}$ ~~come~~], too.

The VP parts of two conjuncts are identical in (1a), and the VP of the second conjunct is elided in (1b) while the dummy auxiliary *do* takes the past tense in the second conjunct.

Whereas English has VP-ellipsis, Korean has VP-anaphora phenomena. Let's see the example sentences in (2).

(2) a. Chelsoo-ka o-ass-ko, Younghee-to [$_{VP}$o]-ass-ta.
Chelsoo.NOM come.PAST.and Younghee.too come.PAST.DECL
'Chelsoo came, and Younghee came, too.'
b. * Chelsoo-ka o-ass-ko, Younghee-to [$_{VP}$~~o~~]-ass-ta.
Chelsoo.NOM come.PAST.and Younghee.too come.PAST.DECL
'Chelsoo came, and Younghee came, too.'
c. * Chelsoo-ka o-ass-ko, Younghee-to [$_{VP}$~~ha~~]-yss-ta.
Chelsoo.NOM come.PAST.and Younghee.too come.PAST.DECL
'Chelsoo came, and Younghee came, too.'

d. Chelsoo-ka o-ass-ko, Younghee-to [$_{VP}$kuleha]-yss-ta.
Chelsoo.NOM come.PAST.and Younghee.too come.PAST.DECL
'Chelsoo came, and Younghee came, too.'

Since the VP parts of two conjuncts in (2a) are identical, the VP of the second conjunct is elided in (2b) but it results in an ungrammatical sentence. In (2c), we have a *ha*-support, which is similar to *do*-support in the English sentence in (1b), to take a past tense morpheme *-ess*. However, the *ha*-support does not save the sentence. On the other hand, in (2d), the pro-form *kuleha-ta* is inserted into the elided VP position, and it makes the sentence grammatical. In this sentence, the pro-form *kuleha-ta* refers to the verb *o-ass-ta* 'come' in the first conjunct. The example sentences in (1) and (2) demonstrate that English has VP-ellipsis phenomena but that Korean has VP-anaphora.

The goals of this paper are (i) to develop a unified algorithm which can analyze these two different phenomena and (ii) to explain them using the developed algorithm.[1] In order to analyze both VP-ellipsis and VP-anaphora phenomena in HPSG (Pollard and Sag, 1994; Sag et al., 2003; Kim and Sells, 2008), this paper adopts basic ideas from Categorial Grammar (CG) and provides resolution algorithms for these two different phenomena.

This paper follows the tradition of previous studies and calls the site for VP-ellipsis and VP-anaphora the *target* and the elided VP or the antecedent VP the *source*. Though there are many interesting syntactic phenomena related to VP-ellipsis or VP-anaphora such as quantifiers, scope, strict/sloppy reading, and so on, this paper only focuses on how to search for the source predicate from the target site.

2 Previous Approaches to VP-Ellipsis and VP-Anaphora

2.1 VP-Ellipsis in HPSG

In the traditional HPSG framework, ellipsis has been analyzed with one of the NICE properties where NICE refers to negation, insertion, contraction, and ellipsis. For example, the following pair of sentences contains an ellipsis. (Sag et al., 2003, p. 419)

(3) a. Would there be any point in asking for seconds?
b. Yes, there would.

Here, the second sentence (3b) contains an ellipsis, and the elided VP is *be any point in asking for seconds*.

In order to handle this kind of ellipsis phenomena, Sag et al. (2003, p. 419) proposed the following *d-rule* in their accounts.

[1]This paper is not the first trial to provide a unified analysis of two typologically different phenomena, VP-ellipsis and VP-anaphora. Several previous studies including Hardt (1993) proposed the possibility that VP-ellipsis and VP-anaphora can be analyzed with similar (resolution) algorithms.

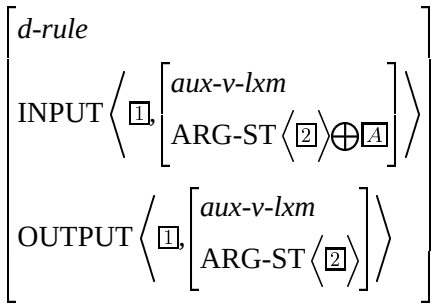

Figure 1: *d-rule* for Ellipsis

Through this *d-rule*, the input Attribute-Value Matrix (AVM) is mapped onto the output AVM. As you can observe in this *d-rule*, the argument structure of the auxiliary lexeme *aux-v-lxm* is changed through the rule and the complement of the auxiliary is deleted in the output AVM.

If we explain the sentence (3b) using this *d-rule*, it will be as follows. First, the input feature structure of the auxiliary *will* will be as in Figure 2. (Sag et al., 2003, p. 419)

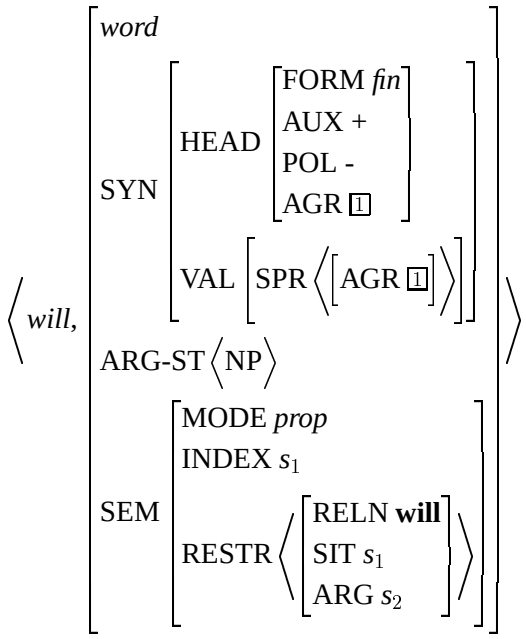

Figure 2: The Auxiliary *will* before *d-rule*

If the auxiliary *will* goes through the *d-rule* in Figure 1, the AVM of Figure 2 is changed into that of Figure 3.

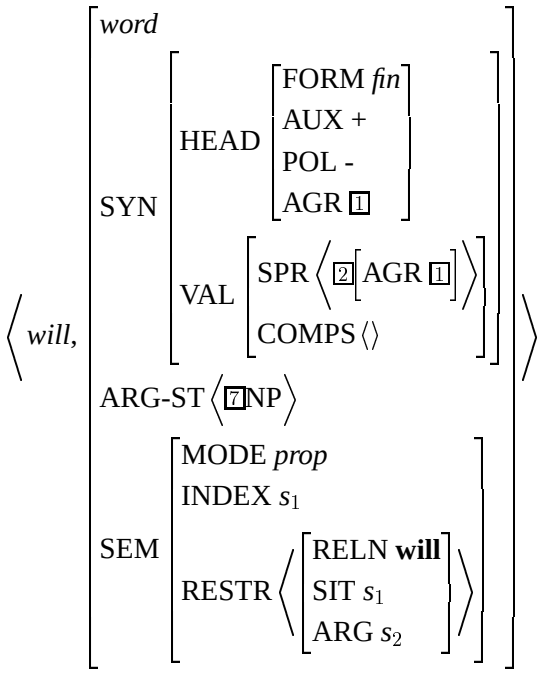

Figure 3: The Auxiliary *will* after *d-rule*

As you can see in the AVM in Fogure 3, the COMP value becomes NULL after applying the *d-rule*. This implies that the auxiliary *will* takes no complement. This means that the VP part is elided in the sentence (3b).

Even though this kind of analysis can explain how the sentence (3b) can be formed, it does not provide an account for which VP is elided after the auxiliary *will* and how the elided part can be recovered from the sentence. As mentioned in the Section 1, since the goal of this paper is to provide a resolution algorithm for VP-ellipsis and VP-anaphora, a more technical algorithm will be developed to account for which VP is elided after the auxiliary *will* and how the elided part can be recovered from the sentence.[2]

2.2 VP-Ellipsis and VP-Anaphora in CG

Through a series of papers (Jacobson, 1996, 1999, 2000, 2001), Pauline Jacobson has developed an alternative categorial approach to pronominal anaphora resolution and applied it to a wide range of empirical phenomena. She introduced a third slash connective that is responsible for anaphoric dependencies, and she used the

[2]I don't deny that VP-ellipsis and VP-anaphora demonstrate different syntactic distributions. As pointed out by many previous studies including Hankamer and Sag (1976) and Sag and Hankamer (1984), the syntactic behaviors of VP-ellipsis are different from those of VP-anaphora. I don't deny the facts. What I want to mention in this paper is that these two different phenomena can be handled with similar resolution algorithms even though they show different syntactic behaviors.

notation A^B for signs of category *A* that needs an antecedent of category *B*. On the other hand, Jäger (2010) used other notation *A*|*B* to stress the similarity with the other slashes. In their analyses of anaphora, a pronominal *himself* has a category *NP*|*NP*, and it translates into $\lambda x.x$.

Based on the category and meaning of *himself*, Jacobson analyzed the sentence *John likes himself* as in Figure 4.

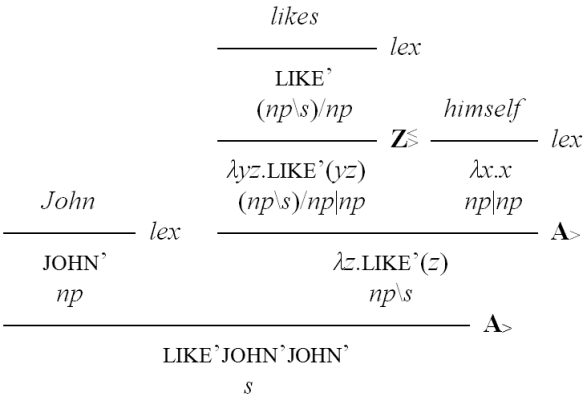

Figure 4: Jacobson's Analysis of the Sentence *John likes himself*

A Geach rule **Z** is applied to the verb *likes*. Its syntactic category is changed from (*np**s*)/*np* to (*np**s*)/*np*|*np*, and its semantic interpretation is changed from LIKE' to λyz.LIKE'(*yz*).[3] Then, the verb *likes* combines with the NP *himself* by $\mathbf{A}_{>}$. Then, the VP *likes himself* combines with the NP *John* by $\mathbf{A}_{<}$.[4] As the final semantic interpretation demonstrates, Jacobson's analysis also succeeded in capturing the meaning of reflexive *himself*.

Jäger (2010) developed a Lambek Calculus with Limited Contraction (LLC) in his book, where a limited version of the Contraction is complied into the logical rules of a logical connective. In his analyses of anaphora, a pronominal *himself* has a category *NP*|*NP*, and it translates into $\lambda x.x$. Based on the category and meaning of *himself*, she analyzed the sentence *John likes himself* as in Figure 5.

[3]Jacobson (2008, p. 49) mentioned that **Z** is a operation which takes a type <a,<e,b>> and maps it into a type <<e,a>,<e,b>> such that $\mathbf{Z}(\alpha)=\lambda f[\lambda x[\alpha(f(x))(x)]]$.

[4]Here, $\mathbf{A}_{>}$ refers to a *forward functional application* $\mathbf{A}_{<}$ to a *backward functional application*.

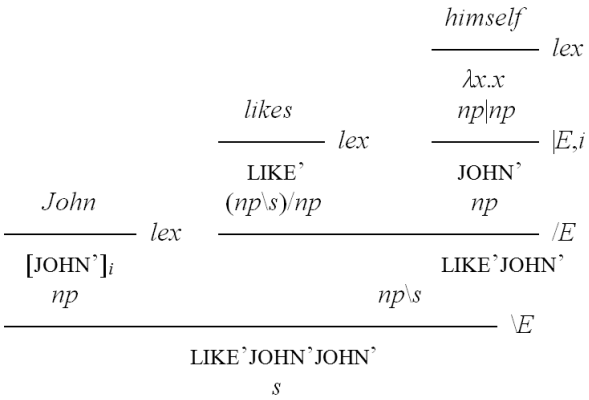

Figure 5: Jäger's Analysis of the Sentence *John likes himself*

For the word *himself*, the |-elimination rule is applied. Its syntactic category is changed from *np*|*np* to *np*, and its semantic interpretation is changed from $\lambda x.x$ to JOHN'. Then, the /E is applied when the verb *likes* combines with the NP *himself*, and the \E is applied when the NP *John* combines with the VP *likes himself*.[5] As we may observe in the final semantic interpretation, Jäger's analysis also correctly captured the meaning of reflexive *himself*.

Then, the dummy auxiliary *do* in English and the pro-form *kuleha-ta* in Korean may have a category $(S\backslash NP)|(S\backslash NP)$ whose translation is $\lambda P.P$. As for category combinatorics for the anaphora, Jacobson adopted Geach rules while Jäger (2010) used |-elimination and |-introduction rules in the analyses. Based on the category and meaning of the auxiliary *did*, she analyzed the sentence *John walked and Bill did* as in Figure 6. (Jäger, 2010, p. 187)

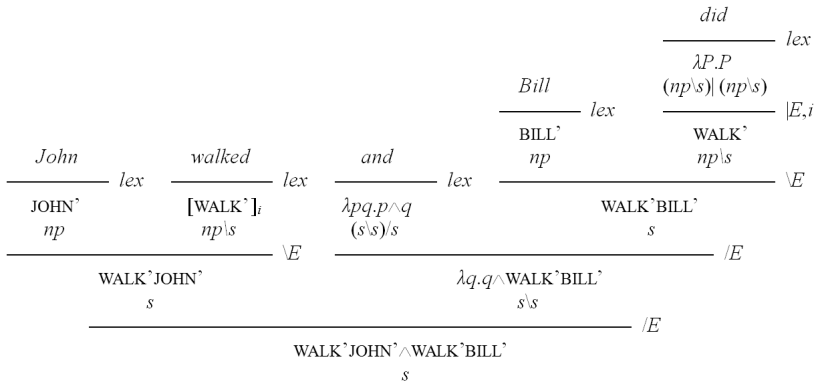

Figure 6: Jäger's Analysis of the Sentence *John walked and Bill did*

[5]Here, /E corresponds to a *forward functional application* and \E to a *backward functional application* respectively in the CG literature.

For the word *did*, the |-elimination rule is applied. Its syntactic category is changed from $(np\backslash s)|(np\backslash s)$ to $np\backslash s$, and its semantic interpretation is changed from $\lambda P.P$ to WALK'. Then, the $\backslash$E is applied when the NP *Bill* combines with the verb *did*, and the /E is applied when a conjunction and combines with the S *Bill did*. Likewise, the $\backslash$E is applied when the NP *John* combines with the verb *walked*. Finally, the /E is applied when the first conjunct *John walked* combines with the second one *Bill did*. As the final semantic interpretation demonstrates, Jäger's analysis correctly recovers the elided part of VP-ellipsis in English.

3 VP-Ellipsis and VP-Anaphora Resolution in HPSG

3.1 Basic Ideas

For the purpose of analyzing both VP-ellipsis and VP-anaphora phenomena in HPSG, this paper incorporates Jäger's anaphora resolution algorithms. In this paper, English VP-ellipsis and Korean VP-anaphora are analyzed as follows. First, the English auxiliary *do* and the Korean pro-form *kuleha-ta* are introduced with the Geach value, and this value is changed with a *slash-elimination* rule. Then, one constituent combines with another by ordinary syntactic rules in HPSG, while the information on the target predicate is percolated up. When the target predicate meets a potential source predicate, a *slash-introduction* rule is applied and the Geach value was changed again. Then the potential source predicate activates the *VP-resolution* rule, and the target predicate is connected with the source in the semantic representations.[6]

3.2 Type Hierarchy and AVM

In order to provide a unified analysis to VP-ellipsis and VP-anaphora phenomena, this paper incorporates Jäger's ideas into the typed feature structure formalism of HPSG and modifies type hierarchy and feature structures as follows.

In the Lexicon, a new type *ellip-ana-aux-v-lxm* is introduced into the type hierarchy as in Figure 7, and English *do* and Korean *kuleha-ta* are instances of *ellip-aux-v-lxm* and *ana-aux-v-lxm* respectively. The AVM for the type *ellip-ana-aux-v-lxm* is shown in Figure 8.

Four attributes/features are introduced into the typed feature formalism: GEACH, ELLIP/ANTE, ASTORE, and PRED-ST. The first one encodes whether a Geach rule is applied or not. If a Geach rule is applied, its value becomes +. If the VP-ellipsis/VP-anaphora resolution algorithms are activated, its value becomes -. For the second attribute, if the given auxiliary is an instantiation of *ellip-aux-v-lxm*, the auxiliary has ELLIP and it refers to the label of the elided VP. If the given auxiliary is an instantiation of *ana-aux-v-lxm*, the auxiliary has ANTE instead and it refers to the label of the antecedent VP. The third attribute PRED-ST contains the

[6]This paper assumes that Minimal Recursion Semantics (Copestake et al., 2005) is used in the semantic interpretation.

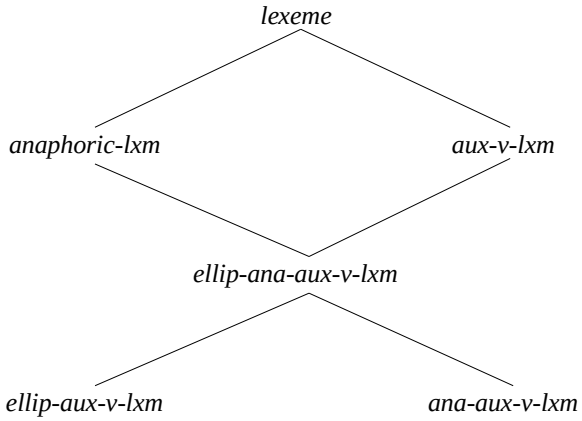

Figure 7: Hierarchy for the Type *ellip-ana-aux-v-lxm*

$$
\begin{bmatrix}
\textit{ellip-ana-aux-v-lxm} \\
\text{STEM } \textit{*dlist*} \\
\text{SYN} \begin{bmatrix} \textit{syn} \\ \text{CAT} \left[\text{HEAD } \textit{verb}\right] \\ \text{GEACH } \textit{boolean} \end{bmatrix} \\
\text{SEM} \begin{bmatrix} \text{HOOK} \begin{bmatrix} \text{LTOP } \textit{handle} \\ \text{INDEX } \boxed{1}\ \textit{index} \\ \text{XARG } \textit{handle} \end{bmatrix} \\ \text{KEY } \boxed{2} \\ \text{RELS} \left\langle \boxed{2} \begin{bmatrix} \textit{relation} \\ \text{PRED } \textit{string} \\ \text{ARG0 } \boxed{1} \\ \text{ARG1 } \textit{index} \\ \text{ELLIP/ANTE } \textit{handle} \end{bmatrix} \right\rangle \\ \text{HCONS } \langle\rangle \end{bmatrix} \\
\text{ASTORE } \left[\text{VP-ANA } \textit{*list*}\right] \\
\text{PRED-ST } \textit{*list*} \\
\text{DTRS } \textit{*list*}
\end{bmatrix}
$$

Figure 8: AVM for the Type *ellip-ana-aux-v-lxm*

predicates of the sentences. The fourth attribute ASTORE (anaphoric expression store) contains the HCONS values in A-HCONS (anaphoric expression HCONS), that encode which source predicate refers to which target predicate.

3.3 Slash Rules

Three types of slash rules are introduced into the type hierarchy to analyze VP-ellipsis and VP-anaphora phenomena in HPSG. They are *slash-elimination* rule (|E), *slash introduction* rule (|I), and *VP-resolution* rule (VP-Resol). These rules are organized in the type hierarchy as follows.[7]

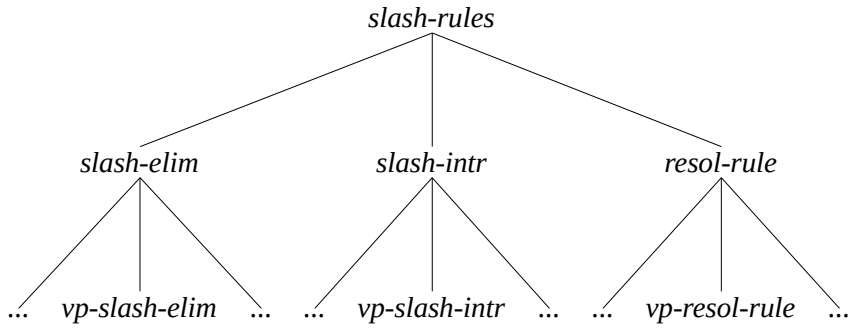

Figure 9: Type Hierarchy for Slash Rule

A *slash-elimination* rule changes the value of GEACH from - to +. Along with this change, a hook for the target predicate has to be stored in other parts of the AVM. A *slash-introduction* rule is triggered when the target predicate meets a potential source predicate, and this rule changes the value of GEACH from + to -. A *VP-resolution* rule finds out the source predicate and connects the target predicate with its source predicate.

4 An Analysis of VP-Ellipsis in English

Based on the AVM of the type *ellip-aux-v-lxm* in Figure 8 and the slashes rules in Figure 9, the overall analysis processes of English VP-ellipsis are as follows. Here, the important operations are marked with Step A, Step B, and Step C.

In the Step A, the English *do* introduced into syntax with the feature [GEACH -].[8] Then, when there is an *ellip-aux-v-lxm* with [GEACH -], a *slash-elimination* rule (|E) is applied and the feature structure of *do* are changed as shown in Figure 11.

[7] Jacobson (2008) also proposed similar unary rules, though her formalism is different from mine.

[8] Although VP-ellipsis and VP-anaphora are two different phenomena, the function of an auxiliary *do* in the English VP-ellipsis seems to be similar to that of the pro-form *kuleha-ta* in Korean. Jacobson (2008, p. 57) also mentioned similar idea. She said that, in the analysis of VP-ellipsis, *note that we are not positing a silent proform in the ellipsis site; the auxiliary itself is the 'proform'*.

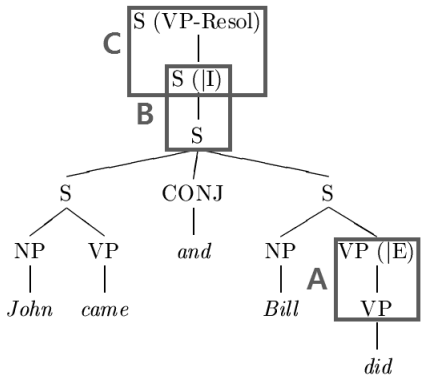

Figure 10: An Example Analysis of VP-Ellipsis

After the *slash-elimination* is applied, the GEACH value is changed from - to +, and HCONS includes a new *qeq* whose HARG value is equal to the ELLIP value of English *do*. Here, LARG will refer to the handle of the source predicate in the final step of the algorithm. This HCONS value is stored in A-HCONS of VP-ANA.

Then, the top part of feature structure in Figure 11 is percolated up until PRED-ST contains a potential source predicate. In the English sentence (1), when the first conjunct *John came* combines with *Mary did*, since PRED-ST contains a potential predicate (*came*), a *slash-introduction* (|I) is applied in Step B and the AVM of Figure 11 is changed into that of Figure 12 (Step B).

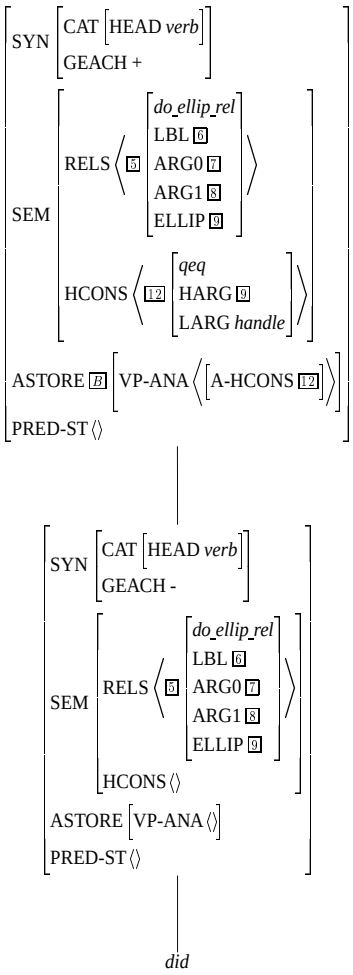

Figure 11: Applying a *slash-elimination* Rule

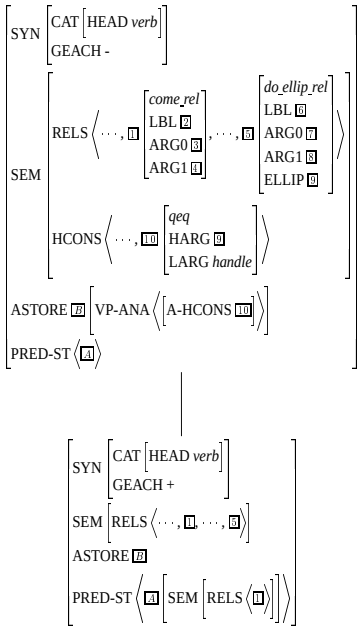

Figure 12: Applying a *slash-introduction* Rule

This rule changes the value of GEACH from + to -, which implies that there is a potential source predicate for the VP-ellipsis phenomena. This potential source predicate will activate the *VP-resolution* rule.

In Step C, the *VP-resolution* rule (VP-Resol) is applied when (i) the value of GEACH is - and (ii) VP-ANA is not empty. Then, the AVM of Figure 12 is changed into that of Figure 13.

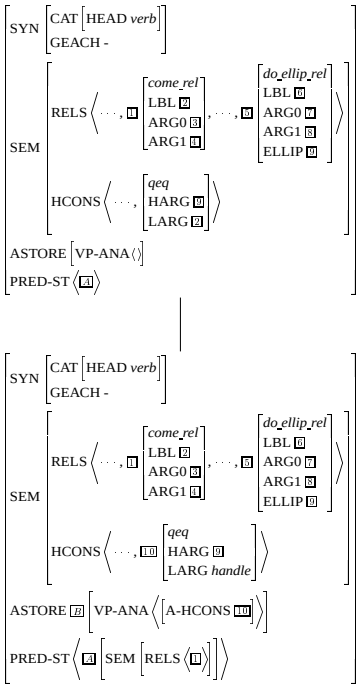

Figure 13: Applying a *VP-resolution* Rule

Since the PRED-ST value has the AVM of the verb *came* in the first conjunct, it also contains the RELS value of *came* in the MRS. Then, the *VP-resolution* rule searches for the LBL value of the source predicate *came* and it connects the value to the LARG value of A-HCONS (in VP-ANA). Then, after the LARG of A-HCONS gets its value, VP-ANA becomes empty. This implies that the handle of the ELLIP value of *do_ellip_rel* is identical to the LBL value of *come_rel*, which in turn means that the head of the elided VP is *come*.[9]

5 An Analysis of VP-Anaphora in Korean

On the other hand, the VP-anaphora in Korean can be analyzed as follows, based on the AVM of the type *ana-aux-v-lxm* in Figure 8 and slashes rules in Figure 9.

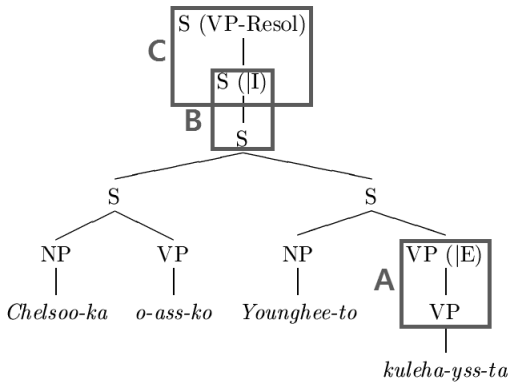

Figure 14: An Example Analysis of VP-Anaphora

As in English example, the important operations are marked with Step A, Step B, and Step C.

In the Step A, the Korean pro-form *kuleha-ta* introduced into syntax with the feature [GEACH -]. Then, since there is an *ana-aux-v-lxm* with [GEACH -], a *slash-elimination* rule (|E) is applied and the AVM of *kuleha-ta* is changed as shown in Figure 15.

[9]The VP-ellipsis resolution algorithm developed in this paper may be applied to the analysis of Antecedent Contained Deletion (ACD) constructions, though some problems such as Kennedy's puzzle Kennedy (1994) has to be solved.

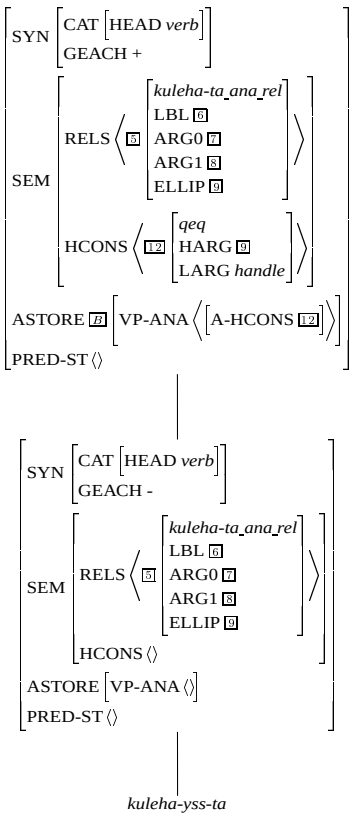

Figure 15: Applying a *slash-elimination* Rule

After the *slash-elimination* is applied, the GEACH value is changed from - to +, and HCONS includes a new *qeq* whose HARG value is equal to the ANTE value of the Korean pro-form *kuleha-ta*. Here, LARG will refer to the handle of source predicate in the final step of the algorithm. This HCONS value is stored in A-HCONS of VP-ANA.

Then, the top part of feature structure in Figure 15 is percolated up until PRED-ST contains a potential source. In the sentence (2), when the first conjunct *Chelsoo-ka o-ass-ko* combines with *Younghee-to kuleha-yss-ta*, since PRED-ST contains a potential predicate (*o-ass-ko*), a *slash-introduction* is applied and the AVM of Figure 15 is changed into that of Figure 16 (Step B).

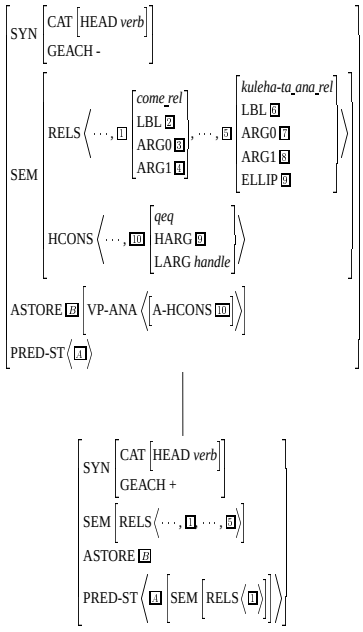

Figure 16: Applying a *slash-introduction* Rule

This rule changes the value of GEACH from + to -, which implies that there is a potential source predicate for the VP-anaphora phenomena. This potential source predicate will activate the *VP-resolution* rule.

In Step C, as in the analysis of English VP-ellipsis, the *VP-resolution* rule (VP-Resol) is applied when (i) the value of GEACH is - and (ii) VP-ANA is not empty. Then, the AVM of Figure 16 is changed into that of Figure 17.

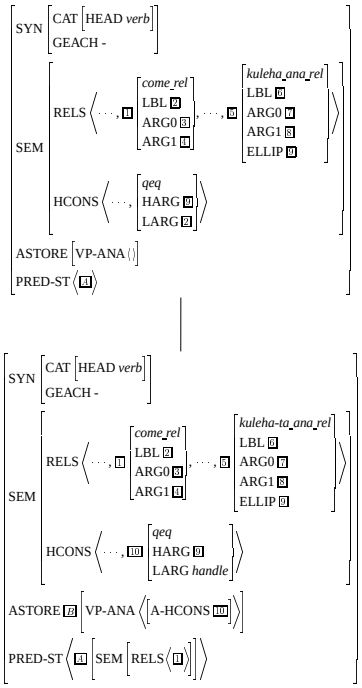

Figure 17: Applying a *VP-resolution* Rule

Since the PRED-ST value includes the AVM of the verb *o-ass-ko* of the first conjunct, it also contains the RELS value of *come_rel* in the semantic interpretation. Then, the *VP-resolution* rule searches for the LBL value of source predicate *come_rel* and it connects the value to the LARG value of A-HCONS (in VP-ANA). Then, after LARG of A-HCONS gets its value, VP-ANA becomes empty. This implies that the handle of the ANTE value of *kuleha-ta_ana_rel* is identical to the LBL value of *come_rel*, which in turn means that *kuleha-yss-ta* refers to *o-ass-ko*.

6 Conclusion

In this paper, a unified resolution algorithm was developed which can account for both VP-ellipsis and VP-anaphora in HPSG. In order to analyze these two phenomena, this paper incorporated Jäger's anaphora resolution mechanism into the typed feature structure formalism of HPSG, and these two typologically phenomena were explained using the unified resolution algorithm.

In this paper, English VP-ellipsis and Korean VP-anaphora were analyzed as follows. First, the English auxiliary *do* and the Korean pro-form *kuleha-ta* were introduced with the Geach value, and this value was changed with a *slash-elimination* rule. Then, one constituent combined with another by ordinary syntactic rules in HPSG, while the information on the target predicate was percolated up. When the target predicate met a potential source predicate, a *slash-introduction* rule is applied and the Geach value was changed again. Then, the source predicate activates the *VP-resolution* rule, and the target predicate is connected with the source in the semantic representation.

Through the analysis, we observed that both VP-ellipsis and VP-anaphora could be analyzed with a unified resolution algorithm. This was possible by incorporating the type *ellip-ana-aux-v-lxm* and three kinds of slash rules in the type hierarchy.

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On the semantics of the Japanese infinitive/gerund-clause constructions: Polysemy and temporal constraints

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Chungnam National University Daejeon

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Abstract

The Japanese infinitive-clause construction (InfCx) and gerund-clause construction (GerCx) may convey a wide range of interclausal semantic relations, including 'temporal sequence', 'cause', and 'manner', largely due to pragmatic enrichment. This work addresses the question of what the core meaning(s) of the two constructions is (are), and demonstrates (i) that the InfCx and GerCx indicate either that the first-clause eventuality precedes or temporally subsumes the second-clause eventuality or that the two clauses stand in the rhetorical relation of *contrast*, and (ii) that the GerCx has a distinct sense that the InfCx lacks, which gives rise to the 'resulting state' interpretation.

1 Introduction

This paper examines the semantic properties of the Japanese infinitive/gerund-clause constructions (considered as coordination constructions by some), which are the most basic means of clause-linking in the language. Comparable to the English *and*-coordination construction (e.g., *John pressed the button and the engine started*) and free adjunct/absolute constructions (e.g., *John started the engine pressing the button*; *The nurses having arrived, the doctor started the surgery*), the Japanese infinitive-clause construction (InfCx) and gerund-clause construction (GerCx) may convey a wide range of interclausal semantic relations, including 'temporal sequence', 'cause', and 'manner', largely due to pragmatic enrichment.

This work addresses the question of what the core meaning(s) of the two constructions is (are), and demonstrates (i) that, contra authors such as Lee and Tonhauser (2010), the InfCx and GerCx pose a semantic constraint on the temporal order between the two described eventualities, and (ii) that the GerCx has a distinct sense that the InfCx lacks, which gives rise to the 'resulting state' interpretation.

2 Basic facts

2.1 Morphological and syntactic properties of the InfCx/GerCx

The InfCx refers to a kind of complex clause where a clause headed by a predicate in its infinitive form (also called *ren'yookei*) is subordinated to another clause (typically the matrix clause). The GerCx refers to a similar structure where the head of the subordinate clause is a gerund form (also called *te*-form). Gerund forms are formed by attaching the particle *te* to infinitive forms,[1] although they are

[†]I would like to thank Shin-ichiro Sano, Kimi Akita, Tsutomu Ohna, and the audience of HPSG 2012 for valuable comments. All remaining errors are my own.

[1]Some scholars consider *te* as an inflectional affix directly following the stem.

not always realized as the mere concatenation of the infinitive form and *te* due to morphophonological processes. (1) exemplifies the two constructions:[2]

(1) a. **Hiroshi-ga booru-o** {**nage/nagete**}, Akira-ga uketa.
H.-Nom ball-Acc throw.Inf/throw.Ger A.-Nom receive.Pst
'Hiroshi threw the ball and Akira caught it.'
b. **Hiroshi-ga** {**kogi/koide**}, Akira-ga kaji-o kitta.
H.-Nom row.Inf/row.Ger A.-Nom rudder-Acc handle.Pst
'Hiroshi rowed and Akira steered.'

Infinitive and gerund clauses are functionally similar and in many cases interchangeable. They stylistically differ, however, the former being more formal.

All Japanese verbs have infinitive and gerund forms. However, infinitive clauses headed by a verb whose stem is monosyllabic and ends with a vowel, including the imperfective auxiliary *-i*(*ru*), sound awkward, if not completely acceptable; hence the degraded acceptability of (2a):

(2) **Ame-ga** {a. ??**futtei** /b. **futteite** }, kaze-mo tsuyoi.
rain-Nom fall.Ipfv.Inf fall.Ipfv.Ger wind-also be.strong.Prs
'It is raining and the wind is strong too.'

To circumvent this distributional gap, speakers have to use the gerund-form (e.g., *futteite*) or a more formal variety of the imperfective auxiliary, *-or*(*u*) (e.g., *futte-ori*).[3]

Infinitive/gerund clauses are non-finite (untensed), and in this regard the InfCx and GerCx are more similar to English free adjunct/absolute constructions than to *and*-coordination constructions. Some scholars (e.g., Fukushima 1999:297–298; Hirata 2006:72–76; Lee and Tonhauser 2010:308) nevertheless regard the two constructions as coordination structures.[4] One piece of evidence against this view is the possibility of the 'dislocation' out of the second (right) clause; under the coordination analysis, (3a,b) would be wrongly predicted to be ill-formed due to the Coordinate Structure Constraint, a type of the strong island effect.

(3) a. [$_S$ Ensoku-ga chuushi-ni {nari/natte} GAP$_i$
excursion-Nom cancellation-Dat become.Inf/become.Ger
ichiban zannengatta] gakusei$_i$-wa Hiroshi$_i$-da.
most be.disappointed.Pst student-Top H.-Copula.Prs
'The student who was most disappointed when the excursion was canceled is Hiroshi.'

[2]The abbreviations used in glosses are: Acc = accusative, Dat = dative, Ger = gerund, Inf = infinitive, Ipfv = imperfective, Nom = nominative, Pass = passive, Prs = present, Pst = past, Top = topic.

[3]The latter solution, of course, is available only when imperfective verb forms are involved.

[4]From the functional viewpoint, the InfCx/GerCx may correspond better to the English *and*-coordination than the free adjunct/absolute constructions, being the most unmarked means to link two clauses.

cf. *The student$_i$ who [[the excursion was canceled] and [GAP$_i$ was most disappointed]] is Hiroshi$_i$.

b. [S sensoo-ga {owari/owatte} GAP$_i$ kakki-o torimodoshita] machi$_i$
war-Nom end.Inf/end.Ger liveliness-Acc regain.Pst
city
'a city that regained its liveliness after the war ended'
cf. *a city$_i$ that [[the war ended] and [GAP$_i$ regained its liveliness]]

2.2 Semantic properties of the InfCx/GerCx

An infinitive/gerund clause may stand in a wide variety of semantic relations with the main clause. The reference work by Nihongo Kijutsu Bunpoo Kenkyuukai (NKBK; 2008) lists eight such relations: (i) simultaneity, (ii) sequence, (iii) cause, (iv) contrast, (v) accompanying circumstance, (vi) concession, (vii) preliminary remark, and (viii) condition (the last three of them are available only in rather limited configurations).

Note that comparably wide ranges of interpretations are available for similar constructions in other languages. Kortmann (1991:121ff) lists fifteen semantic relations that can be expressed by English free adjunct/absolute constructions. Also, it is well-known that conjunctive coordination structures may conversationally implicate such semantic relations as sequence, cause, and means-end (*conjunction buttressing*; Levinson 2000:117).

(4) Hans pressed the spring and the drawer opened.
+> 'Hans pressed the spring and then the drawer opened.'
+> 'Hans pressed the spring and thereby caused the drawer to open.'
+> 'Hans pressed the spring in order to make the drawer open.'

The most parsimonious account of the diverse interpretations of the InfCX and GerCx would be to assign to them a single simple meaning, say logical conjunction, and let the pragmatics do the rest of the job. Fukushima (1999) and Lee and Tonhauser (2010) take this position. Also, the following quote from NKBK (2008:280; my translation) points to the same idea:

> *Te*-forms [(gerund forms)] and infinitive forms have little semantic content, and their semantic interpretation depends on the states of affairs described in the first and second clauses as well as on the context. Because of this property, *te*-forms and infinitive forms have various uses.

In the following, however, I will point out (i) that the basic meaning shared by the InfCx and GerCx is not the mere logical conjunction but involves a constraint regarding the temporal order between the two described eventualities, and (ii) that the GerCx has a distinct meaning that the InfCx lacks.

3 Temporal constraints

As noted earlier, the first (left, subordinate) clause in an InfCx or GerCx lacks a tense. There has been some discussion in the literature as to how the temporal location of the first-clause eventuality is restricted. In the following, I will argue that, contrary to some previous claims, the InfCx and GerCx semantically entail that the second-clause eventuality (E_2) does *not* precede the first-clause eventuality (E_1).

For some examples (sentences or discourse segments) to be discussed below, I conducted a survey to investigate whether speakers accept or reject them on the intended interpretation. The survey was conducted in 2012 and involved 22 respondents, all of whom were graduate students of Nagoya University; 11 of them had background in linguistics. In the survey, the respondents were asked to evaluate 24 examples, which were presented to them in a randomized order, following (the Japanese version of) the instructions given below:

> Several Japanese passages will be presented. Each passage consists of one or two sentence. Please evaluate each passage, in terms of whether it explains the temporal order of events without contradiction, and choose one of the three options that comes the closest to your evaluation: (1) I feel like there is contradiction, (2) I cannot judge with certainty whether there is contradiction, (3) I feel like there is no contradiction. Evaluations should be based on your own linguistic intuition and be subjective/impressionistic.

The respondents were explicitly asked about temporal consistency (rather than, say, acceptability or naturalness) of the linguistic stimuli, in attempt to reduce the influence of secondary factors (e.g. stylistic awkwardness) on their evaluations.

In the rest of this paper, where applicable, the results of the survey will be reported in the following form: [$<a$, b, $c>$; S], where a, b, and c are respectively numbers of respondents who chose (1): contradictory, (2): uncertain, and (3): not contradictory, and S is the 'acceptability score' calculated by the formula: ($0.5b$ + c) / (a + b + c). Roughly, a higher score indicates a higher acceptability of the intended temporal interpretation. I will assume that an example within the score range of $0 \leq S \leq 0.33$ can be reasonably regarded as unacceptable (marked with '*'), and one within the score range of $0.67 \leq S \leq 1$ can be reasonably regarded as acceptable (no mark), although admittedly this assumption can be challenged. Where no score is provided, the judgment is my own or the cited author's.

3.1 Previous discussion

Fukushima (1999) proposes that the 'missing' tense in the first clause is recovered by the tense of the second clause, through a version of the ellipsis resolution process discussed in Dalrymple et al. (1991). Sentence (5a), for example, is assigned

the logical form (5b) where P is an underspecified functor. Then, (5b) is resolved into (5c).

(5) a. Taro-ga utai odotta.
T.-Nom sing.Inf dance.Pst
'Taro sang and danced.'
b. P(**sing**(**Taro**)) ∧ PAST(**dance**(**Taro**))
c. PAST(**sing**(**Taro**)) ∧ PAST(**dance**(**Taro**))

He also notes that when a temporal adverbial occurs in the first clause as in (6), the functor P is recovered from the adverbial, rather than the tense of the second clause (pp.308–309).

(6) Taro-ga kinoo-wa utai, kyoo-wa odoru.
T.-Nom yesterday-Top sing.Inf today-Top dance.Prs
'Taro sang yesterday and will dance today.'

Lee and Tonhauser (2010) maintain that in the InfCx and GerCx, the temporal order between the two described eventualities is not semantically fixed but is resolved by the joint effects of (i) temporal adverbials (if any occurs), (ii) the contextual information, and (iii) the independently motivated discourse principle that, by default, event descriptions (dynamic predicates) update the reference time (topic time; the interval serving as the temporal setting for the discourse segment) by putting it forward while state descriptions (stative predicates) leave it unaffected (e.g., Dowty 1986). More specifically, they assume that the following TID principle determines the default (defeasible) temporal interpretation of clauses constituting a coherent discourse:

(7) **Temporal interpretation in discourse (TID) principle**:
Sentences S_1, ..., S_n are temporally interpreted in narrative discourse as follows:
a. The reference time of a sentence S_i (for $1 \leq i \leq n$) is either (i) a time consistent with the temporal adverb(s) of S_i or (ii) if no temporal adverb occurs in S_i, the reference time provided by the preceding sentence $S_{i\text{-}1}$.
b. Event descriptions update the reference time to a new reference time shortly after the original reference time; state descriptions do not update the reference time.

To demonstrate that the first-clause eventuality in the InfCx/GerCx may temporally follow the second-clause eventuality, Lee and Tonhauser provide three examples, presented below with some modifications[5] (pp.318–319).

[5]The original version of (8b) is:

(i) Context: How is Chelswu doing in the hospital?

(8) a. Kyoo-wa hareteite, kinoo-wa ame-ga futta.
today-Top clear.up.Ipfv.Ger yesterday-Top rain-Nom fall.Pst
'It is sunny today, and it rained yesterday.'

b. Hiroshi-wa shikkari rihabiri-o shiteite,
H.-Top hard rehabilitation-Acc do.Ipfv.Ger
shujutsu-wa senshuu uketa.
surgical.operation-Top last.week receive.Pst
'Hiroshi is in a tough rehabilitation program and had the operation last week.'

c. Imiron gakkai-ga atte, ima-wa happyoo-no
semantics conference-Nom occur.Ger now-Top presentation-Gen
junbi-o shiteiru.
preparation-Acc do.Ipfv.Prs
'There will be a conference on semantics and I am preparing for my presentation now.'

(8a,b) were included in my survey,[6] and respectively rated as [<7, 5, 10>; 0.57] and [<7, 8, 7>; 0.50]. (8c) was not included, but a similar sentence, (9), was included and received a high score (S = 0.86).

(9) Raishuu shinrigaku-no gakkai-ga atte, ima
next.week psychology-Gen conference-Nom occur.Ger now
happyoo-no junbi-o shiteiru.
presentation-Gen preparation-Acc do.Ipfv.Prs
'There will be a conference on psychology next week, and I am preparing for my presentation now.' [<2, 2, 18>; 0.86]

Also, (10), which is similar to (8a) but consists of two clauses headed by a perfective verb, received a relatively high score (S = 0.77).

(10) Kinoo-wa yuki-ga futte, ototoi-wa
yesterday-Top snow-Nom fall.Ger the.day.before.yesterday-Top
ame-ga futta.
rain-Nom fall.Pst
'It snowed yesterday, and it rained the day before yesterday.'
[<4, 2, 16>; 0.77]

Rihabiri-o shikkari shiteite, shujutsu-wa senshuu uketa.
rehabilitation-Acc hard do.Ipfv.Ger surgical.operation-Top last.week receive.Pst
'He is in a tough rehabilitation program and had the operation last week.'

(8a,c) are the same as the original, except for some differences in glosses.

[6]The stimulus (8b) was accompanied by the note: '"Rihabili" refers to the rehabilitation after the operation'.

3.2 An alternative proposal

As an alternative to these authors' claims, I propose that the InfCx and GerCx require that the first-clause eventuality either precedes or temporally subsumes the second-clause eventuality ($E_1 < E_2$ or $E_1 \supseteq E_2$).[7] This roughly amounts to saying that the two constructions require that the second-clause eventuality do *not* precede the first-clause eventuality. While sentences like (9) and (10) appear to evidence that the order of '$E_1 > E_2$' is possible, it can be shown that they are exceptional cases that call for a separate treatment.

In sentences (11a–b), the temporal interpretation of '$E_1 > E_2$' is impossible. Throughout the paper, the survey results shown under a pair of an InfCx and GerCx, such as (11a) and (11c), are for the GerCx version (the survey did not include InfCx's).

(11) a. *Hiroshi-wa chichioya-ni man'nenhitsu-o purezento-shi(te), sono
H.-Top father-Dat fountain.pen-Acc present.Inf(Ger) that
man'nenhitsu-o Ginza-no depaato-de katta.
fountain.pen-Acc G.-Gen department.store-Loc buy.Pst
(Hiroshi {gave/will give} his father a fountain pen, and he bought it at a department store in Ginza.) [<15, 2, 5>; 0.27]

b. *Hiroshi-wa ima chooshoku-o tabeteite, shichi-ji-ni
H.-Top now breakfast-Acc eat.Ipfv.Ger 7-o'clock-Dat
okita.
wake.up.Pst
(Hiroshi is eating his breakfast now, and woke up at 7 o'clock.) [<13, 4, 5>; 0.32]

c. *Raishuu shinrigaku-no gakkai-ga kaisai-sare(te),
next.week psychology-Gen conference-Nom hold.Pass.Inf(Ger)
ima happyoo-no junbi-o shiteiru.
now presentation-Gen preparation-Acc do.Ipfv.Prs
(A conference on psychology will be held next week, and I am preparing for my presentation now.) [<13, 4, 5>; 0.32]

(cf.) a. Hiroshi-wa man'nenhitsu-o Ginza-no depaato-de
H.-Top fountain.pen-Acc G.-Gen department.store-Loc
kai/katte, sono man'nenhitsu-o chichioya-ni
buy.Inf/buy.Ger that fountain.pen-Acc father-Dat

[7] Examples of InfCx/GerCx which describe a situation where E_1 temporally subsumes E_2 ($E_1 \supseteq E_2$) are provided below.

(i) a. Netsu-ga {ari/atte}, nyuujoo-o kyohi-sareta.
fever-Nom be.present.Inf/be.present.Ger entrance-Acc refuse.Pass.Pst
'I had fever, and was refused entrance.'

b. Hiroshi-wa yotteite kaidan-kara korogeochita.
H.-Top get.drunk.Ipfv.Ger staircase-from fall.down.Pst
'Hiroshi was drunk and fell down from the staircase.'

purezento-shita.
present.Pst
'Hiroshi bought a fountain pen at a department store in Ginza, and gave it to his father.' [<0, 0, 22>; 1.00]

b. Hiroshi-wa shichiji-ni oki(te), ima chooshoku-o
H.-Top 7-o'clock-Dat wake.up.Inf(Ger) now breakfast-Acc
tabeteiru.
eat.Ipfv.Prs
'Hiroshi woke up at 7 o'clock, and is eating his breakfast now.'
[<0, 0, 22>; 1.00]

The unacceptability of (11a–c) contradicts Fukushima's analysis, as well as Lee and Tonhauser's. The acceptability of (9) and (10), on the other hand, is at odds with my claim, suggesting that the proposed temporal constraint is not always present.

One may hypothesize that the low acceptability of (11a–c) is due to clash between the stated meaning and conversational implicature attributable to the TID principle (see (7) above) or the like, the latter of which is exemplified in (12).

(12) a. John looked out of the window. The train started to move slowly.
+> 'John looked out of the window before the train started to move.'

b. The train started to move slowly. John looked out of the window.
+> 'The train started to move before John looked out of the window.'

Such implicature, however, should be defeasible and thus disappear when it conflicts with the literal meaning and/or our world knowledge (Levinson 2000:123–125; Lee and Tonhauser 2010:314). Indeed, discourse segments (13a–c), where two clauses are paratactically arranged, were considered 'not contradictory' by most respondents, contrasting with (11a–c).[8] This contrast is unexpected if InfCx's and GerCx's do not convey temporal information as part of their conventional (literal) meaning.

(13) a. Hiroshi-wa chichioya-ni man'nenhitsu-o purezento-shita.
H.-Top father-Dat fountain.pen-Acc present.Pst
Kare-wa sono man'nenhitsu-o Ginza-no depaato-de
he-Top that fountain.pen-Acc G.-Gen department.store-Loc
katta.
buy.Pst
'Hiroshi gave his father a fountain pen. He bought it at a department store in Ginza.' [<2, 4, 16>; 0.82]

b. Hiroshi-wa ima chooshoku-o tabeteiru. Kare-wa shichi-ji-ni
H.-Top now breakfast-Acc eat.Ipfv.Prs he-Top 7-o'clock-Dat

[8]The contrast between (13a) and (11a), that between (13b) and (11b), and that between (13c) and (11c), were all determined to be significant at the 0.01 level by the Wilcoxon signed ranks test (Z = -3.203, p = 0.001; Z = -2.863, p = 0.004; Z = -3.827, $p < 0.001$, respectively).

okita.
wake.up.Pst
'Hiroshi is eating his breakfast now. He woke up at 7 o'clock.'
[<5, 4, 13>; 0.68]

c. Raishuu shinrigaku-no gakkai-ga kaisai-sareru. Ima
next.week psychology-Gen conference-Nom hold.Pass.Prs now
happyoo-no junbi-o shiteiru.
presentation-Gen preparation-Acc do.Ipfv.Prs
'A conference on psychology will be held next week. I am preparing for my presentation now.' [<0, 1, 21>; 0.98]

Note also that the English *and*-coordination constructions provided in (11) to illustrate the intended interpretations are compatible with the 'reversed' temporal order.

3.3 Contrast as a factor licensing the InfCx/GerCx

I propose that the crucial factor for the acceptability of sentence (10), and the marginal acceptability of (8a,b), is the rhetorical relation (see Asher and Lascarides 2003; Zeevat 2011 and references therein) of *contrast*. In (8a)/(10), the weather of a day is explicitly contrasted with that of another. In (8b), *wa*-topicalization of the direct object of the second clause induces contrast, and the whole sentence naturally translates as 'Hiroshi is in a tough rehabilitation program, and as for the operation, he had it last week'.[9] Without topicalization of the object of the second clause, the acceptability significantly degrades.[10]

(14) *Hiroshi-wa shikkari rihabiri-o shiteite,
H.-Top hard rehabilitation-Acc do.Ipfv.Ger
shujutsu-o senshuu uketa.
surgical.operation-Acc last.week receive.Pst
(Hiroshi is in a tough rehabilitation program and had the operation last week.) [<17, 2, 3>; 0.18]

Interestingly, even if the two clauses are in the relation of contrast, the InfCx/GerCx cannot describe a situation where E_1 takes place in the future and E_2 takes place in the past.

(15) a. Hiroshi-wa ototoi toochaku-shi(te), Akira-wa
H.-Top the.day.before.yesterday arrive.Inf(Ger) A.-Top
kinoo toochaku-shita.
yesterday arrive.Pst

[9] As discussed in Oshima (2010), *wa*-marking on a direct object has a similar information-structural effect as English *as for*-topicalization, while *wa*-marking on a subject does not.

[10] Like (8b), the stimulus (14) was accompanied by the note: '"Rihabili" refers to the rehabilitation after the operation'.

'Hiroshi arrived the day before yesterday and Akira arrived yesterday.' [<2, 1, 19>; 0.89]

b. Akira-wa kinoo toochaku-shi(te), Hiroshi-wa
A.-Top yesterday arrive.Inf(Ger) H.-Top
ototoi toochaku-shita.
the.day.before.yesterday arrive.Pst
'Akira arrived yesterday and Hiroshi arrived the day before yesterday.' [<2, 3, 17>; 0.84]

c. Hiroshi-wa kinoo toochaku-shi(te), Akira-wa ashita
H.-Top yesterday arrive.Inf(Ger) A.-Top tomorrow
toochaku-suru.
arrive.Prs
'Hiroshi arrived yesterday and Akira will arrive tomorrow.' [<1, 2, 19>; 0.91]

d. *Akira-wa ashita toochaku-shi(te), Hiroshi-wa kinoo
A.-Top tomorrow arrive.Inf(Ger) H.-Top yesterday
toochaku-shita.
arrive.Pst
(Akira will arrive tomorrow and Hiroshi arrived yesterday.) [<18, 2, 2>; 0.14]

Note that (15d) is predicted to be acceptable under Fukushima's and Lee and Tonhauser's analyses.

3.4 The temporal extent of *aru*

Sentence (9) (repeated below), where there is no clear contrast between the two clauses, requires a different explanation.

(9) Raishuu shinrigaku-no gakkai-ga atte, ima
next.week psychology-Gen conference-Nom occur.Ger now
happyoo-no junbi-o shiteiru.
presentation-Gen preparation-Acc do.Ipfv.Prs
'There will be a conference on psychology next week, and I am preparing for my presentation now.' [<2, 2, 18>; 0.86]

I suggest that the eventuality referred to by the existential predicate *atte* (*aru*), here used in the sense of 'occur, take place',[11] has a temporal extent that is not limited to the time when the conference takes place, but includes the preceding temporal stretch overlapping with the second-clause eventuality (preparing for the presentation). There is independent evidence that *aru* predicated of an expression denoting an event (a conference, a party, etc.) could have such a temporally extended denotation. Compare (16a–d):

[11] *Aru* could also mean 'exist, be present', predicated of an expression denoting an object (rather than an event).

(16) a. Kinoo-no enkai-de-wa, kuruma-de
yesterday-Ger banquet-Loc-Top car-by
{kaeru/*kaetta}-node non'arukooru biiru-o nonda.
go.home.Prs/go.home.Pst-because non.alcoholic beer-Acc drink.Pst
'At the banquet yesterday, I drank non-alcoholic beer because I was going to drive home.'

b. Kinoo-wa hisashiburi-ni kazoku minna-ga yoru
yesterday-Top after.a.long.time family everyone-Nom evening
uchi-ni {iru/*ita}-node, hirusugi
home-Dat be.present.Prs/be.present.Pst-because early.afternoon
jootoo-na niku-o kai-ni-itta.
quality meat-Acc buy-go.Pst
'Yesterday, I went to buy some quality meat in the early afternoon because all members of my family were going to be home in the evening for the first time in a long time.'

c. Kinoo-wa ame-ga {?futteiru/futteita}-node
yesterday-Top rain-Nom fall.Ipfv.Prs/fall.Ipfv.Pst-because
kuruma-de itta.
car-by go.Pst
'Yesterday, I went there by car because it was raining.'

d. Kinoo-wa yoru boonenkai-ga
yesterday-Top evening year.end.party-Nom
{aru/atta}-node hiru-wa karuku sumaseta.
occur.Prs/occur.Pst-because lunch-Top lightly finish.Pst
'Yesterday, I had a light lunch because there was a year-end party in the evening.'

When an adjunct reason-clause with *node* is subordinated to a past-tensed clause, it must be present-tensed if the subordinate eventuality temporally follows the main-clause eventuality (as in (16a,b)), and is preferred to be past-tensed if the subordinate eventuality temporally subsumes the main-clause eventuality (as in (16c)). In (16d), the embedded tense can be past, and this implies that the eventuality denoted by *atta* (*aru*) could have a temporal extent that subsumes some period preceding the actual year-end party and the time of the lunch – perhaps the period in which the party *is planned* to take place. As such, sentence (9) is expected to have a reading on which E_1 does not actually follow but temporally subsumes E_2.

3.5 Section summary

In summary, (i) the InfCx and GerCx as a rule entail that the temporal relation of 'precedence or inclusion' ($E_1 < E_2 \vee E_1 \supseteq E_2$) holds between the two described eventualities, but (ii) the reverse order interpretation ($E_1 > E_2$) becomes available when the rhetorical relation of contrast holds between the two clauses, but (iii) it is never possible for the first clause to refer to a future eventuality with the second

clause referring to a past eventuality.

A possible way to account for these facts is to postulate that there are two varieties (each) of the InfCx/GerCx, or perhaps two distinct senses (each) of these constructions: one variety poses a temporal restriction, and the other poses a rhetorical-structural restriction. In Section 5, I provide a formal analysis of the two kinds of InfCx and GerCx.

4 The 'resulting state' interpretation of the GerCx

As mentioned above, infinitive and gerund clauses are functionally similar and in many cases interchangeable. There are, however, cases where the choice between the two constructions leads to an interpretative difference. Specifically, the GerCx, but not the InfCx, allows the interpretation that the *resulting state* of the event described in the first clause, rather than the event itself, temporally subsumes the eventuality described in the second clause, when the first-clause predicate is one of certain telic verbs including *tatsu* 'stand up', *kiru* 'put on (clothes)', and *motsu* 'grab, take in one's hand' (cf. NKBK 2008:286–287). Consider the following pair of sentences:

(17) a. Hiroshi-wa booshi-o **kaburi** e-o kaita.
H.-Top hat-Acc put.on.Inf picture-Acc paint.Pst
'Hiroshi put on a hat and painted a picture.'

b. Hiroshi-wa booshi-o **kabutte** e-o kaita.
H.-Top hat-Acc put.on.Ger picture-Acc paint.Pst
'Hiroshi put on a hat and painted a picture.'
OR: 'Hiroshi painted a picture wearing a hat.'

(17a) is compatible with the state of affairs described in (18a) but not with the one described in (18b). (17b), on the other hand, allows a second interpretation on which it is compatible with (18b) as well as (18a).

(18) a. Hiroshi came to a beach to paint a picture. The sun was strong. He put on his hat before starting painting.

b. Hiroshi always wears his hat, except when he is in bath or bed. This afternoon, he painted a picture in his art class, wearing his hat as usual.

On the second interpretation, (17b) does not imply that Hiroshi's putting on a hat occurs within the topic time (the interval serving as the temporal setting for the discourse segment; Klein 1994) but rather that the resulting state of his putting on hat – i.e., his wearing a hat – holds then. The following pair of sentences illustrates the same point.

(19) a. Hiroshi-wa **tachi** shashin-o totta.
H.-Top stand.up.Inf photo-Acc take.Pst

'Hiroshi stood up and took a photo.'

b. Hiroshi-wa **tatte** shashin-o totta.
H.-Top stand.up.Ger photo-Acc take.Pst
'Hiroshi stood up and took a photo.'
OR: 'Hiroshi took a photo standing on his feet.'

Possible logical translations of (i) (17a,b) on the 'precedence or subsumption' reading and (ii) (17b) on the 'resulting state' reading are provided in (20), where τ = the trace function that maps an eventuality to the time in which it occurs/holds (Krifka 1998), TT = the topic time, and **RS** = the relation of 'is a resulting state of':

(20) (i) $\exists e_2[\exists e_1[$**put.on.hat**$(e_1,$ **hiroshi**$) \wedge \tau(e_1) \subseteq \text{TT} \wedge [\tau(e_1) < \tau(e_2) \vee \tau(e_1) \supseteq \tau(e_2)] \wedge$ **draw.picture**$(e_2,$ **hiroshi**$) \wedge \tau(e_2) \subseteq \text{TT} \wedge \tau(e_2) <$ now]]

(ii) $\exists e_2[\exists e_1[\exists e_3[$**put.on.hat**$(e_1,$ **hiroshi**$) \wedge$ **RS**$(e_3, e_1) \wedge \tau(e_3) \supseteq \text{TT} \wedge \tau(e_3) \supseteq \tau(e_2) \wedge$ **draw.picture**$(e_2,$ **hiroshi**$) \wedge \tau(e_2) \subseteq \text{TT} \wedge \tau(e_2) <$ now]]]

5 A Sign-Based Construction Grammar analysis

This section provides a formal analysis of the InfCx and GerCx in a version of Sign-Based Construction Grammar (SBCG; Sag 2010, forthcoming) coupled with Montague-style semantics.

5.1 The InfCx/GerCx with a temporal constraint

(21) shows a construction (in the SBCG sense) that licenses the versions of the InfCx and GerCx with the 'precedence or subsumption' sense. The type *suspensive* is the immediate supertype of *infinitive* and *gerund*, and the definition of **R** is provided in (22). The attribute LF, which stands for 'logical form', has a logical expression as its value. The up and down arrows with a subscript are metavariables over logical expressions; $\uparrow_n$ in (the LF of) a daughter sign should match $\downarrow_n$ in (the LF of) the mother sign.

(21)
$$\begin{bmatrix} \textit{temporal-suspensive-clause-cxt} & \\ \text{MTR}|\text{SEM}|\text{LF} & \left(\begin{array}{l}\lambda P_{\langle v,t\rangle}[\lambda Q_{\langle v,t\rangle}[\lambda e_2[\exists e_1[P(\text{e}_1) \wedge \mathbf{R}(P, \tau(e_1), \text{TT}) \wedge \\ [\tau(e_1) < \tau(e_2) \vee \tau(e_1) \supseteq \tau(e_2)] \wedge Q(e_2)]]]](\downarrow_1)(\downarrow_2)\end{array}\right) \\ \text{DTRS} & \left\langle \text{S}:\begin{bmatrix}\text{SYN}|\text{CAT}|\text{FORM} & \textit{suspensive} \\ \text{SEM}|\text{LF} & \uparrow_1\end{bmatrix}, \boxed{1} \right\rangle \\ \text{HD-DTR} & \boxed{1}\ \text{S}:\begin{bmatrix}\text{SEM}|\text{LF} & \uparrow_2\end{bmatrix} \end{bmatrix}$$

(22) $\mathbf{R}(P, i_1, i_2) = \begin{cases} i_1 \supseteq i_2 \text{ if } P \text{ is stative} \\ i_1 \subseteq i_2 \text{ if } P \text{ is dynamic} \end{cases}$

It is assumed here (i) that an infinitive/gerund clause modifies the main clause (rather than the main predicate), (ii) that linear word order does not necessarily reflect constituent structure, and variation in relative order between an adjunct clause and complements of the main clause is to be dealt with a Reape-style linearization mechanism, and (iii) a matrix sentence denotes a property of eventualities and its truth/falsehood is determined by the Truth Definition presented in (23) (cf. Ogihara 1996).

(23) **Truth Definition**: The logical expression $\phi_{\langle v,t\rangle}$ serving as a translation of a natural language matrix sentence is true with respect to context c, world w, and assignment g iff $[\![\exists e_0[\phi(e_0)]]\!]^{c,w,g} = 1$

In the case of (17a), the slots of $\uparrow_1$ / $\downarrow_1$ are filled by 'λe_4[**put.on.hat**(e_4, **hiroshi**)]', and the slots of $\uparrow_2$ / $\downarrow_2$ are filled by 'λe_5[**paint.picture**(e_5, **hiroshi**) $\wedge$ $\tau(e_5) \subseteq$ TT $\wedge$ $\tau(e_5) <$ now]'; by existentially binding the lambda-bound event variable in the resulting expression (Truth Definition), (20i) is obtained.

A key feature of the presented analysis is that it regards the temporal meaning of the InfCx/GerCx as contribution by the clause-linking construction, rather than by the infinitive/gerund form. This move is motivated by the fact that infinitive and gerund forms occurring in other environments do not necessarily convey temporal information. For example, in (24b), the gerund form of *kuru* 'come' occurring as part of a complex predicate with the benefactive auxiliary *kureru* does not convey any temporal information.

(24) a. Ashita chichi-ga kuru.
tomorrow father-Nom come.Prs
'My father will come tomorrow.'
b. Ashita chichi-ga **kite**-kureru.
tomorrow father-Nom come.Ger-Benefactive.Prs
'My father will come tomorrow for my sake.'

Likewise, in (25b), the infinitive form of *miru* 'see, watch' combined with an exemplificational particle *tari* does not convey any temporal information.

(25) a. Ato-de terebi-o miru.
later TV-Acc see.Prs
'I will watch TV later.'
b. Ato-de terebi-o **mi**-tari suru.
later TV-Acc see.Inf-for.example do.Prs
'I will do such things as watch TV later.'

5.2 The InfCx/GerCx with a rhetorical structural constraint

The versions of the InfCx/GerCx which indicate contrast between the two combined clauses can be formulated as in (26). The attribute RS, which stands for 'rhetorical structure', has a list of rhetorical relational specifications as its value. I suggest that the RS value of the mother is a list that (i) has all elements in the RS values of the daughters, and (ii) may further be augmented by rhetorical relational specifications introduced by the construction. By this principle, rhetorical relational specifications introduced within a sentence are all percolated up to the root level, and serve to update the rhetorical structural component of the discourse representation.

(26)
$$\left[\begin{array}{l} \textit{contrast-suspensive-clause-cxt} \\ \text{MTR}|\text{SEM} \quad \left[\begin{array}{ll} \text{LF} & \left(\begin{array}{l}\lambda P_{\langle v,t\rangle}[\lambda Q_{\langle v,t\rangle}[\lambda e_2[\exists e_1[P(\mathrm{e}_1) \wedge \\ \mathbf{R}(P, \tau(e_1), \mathrm{TT}) \wedge Q(e_2)]]]](\downarrow_1)(\downarrow_2)\end{array}\right) \\ \text{RS} & \left\langle \textit{contrast}(^\wedge\exists e_3[\downarrow_1](e_3), {}^\wedge\exists e_4[\downarrow_2](e_4))\right\rangle \oplus \boxed{\text{a}} \oplus \boxed{\text{b}} \end{array}\right] \\ \text{DTRS} \quad \left\langle \text{S}:\left[\begin{array}{ll} \text{SYN}|\text{CAT}|\text{FORM} & \textit{suspensive} \\ \text{SEM} & \left[\begin{array}{ll}\text{LF} & \uparrow_1 \\ \text{RS} & \boxed{\text{a}}\end{array}\right]\end{array}\right], \boxed{1}\right\rangle \\ \text{HD-DTR} \quad \boxed{1}\,\text{S}:\left[\text{SEM} \quad \left[\begin{array}{ll}\text{LF} & \uparrow_2 \\ \text{RS} & \boxed{\text{b}}\end{array}\right]\right] \end{array}\right]$$

5.3 The GerCx on the resulting state interpretation

(27) illustrates a construction that licenses the version of the GerCx with the 'resulting state' sense. It specifies that the first daughter (the first clause) has to be headed by a gerund form, rather than an infinitive form.

(27)
$$\left[\begin{array}{l} \textit{result-gerund-clause-cxt} \\ \text{MTR}|\text{SEM}|\text{LF} \quad \left(\begin{array}{l}\lambda P_{\langle v,t\rangle}[\lambda Q_{\langle v,t\rangle}[\lambda e_2[\exists e_1[\exists e_3[P(e_1) \wedge \mathbf{RS}(e_3, e_1) \wedge \\ \tau(e_3) \supseteq \mathrm{TT} \wedge \tau(e_3) \supseteq \tau(e_2) \wedge Q(e_2)]]]]](\downarrow_1)(\downarrow_2)\end{array}\right) \\ \text{DTRS} \quad \left\langle \text{S}:\left[\begin{array}{ll} \text{SYN}|\text{CAT}|\text{FORM} & \textit{gerund} \\ \text{SEM}|\text{LF} & \uparrow_1 \end{array}\right], \boxed{1}\right\rangle \\ \text{HD-DTR} \quad \boxed{1}\,\text{S}:\left[\text{SEM}|\text{LF} \quad \uparrow_2\right] \end{array}\right]$$

6 Summary

It was argued that the Japanese infinitive/gerund-clause constructions have more complex meanings than previously claimed in the literature. They do not merely convey that the two described eventualities both hold, but indicate either that (i) the first-clause eventuality precedes or temporally subsumes the second-clause eventuality, or (ii) that (the propositions denoted by) the two clauses stand in the rhetorical relation of *contrast*. It was shown, with survey data, that the use of an infinitive/gerund-clause construction is infelicitous when neither of these conditions is satisfied. It was also pointed out that the gerund-clause construction has a distinct sense that the infinitive-clause construction lacks, which conveys that the resulting state of the first-clause eventuality, rather than the first-clause eventuality itself, temporally subsumes the second-clause eventuality. A formal analysis, couched in the Sign-Based Construction Grammar framework, of the two constructions and their three senses was presented.

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An HPSG approach to English comparative inversion

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Abstract

It has been analyzed that the word order of English comparative inversion is analogous to that of other subject-auxiliary inversions in that only a finite auxiliary verb can be followed by the subject. However, English comparative inversion should be distinguished from other inversions because the subject can be located between a cluster of auxiliary verbs and the non-auxiliary verb phrase in English comparative inversion. Existing analyses on subject-auxiliary inversion cannot account for this special kind of inversion. This paper proposes a new phrase type for English comparative inversion within the construction-based HPSG. In addition, I suggest that constraints on properties of lexemes participating in the new phrase type are governed by the construction-based approach, while the word order of English comparative inversion is determined by rules that the word order domain approach adopts. Also, it will be shown that these proposals can capture the word order of *nor*-inversion, *as*-inversion, and *so*-inversion as well as that of comparative inversion.

1. Introduction

English Comparative inversion (henceforth CI) has been analyzed in the same way as other inversions (Merchant 2003 and Maekawa 2007, among others). This is because both comparative inversion and other inversions seem to have the same word order: only a finite auxiliary verb can precede the subject as in (1).

(1) a. Humans can climb trees more carefully than can monkeys. [CI]
b. Have you ever been to Seoul? [Interrogative inversion]
c. Not until the evening did John find his son. [Negative Inversion]
d. Had John finished his homework, he would be with us now. [*If*-less inversion]

However, Culicover and Winkler (2008) provide some examples indicating that, unlike other inversions, CI allows the subject to be preceded by more than one auxiliary verb as in (2).

(2) a. Who was responsible for keeping the records would be a more reliable witness as to their accuracy as a whole than would be any of the original makers.

† I would like to thank Prof. Eun-Jung Yoo for her invaluable suggestions and advice. My gratitude also goes to three anonymous reviewers of this conference for their comments. All remaining errors are solely mine.

b. To her, thinking, as she ever was thinking, about Johnny Eames, Siph was much more agreeable than might have been a younger man.
(Culicover and Winkler, 2008)

Also, a host of authentic data showing this fact can be found from books, the Web, and corpora such as the British National Corpus (BNC) and the Corpus of Contemporary American English (COCA) as follows.

(3) a. It is no more expensive than would be the system you are proposing.
(Huddleston and Pullum, 2002)
b. White women in our study would have used relatively more IAAT than would have the black women.
<The America Journal of Clinical Nutrition>
c. The Relief and Aid Society was a genuinely civic-minded organization that very possibly did administer the world's contributions more efficiently and honestly than could have the city government. <Urban disorder and the shape of belief>
d. Her name on that list affected me more than would have divorces from a dozen Kathyrns. (COCA)

These examples are quite challenging because existing explanations on subject-auxiliary inversion do not have any method to locate more than one auxiliary verb before the subject in subject auxiliary inversions. To be specific, T-to-C movement in Minimalist Program does not allow a cluster of auxiliary verbs to move to C. Additionally, *subject-auxiliary inversion phrase* (*sai-ph*) in Head-driven Phrase Structure Grammar also permits only a finite auxiliary verb to precede the subject.

The subjects in examples in (2) and (3) are located at the sentence final position, which causes some researchers to regard this inversion as Heavy NP Shift (HNPS). However, sentences in (4) illustrate that CI is not HNPS.

(4) a. Ali would have driven a car to the park more eagerly than would have the students (in our class on environmental consciousness) to the concert. (Potts, 2002)
b. Jim would have translated the English much better than would have students in his class read the Spanish.
c. John could have read French more fluently than could have Joe.
d. Don would have been more proud of what he had achieved than would have been Bill.

In (4a) and (4b), each subject in comparative clauses is followed by PP and VP, respectively. If this inversion is HNPS, the subjects should be located at the sentence final position, adjoined to TP. Besides, the inverted subjects in (4c) and (4d) are one-word proper nouns. Even though it is difficult and

subtle to define to what extent 'heavy' can cover, it is unreasonable to consider the proper noun as heavy NP. Thus, the conclusion can be drawn that CI is not HNPS.

This paper aims to propose constraints for capturing the word order of English comparative inversion by suggesting a new phrase type within the construction-based approach. In addition, this paper suggests that the new phrase type should follow word order domain rules instead of the constituency that the construction-based approach adopts. I will also make a prediction that if other inversion constructions have the same conditions CI has, both other inversions and CI will have the identical word order and those inversions can be analyzed with the new phrase type. The last part of this paper will show how this prediction is borne out through *nor*-inversion, *so*-inversion, and *as*-inversion.

In Chapter 2, I will present recent studies on CI and their problems. In Chapter 3, I will propose a new approach to explain the word order of CI within the construction-based approach and introduce word order domain rules that can be applied to all phrases in English, including the new phrase for CI. In Chapter 4, it will be shown that how the new phrase and related rules can be applied to other inversions. Finally, I will present concluding remarks.

2. Previous studies on CI and problems

2.1. Culicover and Winkler (2008)

Culicover and Winkler (2008) discuss that a cluster of auxiliary verbs can be followed by the subject in CI for the first time. They mention four logical possibilities to derive the word order of CI as in (5).

(5) a. The subject is in canonical subject position (e.g. Spec IP) and all of the verbs move to the left;
b. The subject is in canonical subject position and moves to the right.;
c. The subject is in canonical subject position, and everything in I' moves to the left of it;
d. The subject is in situ in Spec vP, and remains in situ.

They suggest that (5d) is the easiest and most plausible possibility in terms of both derivation and stipulations. They point out that even though (5c) is closely related to the assumption that Minimalist Program adopts for subject-auxiliary inversion – T-to-C movement, a problem is that it allows only a finite auxiliary verb to move to C.

In order for (5d) to be on the right track, they propose that *than* and *as* are all complementizers and can select TP without an EPP. This suggestion is

based on the fact that the order of auxiliary verbs and the subject in CI is totally identical to the order of them when the subject in the specifier position of *v*P does not undergo any movement.

They suggest that this suspension of an EPP is possible only when following three rules, based on Selkirk (2005), are satisfied.

(6) Align R(Comma, ip)
Align the right edge of a constituent type Comma Phrase in syntactic representation with the right edge of an ip in phonological representation.

(6) is indicative of the correspondence between clausal syntactic constituent and intonational phrase.

(7) Contrastive-Focus-dominate-Δip (FOC/Δip)
The terminal string of a contrastive FOCUS constituent in syntactic representation correspond to a string containing the metrical prominence of an Intonational Phrase in phonological representation.

(7) demonstrates that there is a close relationship between contrastive focus and metrical prominence of an ip.

(8) Right Edge Alignment of Focus (REAF)
Each focused element is right aligned in ip.

At last, (8) specifies the position where focus occurs - right edge of ip.

Examples in (9) show that whether three constraints are satisfied can result in two different comparatives. Capitalization signals the metrical prominence.

(9) a. ?Anna ran much faster (than could have MANNY)$_{ip}$.
b. Anna ran much faster (than MANNY could have)$_{ip}$.

In (9a), three constraints are conformed. *Than could have MANNY* corresponds with an intonational phrase. In addition, the contrastively focused subject *MANNY* has a metrical prominence of ip and is right aligned in ip. These result in the EPP suspension. On the other hand, an EPP is not suspended in (9b), since this sentence violates the REAF which prevents the subject from moving to spec,TP. In brief, they suggest that an EPP competes with REAF. Thus, the REAF is stronger than an EPP in CI, while an EPP is stronger than the REAF in canonical comparative.

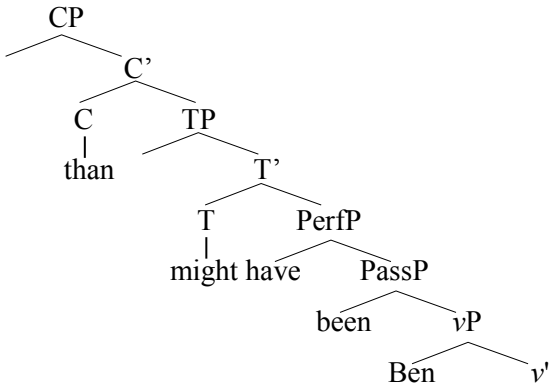
However, this approach has a non-trivial objection. This analysis cannot explain the cases where auxiliary verb phrases are elided optionally as in (10).

(10) John might have been injured much more severely

a. than might have been Ben.
b. than might have Ben.
c. than might Ben.

Both (10b) and (10c) can be interpreted as (10a). The syntactic structure for (10a) can be roughly described as in (11).

(11)



The elided part in (10a) is some node under *v*P. In this case, it is not clear what node is elided and what licenses this ellipsis. In addition, if any further movement of the subject is not assumed, (10b) and (10c) cannot be produced when PassP and PerfP are elided respectively, since the subject *Ben* should be also deleted when auxiliary verb phrases go though VP-ellipsis. Even though a feature that triggers the displacement of the subject or a proper landing site is devised, it is no more than a stipulation unless further evidence is provided.

2.2. Maekawa (2007)

Based on Kathol (1995, 2000, 2001), which try to explain the linear word order of German by means of 'topological field' within HPSG, Maekawa (2007) suggests the distribution of domain elements in English as in (12). The distribution specifies what elements can occupy each field. As the name 'topological field' indicates, sentences are divided into fields and each field is occupied by certain domain elements.

(12) Distribution of domain elements in English

first	Matrix non-subject *wh*-phrases, Preposed negative phrases, etc.
second	Finite auxiliary verbs in subject-auxiliary inversion (SAI) sentences, Complementizers, Subordinate non-subject *wh*-phrases

third	Subjects
fourth	Finite verbs in non-SAI-sentences
fifth	Complements of the finite verb

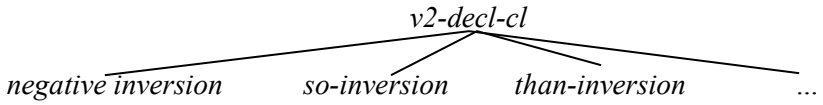
To determine the word order of English, two additional Linear Precedence (LP) constraints are proposed. The first one is to deal with the order of fields as in (13) and the other has to do with the cardinality restriction imposed to the *first* and the *second* fields as in (14).

(13) Topological Linear Precedence Constraint for English
first ≺ *second* ≺ *third* ≺ *fourth* ≺ *fifth*

(14) Topological Uniqueness Condition
a. *first* ≺ *first*
b. *second* ≺ *second*

In (13), 'A≺B' means that A is followed by B in linear order. For example, elements assigned to *first* topological field always precede those assigned to other topological fields. The other constraint (14) illustrates that the *first* and the *second* fields should contain only one element.
On the basis of the LP constraints mentioned above, Maekawa (2007) characterizes CI as an instance of declarative *verb-second clause* (*v2-decl-cl*) in which a finite auxiliary verb is located in the *second* field. The subtypes of *v2-decl-cl* are described as in (15).

(15) Subtypes of *v2-decl-cl*



These inversion types are classified according to what sort of element occupies the *first* field. In the case of *than*-inversion, the *first* field is occupied with *than*.

However, this approach is insufficient to capture the exact characters of CI. The problem is that it cannot license the cases where more than one auxiliary verb is followed by the subject. Generally, it is analyzed in HPSG that the non-finite auxiliary verb phrase following the finite auxiliary verb is the complement of the finite auxiliary verb. Then the complement of the first auxiliary verb should be located in the *fifth* field, according to (12). This cannot explain the way a cluster of auxiliary verbs precedes the subject in CI.

Even if we propose a new constraint allowing that auxiliary verbs can be placed before the subject, the problem still remains. Recall that the subject

should be contained in the *third* field and *than* is the element the *first* field should contain. Then, auxiliaries should be located in the *second* field. However, the constraint mentioned in (14) prohibits more than one auxiliary verb from occupying the *second* field.

3. Proposals

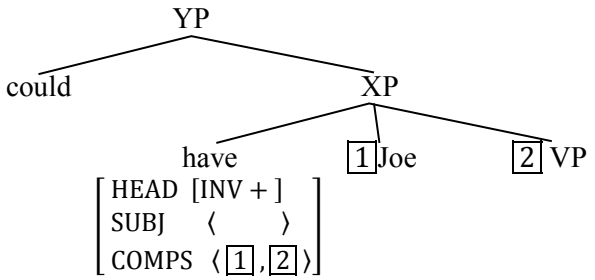
Unlike other subject-auxiliary inversions, CI allows the subject to be preceded by a cluster of auxiliary verbs as in (16a). In addition, the inverted subject can be followed by the phrase with contrastive focus meaning as in (16b) and (16c).

(16) a. Megan can jump higher than could have Bill.
b. John read French more fluently than could have Joe spoken English.
c. ?Mary would have been angry much longer than would have been John, happy. (Culicover and Winkler, 2008)

This chapter provides three possible options to account for the word order of CI. I propose that the best analysis among them is to make use of both the construction-based approach and the word order domain rules.

One of the possible options is to adopt the existing phrase rules. In this approach, the word order is determined by the constituency in local trees. In this respect, the brief syntactic representation of (16b) can be depicted as in (17).

(17)



In (17), the XP could be considered as *subject-auxiliary inversion phrase* (*sai-ph*) because only this phrase allows the subject to be located between the auxiliary verb and the non-auxiliary verb phrase among many phrases. In other phrases, subjects should be followed by verb phrases, according to the *head-subject phrase* rule. In the lexical entry of *have* in (17), the subject *Joe* is not specified in the SUBJ list, but in the COMPS list because of the subject-auxiliary inversion lexical rule as in (18).

(18) subject-auxiliary inversion lexical rule:

$$\begin{bmatrix} \text{HEAD} & verb\,[\,\text{AUX}+, \text{INV}-, fin\,] \\ \text{SUBJ} & \langle [\text{N}''[nom]] \rangle \\ \text{COMPS} & \boxed{1} \end{bmatrix} \Rightarrow \begin{bmatrix} \text{HEAD} & verb\,[\,\text{AUX}+, \text{INV}+, fin\,] \\ \text{SUBJ} & \langle \quad \rangle \\ \text{COMPS} & \text{N}''[nom],\ \boxed{1} \end{bmatrix}$$

(Pollard and Sag, 1994)

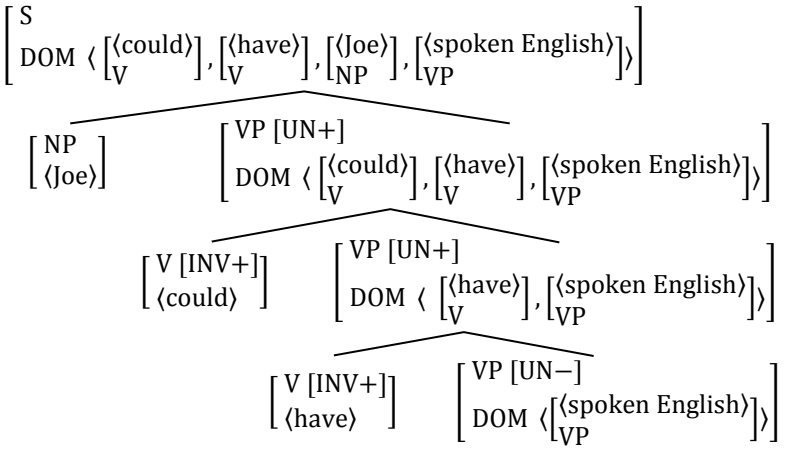
(18) states that the finite auxiliary verb in inversion takes its subject as a complement.

There are, however, two problems in this analysis. Firstly, XP is not *subject-auxiliary inversion phrase* (*sai-ph*) because the head of XP is not a finite verb. (18) shows that the head of *sai-ph* should be a finite verb. In addition, it is not clear what kind of phrase XP is. When the SUBJ value and the COMPS value are saturated, the phrase is not VP anymore, but a sentence. Yet, *have Joe spoken* is not a sentence in the sense that the head *have* is not a finite auxiliary verb. Secondly, it cannot be explained what rule licenses the combination of XP and its sister. Even though we assume that XP is a kind of peculiar sentences, sentences cannot be the complements of finite auxiliary verbs in English.

Another option is to adopt the word order domain approach introduced by Reape (1994, 1995). According to Reape, domain elements in daughters are put together in the mother's domain when daughters merge. Then, the order of domain elements in the mother node is determined not by the Immediate Dominance (ID) rules or the constituency, but by domain rules. One of the most important features in this approach is the UN(IONED) feature. The value of the UN feature is represented as binary notation, negative and positive. If a phrase α contains [UN –], domain elements in α are frozen like an inseparable cluster and do not allow other domain elements in the α's sister to be inserted between domain elements in α. On the other hand, when a phrase β contains [UN +], domain elements in β can be shuffled with domain elements in the β's sister.

In order to allow the word order of the sentence (16b), the domain structure should be represented as in (19).

(19)



(19) illustrates that the subject is preceded by auxiliary verbs in the domain of S, even though the subject precedes auxiliaries according to the head-subject ID rule. In order to produce a sentence with the proper word order, all auxiliary verbs in (19) should contain [INV+], since only elements with [INV +] can be followed by the subject. In addition, VPs whose head is the auxiliary verb with [INV +] must contain [UN +] in order not to make itself frozen, allowing auxiliary verbs and the subject to be shuffled.

This analysis also has a non-trivial objection. The word order of (19) is possible when a rule is assumed that the auxiliary verb with [INV +] should subcategorize for a certain complement. The complement should have [UN +] and its head must contain [INV +], when the head has [AUX +]. Otherwise, the subject could be located between auxiliary verbs, producing CI with the improper word order. However, if this rule is applied to all verbs with [INV +], we cannot properly rule out ungrammatical sentences. (20a) is an interrogative clause with the appropriate word order, while (20b) is ill-formed due to the position of the subject.

(20) a. How might they have been produced?
b. *How might have been they produced?

When the rule is applied to all auxiliary verbs containing [INV +] in (20), *have* - the head of the complement of *might* - should have [INV +] and its projection has to contain [UN +]. Besides, the complement VP of *have* should contain [UN +] and *been* must have [INV +]. And the subject is preceded by auxiliary verb with [INV +]. Then, (20a) cannot be produced, making (20b) grammatical unexpectedly.

Consequently, this analysis falls in a dilemma. If we make a rule that a finite auxiliary verb with [INV +] subcategorizes for a phrase whose head has [INV –], the word order of other inversions can be explained, while CI where

a cluster of auxiliary verbs precedes the subject cannot. On the other hand, if the rule for CI is applied to all verbs with [INV +], the proper word order of other inversions cannot be derived.

Until now, I have examined two possible options to explain the word order of CI. The phrase structure rule approach has a serious problem that it has to violate some existing phrase structure rules. Additionally, the word order domain approach does not have a device to rule out overgenerated sentences when the word order rule for CI is adopted. Thus, an interim conclusion can be drawn that CI cannot be analyzed with the existing phrase structure rule approach or the word order domain approach.

Now, I turn to the last option. This one takes advantage of both the construction-based approach and the word order domain approach. In the existing construction-based approach, the word order of English is determined by the constituency. In my analysis, however, the word order is determined by word order domain rules. That is to say, constraints on properties of lexemes participating in certain phrases are governed by the construction-based approach, while the word order of the phrases is determined by domain rules.

In this approach, one thing I assume is that the default value of the UN feature is negative in the absence of any additional constraint. This assumption prevents word order domain rules from producing sentences with the improper word order by means of shuffling.

When the constraints in charge of the word order is separated from construction-based approach and the word order is not determined by the constituency any more, all phrases need rules to obey which will allow every element in them to be located at the proper position. The first domain rule specifies the order between the head and the complement. In all phrases in English, the head is always followed by its complement. This basic rule can be represented as in (21).

(21) Head-complement rule:
DOM ⟨ [**COMPS** ⟨ [**HEAD** 1]⟩] ⟩ ≺ DOM ⟨ [**HEAD** 1] ⟩

(21) illustrates that a head should be followed by its complement's head in the domain. If this rule is not present, we cannot rule out the phrase where the complement precedes the head.

Another rule essential to explain the order of phrase elements has to do with the position of the subject. The position of the subject is pivotal to identify the clausal type. To illustrate, in most declarative clauses subjects are located before finite verbs. However, subjects are preceded by finite auxiliary verbs in interrogative clauses. The position of the subject depends on the value of the INV feature in verbs. A finite auxiliary verb in the declarative clause without the subject-auxiliary inversion has [INV –], while that in the

interrogative clause contains [INV +]. A rule which can capture this word order is described as in (22).

(22) Subject rule:

$$\left[\begin{array}{l}\textbf{INV}\ + \\ \textbf{SUBJ}\ \langle \boxed{2} \rangle\end{array}\right] \prec \boxed{2} \prec \left[\begin{array}{l}\textbf{INV}\ - \\ \textbf{SUBJ}\ \langle \boxed{2} \rangle\end{array}\right]$$

(22) implies that all auxiliary verbs with [INV +] must precede the subject and that those with [INV –] should follow the subject.

Given the word order domain rules above, a phrase type CI belongs to should be identified. This is related to explaining where constraints of the phrase type for CI inherit from, according to multiple inheritance hierarchy.

In the construction-based approach in English, non-finite auxiliary verbs have [INV –] by default in the absence of any constraint, which assures that the non-finite auxiliary verb in every English phrase type has [INV –]. This means that CI cannot be analyzed with existing types of phrases, since all non-finite auxiliary verbs in CI should have [INV +], given the fact that all auxiliary verbs preceding the subject cannot contain [INV –] in any kind of inversions, according to (22).

This translates into the need to devise a new phrase type that forces non-finite auxiliary verbs participating in CI to have [INV +]. In addition, the perspective phrase type must allow the subject to shuffle with elements in the auxiliary verb phrase. If the subject merges with the auxiliary verb phrase with [UN –], the subject cannot be located between more than one auxiliary verb and the non-auxiliary verb phrase.

The phrase type should also evince that a finite auxiliary verb must subcategorize for one of two kinds of complements – VP with [INV +] and [UN +] or a phrase with [AUX –]. The former allows the subject to be shuffled with elements in the auxiliary verb phrase when CI has more than one auxiliary verb, while the latter can capture the word order of CI that has only one finite auxiliary verb.

One question arises here is why the subject is preceded by more than one auxiliary verb in CI. I accept the suggestion by Culicover and Winkler (2008) and Gergel, Gengel, and Winkler (2007) that this inversion is caused by the information structure restriction that the inverted subject should be interpreted only as focus, especially contrastive focus. This is why Culicover and Winkler (2008) regard CI as a type of focus inversions. According to Gundel and Fretheim (2004), contrastive focus is a material that plays a role in calling to the hearer's attention and mentioning contrasts with other entities. In CI, the inverted subject contrasts with the subject in the main clause and, thus, it is emphasized enough to capture the hearer's attention.

Culicover and Winkler (2008) use the behavior of epithets to show that the inverted subject in CI is restricted to be interpreted as contrastive focus as follows.

(23) a. Bill Clinton$_i$ said more than the president$_i$ could have.
b. Bill Clinton$_i$ said more than could have the president$_j$.
c. Bill Clinton$_i$ said more than the president$_j$ could have.
d. *Bill Clinton$_i$ said more than could have the president$_i$.

(23a) indicates that a coreferential reading is possible because the subject in comparative clause is not interpreted as contrastive focus. The subjects without contrastive meaning can precede auxiliary verbs in comparative clauses. This shows that the canonical subject position is not the place only for contrastive focus. This implies that the information structure of subjects in canonical comparatives does not have to be restricted to contrastive focus. On the other hand, the contrast between (23b) and (23d) manifests that the subject only with contrastive focus meaning can be preceded by a cluster of auxiliary verbs in CI. Otherwise, the coreferential subject could be located at the sentence final position in (23d).

Gergel, Gengel and Winkler (2007) also examine that only elements with contrastive focus meaning can occupy the inverted subject position in CI with the pronominalization.

(24) a. Manny$_i$ plays the piano better than did HE$_{*i/j.}$
b. He$_i$ said he could play the piano better than did HE$_{*i/j}$.

Sentences in (24) depict that the pronoun non-coreferential with the subject in the main sentence can follow the auxiliary verb, while the pronoun subject without contrastive focus meaning cannot undergo the subject-auxiliary inversion.

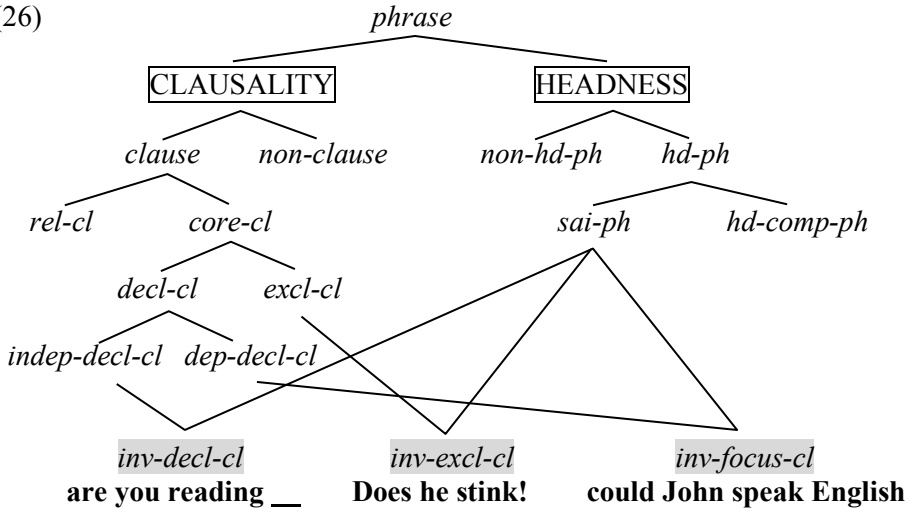
This delineates the close relationship between information structure and a specific phrase type because the subject in this phrase type should be interpreted only as focus. Thus, I propose that the information structure of the construction should be specified as a constraint of the phrase for CI. That is to say, the subject in CI contains the INFO-STRUC|FOC feature and its value is identical to that of the CONT feature, following the Engdahl (1999)'s approach. Of course, the information structure value is not specified in the lexical entry of the subject in other phrase types, since the information structure of elements in phrases is not guaranteed by the phrase type in general. However, I make this suggestion in order to emphasize that the phrase type for CI is caused by information structure and to make a distinction from phrase types related to other inversions.

All constraints for CI that should be taken into account are put together in a following new phrase type as in (25). I will name this *inv-focus-cl*.

(25) *inv-focus-cl:* [ ] → H $\left[\begin{array}{l}\text{SUBJ} \quad \langle [\text{FOC} \quad \boxed{\text{A}}] \rangle \\ \text{COMPS} \quad \left\langle \left[\begin{array}{l}\text{INV} + \\ \text{UN} \ +\end{array}\right] \middle| [\text{AUX} -] \right\rangle\end{array}\right]$, …

According to the construction-based approach, all phrase types are defined by two dimensions - CLAUSALITY and HEADNESS. In other words, constraints of a certain phrase should show its clause type and the relationship between the head daughter and the non-head daughters. Constraints of *inv-focus-cl* inherit from both *dep(endent)-decl(arative)-cl(ause)* and *inv(ersion)-ph(rase)*. This is because *inv-focus-cl* cannot stand alone, containing *austinian* semantic type, and the subject is preceded by a finite auxiliary verb. Thus, the location of *inv-focus-cl* in the phrasal type hierarchy can be sketched as in (26).

(26)



(26) shows that *inv-decl-cl* and *inv-focus-cl* have their own distinct status as a phrase type through the distinction between *dep-decl-cl* and *indep-decl-cl*.

When a comparative clause contains two auxiliary verbs, *inv-focus-cl* guarantees that the finite auxiliary verb subcategorizes for VP with [INV +] as the HEAD feature and [UN +]. This allows the subject to be located between the second auxiliary verb and the non-auxiliary verb phrase as follows.

(27) a. John might have eaten cookies faster than might have Paul made.
b. Mike wrote more books than would have John read.

Yet, *inv-focus-cl* is not sufficient, because this phrase type cannot control properties of the third auxiliary verb when a cluster of auxiliaries consists of three auxiliary verbs. This means that *inv-focus-cl* cannot force

the third auxiliary verb to have [INV +], because all non-finite auxiliary verbs have [INV –] by default. Then, *inv-focus-cl* cannot guarantee the word order of (2b) and (16c) (They are repeated here as (28a) and (28b), respectively).

(28) a. To her, thinking, as she ever was thinking, about Johnny Eames, Siph was much more agreeable than might have been a younger man.
b. ?Mary would have been angry much longer than would have been John, happy.

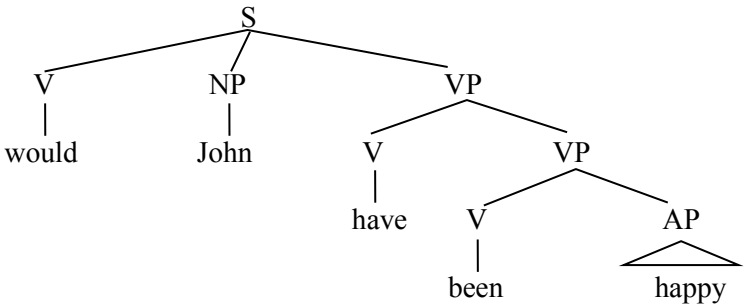
In order to capture the word order of CI that cannot be covered by constraints in *inv-focus-cl*, an additional rule is necessary. The prospective rule must be able to guarantee that the complement of the second auxiliary verb should satisfy following condition: Either VP whose head is the auxiliary verb should contain [UN +] and its head should have [INV +] or a phrase must have [AUX –]. This constraint is represented as in (29).

(29) [INV +] verb rule
When a non-finite verb with [INV +] subcategorizes for an auxiliary verb phrase, the phrase has [UN+] and its HEAD feature contains [INV +].

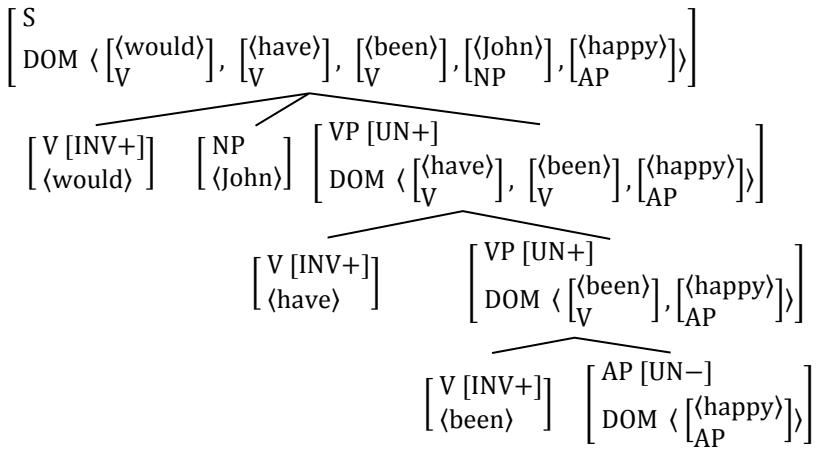
This rule implies that non-finite auxiliary verbs can have either [INV +] or [INV –]. Nonetheless, all non-finite auxiliaries in CI can have [INV +] through (29). This is possible because *inv-focus-cl* guarantees that the second auxiliary verb should contain [INV +] and then the [INV +] verb rule is applied to all non-finite auxiliary verbs in CI.

When constraints that have been mentioned so far are integrated, the syntactic tree and the word order tree for (28b) can be represented as in (30a) and (30b), respectively.

(30) a. Syntax tree



b. Word order tree



It is natural to have this discrepancy between the syntax tree and the word order tree. This is because syntactic properties of CI except the word order come from constraints adopted by the construction-based approach, while the word order of this inversion is determined by the word order domain rules.

In (30b), the domain order of the lowest VP is determined by the head-complement rule, so *been* precedes *happy*. When *have* combines with VP containing [UN +], the head-complement rule is also applied and *have* is followed by *been* as a result. At last, the domain elements in S are arranged by the subject rule as well as the head-complement rule. Then, *could* precedes *have* and the subject is located between *been* and *happy*.

This approach seems to be rather more complex than other analyses, since this adopts two very strong approaches. However, this analysis is superior to previous analyses due to the following reasons. Unlike the word order domain approach, this approach can stop sentences with the improper word order from being produced. To be specific, *inv-focus-cl* specifies that the complement of the finite auxiliary verb should have [INV +] when its head – the second auxiliary – contains [AUX +] and this causes the third auxiliary with [INV +] to be followed by the subject. Since any phrase type participating in producing interrogative inversion does not specify the constraint that the finite auxiliary verb should take VP whose head has [INV +], the non-finite auxiliary verbs in interrogatives contain [INV –] by default.

This approach can also account for the optional ellipsis of auxiliary verb phrases. In my analysis, all auxiliary verbs can delete their complements before combining with the subject. Thus, the inverted subject can be present in CI with auxiliary VP ellipsis without any specific rule. This avoids the crucial problem Culicover and Winkler (2008) encounter.

4. Implication

In the previous chapter, I conclude that a cluster of auxiliary verbs can be followed by the subject in CI when the subject is interpreted as focus and the word order of this construction is licensed by *inv-focus-cl* and related word order rules. This conclusion makes us to predict that other inversion constructions which are under the same conditions CI has can have the word order identical to that of CI. This follows that those inversions can be subtypes of *inv-focus-cl*. The following constructions show how this prediction is borne out.

4.1. *nor*-inversion

In (31), only a finite auxiliary verb precedes the subject in *nor*-clauses, leaving its following auxiliary verbs in the original position.

(31) a. Our man from Pernambuco had no inkling of this treachery, nor would he have given it his approval. (COCA)
b. Edict 1 had been passed so long ago that most citizens of Spyre did not even know it existed, nor would they have understood its significance if it were described to them. (COCA)

Examples in (31) do not pattern with CI this paper focuses on in that the subjects are located between auxiliary verbs. This is not surprising since the subjects in sentences in (31) are co-referential with their antecedents in the main sentences and they can never be interpreted as focus. In (32), however, the subjects with focus meaning in *nor*-inversion are preceded by a cluster of auxiliary verbs. This means that examples in (32) cannot be analyzed with the phrase type for the inversion in (31). The examples come from American and British English corpora and the Internet.

(32) a. A minor brawl between Arabs and Jews would have been nothing, nor would have been Israeli Arab demonstrators clashing with police in Arab townships, or Jewish settlers and Palestinians attacking each other's persons and property in the occupied territories. (COCA)
b. This harassment used the mechanisms provided by the research ethics industry on campus, and it seems likely that a private therapist would not have been such an easy target, nor would have a journalist. (BNC)
c. I haven't been surprised by the rally, nor should have been my readers.
d. As for the balancing of the flywheel to the driven plate, my friend wasn't familiar with that, nor might have been the guy who did the conversion originally.
e. ?I have not seen Sobers play nor might have Harsha watched him in his pomp.

f. He did not die on the cross, nor could have any man died on the cross in such a short period.

The subject can be located between a cluster of auxiliaries and the non-auxiliary verb phrase in (32e,f) just like CI, as I predicted. In order to account for this inversion, *inv-focus-cl*, word order domain rules and the [INV+] verb rule are also needed.

4.2. *as*-inversion and *so*-inversion

As Culicover and Winkler (2008) mention, *as*-inversion, *so*-inversion, and CI show the similar word order.

(33) a. Blair fell down the stairs, as did her brother.
b. John made his hair cut, and so did Tom.

At a cursory glance, sentences in (33) indicate that *as*-inversion and *so*-inversion can be analyzed with existing phrase types for inversions. However, it can be found that *inv-focus-cl* and related rules are essential to capture the word order of those two inversions in the sense that they also allow the auxiliary cluster inversion as in (34).

(34) a. As the pyramid rose, the working space would have diminished, of course, and so would have the number of teams that could simultaneously work atop it … .
b. Jane had been there, and so had been her boy friend.
c. Sandy would have been very angry, as would have been all of the people who invested in the project. (Culicover and Winkler, 2008)

Sentences in (34) illustrate that each inverted subject has only focus meaning and it is preceded by a cluster of auxiliary verbs. Even though the non-auxiliary verb phrases do not follow the inverted subjects in *as*-inversions and *so*-inversions as in CI, the word order of two inversions also can be explained with *inv-focus-cl* and related rules.

Thus, from the examples above, a conclusion can be drawn that the inversion construction that *inv-focus-cl* and word order rules can cover is not confined to CI. Rather, they can be applied to *nor*-inversion, *as*-inversion, and *so*-inversion, even though syntactic properties of these inversions are not identical to those of CI.

5. Conclusion

This paper was motivated by the observation that existing syntactic analyses – T-to-C movement, the suspension of an EPP and *v2-decl-cl* – cannot

account for the puzzling phenomenon that a cluster of auxiliary verbs can be followed by the subject in CI.

I proposed that CI should be explained by the combination of both the word order domain approach and the construction-based approach, since the word order of CI does not follow the constituency. Based on this proposal, I introduced a new type of phrase, called *inv-focus-cl*. This new phrase has the following constraints: 1) the inverted subject should have the FOC value and 2) the head of this phrase subcategorizes for the complement which contains either [INV +] as the HEAD value and [UN +] or [AUX –]. In order to explain the word order of CI with three auxiliary verbs, the [INV +] verb rule was suggested. I also provided an implication that constraints for CI can be applied to other kinds of inversions – *nor*-inversion, *as*-inversion, and *so*-inversion – where the inverted subject is restricted to have the focus interpretation.

Given the new suggestions above, this paper makes some contributions toward HPSG as follows. First of all, *inv-focus-cl* and related rules can correctly account for the word order of CI which existing analyses fail to capture. The fact that these constraints can also explain the optional auxiliary VP ellipsis in CI is of great significance. In addition, this paper suggests a uniform way to explain the word order of focus inversions including CI, *nor*-inversion, *as*-inversion, and *so*-inversion within the framework of HPSG. At last, this analysis provides the necessity to adopt the word order domain approach within the construction-based approach in English. This lays the foundation for scrutinizing other possible constructions with discontinuous constituency.

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Individual constraints for information structure

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Abstract

This paper, in the context of multilingual MT, proposes the use of ICONS (Individual CONstraintS) to add a representation of information structure to MRS. The value of ICONS is a list of objects of type *info-str*, each of which has the features CLAUSE and TARGET. The subtypes of *info-str* indicate which information structural role is played by the TARGET with respect to the CLAUSE. This proposal is designed to support both the calculation of focus projection from underspecified representations and the handling of multiclausal sentences.

1 Introduction

This paper presents an HPSG (Pollard and Sag, 1994) analysis of information structure marking, with an eye towards practical applications such as machine translation (MT), adding constraints on information structure to MRS (Copestake et al., 2005) representations. In particular, we aim to improve on our previous analysis presented in Song and Bender (2011), to overcome two difficulties facing that work: First, we did not specify how the analysis could handle the spreading of focus beyond the lexical item directly marked for focus. Second, by encoding information structure as constraints on features of semantic variables ('variable properties'), we predicted that all occurrences of an index could share the same information structural properties. This is not necessarily the case, especially in constructions where semantic indices are shared across multiple clauses. This paper suggests the use of individual constraints (henceforth, ICONS), which (i) leave the information structural values of some constituents underspecified, facilitating an analysis of focus projection, and (ii) allow us to anchor the constraints on information structure with respect to the clause they belong to.

This study aims to provide a theoretical framework to create a grammar library for information structure, which will be added to the LINGO Grammar Matrix

[†]First of all, we are especially grateful to Dan Flickinger and Ann Copestake for the idea of using ICONS for information structure. Thanks also to Woodley Packard for adding support to ICONS to the ACE generator (`http://sweaglesw.org/linguistics/ace`)), which allowed us to confirm the feasibility of our proposal. Russian and Japanese judgments reported in this paper were provided by Varya Gracheva, Zina Pozen, and Sanae Sato. We also thank Frank Van Eynde, Berthold Crysmann, Kiyong Lee, Yo Sato, and David Erschler for their comments and suggestions at the venue, and three anonymous reviewers for helpful feedback. After the conference, the first author had several opportunities to discuss some parts of our proposal with several linguists in Korea, which helped us refine our proposal once again. Though it should be noted that we could not fully accommodate their suggestions in this paper, we thank Jong-Bok Kim, Jae-Woong Choe, Hae-Kyung Wee, and Young Chul Jun. All remaining errors and infelicities are our own.

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(Bender et al., 2002, 2010).[1] The LINGO Grammar Matrix is an environment for developing precision grammars from a typological perspective. The Grammar Matrix customization system, in particular, functions as a starter-kit for the creation of computational grammars within the HPSG and MRS framework. That means this study has to (i) refer to cross-linguistic findings about information structural meanings and forms to express information structure, and (ii) suggest a range of computational models described in the DELPH-IN joint reference formalism (TDL; Copestake 2002), which (ii-a) deal with different types of information structure marking found in the world's languages and (ii-b) constrain the MRS to reflect the information structure encoded by the marking.

This paper is structured as follows: §2 offers a brief explanation of information structural components and forms of expressing information structure in the languages this paper is concerned with. §3 proposes an analysis based on Individual Constraints. Comparing to previous studies, §4 and §5 show that our proposal processes information structure in a more effective way. Building on the analyses, §6 presents a sample translation from English to Japanese, and §7 explains how our proposal has been implemented and shows the outputs are as expected.

2 Information Structure

2.1 Components of Information Structure

This paper starts from the following assumptions, consistent with Song and Bender (2011): (i) Information structure consists of three components, namely, focus, topic, and contrast. (i-a) Every sentence presumably has at least one focus, while all sentences do not always have a topic. (i-b) Contrast, contra Lambrecht (1996), is treated as an information structural component in that it can be linguistically expressed. (i-c) Sometimes, a linguistic item can convey the meaning of neither focus nor topic, which we call background (a.k.a. tail, represented as *bg* in the hierarchy of this paper). (ii) Semantically empty and syncategorematic categories (e.g. expletives, semantically empty auxiliaries) are informatively empty as well; thus, they cannot signal any information structural meanings.

Focus refers to what is informatively new and/or important in the sentence (Lambrecht, 1996). This leads to an important linguistic property that distinguishes focus from other components: the focus of a sentence (as used in a particular context) can never be omitted, while topic and background elements can. *Wh*-questions have been employed as a tool to probe the focus meaning and marking: For instance, if the question is *What barks?*, the constituent corresponding to the *wh*-word in the answer bears focus. In English, this is typically marked with the the A-accent (H*), as in *The* DOG *barks.*[2]

[1] The LINGO Grammar Matrix has been developed in the context of the DELPH-IN consortium (`http://www.delph-in.net`).

[2] In this paper, SMALL CAPS stands for an A-accented phrase, **boldface** for a B-accented one, and $[_f\ ]$ for focus projection.

Topic is what an utterance is about. As mentioned in the previous paragraph, some languages (a.k.a. topic-drop languages (Huang, 1984)) frequently drop topics from sentences; thus, topics do not always appear overtly in running text or speech. Choi (1999) suggests the tell-me-about test for identifying topic: e.g. In a reply to *Tell me about the dog.* an NP referring to the dog will be the topic. In English, this can be marked with the B-accent (L+H*): *The* ***dog*** BARKS.

Contrast (realized as either contrastive topics or contrastive foci) always entails an alternative set, and can be expressed lexically (e.g. *thì* in Vietnamese (Nguyen, 2006)) or syntactically (e.g. preposing to the initial position in Standard Arabic (Ouhalla, 1999)), depending on the language. Several tests to detect contrast, such as the conditional test (Wee, 2001) for contrastive topic, the correction test (Gryllia, 2009) for contrastive focus, have been suggested, though they are not always cross-linguistically valid.[3]

2.2 Languages

While the analysis we develop is intended to be flexible enough to work cross-linguistically, we will use English, Japanese and Russian to exemplify three common types of information structure marking. English primarily uses prosody for this function (e.g. A/B-accents (Jackendoff, 1972)).[4] Japanese employs morphological markers: For instance, if the topic marker *wa* is attached to an NP, the NP involves either topic or contrast, or both (i.e. contrastive topic). On the other hand, if the case markers (e.g. *ga* for nominatives) are used instead of *wa*, the NP cannot fill the role of topic (Heycock, 1994). In contrast to English and Japanese, Russian takes advantage of its relatively free word order to assign a specific position to signal focus: Non-contrastive focus appears clause-finally and contrastive focus is preposed (Neeleman and Titov, 2009). The major patterns of expressing information structure in these languages are summarized are summarized in Table 1.[5]

2.3 Differences in Felicity

Information structure affects the felicity of a sentence in different discourse contexts. Sets of allosentences (i.e. close paraphrases which share truth conditions (Lambrecht, 1996)) differing only in information structure will differ in felicity in

[3] Hae-Kyung Wee and Young Chul Jun, p.c.

[4] There seems to be no consensus regarding this generalization. Dissenting views include Steedman (2000) based on a study of the interface between syntax and phonology and Hedberg and Sosa (2007) from the perspective experimental phonology, among others. Here we are not concerned with a precise account of the phonological realization of information structure marking in English, but rather how to represent the information structural effects of that marking for computational purposes. Therefore, we provisionally take Jackendoff's notion of A and B accents as a stand in for the prosodic representation.

[5] Of course, these languages can make use of others means to express information structure. English also has syntactic means to lay focus a constituent, such as clefts, pre-subject position, etc. So-called scrambling in Japanese also constrains information structure (Ishihara, 2001). Accents can also be used to signal focus in Russian.

Table 1: Languages

	English (eng)	**Japanese** [jpn]	**Russian** [rus]
means	prosody	lexical marking	syntactic positioning
focus	A-accent	case markers (*non-topic*)	clause-final
topic	B-accent	topic marker *wa*	unknown
contrast	A/B-accent	*wa*+scrambling	preposing (*contrast-focus*)

a given context. Multilingual NLP systems (e.g. MT) can be improved by making them sensitive to such constraints. For example, *The dog barks.* can be translated into at least two sentences in Japanese and Russian respectively. If *dog* bears the B-accent in English, the corresponding Japanese word *inu* should be combined with the topic marker *wa*, and the corresponding Russian word *sobaka* cannot occur clause-finally, as given in the first column of (1). On the other hand, if *dog* bears the A-accent, the nominative maker *ga* has to be used in Japanese, and the corresponding word can show up clause-finally in Russian, as shown in the second column of (1).[6]

(1) a. The **dog** BARKS. | The DOG barks.

b. inu-wa hoeru | inu-ga hoeru
dog-TOP bark dog-NOM bark [jpn]

c. sobaka laet | laet sobaka
dog bark bark dog [rus]

3 Individual Constraints

We propose to represent information structure via a feature ICONS (Individual CONstraintS) added to structures of type *mrs* (i.e. under CONT) as in (2). ICONS represents information structure as a binary relation between individuals and events. The items on the ICONS list are feature structures of type *info-str*[7] which indicate which index (the value of TARGET) has an information structural property and with respect to which clause (the value of CLAUSE). ICONS behaves analogously

[6] Angelina Ivanova and David Erschler each pointed out to us that the first sentence of (1c) can lay focus on *sobaka*, if the word bears a specific accent. That means the sentence *sobaka laet* could be ambiguously interpreted, if it were not for the accent on the subject *sobaka*. What we particularly argue is that the second sentence of (1c), in which the subject is overtly postposed, cannot correspond to the first sentences of (1a-b), because there is an obvious clue for the focus meaning whereby the sentence *laet sobaka* becomes unambiguous unlike the first sentence *sobaka laet*.

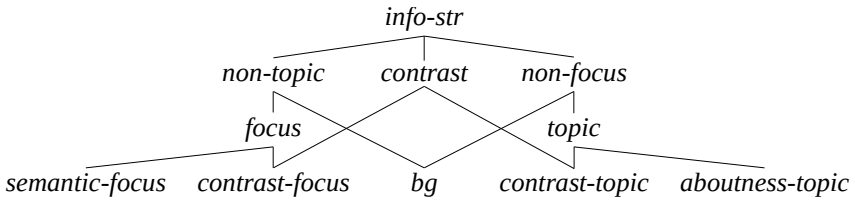
[7] The feature ICONS was originally proposed by Ann Copestake and Dan Flickinger, for the purpose of capturing semantically relevant connections between individuals which are nonetheless not well modeled as elementary predications, such as those found in intrasentential anaphora, apposition, and nonrestrictive relative clauses. Copestake and Flickinger recognized that we could use this same mechanism to anchor information structural constraints to particular clauses. In a more general system that uses ICONS both for our purposes and its original goals, the value of ICONS would be a list of items of type *icons*, where *info-str* is a subtype of *icons*.

to HCONS and RELS in that values of *info-str* are gathered up from daughters to mother up the tree.

(2)
$$\begin{bmatrix} \textit{mrs} & \\ \text{HOOK} & \begin{bmatrix} \textit{hook} & \\ \text{LTOP} & \textit{handle} \\ \text{INDEX} & \textit{individual} \\ \text{XARG} & \textit{individual} \\ \text{ICONS-KEY} & \textit{info-str} \\ \text{CLAUSE-KEY} & \textit{event} \end{bmatrix} \\ \text{RELS} & \textit{diff-list} \\ \text{HCONS} & \textit{diff-list} \\ \text{ICONS} & \left\langle ! \ ..., \begin{bmatrix} \textit{info-str} & \\ \text{CLAUSE} & \textit{individual} \\ \text{TARGET} & \textit{individual} \end{bmatrix}, ... \ ! \right\rangle \end{bmatrix}$$

In a particular ICONS element, the type will typically be resolved from *info-str* to a more specific type, drawn from the hierarchy in (3), to indicate the particular information structural role played by the TARGET in the CLAUSE. The *info-str* hierarchy is inspired by the analogous hierarchy from Song and Bender (2011), but is extended with three additional nodes: *non-topic*, *non-focus*, and *bg*: (i) *non-topic* means the target cannot be read as topic (e.g. case-marked NPs in Japanese); (ii) *non-focus* similarly indicates that the target cannot be the focus, and would be appropriate for e.g. dropped elements in pro-drop languages; (iii) finally, *bg* (background) means the constituent is neither *focus* nor *topic*, which typically does not involve additional marking but may be forced by particular positions in a sentence.

(3)



The type hierarchy (3) has three merits, comparing to our previous version presented in Song and Bender (2011) and other approaches in previous literature. First, (3) reveals that *contrast*, which is in a sister relation to *non-topic* and *non-focus*, behaves independently of *topic* and *focus* themselves. It has often been observed that a constituent in a language can convey an ambiguous meaning (i.e. contrastive meanings *vs.* non-contrastive meaning) even though it is marked in a specific form to express information structure in the language, and the meaning can be resolved only depending upon the given context in many cases. In order to represent the undetermined meanings properly in MRS, it is necessary to use a more flexible hierarchy which involves a cross-classification between *contrast*

and *topic/focus*. Second, *non-topic* and *non-focus* facilitate more flexible representation for informatively undetermined items in some languages. For example, case-marked NPs can convey the meaning either focus or background in Japanese (Heycock, 1994). That is, since a Japanese case marker (i.e. *ga* for nominatives) can convey two information structural meanings (*focus* and *bg*), the marker itself has to be less specifically represented as *non-topic* that both *focus* and *bg* inherit from. Third, we can make use of *bg* as a cross-cutting category, which sometimes needs to be explicitly marked. For instance, in English cleft constructions, the remaining part of the sentence after the relative pronoun should be represented as *bg*, because English cleft constructions belong to *focus-bg* in terms of sentential forms (Song and Bender, 2011).

The value of ICONS is constrained by both lexical and phrasal types. First, every lexical entry that introduces an index which can participate in information structure inherits from *icons-lex-item* (4a). This type bears the constraints which introduce an ICONS element as well as providing a pointer to the ICONS element inside the HOOK (ICONS-KEY), for further composition. *Icons-lex-item* also links the HOOK|INDEX to the TARGET value. On the other hand, lexical entries that cannot play a role in the information structure (e.g. semantically void lexical entries, such as case marking adpositions) inherit from *no-icons-lex-item* (4b), which provides an empty ICONS list.

(4) a.
$$\left[\begin{array}{l} \textit{icons-lex-item} \\ \text{HOOK}\left[\begin{array}{ll}\text{INDEX} & \boxed{1}\\ \text{ICONS-KEY} & \boxed{2}\end{array}\right] \\ \text{ICONS}\left\langle !\ \boxed{2}\left[\text{TARGET}\ \ \boxed{1}\right]!\right\rangle \end{array}\right]$$

b.
$$\left[\begin{array}{l} \textit{no-icons-lex-item} \\ \text{HOOK}\left[\begin{array}{ll}\text{ICONS-KEY}|\text{CLAUSE} & \boxed{1}\\ \text{CLAUSE-KEY} & \boxed{1}\end{array}\right] \\ \text{ICONS}\left\langle !\ !\right\rangle \end{array}\right]$$

Because the CLAUSE value needs to reflect the position in which a constituent is realized overtly, it is constrained via the phrase structure rules. Verbs which head their own clauses (i.e., finite verbs, plus certain uses of non-finite verbs) identify their CLAUSE value with their own INDEX (and thus their own TARGET) as shown in (5a).[8] For elements that do not head clauses, the CLAUSE value is constrained to be the INDEX of the verbal projection they attach to by *head-icons-phrase* (5b). This type is supertype to headed rules which can constrain information structure: e.g. *head-subj-phrase*, *head-comp-phrase*, and *head-mod-phrase*.

[8]The restriction to clause-heading verbs is meant to allow for examples like *The dog sitting on the mat barks.* where we believe that all elements of the VP *sitting on the mat* should take the INDEX of *barks* as their CLAUSE, not that of *sitting*.

(5) a.
$$\begin{bmatrix} \textit{verb-lex} & \\ \text{HOOK} & \begin{bmatrix} \text{INDEX} & \boxed{1} \\ \text{CLAUSE-KEY} & \boxed{1} \\ \text{ICONS-KEY|CLAUSE} & \boxed{1} \end{bmatrix} \end{bmatrix}$$

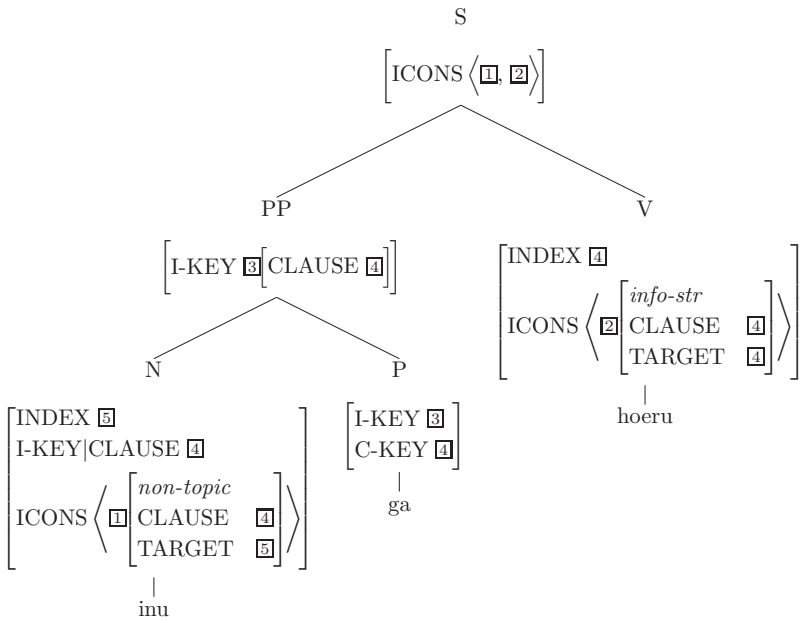
b.
$$\begin{bmatrix} \textit{head-icons-phrase} & \\ \text{HD-DTR|...|HOOK|CLAUSE-KEY} & \boxed{1} \\ \text{NON-HD-DTR|...|HOOK|ICONS-KEY|CLAUSE} & \boxed{1} \end{bmatrix}$$

The type of the ICONS-KEY value of a constituent (which, recall, points to an element of the ICONS list) can be constrained by accents responsible for information structural meanings, lexical rules attaching information structure marking morphemes, phrase structure rules corresponding to distinguished positions, or particles like Japanese *wa* combining as heads or modifiers with NPs. The headed rules can have subtypes which handle information structure differently, resolving the type of an ICONS element or leaving it underspecified. For example, the Russian allosentences (1c) are instances of *head-subj-phrase*, but the first one (*sobaka laet*), in which the subject is in situ, is licensed by a subtype that does not resolve the ICONS value, while the second one (*laet sobaka*), in which the subject is marked through being postposed, is licensed by the one which does. Hence, as shown in (7), the in-situ subject in Russian is specified as *info-str* (i.e. underspecified), whereas the overtly postposed subject is specified as *focus*.

The strategy of having phrase structure rules constrain the CLAUSE value of ICONS elements runs into a potential problem with *head-comp-phrase* because this rule is used in many different ways in our grammars. In particular, the problem arises with elements like Japanese case-marking adpositions: *inu-ga* 'dog-NOM' is an instance of *head-comp-phrase*, but *inu* has no informational structural relation with its head *ga*, and *ga* itself is semantically empty and thus has an empty ICONS list.[9] On the other hand, when *head-comp* joins a verb with its object (such as the PP *inu ga*), we want to connect the object's CLAUSE to the verb's INDEX. Rather than creating subtypes of *head-comp* to handle this differing behavior, we add the feature CLAUSE-KEY to mediate between the INDEX of the head and the CLAUSE value of the dependent. The phrase structure rules identify the head's CLAUSE-KEY with the non-head's ICONS-KEY|CLAUSE. Clause-heading verbs identify their INDEX and CLAUSE-KEY values. Case marking adpositions, on the other hand, inherit from *no-icons-lex-item*, which identifies CLAUSE-KEY with ICONS-KEY|CLAUSE. Note, however, that the value of ICONS-KEY is not identified with anything on the actual ICONS list for these elements, allowing ICONS-KEY|CLAUSE to function as sort of a scratch slot.

[9] On why *ga* et al are best treated as postpositions rather than affixes, see Siegel (1999).

(6) a.



b.

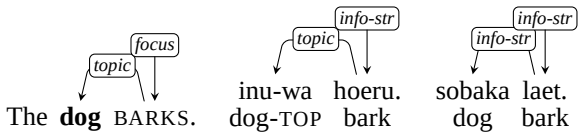
$$\begin{bmatrix} \textit{mrs} \\ \text{LTOP} \quad \boxed{h1} \\ \text{INDEX} \quad \boxed{e2} \\ \text{RELS} \quad \left\langle \begin{bmatrix} \textit{\_inu\_n\_rel} \\ \text{LBL} \quad \boxed{h3} \\ \text{ARG0} \quad \boxed{x4} \end{bmatrix}, \begin{bmatrix} \textit{exist\_q\_rel} \\ \text{LBL} \quad \boxed{h5} \\ \text{ARG0} \quad \boxed{x4} \\ \text{RSTR} \quad \boxed{h6} \\ \text{BODY} \quad \boxed{h7} \end{bmatrix}, \begin{bmatrix} \textit{\_hoeru\_v\_rel} \\ \text{LBL} \quad \boxed{h8} \\ \text{ARG0} \quad \boxed{e2} \\ \text{ARG1} \quad \boxed{x4} \end{bmatrix} \right\rangle \\ \text{HCONS} \quad \left\langle \begin{bmatrix} \textit{qeq} \\ \text{HARG} \quad \boxed{h6} \\ \text{LARG} \quad \boxed{h3} \end{bmatrix} \right\rangle \\ \text{ICONS} \quad \left\langle \begin{bmatrix} \textit{non-topic} \\ \text{CLAUSE} \quad \boxed{e2} \\ \text{TARGET} \quad \boxed{x4} \end{bmatrix}, \begin{bmatrix} \textit{info-str} \\ \text{CLAUSE} \quad \boxed{e2} \\ \text{TARGET} \quad \boxed{e2} \end{bmatrix} \right\rangle \end{bmatrix}$$

Building upon the constraints presented so far, a sample derivation for a Japanese sentence is illustrated in (6a): First, CLAUSE-KEY of the nominative marker *ga* is identified with its own ICONS-KEY|CLAUSE. Second, when the *head-comp-phrase* combines *inu* and *ga*, the ICONS-KEY|CLAUSE of *inu* is identified with the CLAUSE-KEY of *ga*, in accordance with *head-icons-phrase*. The ICONS-KEY of *ga* is passed up to the mother (Semantic Inheritance Principle). When the *head-subj-phrase* combines *inu-ga* and *hoeru*, the ICONS-KEY|CLAUSE of the subject *inu-ga* (and thus of both *inu* and *ga*) is identified with the INDEX of *hoeru*. The corresponding MRS representation is given in (6b).

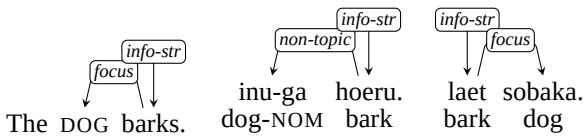
3.1 How MT works via ICONS

In the remainder of the paper, we will present information structural constraints in the style of dependency graphs of DMRS (Dependency MRS; Copestake 2009), for ease of exposition. In these graphs, the ICONS values are represented as links between head nouns (introducing the referential index that is the value of TARGET) and verbs (introducing the event variable that is the value of CLAUSE) and as unary properties of verbs themselves.[10] The graphs of the translations given in (1) are sketched in (7). The dependency graphs in (7) illustrate how our proposal gives rise to underspecified representations when information structure is not explicitly marked. Unless there is a specific clue to identify information structure such as A/B-accents in English, the topic marker *wa* in Japanese, and the clause-final position in Russian, the ICONS value remains just *info-str*.

(7) a.



b.



In (7a), the first graph represents an English sentence in which the subejct *the* ***dog*** bears the B-accent, thereby plays the role of topic, while the verb BARKS with the A-accent conveys the focus meaning. The direction of arrow stands for the binary relation between a TARGET (an entity) and a CLAUSE that the TARGET belongs to. The arc from BARKS to **dog** means the index of **dog** has a topic relation to the index of BARKS. The arrow to BARKS means the verb is linguistically marked as focus, with respect to the clause that it heads. The second graph in (7a) represents the Japanese translation, but since *hoeru* corresponding to BARKS has no overt mark of information structure, it remains just underspecified as *info-str*, differently from BARKS in the first graph. Likewise, in the third graph, since there is no information structural clue on *sobaka* corresponding to **dog** in the English translation, it also remains underspecified.

This ability to partially specify information structure allows us to reduce the range of outputs in translation while still capturing all legitimate possibilities. As mentioned in the foonote 6, the unmarked Russian sentence *sobaka laet* itself can correspond to both *The* ***dog*** BARKS in (7a) and *The* DOG *barks* in (7b), unless a phonological factor signals focus. That means, *The* ***dog*** BARKS can be translated into only *sobaka laet* corresponding to the third graph in (7a), but the same Russian sentence can be translated into both *The* ***dog*** BARKS and *The* DOG *barks*.

[10]This difference is because we use the event variable introduced by the verb to represent the clause, thus in the *info-str* constraint on the ICONS list of a verb, the TARGET and CLAUSE values are identified (cf. (5a)). Note also that though our examples focus on nominal arguments of verbs, the analysis is intended to scale to all semantically contentful elements.

3.2 Comparison to Previous Studies

The first main difference between our approach and previous studies has to do with the calculation of focus projection and in particular the role of underspecification. (8) provides a simple example of focus projection. The overt mark of focus is the A-accent on DOG, but this can be interpreted as spreading only to the NP or as spreading or projecting to the entire sentence. These different interpretations have different felicity conditions. The first could be the answer to the question *What barks?* (i.e. *focus-bg*), while the second to the question and *What happens?* (i.e. *all-focus*).

(8) a. [$_f$ The DOG] barks.

b. [$_f$ The DOG barks.]

Regarding the interpretation of (8), we can assume that (i) the two readings correspond to two distinct structures (parse trees), or (ii) the two readings are further specializations of one MRS, which is associated with one syntactic structure and includes some underspecified values. Here, as our goal is a computational model, we take the second approach for practical reasons and underspecify the type of the ICONS element for unmarked constituents such as *barks* in (8). Some previous work (Engdahl and Vallduví, 1996; De Kuthy, 2000; Chung et al., 2003), in contrast, takes the first approach without using underspecification: All sentences, within these frameworks, have as many syntactic trees as potential information structural interpretations.

Second, our approach has both similarities and differences to earlier work representing information structure in MRS. Wilcock (2005) models the scope of focus similarly to quantifier scope (i.e. HCONS), which is close to the idea that we take as our departure point for discussion. The difference between Wilcock's proposal and ours is that information structure in his model is represented as variables over handles, but ICONS captures the clause that an individual informatively belongs to as a binary relation, which facilitates scaling to multiclausal constructions.

(9) a. The president [$_f$ hates the china set].

b. 1:the(x,2), 2:president(x), 3:the(y,4), 4:china(y), 4:set(y), 5:hate(e,x,y)
TOP-HANDLE:5, LINK:1, FOCUS:3,5 (wide focus)

For instance, (9b) taken from Wilcock (2005, p. 275) represents the wide focus reading of (9a) (i.e. from 3 to 5). Note that in this representation, LINK (*topic* in this paper) and FOCUS have no relation to the clause or its head (*hate*). Paggio (2009) also models information structure within the MRS formalism, but information structural components in her proposal are represented as a part of the context, not the semantics. Though each component under CTXT|INFOSTR involves coindexation with individuals in MRS, her approach cannot be directly applied to the LOGON MT infrastructure that requires all transfer-related ingredients accessible in MRS (Oepen et al., 2007). Bildhauer and Cook (2010) offer an MRS-based architecture, too: Information structure in their proposal is represented directly under

SYNSEM (i.e. SYNSEM|IS) and each component (e.g. TOPIC, FOCUS) has a list of indices identified with ones that appear in EPs in SYNSEM|LOC|CONT|RELS, which is not applicable to the LOGON infrastructure for the same reason.[11]

In short, using ICONS has two merits in the context of implementing NLP systems; (i) underspecifiability, and (ii) the availability of a binary relation between individuals. The former facilitates flexible, partial representations and the latter enables us to capture information structure even in multiclausal sentences. The following sections cover each of these points in turn.

4 Underspecifiability

Previous approaches to the modeling of information structure are not efficient in NLP systems because having a large number of trees eventually has an adverse effect on performance as well as accuracy. Since it is important for transfer-based MT to reduce the number of potential analyses in each step, it is necessary to use a more effective and flexible method to represent information structure. We believe that our underspecified representations[12] can be further constrained to represent different information structural interpretations (consistent with the given ICONS list) in the same way that scope-underspecified MRSs can be further constrained with handle identities to yield fully scoped representations consistent with the given HCONS list. Thus, similarly to how a sentence with a scopal ambiguity (e.g. *Every dog chases some white cat.*) has a single MRS partially constrained via *qeq*s, the current work proposes that (8) be given a single representation whose information structure is partially constrained via ICONS.

We leave the development of the algorithm that calculates focus projection over MRS+ICONS to future work. We are particularly interested to investigate whether the MRS structure augmented with ICONS is sufficient, or if the focus projection algorithm would require access to syntactic structure. We note that previous work on focus projection (De Kuthy, 2000; Chung et al., 2003) highlights the importance of grammatical functions. However, the relevant distinctions (argument *vs.* adjunct status, peripheral *vs.* non-peripheral arguments) can be reconstructed on the basis of the MRS alone. Therefore, we consider it at least plausible that MRS+ICONS will contain enough information to calculate the range of fully-specified information structures for each sentence.

[11] We, of course, do not claim that every grammar should be compatible with the LOGON infrastructure. As mentioned in the introduction, the ultimate goals of this study include creating a computational library within the Grammar Matrix, which can be effectively used to enhance performance of HPSG/MRS-based MT systems. Given that LOGON, for now, is the readily available infrastructure for the purpose, our approach follows the requirements as far as possible.

[12] In early work on information structure in HPSG, Kuhn (1996) also suggests an underspecified representation for information structure, noting that prosodic marking of information structure often yields ambiguous meanings, which cannot in general be resolved in computational sentence-based processing.

5 Multiclausal Utterances

In addition to the ability to partially specify information structure (a property shared with some previous approaches, including Kuhn (1996) and Song and Bender (2011)), the current proposal has the benefit of sufficient flexibility to handle multiclausal utterances. Specifically, the difference between our current proposal and our previous one is in the representation of the constraints: Where Song and Bender (2011) used features on semantic variables, here we introduce binary relations on ICONS in order to handle information structure in multiclausal sentences within the MRS representation.

(10)–(11) show how the move to binary relations helps represent cases where an individual has different information structural relations to the matrix and subordinate clauses. The answer in (10), which assigns the main stress (i.e. A-accent) on a constituent inside a relative clause, can be a proper answer to only Q1. Q2 is not a contextually appropriate question because it would require focus on the whole subject NP, and a non-head daughter (i.e. modifier) cannot project focus to its head daughter (i.e. modifiee) (Chung et al., 2003). In other words, [$_f$ *The dog that* KIM *saw*] is not a possible focus projection result because the head noun *dog* without an accent cannot inherit focus from KIM in the relative clause.[13] For the same reason, the answer sounds infelicitous in the *all-focus* context set up by Q3 as well. These facts suggest the range of focus projection possibilities shown in (11a). The encoding of these possibilities in our underspecified representation, along with further information structural information, is shown in (11b). The key property of (11b) is that one element *dog* is related via different elements of ICONS to two verbs; one is *barked* in the matrix clause, and the other is *saw* in the relative clause.[14] On the one hand, *dog* has the *non-focus* relation (i.e. either *topic* or *bg*) with the main verb *barked*, because it cannot inherit focus from the A-accent in the relative clause.[15] On the other hand, since there is no specific clue to identify the relation between *dog* and *saw*, *dog* is specified as just *info-str* in relation to *saw*. In (11b) there are three additional relations as well: On the one hand, KIM, which bears the A-accent (i.e. is overtly marked), has the *focus* relation with *saw* in the relative clause. On the other hand, *saw* and *barked* lack specific marking and so are left underspecified.

[13] If *dog* also bears the A-accent, it can get focus (i.e. multiple foci: *The* DOG *that* KIM *saw barked.*), but it cannot be focused through focus projection from the adjunct (Chung et al., 2003).

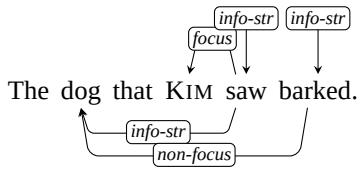
[14] The ICONS relationship between *dog* and *saw* is mediated by the coindexation of *dog* and the gap in the relative clause.

[15] Heycock (1994) and Chung et al. (2003) claim whether the focus on subjects can be projected to the whole sentence or not depends on an aspectual property of the predicates (i.e. individual-level *vs*. stage-level). Exploring naturally occurring texts, however, presents quite a number of examples which the distinction between individual-level and stage-level cannot be straightforwardly applied to. Thus, it would be more feasible to leave formally unmarked constituents (e.g. *barked* in (7b)) informatively underspecified.

(10) Q1: Which dog barked?
Q2: #What barked?
Q3: #What happened?
A: The dog that KIM saw barked.

(11) a. The dog that [$_f$ [$_f$ KIM] saw] barked.

b.



c.

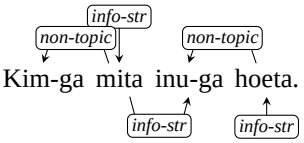
$$\begin{bmatrix} mrs \\ \text{LTOP} \quad h1 \\ \text{INDEX} \quad e2 \\ \text{RELS} \quad \left\langle \begin{bmatrix} \textit{\_the\_q\_rel} \\ \text{LBL} \quad h3 \\ \text{ARG0} \quad x5 \\ \text{RSTR} \quad h6 \\ \text{BODY} \quad h4 \end{bmatrix}, \begin{bmatrix} \textit{\_dog\_n\_rel} \\ \text{LBL} \quad h7 \\ \text{ARG0} \quad x5 \end{bmatrix}, \begin{bmatrix} \textit{proper\_q\_rel} \\ \text{LBL} \quad h8 \\ \text{ARG0} \quad x10 \\ \text{RSTR} \quad h9 \\ \text{BODY} \quad h11 \end{bmatrix}, \right. \\ \left. \begin{bmatrix} \textit{named\_rel} \\ \text{LBL} \quad h12 \\ \text{ARG0} \quad x10 \\ \text{CARG} \quad \textit{kim} \end{bmatrix}, \begin{bmatrix} \textit{\_see\_v\_rel} \\ \text{LBL} \quad h7 \\ \text{ARG0} \quad e13 \\ \text{ARG1} \quad x10 \\ \text{ARG2} \quad x5 \end{bmatrix}, \begin{bmatrix} \textit{\_bark\_v\_rel} \\ \text{LBL} \quad h14 \\ \text{ARG0} \quad e2 \\ \text{ARG1} \quad x5 \end{bmatrix} \right\rangle \\ \text{HCONS} \quad \left\langle \begin{bmatrix} \textit{qeq} \\ \text{HARG} \quad h6 \\ \text{LARG} \quad h7 \end{bmatrix}, \begin{bmatrix} \textit{qeq} \\ \text{HARG} \quad h9 \\ \text{LARG} \quad h12 \end{bmatrix} \right\rangle \\ \text{ICONS} \quad \left\langle \begin{bmatrix} \textit{focus} \\ \text{CLAUSE} \quad e13 \\ \text{TARGET} \quad x10 \end{bmatrix}, \begin{bmatrix} \textit{info-str} \\ \text{CLAUSE} \quad e13 \\ \text{TARGET} \quad e13 \end{bmatrix}, \begin{bmatrix} \textit{info-str} \\ \text{CLAUSE} \quad e13 \\ \text{TARGET} \quad x5 \end{bmatrix}, \right. \\ \left. \begin{bmatrix} \textit{non-focus} \\ \text{CLAUSE} \quad e2 \\ \text{TARGET} \quad x5 \end{bmatrix}, \begin{bmatrix} \textit{info-str} \\ \text{CLAUSE} \quad e2 \\ \text{TARGET} \quad e2 \end{bmatrix} \right\rangle \end{bmatrix}$$

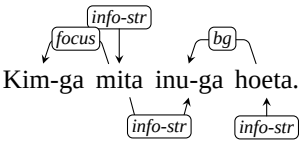
6 A Sample Translation

This section briefly illustrates how our representations are used in machine translation. The LOGON MT infrastructure (Oepen et al., 2007) handles translation in three steps: first, a sentence from the source language is parsed using the source language grammar, resulting in an MRS representation. Then that MRS is used as input to the transfer process where it is modified by transfer rules into an MRS interpretable by the target language grammar. Finally, the target language MRS is given to the generator, along with the target language grammar, and the generator finds realizations (surface strings) which the grammar licenses as compatible with the MRS.

(11c) above shows the full, underspecified MRS representation of (11a). The simpler graph-based view is in (11b). One potential translation of this sentence into Japanese is (12a). If we parse (12a) with the Japanese grammar, the resulting ICONS constraints are as in (12b). This is compatible with (11b,c). Thus, if we were to put (11c) through the transfer component, with an appropriate transfer grammar to map the English predicates to Japanese ones (leaving the ICONS intact), the resulting MRS could be used as input by the generator with the Japanese grammar to generate (12a).

(12) a. Kim-ga mita inu-ga hoeta
Kim-NOM saw dog-NOM barked [jpn]

b.


c.


In the process of generation, information from the input MRS is unified with constraints provided by the grammar. Thus the actual ICONS value associated with (12a) as translation output from (11a) will be the more specific representation shown in (12c). The *focus* relation between *Kim* and *mita* 'saw', which is a more specific type of *non-topic*, is taken from (11c). *Non-focus* between *dog* and *barked* in (11c) and *non-topic* between *inu* 'dog' and *hoeta* 'barked' are consistent with each other, and unified as *bg*. The others are the same as those in (12b).

7 Implementation

We have actually implemented the analyses discussed so far with ACE (`http://sweaglesw.org/linguistics/ace`).[16]

As the first step, we created toy grammars for English and Japanese using the LINGO Grammar Matrix customization system. Next we added the type hierarchy of ICONS and the related constraints into each grammar, which include (4), (5), and language-specific rules to mark information structure (i.e. A/B-accents in English, and lexical markers in Japanese). Using ACE, we conducted a small experiment to check out whether our grammars provide the translations as expected. For example, the English words *dog* and *barks* can bear the different ICONS values shown in (13), depending on their associated accents. We represent these accents with the hypothetical suffixes '-a' and '-b'. The '-b' suffix cannot be attached to the verb *barks* in our toy grammar because verbs presumably cannot be marked via B-accent for the information structural role of *topic* in English.

[16] ACE, using DELPH-IN grammars (such as the ERG (Flickinger, 2000) or grammars output by the Grammar Matrix customization system), parses sentences of natural languages, and generates sentences based on the MRS representation that the parser creates. It is the first DELPH-IN processor to specifically handle ICONS as part of the MRS.

(13) dog dog: info-str [ICONS: < e2 info-str x4 >]
dog-a: focus [ICONS: < e2 focus x4 >]
dog-b: topic [ICONS: < e2 topic x4 >]
bark barks: info-str [ICONS: < e2 info-str e2 >]
barks-a: focus [ICONS: < e2 focus e2 >]

Thus, *The dog barks* without any information structural marking logically can be interpreted as six types of sentences (3×2). However, if we apply ICONS to generation, we can filter out sentences which are not informatively equivalent to the input sentence. For example, if the input sentences are *The* DOG *barks* and *The **dog** barks* in which the subject bears the A/B-accents respectively, they can be monolingually paraphrased as (14). That is, we can get rid of two infelicitous sentences from each set of sentences.

(14) a. The dog-**a** barks [ICONS: < e2 **focus** x4, e2 info-str e2 >]
(i) The dog barks
(ii) The dog-a barks
(iii) The dog barks-a
(iv) The dog-a barks-a
(v) ~~The dog-b barks~~
(vi) ~~The dog-b barks-a~~
b. The dog-**b** barks [ICONS: < e2 **topic** x4, e2 info-str e2 >]
(i) The dog barks
(ii) ~~The dog-a barks~~
(iii) The dog barks-a
(iv) ~~The dog-a barks-a~~
(v) The dog-b barks
(vi) The dog-b barks-a

The same goes for Japanese in which lexical markers play a role to signal information structure. There are at least three Japanese translations (i.e. case-marking, topic-marking, and null-marking) corresponding to *The dog barks*, but case-marked NPs cannot be paraphrased into topic-marked NPs within our *info-str* hierarchy given in (3), and vice versa.

(15) a. inu **ga** hoeru [ICONS: < e2 **non-topic** x4, e2 info-str e2 >]
(i) inu ga hoeru
(ii) ~~inu wa hoeru~~
(iii) inu hoeru
b. inu **wa** hoeru [ICONS: < e2 **topic** x4, e2 info-str e2 >]
(i) ~~inu ga hoeru~~
(ii) inu wa hoeru
(iii) inu hoeru

Translating across languages is constrained in the same manner. An English sentence (16a) cannot be translated into (16a-ii), because the *focus* role that DOG involves is incompatible with the *topic* role that the topic maker *wa* assigns. On the other hand, a Japanese sentence (16b) cannot be translated into (16b-v) and (16b-vi), because *non-topic* that comes form the nominative marker *ga* is contradictory to *topic* that the B-accent signals in English.

(16) a. The dog-**a** barks [ICONS: < e2 **focus** x4, e2 info-str e2 >]
(i) inu ga hoeru
(ii) ~~inu wa hoeru~~
(iii) inu hoeru
b. inu **ga** hoeru [ICONS: < e2 **non-topic** x4, e2 info-str e2 >]
(i) The dog barks
(ii) The dog-a barks
(iii) The dog barks-a
(iv) The dog-a barks-a
(v) ~~The dog-b barks~~
(vi) ~~The dog-b barks-a~~

In our small experiment, we conducted four types of translation or paraphrasing (English-English, Japanese-Japanese, English-Japanese, and Japanese-English), and found that for our simple example sentences incorporating information structure into the translation process reduces the number of outputs by 22%.

8 Conclusion

This paper, in the context of multilingual MT, shows that information structure can be effectively represented within MRS via ICONS. ICONS takes as its value a list of *info-str* objects with CLAUSE and TARGET properties; the subtypes of *info-str* indicate which information structural role is played by the TARGET with respect to the CLAUSE.

Our future work includes two directions: Theoretically, it is important to understand how information structure works in various types of embedded clauses (e.g. clefts, control constructions) as well as what kinds of embedded constituents create their own information structural domains (e.g. relative clauses *vs*. progressive participles used as modifiers). Distributionally, we plan to exploit multilingual parallel texts to learn whether ICONS can be straightforwardly applied to other languages from a cross-linguistic viewpoint.

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On the agreement between predicative complements and their target

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Abstract

Predicative complements canonically show number and/or gender agreement with their target. The most detailed proposal on how to model it in HPSG is in Kathol (1999). This proposal, though, mainly deals with the predicative adjectives of the Romance languages, and turns out to be rather inappropriate for dealing with predicate nominals. There is an obvious way to repair it, but it cannot be fitted in the canonical HPSG treatment of clauses with a predicative complement. It can be fitted, though, in a treatment of such clauses that was proposed in Van Eynde (2009). Adopting that treatment, the agreement will be modeled in terms of a constraint on the lexemes which select a predicative complement.

1 Introduction

The most conspicuous type of agreement in clauses with a predicative complement concerns the number and gender agreement between a predicative adjective and its target, as illustrated in the Italian (1).

(1) a. Il cane mi sembra contento/*contenti.
the dog-SG.MAS me seems happy-SG.MAS/*happy-PL.MAS
'The dog seems happy to me.'

b. I cani mi sembrano contenti/*contento.
the dog-PL.MAS me seem happy-PL.MAS/*happy-SG.MAS
'The dogs seem happy to me.'

c. La gatta mi sembra contenta/*contente.
the cat-SG.FEM me seems happy-SG.FEM/*happy-PL.FEM
'The cat seems happy to me.'

d. Le gatte mi sembrano contente/*contenta.
the cat-PL.FEM me seem happy-PL.FEM/*happy-SG.FEM
'The cats seem happy to me.'

While the data in (1) are straightforward, the phenomenon is more complex than these examples suggest, as demonstrated in (2–3).

(2) Su Majestad suprema está contento.
his majesty-FEM supreme-FEM is happy-MAS
'His Majesty is happy.'

[†]For their comments on the first version of this text I want to thank the three anonymous reviewers, my colleagues at the Centre for Computational Linguistics and the audience of an HPSG workshop in Frankfurt on May 11–12, 2012, where I gave a talk about a similar topic. Special thanks go to Gert Webelhuth for the invitation to the workshop in Frankfurt, to Byong-Rae Ryu for the offer to deliver the keynote speech at the conference in Daejeon, and to Stefan Müller for his comments on the prefinal version of this paper.

(3) a. Vous êtes/*es loyal.
you-2.PL be-2.PL/*be-2.SG loyal-SG
'You are loyal.'

b. On a/*ont été loyaux.
one-SG have-3.SG/*have-3.PL been loyal-PL
'We have been loyal.'

In the Spanish example, quoted from Corbett (1991, 225), the attributive adjective *suprema* shares the grammatical gender of the feminine *Majestad*, but the predicative adjective does not. Instead, it takes the masculine form if it denotes a male monarch, and the feminine form if it denotes a female monarch. Similarly, in the French examples, quoted from Wechsler and Zlatić (2003, 98, 102), the finite verbs shares the grammatical number of the subject, which is plural for *vous* and singular for *on*, but the predicative adjectives do not: They are singular if the subject denotes an individual and plural if it denotes an aggregate, irrespective of the pronouns' grammatical number.

The challenge for a treatment of this type of agreement is to model it in such a way that it blocks the starred combinations in (1), but allows the mismatches in (2) and (3). A useful starting point for that purpose is the distinction between morphosyntactic agreement (also known as concord) and index agreement, as introduced in Pollard and Sag (1994) and further developed in a.o. Kathol (1999) and Wechsler and Zlatić (2003).

2 Two kinds of agreement

What underlies the distinction between two kinds of agreement is the intuition that the morphosyntactic number and gender of a noun do not always correspond to its 'semantic' number and gender. The Spanish *Majestad*, for instance, is grammatically feminine, but is treated as masculine for the purpose of agreement with the predicative adjective if it denotes a male monarch, as in (2). Similarly, the French *vous* is grammatically plural, but is treated as singular for the purpose of agreement with the predicative adjective if it denotes a single entity, as in (3a). To make this more precise Wechsler and Zlatić (2003, 30) employs the scheme in (4).

(4) morphology $\Longleftrightarrow$ CONCORD $\Longleftrightarrow$ INDEX $\Longleftrightarrow$ semantics

"We recognize two distinct grammaticalization 'portals', one each via semantics and morphology. These two sources of grammaticalization lead to two distinct bundles of agreement features for a given noun. The morphology-related agreement bundle wil be called CONCORD (which includes case, number and gender) and the semantics-related agreement bundle which will be called INDEX (which includes person, number and gender)." (Wechsler and Zlatić, 2003, 28) For most nouns, the number and gender features in the two 'portals' match, but if there is a mismatch between morphology and semantics, as in the case of a grammatically

feminine noun with a male referent, the INDEX|GENDER value may reflect the latter and deviate from the former. This is made explicit in the lexical entry that Kathol (1999, 248) assigns to *Majestad*.[1]

(5)
$$\begin{bmatrix} \ldots \mid \text{AGR} \begin{bmatrix} \text{NUMBER} & \textit{sg} \\ \text{GENDER} & \textit{fem} \end{bmatrix} \\ \ldots \mid \text{INDEX} \begin{bmatrix} \text{PERSON} & \textit{3} \\ \text{NUMBER} & \textit{sg} \\ \text{GENDER} & \textit{gender} \end{bmatrix} \end{bmatrix}$$

The AGR|GENDER value is unambiguously *feminine*, but its counterpart in the index is left underspecified. This accounts for (2), if one assumes that the agreement between an attributive adjective and its nominal head is an instance of concord, whereas the agreement between a predicative adjective and the subject is an instance of index agreement, as spelled out in (6), quoted from Kathol (1999, 241).[2]

(6) a. morphosyntactic: AGR(selector) $\approx$ AGR(argument)
b. semantic: AGR(selector) $\approx$ INDEX(argument)

The selector is the adjective, and the argument is the head nominal in (6a) and the subject in (6b). "$\approx$" stands for something like "is structure-shared in its relevant parts with" (o.c.).

The number agreement in the French examples can be described along the same lines: If it is assumed that *on* 'one' and *vous* 'you' have a specific AGR|NUMBER value but an underspecified INDEX|NUMBER value, and if it is assumed that the agreement between subject and finite verb is an instance of concord (in French), while the agreement between a predicative adjective and its target is an instance of index agreement, one accounts for the data in (3).

From a more general perspective, the introduction of the distinction between morphosyntactic agreement and index agreement begs the question of which types of agreement belong to the former and which to the latter. Surveying the HPSG literature on the topic, there appears to be a large consensus that the agreement between a noun and an attributive adjective, as in *cane contento/*-i* and *Majestad suprema/*-o*, is an instance of morphosyntactic agreement. Likewise, there is a broad consensus to treat the agreement between an anaphoric pronoun and its antecedent, as in (7), as an instance of index agreement.

(7) a. Joan washed herself/*himself/*itself/*themselves.
b. The brothers/*brother killed each other.

[1] Kathol's AGR feature corresponds to Wechsler and Zlatic's CONCORD feature.
[2] Kathol's characterization of (6b) as 'semantic' is misleading, but it is part of the quote.

The reflexive pronoun in (7a) must be singular feminine if its antecedent denotes a female individual, and the inherently plural reciprocal pronoun in (7b) is only compatible with a plural antecedent.

For other types of agreement, though, one finds different proposals. This is partly due to differences between languages. Pollard and Sag (1994), for instance, argues that the agreement between subject and finite verb is an instance of index agreement, mainly on the basis of English examples, while Kathol (1999) argues that it is an instance of morphosyntactic agreement, mainly on the basis of German and French examples. These proposals are not incompatible: It is perfectly conceivable that English differs from German and French in this respect.

Precisely for this reason it is worth investigating the agreement between predicative complements and their target in other languages than the Romance ones.

3 The agreement between predicate nominals and their target

In English, Dutch and German, there is no overtly marked agreement between predicative adjectives and their target, since the predicative adjectives of these languages do not show any inflectional variation for number or gender. Their predicate nominals, however, are inflected for number and canonically show agreement with the target, as illustrated in (8).

(8) a. His brother is an engineer/*engineers.
b. His brothers are both engineers/*an engineer.

At the same time, there is ample room for mismatches, as shown by the following German example, quoted from Müller (1999, 273).

(9) Die Hooligans sind eine Schande.
the hooligan-PL are a shame-SG
'The hooligans are a shame.'

Similar examples from Dutch are given in (10–11), quoted from LASSY-small, a treebank for written Dutch, described in Van Noord et al. (2012).[3]

(10) Hiervan zijn tevens zes Belgische Europarlementariërs lid.
here-of are also six Belgian Europarlementarian-PL member-SG
'Six Belgian Europarlementarians are members of this.'

(11) Politieke tegenstellingen zijn een wezenskenmerk van elke democratie.
political contrast-PL are a characteristic-SG of every democracy
'Political contrasts are a characteristic of every democracy.'

[3]The identifiers of the sentences are respectively wiki-154.p.25.s.3 and dpc-kok-001320-nl-sen.p.6.s.2.

This clearly shows that the agreement between predicate nominals and their target is not an instance of morphosyntactic agreement in these languages. At the same time, the treatment which Kathol (1999) proposes for the predicative adjectives of the Romance languages, as spelled out in (6b), is not appropriate either: Given that the predicate nominal in (10), for instance, is grammatically singular, (6b) requires the subject to have a singular index, which implies that it is individuated as a single entity, yielding the implausible interpretation that (10) is about one member that consists of six people. The problem is worse in (12).

(12) Die politici zijn niet bepaald elkaars beste vriend.
those politician-PL are not exactly each-other-GEN best friend-SG
'Those politicians are not exactly each other's best friends.'

Also here the grammatical number of the predicate nominal is singular, which given (6b) implies that the index of the subject must be singular. However, since the agreement between an anaphoric pronoun and its antecedent is an instance of index agreement, the subject must have a plural index, just like the inherently plural reciprocal pronoun. In spite of these conflicting constraints on the INDEX|NUMBER value of the subject the sentence is wellformed. As an alternative I propose the scheme in (13).

(13) INDEX(selector) $\approx$ INDEX(argument)

What differentiates it from (6b) is that the predicate nominal is required to share its INDEX|NUMBER value, rather than its AGR|NUMBER value, with the INDEX|NUMBER value of its target.

In the following I first present a treatment of the agreement between predicative complements and their target along the lines of (13) (section 4). Then I demonstrate that this treatment is not compatible with the basic assumptions of the canonical HPSG treatment of predicative complements and argue that that treatment needs to be revised anyway (section 5). Finally, I present an alternative treatment of predicative complements, based on Van Eynde (2008) and Van Eynde (2009), and show how (13) can be integrated in this treatment (section 6).

4 Modeling the agreement

Remember that the mismatches in (2-3), repeated in (14-15), were accounted for by assuming that the morphosyntactic number and gender values of the subject are not necessarily identical to the number and gender values in its index.

(14) Su Majestad suprema está contento.
his majesty-FEM supreme-FEM is happy-MAS
'His Majesty is happy.'

(15) a. Vous êtes/*es loyal.
you-PL be-PL/*be-SG loyal-SG
'You are loyal.'

b. On a/*ont été loyaux.
one-SG have-SG/have-PL been loyal-PL
'We have been loyal.'

More specifically, while the subjects have specific values for morphosyntactic gender and/or number, the corresponding values in their index are underspecified and are resolved contextually.

Since predicate nominals are nouns or projections of nouns, just like subjects, it follows that their morphosyntactic number and gender values are not necessarily identical to the number and gender values in their index either. In fact, this is what accounts for the fact that the bare singular noun in the Dutch (16) is compatible with both singular and plural subjects.

(16) a. Zijn broer is ingenieur.
his brother is engineer
'His brother is an engineer.'

b. Zijn broers zijn ingenieur.
his brothers are engineer
'His brothers are engineers.'

The nouns in the predicate nominal are morphosyntactically singular, but their INDEX|NUMBER value is resolved to *singular* in the combination with a singular subject and to *plural* in the combination with a plural subject. It, hence, depends on the context whether it individuates a single entity or an aggregate. This also accounts for the mismatch in (10), repeated in (17).

(17) Hiervan zijn tevens zes Belgische Europarlementariërs lid.
here-of are also six Belgian Europarliamentarian.PL member.SG
'Six Belgian Europarliamentarians are members of this.'

The predicate nominal *lid* 'member' is morphosyntactically singular, but its index is underspecified and can, hence, be resolved to plural. The resulting interpretation is the distributive one, in which each of the six parliamentarians is claimed to be a member.

To counter the impression that this treatment is overly permissive it is worth stressing that the underspecification of the INDEX|NUMBER value is limited to certain nominals. In the same way as not every Spanish noun is like *Majestad* and not every French pronoun like *on* and *vous*, not every Dutch nominal is like *ingenieur* and *lid*. Of crucial relevance in that respect is the presence of a determiner. This is especially clear if we add the indefinite article to the predicate nominal, as in (18).

(18) a. Zijn broer is een ingenieur.
his brother is an engineer
'His brother is an engineer.'

b. ?? Zijn broers zijn een ingenieur.
?? his brothers are an engineer

As the question marks indicate, (18b) is much worse than (16b). This is due to the fact that the indefinite article requires a count noun with a singular index as its head. Its addition, hence, yields a predicate nominal which is only compatible with a target with a singular index. As a consequence, if the target is morphosyntactically plural, as in (18b), the combination is only possible if it is given a non-distributive interpretation, i.e. if my brothers jointly constitute one engineer. Since this interpretation is highly unnatural, (18b) is of doubtful quality. This also accounts for the illformedness of the English (19).

(19) * His brothers are both an engineer.

The presence of the floating quantifier *both* imposes a distributive interpretation on the subject, which is obviously incompatible with the non-distributive interpretation that the predicate nominal triggers.

By contrast, if the non-distributive interpretation makes good sense, the combination is impeccable. This accounts for the wellformedness of (11), repeated in (20).

(20) Politieke tegenstellingen zijn een wezenskenmerk van elke democratie.
political contrast-PL are a characteristic-SG of every democracy
'Political contrasts are a characteristic of every democracy.'

The most plausible interpretation of (20) is not that every single political contrast is a characteristic of democracy, but rather that the phenomenon of having political contrasts in general is a characteristic of democracy. Similar remarks apply to the German (9), repeated in (21).

(21) Die Hooligans sind eine Schande.
the hooligan-PL are a shame-SG
'The hooligans are a shame.'

The most plausible interpretation of this sentence is not that every single hooligan is a shame, but rather that the phenomenon of having hooligans in general is a shame.

Summing up, the addition of the indefinite article resolves the underspecification of the NUMBER|INDEX value of the predicate nominal, which in combination with the agreement constraint in (13) imposes a non-distributive interpretation on the subject. If the subject is morphosyntactically plural, this yields an anomaly if the assignment of a non-distributive interpretation is implausible, as in (18b), or

impossible, as in (19), but if that interpretation makes sense, the combination is wellformed, as in (20–21).

Not all determiners resolve the underspecification. The negative *geen* 'no', for instance, leaves the INDEX|NUMBER value underspecified. A relevant example is (22).[4]

(22) Zijn vijftien goals van vorig seizoen waren dan ook geen toeval.
his fifteen goal.PL of last season were then also no accident.SG
'His fifteen goals of last season were no accident.'

Because of the underspecification, this combination is ambiguous, allowing both the distributive interpretation, in which each of his fifteen goals was no accident, and the non-distributive interpretation, in which it is the totality of his fifteen goals that is no accident. Predictably, if *geen* 'no' is replaced by *een* the former interpretation is ruled out.

Other determiners that leave the INDEX|NUMBER value underspecified are the possessive pronouns and the prenominal genitives. That paves the way for an account of the mismatch in (12), repeated in (23).

(23) Die politici zijn niet bepaald elkaars beste vriend.
those politician-PL are not exactly each-other-GEN best friend-SG
'Those politicians are not exactly each other's best friends.'

The predicate nominal is grammatically singular, but has an underspecified index, so that it is compatible with a subject that has a plural index. The resulting interpretation is unambiguously distributive: Not being each other's best friend is predicated of each member of the set that is denoted by *die politici* 'those politicians'.

To round off this survey, let us again compare (6b) with (13), repeated in (24) and (25).

(24) AGR(selector) $\approx$ INDEX(argument)

(25) INDEX(selector) $\approx$ INDEX(argument)

The former was proposed for the predicative adjectives of the Romance languages in Kathol (1999), but is not appropriate for the predicate nominals of the Germanic languages: It assigns an implausible interpretation to (16b) and (17), it models only one of the two interpretations of (22), and it erroneously discards (23) as ill-formed. By contrast, (25) gets the more plausible distributive interpretation of (16b) and (17), it captures both interpretations of (22), and it treats (23) as wellformed. In sum, there is ample evidence in favor of (25). At the same time, there is a residual problem: It cannot smoothly be integrated in the canonical HPSG treatment of clauses with a predicative complement.

[4]The identifier of this sentence is dpc-rou-000360-nl-sen.p.4.s.1.

5 The Fregean treatment of predicative complements

The canonical HPSG treatment of clauses with a predicative complement can best be understood by comparing it with the treatment of clauses with an object complement, as in (26).

(26) a. Kim hired a plumber.
b. ∃ x y [Kim(x) & plumber(y) & hired(x,y)]

In the semantic analysis of (26) the subject and the direct object each introduce a discourse marker and the role of the verb is to relate those two discourse markers. By contrast, in the semantic analysis of a clause with a predicative complement, such as (27), the subject introduces a discourse marker, but the predicate nominal does not. Instead, it is assumed to denote a property which is attributed to the referent of the subject, as in (27b).

(27) a. Kim is a plumber.
b. ∃ x [Kim(x) & be(plumber(x))]
c. ∃ x [Kim(x) & plumber(x)]

Moreover, the copula is assumed to be semantically vacuous and, therefore, omitted from the semantic representation, yielding (27c). I call this treatment Fregean, since it is an integral part of predicate calculus, see Frege (1892).

Converted into the TFS style notation of HPSG, the object complement in (26) denotes a scope-object, while the homophonous predicative complement in (27) denotes a state-of-affairs (*soa*). This is important in the present context, since scope-objects have an index, while states-of-affairs do not, as is clear from their definition in Ginzburg and Sag (2000, 387).

(28)
$$\begin{bmatrix} \textit{scope-object} \\ \text{INDEX} \quad \textit{index} \\ \text{RESTR} \quad \textit{set}\left(\textit{fact}\right) \end{bmatrix} \qquad \begin{bmatrix} \textit{soa} \\ \text{QUANTS} \quad \textit{list}\left(\textit{quant-rel}\right) \\ \text{NUCLEUS} \quad \textit{relation} \end{bmatrix}$$

In words, a scope-object consists of an index and a set of constraints on its denotation, while a state-of-affairs consists of list of quantifiers and a relation. The distinction is also made in the AVMs of the verbs. The transitive *hire* takes two arguments which both denote a scope object and assigns semantic roles to their indices, as in (29).

(29)
$$\begin{bmatrix} \text{PHON} \quad \langle \textit{hire} \rangle \\ \text{ARG-ST} \quad \langle \text{NP}_{\boxed{1}} , \text{NP}_{\boxed{2}} \rangle \\ \\ \text{SYNSEM} \mid \text{LOCAL} \mid \text{CONTENT} \mid \text{NUCLEUS} \begin{bmatrix} \textit{hire-rel} \\ \text{HIRER} \quad \boxed{1}\,\textit{index} \\ \text{HIRED} \quad \boxed{2}\,\textit{index} \end{bmatrix} \\ \\ \end{bmatrix}$$

The copula, by contrast, takes a predicative complement that denotes a state-of-afairs and identifies its own CONTENT value with that of its complement, as spelled out in (30), quoted from Pollard and Sag (1994, 147).[5]

(30)
$$\begin{bmatrix} \text{PHON} & \langle \textit{be} \rangle \\ \text{ARG-ST} & \langle \boxed{1}, \text{XP}\,[+\,\text{PRD}\,,\,\text{SUBJ}\ \langle \boxed{1} \rangle] : \boxed{2} \rangle \\ \text{SYNSEM}\,|\,\text{LOCAL} & \begin{bmatrix} \text{CAT}\,|\,\text{HEAD} & \textit{verb}[+\,\text{AUX}] \\ \text{CONTENT} & \boxed{2}\ \textit{soa} \end{bmatrix} \end{bmatrix}$$

This identification captures the assumption that it is semantically vacuous. If the verb which selects a predicative complement is not semantically vacuous, its CONTENT value contains a relation of its own, but also then the predicative complement denotes a state-of-affairs, as in the following AVM of the German *erscheinen* 'seem', quoted from Müller (2002, 104–109).[6]

(31)
$$\begin{bmatrix} \text{PHON} & \langle \textit{erscheinen} \rangle \\ \text{ARG-ST} & \langle \boxed{1}, \text{NP}[\textit{dative}]_{\boxed{3}}, \text{XP}\,[+\,\text{PRD}\,,\,\text{SUBJ}\ \langle \boxed{1} \rangle] : \boxed{2} \rangle \\ \text{SYNSEM}\,|\,\text{LOCAL}\,|\,\text{CONTENT} & \begin{bmatrix} \textit{erscheinen} & \\ \text{EXPERIENCER} & \boxed{3}\ \textit{index} \\ \text{SOA-ARG} & \boxed{2}\ \textit{soa} \end{bmatrix} \end{bmatrix}$$

The dative NP is assigned the EXPERIENCER role.

Taking stock, it is an integral part of the canonical HPSG treatment of clauses with a predicative complement that the latter denotes a state-of-affairs, rather than a scope-object. As a consequence, since a state-of-affairs does not contain an index, the predicative complements cannot be required to share the number value in their index with that of their target. At this point, we are faced with a dilemma: Either we stick to the canonical treatment of clauses with a predicative complement and modify the treatment of agreement, or we keep the treatment of agreement as it is and modify the canonical treatment of predicative complements. The option that will be chosen and defended in this paper is the second one, mainly because the Fregean analysis of predicative complements runs into a number of problems anyway, as will be shown now.

For a start, notice that the assignment of CONTENT values of type *state-of-affairs* to the predicate nominals implies that all nouns undergo a type shift, as they are canonically assumed to denote a scope-object, i.e. a pair of an index and a set

[5] This is not an exact copy of the original. The major difference is due to the fact that Pollard and Sag (1994, 147) describes the use of *be* in existential sentences, such as *there is a unicorn in the garden*, in which *there* is treated as an extra-argument. This is left out in (30). A minor difference concerns the replacement of SUBCAT with ARG-ST.

[6] This is not an exact copy of the original either. Also here I use ARG-ST instead of Müller's SUBCAT and XCOMP.

of constraints on its denotation.[7] To model this shift Pollard and Sag (1994, 360) employs a lexical rule.[8]

(32) PREDICATIVE NP LEXICAL RULE:

$$\left[\begin{array}{l}\text{CAT}\left[\begin{array}{ll}\text{HEAD} & \left[\begin{array}{ll}\textit{noun} & \\ \text{PRD} & -\end{array}\right] \\ \text{SUBJ} & \langle\ \rangle\end{array}\right] \\ \text{CONTENT}\left[\begin{array}{ll}\textit{scope-obj} & \\ \text{INDEX} & \boxed{1} \\ \text{RESTR} & \boxed{2}\ \textit{set}(\textit{psoa})\end{array}\right]\end{array}\right] \Rightarrow \left[\begin{array}{l}\text{CAT}\left[\begin{array}{ll}\text{HEAD} & \left[\begin{array}{ll}\textit{noun} & \\ \text{PRD} & +\end{array}\right] \\ \text{SUBJ} & \langle\ \text{XP}_{\boxed{1}}\ \rangle\end{array}\right] \\ \text{CONTENT}\ \boxed{2}\end{array}\right]$$

In words, for every nonpredicative noun which denotes a scope-object, there is a homophonous predicative noun which denotes the set of restrictions which are part of the scope-object (2). In the type hierarchy of Pollard and Sag (1994), which treats the RESTRICTION value as a set of parametrized states of affairs, this rule yields a semantic object which can be identified with the CONTENT value of the copula.[9] Besides, while the nonpredicative noun has an empty SUBJ list, its predicative counterpart selects a subject whose index is identified with the index of the nonpredicative noun (1). In combination with the assumption that the predicate selecting verbs are subject raisers, this has the effect of ensuring that the property which the predicate nominal denotes is attributed to its target.

As argued in Müller (2009), the lexical rule in (32) does not interact properly with the canonical HPSG treatment of nominal adjuncts. This can be illustrated with a predicate nominal that contains an attributive adjective, as in (33).

(33) John is a good candidate.

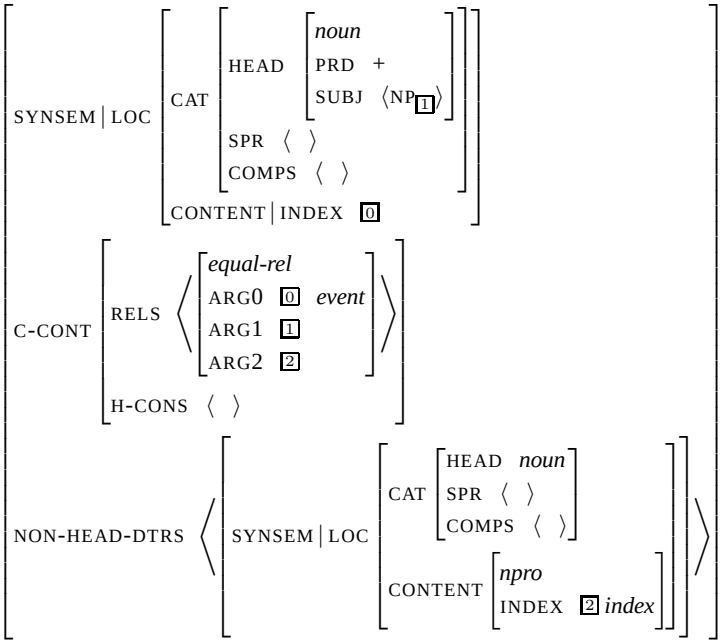
In the canonical HPSG treatment the adjective selects an N-bar head and identifies its own index with that of the noun, but if the noun is in predicative position, it has no index! To repair this Müller (2009) applies the type shift at the level of the full NP, rather than at the lexical level. More specifically, he employs a unary syntactic rule which transforms a nonpredicative NP into a predicative one.

[7] The notion of type shift was introduced in Partee (1987).

[8] Pollard and Sag (1994) uses the term *nominal-object* for what is called a *scope-object* in Ginzburg and Sag (2000). I use the latter term.

[9] In the type hierarchy of Ginzburg and Sag (2000), which treats the RESTRICTION value as a set of facts, the type shift has to be modeled in another way, but since the equivalent of (32) in Ginzburg and Sag (2000, 409) does not mention the CONTENT values, it is not made clear how this is done.

(34) PREDICATIVE NP PROJECTION SCHEMA:
np-pred-phrase ⇒



In words, the rule turns a fully saturated nonpronominal NP which denotes a scope-object (= the non-head-daughter) into a predicative NP which selects a subject and which denotes a relation of type *equal-rel* between the indices of the subject (1) and the NP daughter (2).[10] Moreover, the relation has a third argument whose value is of type *event*.

This treatment avoids the problem with (32), since the type shift is now applied after the addition of the adjuncts. At the same time, since (34) explicitly requires a fully saturated NP daughter, it does not subsume the determinerless predicate nominal in (35).

(35) Er ist Lehrer.
he is teacher
'He is a teacher.'

To cover this, Müller (2009) keeps a version of lexical rule (32), but the exact form of that version is not spelled out.

Returning to the issue of how to model the agreement between a predicate nominal and its target, Stefan Müller's unary syntactic rule is an improvement, since the mother node contains indices for both the predicative complement (2) and its target (1). The lexical rule, however, does not provide an index for the predicative complement, at least not in the version of Pollard and Sag (1994). Moreover, as

[10]The C-CONT attribute captures the constructional aspects of the semantic composition.

Pollard and Sag (1994, 360) acknowledges, the lexical rule is problematic for predicative proper nouns, as in (36), since it does not make much sense to treat a proper noun as denoting a state-of-affairs. The same is true for predicative pronouns, as in (37).[11]

(36) Cicero is Tully.

(37) a. Kim is somebody with good taste.
b. That bag is mine.

Another problem which applies both to the lexical rule and the unary syntactic rule is the assumption that the target of the predicative complement can be identified with its unexpressed subject. This is not only awkward for predicative proper nouns and pronouns, obliging one to assume that words like *Tully, somebody* and *mine* take a subject, it also makes erroneous predictions about predicative gerunds, as illustrated in (38).

(38) The greatest pleasure on earth is eating oysters and drinking champagne.

The unexpressed subject of eating and drinking is not the pleasure but rather PRO with arbitrary reference. The same holds for the Dutch bare infinitives in predicative position.

(39) Zo'n schoolreis is altijd weer hard werken.
such-a school-trip is always again hard work
'Such a school trip is always hard work.'

The understood subject of the infinitive is not the school trip, but PRO with arbitrary reference. Depending on the context it might refer to the teachers, the pupils, the bus driver, the parents, the secretary of the school, a local guide, etc.

Summing up, my treatment of the agreement between a predicative complement and its target as an instance of index agreement is not compatible with the canonical treatment of predicative complements in HPSG, but this does not mean that it should be given up, since the canonical treatment is marred by a number of problems anyway.

6 A Montagovian treatment of predicative complements

An alternative for the canonical HPSG treatment of predicative complements is proposed in Van Eynde (2008) and Van Eynde (2009). It is based on the assumption, originally due to Quine (1960) and formalized in Montague (1974), that the predicative complement introduces its own referent (or discourse marker) and that the function of the copula is to relate it to the referent of the subject, as in (40b).

[11] Perhaps for that reason, Müller (2009) excludes the application of the unary rule to pronominal predicates.

(40) a. Kim is a plumber.

b. ∃ x y [Kim(x) & plumber(y) & is(x,y)]

In terms of the semantic ontology of HPSG the predicative complement and its target both denote a scope-object and the function of the copula is to relate their respective indices. Speaking in more general terms, verbs which select a predicative complement denote a relation between the index of that complement and the one of its target, as in (41–42).

(41)
$$\begin{bmatrix} \textsc{phon} & \langle \textit{be} \rangle \\ \textsc{arg-st} & \langle \textsc{np}_{\boxed{1}}, \textsc{xp}_{\boxed{2}} \rangle \\ \textsc{synsem}\,|\,\textsc{loc}\,|\,\textsc{content}\,|\,\textsc{nucleus} & \begin{bmatrix} \textit{be-rel} \\ \textsc{theme} & \boxed{1}\ \textit{index} \\ \textsc{attribute} & \boxed{2}\ \textit{index} \end{bmatrix} \end{bmatrix}$$

(42)
$$\begin{bmatrix} \textsc{phon} & \langle \textit{erscheinen} \rangle \\ \textsc{arg-st} & \langle \textsc{np}_{\boxed{1}}, \textsc{xp}_{\boxed{2}}, \textsc{np}[\textit{dative}]_{\boxed{3}} \rangle \\ \textsc{synsem}\,|\,\textsc{loc}\,|\,\textsc{content}\,|\,\textsc{nucleus} & \begin{bmatrix} \textit{erscheinen-rel} \\ \textsc{theme} & \boxed{1}\ \textit{index} \\ \textsc{attribute} & \boxed{2}\ \textit{index} \\ \textsc{experiencer} & \boxed{3}\ \textit{index} \end{bmatrix} \end{bmatrix}$$

This analysis does not require any type shift for the predicate nominals, since they canonically denote a scope-object anyway, and it avoids the problems with the predicative proper nouns and pronouns. It also avoids the problem with the predicative gerunds and bare infinitives, since the link between the predicative complement and its target is not defined in terms of subject raising. Moreover, and that is what matters most in the context of this paper, it provides the means to express the agreement between a predicative complement and its target. More specifically, the agreement can be modelled in terms of a constraint on the predicate selecting lexemes, as in (43).

(43)
$$\begin{bmatrix} \textsc{arg-st} & \boxed{A} \oplus \langle \textsc{np}_{\boxed{1}}, \textsc{xp}_{\boxed{2}} \rangle \oplus \boxed{B} \\ \textsc{ss}\,|\,\textsc{loc}\,|\,\textsc{content}\,|\,\textsc{nucleus} & \begin{bmatrix} \textsc{theme} & \boxed{1}\begin{bmatrix}\textsc{number} & \boxed{3}\ \textit{number}\end{bmatrix} \\ \textsc{attribute} & \boxed{2}\begin{bmatrix}\textsc{number} & \boxed{3}\end{bmatrix} \end{bmatrix} \end{bmatrix}$$

In words, lexemes which select a predicative complement, such as *be*, *seem* and *consider*, require token-identity of the number value in the index of the argument which supplies the ATTRIBUTE role, and the corresponding value in the index of the argument which supplies the THEME role; this is the subject if $\boxed{A}$ is the empty list, and the direct object otherwise.

A further piece of evidence for (43) is provided by the fact that predicate nominals show the same kind of agreement with their target when they are introduced by an argument marking preposition, as illustrated by a comparison of (44) with (45).

(44) a. We consider Kim an acceptable candidate.
b. ?? We consider his brothers an acceptable candidate.

(45) a. We regard Kim as an acceptable candidate.
b. ?? We regard his brothers as an acceptable candidate.

The presence of the indefinite article in (44) resolves the INDEX|NUMBER value of the predicate nominal to singular, so that the target must have a singular index as well. This is unproblematic for *Kim*, but not for *his brothers*, since the assignment of a non-distributive interpretation to this plural is implausible. Turning to (45) the data are exactly the same, but the analysis requires an extra step, i.e. the assumption that the index of the PP[*as*] is token-identical with the index of the NP that it contains. Interestingly, this extra step need not be stipulated, since it is independently needed for the treatment of binding and control relations, as spelled out in Sag et al. (2003, 209–213). The binding facts in (46), for instance, show that NPs which are introduced by an argument marking preposition behave in the same way as NP complements, and the control data in (47) confirm this.

(46) a. They$_i$ washed themselves$_i$ / *them$_i$.
b. They$_i$ talk to themselves$_i$ / *them$_i$.

(47) a. They$_i$ asked us$_j$ [PRO$_j$ to behave ourselves$_j$ / *themselves$_i$].
b. They$_i$ appealed to us$_j$ [PRO$_j$ to behave ourselves$_j$ / *themselves$_i$].

Also here, there is no need to tinker with the constraints on binding and control if it is assumed that the index of the PP is identical to the one of the NP that it contains.

Similar data for Dutch are provided in (48–49).

(48) a. Ze vindt hem een idioot.
she finds him an idiot-SG
'She considers him an idiot.'
b. ?? Ze vindt ons een idioot.
?? she finds us an idiot-SG

(49) a. Ze houdt hem voor een idioot.
she holds him for an idiot-SG
'She considers him an idiot.'
b. ?? Ze houdt ons voor een idioot.
?? she holds us for an idiot-SG

In contrast to *vinden*, the nearly-synonymous *houden* requires its predicative complement to be introduced by the preposition *voor* but this does not make any difference for the agreement data.

Finally, notice that (43) also captures the agreement in number between predicative adjectives and their target in the Romance languages, if we make two ancillary assumptions. The first one is that predicative adjectives denote a scope-object, just like the predicate nominals, as in (50).

(50) a. Tim is friendly.
b. ∃ x y [Tim(x) & friendly(y) & is(x,y)]

This is not too far-fetched, since the homophonous attributive adjectives are canonically treated in this way, as shown in (51).

(51) a. Tim is a friendly guy.
b. ∃ x y [Tim(x) & friendly(y) & guy(y) & is(x,y)]

The second ancillary assumption is that the number value in the index of the adjective is token-identical with its morphosyntactic number value. An adjective with a singular index, for instance, is also morphosyntactically singular.

This, in turn, paves the way for an account of the fact that the predicative adjectives of English, Dutch and German do not show overt agreement with their target. Given that inflectional variation correlates with the CAT|HEAD distinctions, rather than with the CONTENT|INDEX distinctions, their inflectional invariance can be attributed to the fact that they lack the AGR|NUMBER feature. This assumption is not incompatible with the fact that the attributive adjectives of German and Dutch show agreement with the nominals they modify, since that agreement is canonically modeled in terms of government. In Pollard and Sag (1994, 88-91), for instance, the adjective in *ein kluges Mädchen* 'a clever girl' is claimed to select a nominal that is singular, neuter and either nominative or accusative, but the adjective itself does not have these features. In other words, while the adjective has an index, just like the noun it modifies, it does not have CASE or AGR features of its own. The adjectives of the Romance languages, by contrast, have AGR features of their own, and therefore show inflectional variation, also in nonattributive positions.

In sum, the Montagovian treatment not only avoids the problems of the Fregean treatment with predicative proper nouns, pronouns, gerunds and bare infinitives, it also accommodates the independently motivated treatment of the agreement between predicative complements and their target.

7 Conclusion

In many languages, predicative complements show number and/or gender agreement with their target. In terms of the distinction between concord and index agreement, it sides with the latter, at least in the Romance and Germanic languages.

The most detailed proposal to model it is in Kathol (1999), but it chiefly focusses on predicative adjectives and the attempt to apply it to the predicate nominals of the Germanic languages does not give satisfactory results. There is an obvious way to repair it, but this way cannot be fitted in the canonical HPSG treatment of clauses with a predicative complement. Since that treatment has some other shortcomings anyway, it is replaced by an alternative, developed in Van Eynde (2008) and Van Eynde (2009). Adopting that treatment, the agreement can be modeld in terms of a constraint on the lexemes which select a predicative complement. In the present version, it only covers number agreement. In future work I will explore how it can be extended to include gender agreement.

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Part II
Contributions to the Workshop

Fragments vs. null arguments in Korean

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Abstract

Korean has two types of answers shorter than full sentential answers: Fragments and null argument constructions. Apparently the two constructions have the same interpretative processes. However, there are some cases where the fragment and null argument construction behave differently: e.g., *wh*-puzzles, sloppy interpretation. We suggest that the two constructions involve two different types of anaphora and that the sources of sloppy(-like) interpretation are fundamentally distinct. Fragments pattern differently with null arguments in that only the former may display genuine sloppy readings. The latter may yield sloppy-like readings which are pragmatically induced by the explicature that can be cancelled unlike genuine sloppy readings in fragments. Evidence (*wh*-ellipsis, quantifier ellipsis) all lends substantial support to our claim that fragments are analyzed as an instance of clausal ellipsis while null arguments are analyzed as an instance of null pronoun *pro*; hence, the former is surface anaphora whereas the latter is deep anaphora in the sense of Hankamer & Sag (1976).

1 Introduction

Korean has two types of answers shorter than a full sentential answer, as shown in (1B-B').[1]

(1) A: na-nun John-uy hyeng-ul manna-ss-ta.
I-Nom J.-Gen brother-Acc meet-Pst-Dec
'I saw/met John's brother.'
B: na-to. (Fragment)
'I also (met John's brother).'
B': na-to __ manna-ss-ta. (Null Argument)
I-too meet-Pst-Dec
'I also met (John's brother).'

(1B) and (1B') seem to have the same interpretation. However, there are contexts where the fragment and null argument construction show different semantic behavior. In Korean, the pronoun *nwukwu* is ambiguous between indefinite interpretation 'someone' and *wh*-interpretation 'who'. Consider the following sentences:

[1] This is an abridged version of the paper that we delivered in HPSG 2012 Workshop on Ellipsis and Formal Grammar. Some of the materials and discussions that we have omitted here can be found in Ahn & Cho (2012b). We thank Hee-Rahk Chae, Sae-Youn Cho, Jong-Bok Kim, Chungmin Lee, and Kiyong Lee for valuable inputs and discussions during the conference.

(2) A: Chelswu-ka nwukwu-lul manna-ss-ni?
C.-Nom who-Acc meet-Pst-Q
'Who did Chelswu meet?' or 'Did Chelswu meet anyone?'
B: Kulssey, kulem Yenghi-nun?
Well, then Y.-Top?
'Well, then, who did Yenghi meet?' or
'Well, then, did Yenghi meet anyone?'
B': Kulssey, kulem Yenghi-nun manna-ss-ni?
Well, then Y.Top meet-Pst-Q
'Well, then, did Yenghi meet anyone?'
*'Well, then, who did Yenghi meet?'

(2A) is interpreted as either yes-no interrogative or *wh*-interrogative. Note further that the fragment (2B) is also ambiguous between yes-no interpretation and *wh*-interpretation. Interestingly, however, the null object construction in (2B') is unambiguous: it is interpreted only as yes-no question. The puzzle on *wh*-ellipsis seems to shed light on the analysis of the fragment and null argument construction.

We further argue that the sources of interpretation given in (1B-B') are fundamentally distinct. We propose that fragments are analyzed as an instance of clausal ellipsis while null arguments are analyzed as an instance of null pronoun *pro*; hence, the former is surface anaphora whereas the latter is deep anaphora in the sense of Hankamer & Sag (1976).

This paper is organized as follows. Section 2 discusses some conceptual arguments for our claim regarding the two types of reduced constructions. Section 3 deals with the *wh*-puzzles and further extend our analysis of *wh*-puzzles to the quantifier floating constructions and examples containing negative polarity items. Concluding remarks are provided in Section 4.

2 The two types of reduced constructions: Some conceptual arguments

2.1 Fragments as clausal ellipsis

Fragment conveys the same propositional content as its fully sentential counterpart. The case connectivity noted by Morgan (1989) supports that the fragment has the source of full sentential structure.

(3) A: Nwu-ka ku chayk-ul sa-ss-ni?
Who-Nom the book-Acc buy-Pst-Q
'Who bought the book?'
B: Yenghi-ka.
Y.-Nom

B':*Yenghi-lul.
Y-Acc

In the case of a fragment which functions as subject, only nominative case-marked fragment is grammatical. The ellipsis analysis correctly predicts the grammatical contrast shown in (3B-B'). Prior to ellipsis, (3B) and (3B') have the following derivation.

(4) a. Yenghi-ka ku chayk-ul sa-ss-ta.
Y.-Nom the book-Acc buy-Pst-Dec
'Yenghi bought the book.'
b. *Yenghi-lul ku chayk-ul sa-ss-ta.
Y.-Acc the book-Acc buy-Pst-Dec

Now it is clear why (3B') is ruled out while (3B) is in since their source structures before ellipsis directly reflect the contrasts, as shown in (5):

(5) a. Yenghi-ka [~~ku chayk-ul sa-ss-ta~~].
b. *Yenghi-lul [~~ku chayk-ul sa-ss-ta~~].

On the ellipsis analysis, no additional assumptions are necessary to license the cases on fragments. That is, the usual mechanisms that are responsible for shaping cases internal to clauses can be also relevant to cases on fragments.

Ahn & Cho (2006) further indicate the following examples that involve case-alternation in emotional constructions in Korean which support the claim that fragments have hidden sentential structures.

(6) a. Yenghi-nun nwukwu-lul manna-ko siph-ess-ni?
Y.-Top who-Acc meet-Comp want-Past-Q
'Who did Yenghi want to meet?'
b. Chelswu-lul.
C.-Acc
c. Chelswu-ka.
C.-Nom

Note that Jackendoff & Culicover (2005) (a version of direct interpretation analyses) assume that fragments which don't have their own syntactic structure depend on the one of its antecedent. In (6a), the correlate of the fragment *nwukwu* 'who' is marked with accusative case, but the fragment answers can be marked with either accusative (6b) or nominative case (6c). If syntactic well-formedness of fragments were to depend totally upon their correlates, (6c) would be ill-formed, contrary to fact. Hence, the direct

interpretation analyses don't predict that case alternation is possible in some contexts.

By contrast, the ellipsis analysis correctly predicts the case alternation shown in (6b-c) because we assume that fragmentary utterances are derived via ellipsis of the full-fledged sentential structures. Note that there are two possible full sentential answers to (6a): namely, (7a) and (7b), which underlie the fragment answers (6b) and (6c), respectively.

(7) a. Yenghi-nun Chelswu-lul manna-ko siph-ess-ta
Y.-Top C.-Acc meet-Comp want-Past-Dec
'Yenghi wanted to meet Chelswu.'
b. Yenghi-nun Chelswu-ka manna-ko siph-ess-ta
Y.-Top C.-Nom meet-Comp want-Past-Dec
'Yenghi wanted to meet Chelswu.'

(7a) and (7b), then, have the following derivations. Before ellipsis, the fragments undergo movement to the sentence-initial position.[2]

(8) a. [[$_{DP}$ Chelswu lul]$_i$ [~~Yenghi-nun t$_i$ manna-ko siph-ess-ta~~]]
b. [[$_{DP}$ Chelswu ka]$_i$ [~~Yenghi-nun t$_i$ manna-ko siph-ess-ta~~]]

Thus, under Ahn & Cho's (2006) ellipsis analysis, case alternation in fragment answers is expected irrespective of case-forms on *wh*-phrases in antecedent clauses since fragments parallel their non-elliptical sentential counterparts, and case alternation in (6) provides substantial evidence that the fragment involves clausal ellipsis.

2.2 Null arguments = *Pro*

Otani & Whitman (1991) propose, following Huang (1987), that a sentence like (1B') is an instance of VP ellipsis where the head V has been evacuated via V-raising. Park (1994), Hoji (1998), Oku (1998), Kim (1999) and many others have pointed out non-trivial problems that the VP ellipsis analysis encounters.

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[2] We further assume that fragments are derived from movement of remnants followed by PF-deletion on a par with fragments in English put forward in Merchant (2004) (see Ahn & Cho 2006, 2009b, 2010a for detailed discussion). Thus, (1B), for example, can be derived in the following manner:
(i) [$_{CP}$ Na-to$_i$ [$_{TP}$ ~~t$_i$ John-uy hyeng-ul mannass-ta~~]]
In (i), the fragment *na-to* 'I-also' undergoes movement to Spec of C, and TP undergoes ellipsis. Although the object and the verb aren't pronounced in (i), they remain at LF for clausal interpretation. Consequently, (1B) has the same interpretation as its full sentential counterpart, *Na-to John-uy hyeng-ul manna-ss-ta* 'I also met John's brother'.

Park (1994), for example, has extensively discussed the problems of VP ellipsis analysis of null object constructions in Japanese and Korean. Among many arguments against Otani & Whitman's (1991) claim, Park (1994:164-165) observes the following contrasts between English and Korean, as also noted in Oku (1998) for Japanese.

(9) a. John studies English hard, and Mary does (study English hard), too.
b. John came home early, but Mary didn't (come home early).

(10) a. Mary-ka ppalli talli-ko John-to *(ppalli) talli-n-ta.
M.-Nom fast run-Conj J.-also fast run-Pres-Dec
'Intended: Mary runs fast and John does too.'
b. Mary-ka kulen iyu-lo ttena-ss-ko John-to
M.-Nom such reason-for leave-Past-Conj J.-also
*(kulen iyu-lo) ttena-ss-ta.
such reason-for leave-Pst-Dec
'Intended: Mary left for such a reason and John did too.'

Park (1994) points out that if VP ellipsis were available in Korean, the sentence in (10) would be predicted to have an equivalent reading of (9), contrary to fact. Note that (10) does not tell us anything about how John runs or why John left. Thus, he argues that Otani & Whitman's VP ellipsis analysis of null object arguments may not be maintained in Korean.

As one alternative to the VP ellipsis analysis, Oku (1998) and Kim (1999) propose that Japanese and Korean have an ellipsis process like argument ellipsis. Under this analysis, an argument DP itself may directly undergo ellipsis.

On the other hand, Ahn & Cho (2009, 2010b, 2011a,c, 2012a) propose that the Korean examples of apparent DP ellipsis exemplified in (1B') are all instances of *pro* (see also Park 1994, Hoji 1998, Moon 2010 *inter alia*); that is, Ahn & Cho argue that null arguments such as (1B') involve deep anaphora (null pronoun) *pro* but not surface anaphora ellipsis. Hence (1B') should be represented as (11) under the *pro* analysis of null arguments:

(11) [$_{TP}$ Na-to *pro* manna-ss-ta]

Ahn & Cho (2011b) further suggest that the content of the null argument is supplied by the context: The noun takes a salient discourse element as its referent, and the *pro* in (11) may be understood as *John-uy hyeng-ul* 'John's brother'.

Many researchers (Oku 1998, Kim 1999, Saito 2007, Takahashi 2008, Um 2011 and others), however, claim that sloppy identity interpretation in (12B) is a direct challenge to the *pro* analyses of null arguments.

(12) A: Chelswu-ka sensayngnim-ul sey pwun manna-ss-ta.
C.-Nom teacher-Acc three Cl meet-Pst-Dec
'Chelswu met three teachers.'
B: Yenghi-to _____ manna-ss-ta.
Y.-also meet-Pst-Dec
'Yenghi met (three teachers), too.'

Many people indicate that (12B) can be interpreted as either 'Yenghi also met the same teachers Chelswu met.' (strict reading) or 'Yenghi also met three teachers different from the ones Chelswu met.' (sloppy reading).

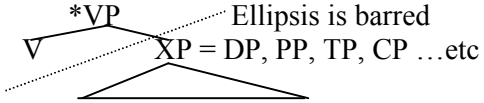
The crucial argument against *pro* analyses comes from the absence of sloppy interpretation when the null argument is replaced by an overt pronoun as shown in (13B).

(13) A: Chelswu-ka sensayngnim-ul sey pwun manna-ss-ta.
C.-Nom teacher-Acc three Cl meet-Pst-Dec
'Chelswu met three teachers.'
B: Yenghi-to kutul-ul manna-ss-ta .
Y.-also them-Acc meet-Pst-Dec
'Yenghi met them, too.'

Note that (13B) only yields strict interpretation in contrast to (12B) in which both sloppy and strict readings are possible.

Ahn & Cho in their recent papers, however, have proposed that this issue seems to be related to the possible interpretation of *pro*. By exploring the cases where apparent sloppy readings arise, they have shown how far the possible interpretation of *pro* is stretched. In this paper we offer additional pieces of evidence to show that what are considered to be sloppy identity readings in the null argument construction in Korean are not in fact genuine sloppy interpretations.

Our *pro* analysis is conceptually based on the proposal that ellipsis of DP (and other XPs) is not possible since they are not complements of functional heads (e.g., C, D, … etc) which can only bear an [E] feature (cf. Merchant 2001, Ahn & Cho 2009a, 2010b).

(14)


Since DP is arguably a complement of a theta-role assigning lexical category like V which cannot have an [E] feature, DP ellipsis cannot occur. On this view, absence of DP ellipsis (and CP ellipsis, for example), as shown in the following, can be accounted for in Korean and English in a unified

way (see Ahn & Cho 2009a, 2010b, 2011b for discussions of absence of CP ellipsis in Korean).

(15) A: John thought that we buy the charcoal grill.
B: I also thought *(that we buy the charcoal grill).
(16) A: I met John's brother.
B: *I also met [$_{DP}$ ~~John's brother~~].
(17) A: na-nun [Yenghi-ka Toli-lul salangha-n-ta-ko] sayngkakha-n-ta.
I-Top Y.-Nom T.-Acc love-Pres-Dec-C think-Pres-Dec
'I think Yenghi loves Toli.'
B: *na-to __ sayngkakha-n-ta.[3]
I-also think-Pres-Dec

As noted in some previous literature, *pro* is needed independently of argument ellipsis in Korean (cf. Saito 2007). For example, the following

[3] Kiyong Lee (by p.c.) points out that although (17B) is not grammatical, the following sentence is possible.
(i) na-to *kulehkey* sayngkakha-n-ta.
I-also so think-Pres-Dec
'I thought so.'
The wellformedness of (i) raises a non-trivial question: why doesn't the covert counterpart of *kulehkey* 'so' exist?
Ahn & Cho (2011b) show that there is crucial evidence that *pro* cannot substitute *kulehkey* in Korean. Witness the following contrasts:
(ii) a. Chelswu-ka chenchenhi ttwuy-ess-ta.
C.-Nom slowly run-Past-Dec
'Chelswu ran slowly.'
b. Yenghi-to ttwuy-ess-ta.
Y.-too run-Past-Dec
'Yenghi also ran.'
c. Yenghi-to kulehkey ttwuy-ess-ta.
Y.-too so run-Past-Dec
'Yenghi also ran so.'
(iii) a. Chelswu-ka wuyam-ulo cwuk-ess-ta.
C.-Nom stomach cancer-from die-Past-Dec
'C-Nom died from stomach cancer.'
b. Yenghi-to cwuk-ess-ta.
Y.-too die-Past-Dec
'Yenghi also died.'
c. Yenghi-to kulehkey cwuk-ess-ta.
Y-also so die-Past-Dec
'Yenghi also died from stomach cancer.'
Note that in (iib) and (iiib), the adverbial readings are all absent; that is, (iib) and (iiib) only denote plain events of Yenghi's running and dying without specifications of how and why. If, however, *kulehkey* 'so' in Korean can undergo ellipsis or be replaced by *pro*, the interpretation of (iib) and (iiib) would be the same as the one of (iic) and (iiic), respectively, contrary to fact. Thus, we conclude that *pro* can only refer to NP/DP but not adverbial *kulehkey* 'so'.

sentence in Korean can be uttered without any relevant discourse when the teacher comes into the classroom:

(18) *pro* o-si-ess-e.
come-Hon-Pst-Dec-
'She/he came.'

Our *pro* analysis of null arguments is conceptually simple (hence, desirable under minimalist spirits) since it provides a uniform account for all null argument cases (see Ahn & Cho 2011b,c, 2012a for discussion).

3 *Wh*-puzzles and other related constructions

The puzzle on *wh*-ellipsis such as (2) repeated here as (19) seems to shed light on the sources of interpretation of null argument and fragment construction.

(19) A: Chelswu-ka nwukwu-lul manna-ss-ni?
C.-Nom who-Acc meet-Pst-Q
'Who did Chelswu meet?' or 'Did Chelswu meet anyone?'
B: Kulssey, kulem Yenghi-nun?
Well, then Y.-Top?
'Well, then, who did Yenghi meet?' or
'Well, then, did Yenghi meet anyone?'
B': Kulssey, kulem Yenghi-nun manna-ss-ni?
Well, then Y.Top meet-Pst-Q
'Well, then, did Yenghi meet anyone?'
*'Well, then, who did Yenghi meet?'

On the analysis advanced here, the fragment (19B) has the structure similar to (19A), as shown in (20).

(20) Yenghi-nun [~~nwukwu-lul manna-ss-ni~~]?
Y.-Top who-Acc meet-Pst-Q

Then, (20) can be interpreted as either yes-no question or *wh*-question on a par with (19A). (19B'), by contrast, is not ambiguous, it only yields yes-no question reading.

Under DP-ellipsis analyses of null arguments such as Kim (1999), Oku (1998), Saito (2004, 2007), Takahashi (2008), Lee & Kim (2010), and Lee (2011) inter alia, (19B') should have the structure like (21).

(21) Yenghi-nun [~~nwukwu-lul~~] manna-ss-ni?
Y.-Top who-Acc meet-Pst-Q

Then, (21) is predicted to be interpreted as either yes-no question or *wh*-question on a par with (19A), contrary to fact.

If *pro*, on the other hand, can directly refer to *nwukwu-lul* 'who-acc', (19B') is also expected to be ambiguous (parallel to (19B)), contrary to fact.

(22) Yenghi-nun pro(=nwukwu-lul) manna-ss-ni?
Y.-Top who-Acc meet-Pst-Q

Recall that (19B') is not ambiguous: it yields only indefinite reading but not WH reading.

We suggest that single *wh*'s in Korean can be analyzed as complex *wh*-phrases; namely, [$_{whP}$ NP + *wh*]. The property of the preceding NP (which can be null *pro*) is determined by an appropriate context that the modifying *wh* is employed.

(23) A: Chelswu-ka (salamtul-ul) nwukwu-lul manna-ss-ni?
C.-Nom people-Acc who-Acc meet-Pst-Q
'Who did Chelswu meet?' or 'Did Chelswu meet anyone?'
B: Yenghi-nun *pro*(=salamtul-ul) manna-ss-ni?
Y.-Top people-Acc meet-Pst-Q
'Did Yenghi meet people?'

The null argument *pro* in (23B), then, can refer to the unpronounced *salamtul-ul* 'people-Acc'. Consequently, apparent *wh*-argument ellipsis can be an instance of *pro* replacement of the NP parts of this structure. Hence, (23B') is predicted to be interpreted only as yes-no question under this proposal.

Likewise, we can explain the contrast between (24B) and (24B').

(24) A: Chelswu-ka mwuess-ul sa-ss-ni?
C.-Nom what-Acc buy-Pst-Q
'What did Chelswu buy' or 'Did Chelswu buy anything?'
B: Kulssey, kulem Yenghi-nun?
Well, then, Y.-Top
'Well, then, what did Yenghi buy?' or
'Well, then, did Yenghi buy anything?'
B': Kulssey, kulem Yenghi-nun sa-ss-ni?
Well, then Y.Top buy-Pst-Q
'Well, then, did Yenghi buy anything?'
*'Well, then, what did Yenghi buy?'

(24B) has the structure like (25).

(25) Yenghi-nun [~~mwuess-ul sa-ss-ni~~]?
Y.-Top what-Acc buy-Pst-Q

Then, (25) can be interpreted as either yes-no question or *wh*-question on a par with (24A).

Again, apparent *wh*-argument ellipsis is an instance of *pro* replacement of the NP part of this structure which is phonetically unrealized in (26B').

(26) A: Chelswu-ka (mwulken-ul) mwuess-lul sa-ss-ni?
C.-Nom thing-Acc what-Acc buy-Pst-Q
'What did Chelswu buy?' or 'Did Chelswu buy anything?'
B: Yenghi-nun *pro*(=mwulken-ul) sa-ss-ni?
Y.-Top buy-Pst-Q
'Did Yenghi buy things?'

The null argument *pro* in (26B) refers to the unpronounced *mwulken-ul* 'thing-Acc'. Hence, (26B) is interpreted only as yes-no question

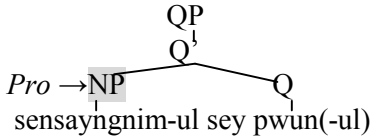
We would further extend our analysis of *wh*-constructions to the quantifier floating constructions below. Consider examples containing a cardinal quantifier *sey pwun-ul* 'three Cl-Acc', as shown in (27).

(27) A: Swunhi-ka sensayngnim-ul sey pwun(-ul) manna-ss-e.
S.-Nom teacher-Acc three Cl-Acc meet-Pst-Dec
'Swunhi met three teachers.'
B: Yenghi-to.
'Y.-also.'
B': Yenghi-to _____ manna-ss-e .
Y.-also meet-Pst-Dec
'Lit. Yenghi met, too.'

At first glance, (27B') gives rise to sloppy reading: 'Yenghi met three teachers, too'.

We propose that the sources of apparent sloppy readings in Q-float constructions are also due to peculiar double object/accusative constructions in Korean, roughly equivalent to [$_{QP}$ NP-Acc Q]-Acc (here Q includes (general) quantifiers & quantifier-like modifiers) parallel to *wh*-constructions. We suggest that the source of apparent sloppy reading hinges on the possibility that the null argument *pro* refers to the NP part of this QP. This reading, however, is not genuine sloppy reading under our proposal assuming the following Q-float structure like (28).

(28)



Notice that (27B') in fact conveys the meaning 'Yenghi met teachers, too' if *pro* refers to the NP *sensayngnim-ul* 'teacher-Acc' in (28). Then, the apparent sloppy reading occurs as a result of explicatures under our *pro* analysis of null arguments.[4]

Note further that the apparent sloppy interpretation (which is called sloppy-like interpretation by Hoji 1998) of the null argument is cancellable as shown in (29). Thus, (29) is possible as a reply to (27A).

(29) Yenghi-to manna-ss-e. kulentey Yenghi-nun sensayngnim-ul
Y.also meet-Pst-Dec but Y.-Top teacher-Acc
twu pwun(-ul) manna-ss-e.
two Cl-Acc meet-Pst-Dec
'Lit. Yenghi met, too. But Yenghi met two teachers.'
'Intended reading: Yenghi met teachers, too. But she met two (but not three) teachers.'

By contrast, the genuine sloppy interpretation of fragments is non-cancellable as shown in (30); i.e., (30) isn't possible as a reply to (27A).

(30) #Yenghi-to. kulentey Yenghi-nun sensayngnim-ul
Y.also but Y.-Top teacher-Acc
twu pwun(-u1) manna-ss-e.
two Cl-Acc meet-Pst-Dec
'Yenghi, too. But Yenghi met two teachers.'

Furthermore, in the null argument construction, the first NP isn't denied in the discourse.

(31) A: Swunhi-ka sensayngnim-ul sey pwun-ul manna-ss-e.

[4] According to Sperber & Wilson (1986:182), an explicature is a combination of linguistically encoded and contextually inferred conceptual features. Consider (i-ii):
(i) a. He is meeting a woman this evening.
b. He is meeting a woman [who is not his wife, mother, or sister] this evening.
(ii) a. I have had breakfast.
b. I have had breakfast [today] (Agerri & Korta 2004:15)
(ib) and (iib) are the explicature of (ia) and (iia), respectively. (ib) and (iib) are the development of the logical form encoded by the utterance or the result of the process of the reference assignment and enrichment to the logical form.

S.-Nom teacher-Acc three Cl-Acc meet-Pst-Dec
'Swunhi met three teachers.'

B:# Yenghi-to manna-ss-e. kulentey Yenghi-nun noin-ul
Y.also meet-Pst-Dec but Y.-Top old man-Acc
manna-ss-e.
meet-Pst-Dec
'Lit. Yenghi met, too. But Yenghi met old men.'
'*if: Yenghi met three people, too. But Yenghi met three old men (but not three teachers).'
'ok if: Yenghi met someone, too. But Yenghi met old men.'

Note that (31B) is impossible only under the interpretation that who Yenghi met are three old men. In other words, (31B) should involve the structure [*noin-ul* pro] 'students-Acc *pro*' in which *pro* refers to *sey pwun(-ul)* 'three Cl(-Acc)', as shown in (32).

(32)Yenghi-to manna-ss-e. kulentey Yenghi-nun [noin-ul *pro*]
manna-ss-e. (*pro* = sey pwun-ul)

Note further that the ill-formedness in (27B) can be explained under the assumption that *pro* cannot directly refer to the "X^o head" *sey pwun-ul* 'three Cl-Acc' since proforms in general are XP categories. On this view, *pro* replaces either the whole QP *sensayngnim-ul sey pwun-ul* 'teacher-Acc three Cl-Acc' or the complement phrase NP *sensayngnim-lul* 'teacher-Acc', but not the head of the phrase.[5]

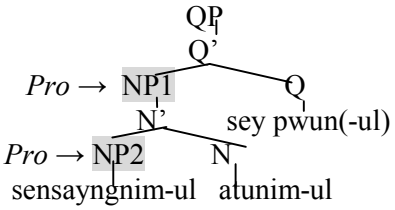
A similar pattern is observed in multiple accusative constructions, as shown in (33).

(33) A: Swunhi-ka sensayngnim-ul atunim-ul sey pwun(-ul)
S.-Nom teacher-Acc son-ul three Cl-Acc
manna-ss-e.
meet-Pst-Dec
'Swunhi met a teacher's three sons.'
B': Yenghi-to _____ manna-ss-e .
Y.-also meet-Pst-Dec
'Lit. Yenghi met, too.'

[5] For example, in English an indefinite proform like *one* can only replace phrasal constituents bigger than a head.
(i) a. Which [student] were you referring to? *The *one* of Physics with long hair? (Radford 1988:186)
b. *The [student] of chemistry was older than the *one* of Physics. (Lightfoot 1982:54)

The multiple accusative constructions can be structured as follows.

(34)



The sloppy-like interpretations occur due to the possibilities of denoting either NP1 or NP2 by *pro*. If *pro* refers to the NP2, the sentence means 'Yenghi met teachers' (=> explicature: 'Yenghi met a teacher's three family members or offsprings'). If *pro* refers to the NP1, the sentence means 'Yenghi met sons' (=> explicature: 'Yenghi met a teacher's three sons'). Since these sloppy-like interpretations are pragmatically induced, they are cancellable, as shown in (35) as replies to (33A).

(35) a. Yenghi-to manna-ss-e. kulentey Yenghi-nun sensayngnim-ul
Y.also meet-Pst-Dec but Y.-Top teacher-Acc
atunim-ul twu pwun(-u1) manna-ss-e.
son-(Acc) two Cl-Acc meet-Pst-Dec
'Yenghi met a teacher's sons, too. But she met a teacher's two sons.'

b. Yenghi-to manna-ss-e. kulentey Yenghi-nun sensayngnim-ul
Y.also meet-Pst-Dec but Y.-Top teacher-Acc
ttanim-ul manna-ss-e.
daughter-(Acc) meet-Pst-Dec
'Yenghi met a teacher's three family members or offsprings, too. But she met a teacher's three daughters.'

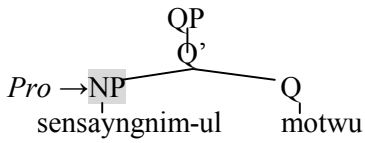
Here too, NP2 isn't denied in the discourse; that is, (33B') cannot convey the meaning like 'Yenghi met someone who has three sons, and that someone is her uncle, for example'.

The examples containing universal quantifiers can be analyzed in a similar way. Consider (36).

(36) A: Swunhi-ka sensayngnim-ul motwu(-lul) manna-ss-e.
S.-Nom teacher-Acc all-Acc meet-Pst-Dec
'Swunhi met all the teachers.'
B: Yenghi-to. 'Y.-also.'
B': Yenghi-to _____ manna-ss-e.
Y.-also meet-Pst-Dec 'Lit. Yenghi met, too.'

(36B') yields sloppy-like reading 'Yenghi met all teachers, too'. This reading, too, is a pragmatic explicature under *pro* analysis of null arguments assuming the following Q-float structure like (37).

(37)



As shown in (38), sloppy-like reading of null arguments is cancellable.

(38) Yenghi-to manna-ss-ta. kulentey Yenghi-nun sensayngnim-ul
Y.also meet-Pst-Dec but Y.-Top teacher-Acc some-
ilpwu-man manna-ss-e.
only meet-Pst-Dec
'Lit. Yenghi met, too. But Yenghi met some teachers.'
'Intended reading: Yenghi met teachers, too. But she met only some (but not all) teachers.'

As shown in (39), genuine sloppy reading of fragments isn't cancellable.

(39) #Yenghi-to. kulentey Yenghi-nun sensayngnim-ul ilpwu-man
Y.also but Y.-Top teacher-Acc some-only
manna-ss-e.
meet-Pst-Dec
'Yenghi, too. But Yenghi met only some teachers.'

In the null argument construction, the first NP isn't denied in the discourse.

(40) A: Swunhi-ka sensayngnim-ul motwu(-lul) manna-ss-e.
S.-Nom teacher-Acc all-Acc meet-Pst-Dec
'Swunhi met all teachers.'
B:# Yenghi-to manna-ss-e. kulentey Yenghi-nun haksayng-ul
Y.also meet-Pst-Dec but Y.-Top student-Acc
manna-ss-e.
meet-Pst-Dec
'Lit. Yenghi met, too. But Yenghi met students.'
'* if: Yenghi met all, too. But Yenghi met all students (but not teachers).'
'ok if: Yenghi met someone, too. But Yenghi met students.'

Our *pro* analysis of null arguments can further be extended to examples containing negative polarity items.

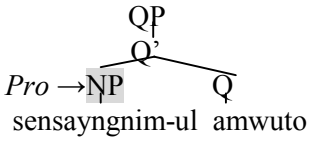
(41) A: Swunhi-ka sensayngnim-ul amwuto an manna-ss-e.
S.-Nom teacher-Acc anyone not meet-Pst-Dec
'Swunhi didn't meet any teachers.'
B: Yenghi-to.
'Y.-also.'
B': Yenghi-to _____ an manna-ss-e .
Y.-also neg meet-Pst-Dec
'Lit. Yenghi didn't meet, either.'

Under our *pro* analysis, the sloppy-like reading 'Yenghi didn't meet any teachers, too' in (41B') is pragmatically derived from the following structure where *pro* refers to *sensayngnim-ul* 'teacher-Acc' in (42):[6]

(42) Yenghi-to *pro* an manna-ss-e.
Y.-also neg meet-Pst-Dec
'Yenghi didn't meet *pro* (=teachers), either.'

We assume the structure like (43). In (43), *pro* refers to NP

(43)



Sloppy-like reading of null arguments seems to be marginally cancellable.

(44) Yenghi-to an manna-ss-e. kulentey Yenghi-nun sensayngnim-ul
Y.also not meet-Pst-Dec but Y.-Top teacher-Acc
amwuto an manna-n kes-un an-i-ta.
anyone not meet-Mod Comp-Top not-be-Dec
'Lit. Yenghi didn't meet, either. But it is not the case that Yenghi didn't meet any teachers.'
'Intended reading: Yenghi didn't meet teachers, either. But it is not the case that Yenghi didn't meet any teachers.'

By contrast, genuine sloppy reading of fragments isn't cancellable at all:

[6] Kawashima & Kitahara (1992), Ko (2005), Lee & Um (2004), and Shi (1997) independently suggest that NPs and negative polarity items form a constituent.

(45) #Yenghi-to. kulentey Yenghi-nun sensayngnim-ul amwuto an
Y.also but Y.-Top teacher-Acc anyone not
manna-n kes-un an-i-ta
meet-Mod Comp-Top not-be-Dec
'Yenghi, too. But it is not the case that Yenghi didn't meet any teachers.'

Further, in the null argument construction the first NP isn't denied in the discourse.

(46) A: Swunhi-ka sensayngnim-ul amwuto an manna-ss-e.
S.-Nom teacher-Acc anyone not meet-Pst-Dec
'Swunhi didn't meet any teachers.'
B:# Yenghi-to an manna-ss-e. kulentey Yenghi-nun haksayng-ul an
Y.also not meet-Pst-Dec but Y.-Top student-Acc not
manna-ss-e.
meet-Pst-Dec
'Lit. Yenghi didn't meet, either. But Yenghi didn't meet students.'
'* if: Yenghi didn't meet anyone, either. But Yenghi didn't meet any students (but not teachers).'
'ok if: Yenghi didn't meet someone, either. But Yenghi didn't meet students.'

Thus, our *pro* analysis of null arguments along with clausal ellipsis analysis of fragments gains further supports from the observed asymmetries in the above Q-floating structures in Korean.

4 Concluding Remarks

In sum, fragments pattern differently with null arguments in that only the former may display genuine sloppy readings. The latter may yield sloppy-like (i.e., apparent sloppy) readings which are pragmatically induced by the explicature that can be cancelled unlike genuine sloppy readings in fragments. Thus, the above evidence (*wh*-ellipsis, weak/strong quantifier ellipsis, NPI ellipsis) all lends crucial support to our claim that fragments and null arguments are fundamentally different: fragments are instances of ellipsis (surface anaphora), while null arguments are instances of *pro* (deep anaphora).

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Tense and honorific interpretations in Korean gapping construction: A constraint- and construction-based approach

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Abstract

Chung (2001) claims that non-final conjuncts without overt tense morphemes which produce asymmetric tense interpretations are to be analyzed as TP; and Lee (2005) argues that the verbal honorific affix *-si-* never occurs in non-final conjuncts so honorific agreement between the subject and the verb takes place in the final conjunct only and thus the Korean gapping constructions should be analyzed as vP coordination. However, these two previous analyses seem to fail to make the generalizations on the distributional behaviors of gapping constructions, facing theoretical and empirical difficulties. To solve the problems they face, we claim that verbal gapping in Korean is allowed to occur in all non-final conjuncts when the covert predicates of the non-final conjuncts have an identical semantic relation value with that of the overt verb in the final conjunct, regardless of the consistency of the honorific and tense values between conjuncts.

1 Introduction

The Gapping Construction in natural languages attracts empirical and theoretical interests due to its complex properties. Among the properties, the licensing conditions and the interpretations of the gapped verbs seem to vary between languages. In Korean, the phonological or morphological form of the gapped verb(s) in the non-final conjunct(s) does not seem to be identical to that of the verb in the final conjunct. Furthermore, tense and honorifics are likely to induce ambiguities in the Korean gapping constructions, while semantic ambiguities in English gapping constructions seem to be due to generalized quantifiers. Specifically, verbal gapping in English appears to be allowed when the predicate in the non-initial conjuncts has an identical tense value with that in the initial conjunct, as shown in (1-2).

(1) a. Kim went to Buffalo, and Lee, to Chicago.
b. Kim went to Buffalo and Lee went to Chicago.

(2) a. Kim went to Buffalo last month and Lee, to Chicago yesterday.

†An earlier version of this paper, Kim and Cho (2012), was presented in the conference of *The Modern Linguistic Society of Korea* and *Korean Society for Language and Information*, November 2011, Gongju National University of Education, and was published as "Tense and Honorifics in Korean Gapping Construction" in *The Society of Modern Grammar*. The data and the theory have been modified and more elaborated in this version.

‡We thank Jong-Bok Kim and Rui Chaves for helpful comments and suggestions. We also thank the anonymous reviewers, to whom we owe much for improvement.

b. *Kim goes to Buffalo today, and Lee, to Chicago yesterday.

Unlike English, Korean allows verbal gapping to occur when the predicates of non-final conjuncts share the same relation value, i.e. they are approximately synonymous, with the predicate in the final conjunct even though the tense or honorific value is not identical across all conjuncts, as in (3).

(3) a. atul-un pusan-ulo (kuliko) apeci(-kkeyse)-nun
son-NOM Pusan-LOC (CONJ) father(-HON)-NOM
sewul-lo ka*(-si)-ess-ta
Seoul-LOC go*(-HON)-PAST-DECL
'(The) son went to Pusan and (his) father, to Seoul.'

b. atul-un pusan-ulo ka(-ass)-ko (kuliko)
son-NOM Pusan-LOC go(-PAST)-CONJ (CONJ)
apeci(-kkeyse)-nun sewul-lo ka*(-si)-ess-ta
father(-HON)-NOM Seoul-LOC go*(-HON)-PAST-DECL
'(The) son went to Pusan and (his) father went to Seoul.'

The gapped verb in the non-final conjunct of (3a) can be construed as either *ka-ko* or *ka-ass-ko* as shown in (3b). The predicate in the non-final conjunct, *ka-ko* 'go', does not contain the past tense marker while the predicate *ka-si-ess-ta* 'went' in the final conjunct has the past tense morpheme; thus the predicates of all conjuncts in (3a) do not need to share tense value for verbal gapping in Korean.

Moreover, the honorific value of the gapped predicate in the non-final conjuncts need not be identical to that of the predicate in the final conjunct. Since *ka(-ass)-ko* in the non-final conjunct has no honorific marker while *ka-si-ess-ta* in the final conjunct contains the verbal honorific marker *-si-*, there is no evidence that honorific values between the predicates in both non-final and final conjuncts must be identical for the predicate in the non-final conjunct to be gapped.

In this paper, we claim that verbal gapping in Korean is allowed in all non-final conjuncts when the covert verbs at the gap of the non-final conjuncts have the same semantic relation value as the overt verb in the last conjunct, regardless of whether the honorific and tense values of all conjuncts are consistent with each other or not. To support our claim, through examining gapping constructions in Korean, we demonstrate that the identity of semantic relational values between the covert predicates in the non-final conjuncts and the overt predicate in the final conjunct licenses verbal gapping in Korean. Based on the licensing condition for Korean verbal gapping, we propose a formalization of the Korean gapping construction, i.e. *K-gapping-cxt*, and show how gapping constructions in

Korean are generated. We further provide constraint-based accounts of the tense and honorific interpretations of the gapped predicates in the non-final conjuncts.

In section 2, we provide data about Korean gapping constructions at issue in this paper and then discuss two previous analyses of coordination in section 3, namely the TP coordination analysis by Chung (2001) and the vP coordination analysis by Lee (2005). In section 4, we postulate a licensing condition for Korean verbal gapping, and within the framework of HPSG, we propose a Construction-Based analysis, based on Beavers and Sag (2004)'s Ellipsis-Based analysis. To account for the various interpretations of gapping constructions in Korean, we give explanations of tense interpretation, following Cho (2006)'s Constraint-Based analysis and of honorific interpretation adopting Choi (2003)'s Constraint-Based approach. Finally, concluding remarks are provided in section 5.

2 Data and Issues on Gapping

In this section, we examine verb gapping constructions in Korean (4), which may have symmetric and asymmetric interpretations of tense and honorifics as in (5).

(4) a. apeci(-kkeyse)-nun sewul-lo (kuliko) atul -un
father(-HON)-NOM Seoul-LOC (CONJ) son-NOM
pusan-ulo ka(*-si)-ass-ta
Pusan-LOC go(*-HON)-PAST-DECL
'(The) father went to Seoul and (his) son, to Pusan.'

b. atul-un pusan-ulo (kuliko) apeci(-kkeyse)-nun
son-NOM Pusan-LOC (CONJ) father(-HON)-NOM
sewul-lo ka*(-si)-ess-ta
Seoul-LOC go*(-HON)-PAST-DECL
'(The) son went to Pusan and (his) father, to Seoul.'

(5) a. apeci(-kkeyse)-nun sewul-lo ka(-si)(-ess)-ko
father(-HON)-NOM Seoul-LOC go(-HON)(-PAST)-CONJ
(kuliko) atul-un pusan-ulo ka(*-si)-ass-ta
(CONJ) son-NOM Pusan-LOC go(*-HON)-PAST-DECL
'(The) father went to Seoul and (his) son went to Pusan.'

b. atul-un pusan-ulo ka(-ass)-ko (kuliko)
son-NOM Pusan-LOC go(-PAST)-CONJ (CONJ)
apeci(-kkeyse)-nun sewul-lo ka*(-si)-ess-ta
father(-HON)-NOM Seoul-LOC go*(-HON)-PAST-DECL

'(The) son went to Pusan and (his) father went to Seoul.'

The possibility that verbal gapping constructions in Korean have both symmetric and asymmetric interpretations of tense and honorifics appears to stem from verb gapping in non-final conjuncts. According to Choi (2003), the elided verb at the gap of the non-final conjunct in (4a) can be construed as one of at least four different morphological forms in (6a-d); the gapped verb in (4b) as either (6b) or (6d).

(6) a. ka-si-ess-ko: go-HON-PAST-CONJ
b. ka-ass-ko: go-PAST-CONJ
c. ka-si-ko: go-HON-CONJ
d. ka-ko: go-CONJ

On the other hand, Lee (2005) claims that the verbal honorific affix *-si-* never appears in the gapped non-final conjuncts and honorific agreement between the subject and the verb should take place only in the final conjunct. Korean gapping constructions are then a case of vP coordination, as illustrated in (7).

(7) $[_{CP}\ [_{TP}\ [_{AgrP}\ [_{vP}\ \ ]$ kuliko $[_{vP}\ \ ]$ Agr (-si/ø)] T] C] (Lee, 2005)

Under this approach, both elided verbs in (4a) and (4b) are derived from the same morphological form as in (6d). If so, this analysis seems to be problematic in that it does not suffice to explain other possibilities: for example, the gapped verb in (4a) can be interpreted as (6a), (6b), or (6c) while the gapped verb in (4b) can be interpreted as (6b)[1].

In the following section, we introduce two previous analyses accounting for Korean coordination constructions including verbal gapping and point out some of the theoretical and empirical problems they face.

3 Previous Analyses

3.1 TP Coordination Analysis

In explaining tense interpretation of coordination constructions in Korean, Chung (2001) has argued that non-final conjuncts with no overt tense morphemes may produce asymmetric tense interpretation as well as symmetric tense interpretation. On the basis of the argument above, Chung

[1]According to Park (1998), honorific agreement may be inconsistent as well as consistent in Korean, since honorific agreement between the subject and the verb is motivated by pragmatic factors and thus inconsistent honorific agreement is grammatical.

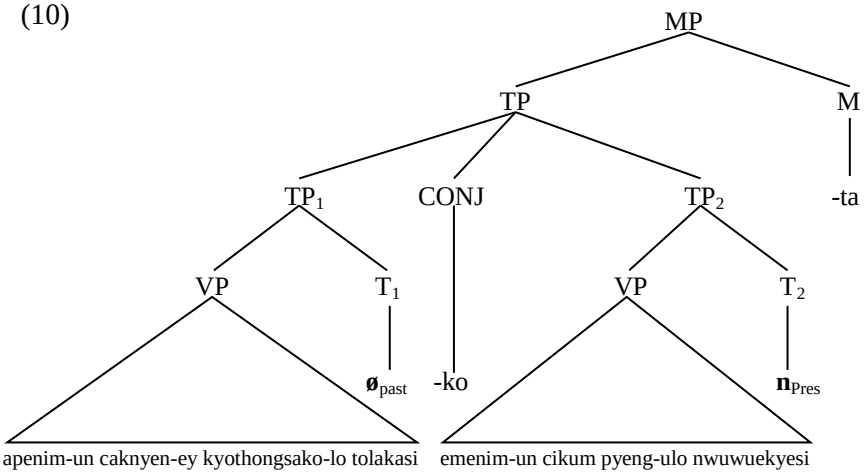
claims that Korean coordination constructions with asymmetric readings produced by absence of tense morpheme in non-final conjuncts are to be analyzed as cases of TP coordination where a null T is postulated in non-final conjuncts. This analysis can be schematized as follows:

(8) [TP Subject … V-$ø_{tense}$]-ko [TP (Subject) … V-Tense] …
↓ ↓
interpreted **interpreted**
(Chung, 2001)

Under this analysis, (9) can be represented as in (10).

(9) [$_{MP}$ [$_{TP}$ [$_{VP}$ apenim-un caknyen-ey kyothongsako-lo
father-NOM last year traffic accident-due to
tolakasi]-**ø**$_{[past]}$]-ko [$_{TP}$ [$_{VP}$ emenim-un cikum
pass away-CONJ mother-NOM now
pyeng-ulo nwuwuekyesi]-**n**$_{[Pres]}$]-ta]
illness-due to lie in bed-PRES-DECL
'My father passed away in a traffic accident last year and my mother is lying in bed due to an illness now.' (Cho, 2006)

(10)



Since T_1 and T_2 project tense values independently under this approach, the predicate of the non-final conjunct, *tolakasi-ko*, whose null T value is PAST yields a past interpretation for the non-final conjunct, producing an asymmetric tense interpretation of the sentence in (9).

The TP analysis, however, gives rise to a question: what determines the tense value of a null T in non-final conjuncts? That is, the question on

how the PAST value of the null T in the non-final conjunct in (10) is licensed is not explainable by this analysis.

Furthermore, against Chung (2001)'s TP analysis, Cho (2006) argues that the predicate of the non-final conjuncts with or without time adverbs may have various temporal interpretations and the interaction between the tense value of the predicate in the final conjunct and that of the time adverbs in the non-final conjunct determines correct temporal interpretations of Korean coordination constructions. According to Cho (2006), the following gapping construction (11a) can be construed as (11b).

(11) a. apenim-un olhay kyothongsako-lo (kuliko)
father-NOM this year traffic accident-due to (CONJ)
emenim-un caknyen-ey pyeng-ulo
mother-NOM last year illness-due to
nwuwue-kyesi-ess-ta
lie in bed-HON-PAST-DECL
Lit. 'My father, in a traffic accident this year and my mother lay in bed due to an illness last year.'

b. apenim-un **olhay** kyothongsako-lo
father-NOM this year traffic accident-due to
nwuwue-kyesi(-ess)-ko (kuliko)
lie in bed-HON(-PAST)-CONJ (CONJ)
emenim-un **caknyen-ey** pyeng-ulo
mother-NOM last year illness-due to
nwuwue-kyesi-ess-ta
lie in bed-HON-PAST-DECL
'My father is lying/lay in a traffic accident **this year** and my mother lay in bed due to an illness **last year**.'

The gapped verb in the non-final conjunct of (11a) may be interpreted as *nwuwue-kyesi-ess-ko* with a past tense morpheme, requiring the non-final conjunct to be understood as a past event, yielding a symmetric tense interpretation of the entire sentence; it can also be interpreted as *nwuwue-kyesi-ko* with no tense morpheme, which conveys not only a present reading but also a past reading of the non-final conjunct, producing either symmetric or asymmetric tense interpretations.

As mentioned above, the TP analysis faces empirical difficulties in that it fails to incorporate the generalization that in Korean the predicate with no tense morpheme in the non-final conjunct can be interpreted diversely with respect to tense.

3.2 vP Coordination Analysis

Honorific agreement phenomena have been taken as providing strong evidence for the vP coordination analysis of gapping constructions in Korean. Lee (2005) claims that Korean gapping constructions are to be analyzed as vP coordination with ATB (Across The Board) movement since honorific agreement between the subject and the verb never occurs in the gapped non-final conjuncts. Under this vP analysis, (12a) and (13a) can be analyzed as illustrated in (12b) and (13b), respectively.

(12) a. Mary-ka sakwa-lul kuliko
Mary-NOM apple-ACC and
emeni-ka panana-lul sa-si-ess-ta
mother-NOM banana-ACC buy-HON-PAST-DECL
'Mary (bought) apples and (her) mother bought bananas.'

b. $[_{CP}\ [_{TP}\ [_{AgrP}\ [_{vP}$ Mary sakwa $v_t]$ kuliko
$[_{vP}$ emeni panana v(sa)] Agr(-si)] T(-ess)] C(ta)] (Lee, 2005)

(13) a. emeni-ka panana-lul kuliko
mother-NOM banana-ACC and
Mary-ka sakwa-lul sa-ass-ta
Mary-NOM apple-ACC buy-PAST-DECL
'(Mary's) mother (bought) banana and Mary bought apples.'

b. $[_{CP}\ [_{TP}\ [_{AgrP}\ [_{vP}$ emeni panana $v_t]$ kuliko
$[_{vP}$ Mary sakwa v(sa)] Agr(ø)] T(-ass)] C(ta)] (Lee, 2005)

According to Lee (2005), in Korean gapping constructions, the subject NP in the non-final conjuncts never agrees with the verbal honorific affix *-si-* while the subject NP in the final conjunct must agree with it[2]. Under this analysis, (13a) can be construed as (14).

(14) emeni-ka panana-lul sa-ass-ko (kuliko)
mother-NOM banana-ACC buy-PAST-CONJ (CONJ)
Mary-ka sakwa-lul sa-ass-ta
Mary-NOM apple-ACC buy-PAST-DECL
'(Mary's) mother bought banana and Mary bought apples.'

[2]Following Niinuma and Park (2003), Lee (2005) assumes that honorific agreement between the subject and the verb operates depending on the notion of closeness where in the head final language the second conjunct is closer to T and hence c-commands the first conjunct.

Specifically, the non-final conjunct in (13a) receives a non-honorific (neutral) reading as in (14) since the verbal honorific affix *-si-* never appears in the non-final conjuncts of gapping constructions and honorific agreement between the subject and the verb never occurs in the non-final conjuncts according to Lee (2005)'s vP coordination analysis.

However, it seems that (13a) may have more than one interpretation since it may have symmetric or asymmetric interpretations of tense and honorifics as in (15).

(15) emeni-ka panana-lul sa(-si)(-ess)-ko
mother-NOM banana-ACC buy(-HON)(-PAST)-CONJ
(kuliko) Mary-ka sakwa-lul sa-ass-ta
(CONJ) Mary-NOM apple-ACC buy-PAST-DECL
'(Mary's) mother buys/bought banana and Mary bought apples.'

The gapped verb in (13a) can be construed as *sa-si-ess-ko*, *sa-ass-ko*, *sa-si-ko*, or *sa-ko*. When the gapped verb is interpreted as *sa-si-ess-ko*, (13a) has an asymmetric honorific interpretation with symmetric past tense. If it is construed as *sa-ass-ko*, non-honorific (neutral) interpretation with past tense is produced symmetrically from the both conjuncts. On the other hand, *sa-si-ko* interpreted in the gapped verb can result in an asymmetric interpretation of tense and honorifics[3]. When the gapped verb is interpreted as *sa-ko*, (13a) has an asymmetric tense interpretation with a symmetric non-honorific (neutral) interpretation[4]. Accordingly, the vP coordination analysis cannot account for all these possible interpretations.

As mentioned above, the vP analysis is empirically problematic in that this approach does not predict all possible interpretations Korean gapping constructions may have. It also faces theoretical difficulties in accounting for various interpretations as a syntactic treatment which is based on the syntactic honorific agreement analysis by Ahn (2002) where there is a syntactic agreement between a verb and its argument[5]. From this point of view, it is assumed that the subject has some honorific feature inherited from the verb. To cope with these difficulties, in section 4.3 we argue that a

[3]According to Cho (2006), in NTC (Non-Tensed Verbal Coordination Structure) with no time adverb the tense value of the predicate in the final conjunct shares with that of non-final conjuncts where the tense value should be 'default'. Under this analysis, when the gapped verb is realized as *sa-si-ko*, (8) may also have a symmetric past tense interpretation 'bought' with an asymmetric honorific interpretation, like *sa-si-ess-ko*.

[4]Under Cho (2006)'s analysis, when the gapped verb is realized as *sa-ko*, past tense interpretation with non-honorific (neutral) interpretation 'bought' may be produced symmetrically from the both conjuncts, like *sa-ass-ko*.

[5]Ahn (2002) analyzed argument honorification, which is referent honorifics such as subject or object honorifics, as an instance of agreement between a verb and the argument, regarding it as a syntactic phenomenon analogous to the subject-verb agreement.

pragmatic approach will be more feasible than the syntactic treatment in order to deal with honorifics.

4 A Construction-Based (ConB) Analysis of V-Gapping

4.1 Constraints on Gapping

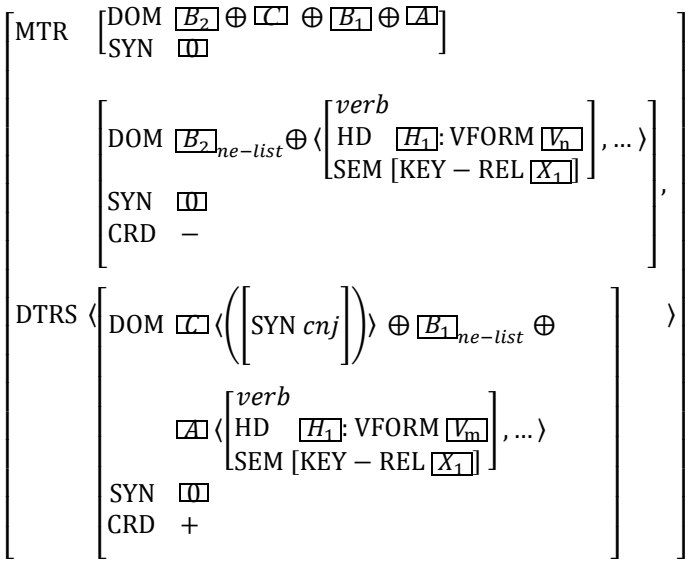
To account for all the possible interpretations Korean gapping constructions may have, we propose that verbal gapping in all non-final conjuncts may occur if the covert verb at the gap of the non-final conjuncts has the same semantic relation value as the overt verb in the last conjunct, regardless of whether the tense and honorific values of all conjuncts are consistent with each other or not. The Verbal Gapping Principle in Korean can be postulated as follows:

(16) The Verbal Gapping Principle (Korean Version)

> In Korean, verbal gapping is allowed in all conjuncts except the last conjunct if the covert verbs at the gap of the non-final conjuncts have the same semantic key-relation value as the overt verb in the last conjunct, regardless of the tense and honorific values of all conjuncts.

Similar to the coordination construction presented by Beavers and Sag (2004), we posit a Korean gapping construction, i.e. *K-gapping-cxt*, based on the principle in (16) as illustrated in (17).

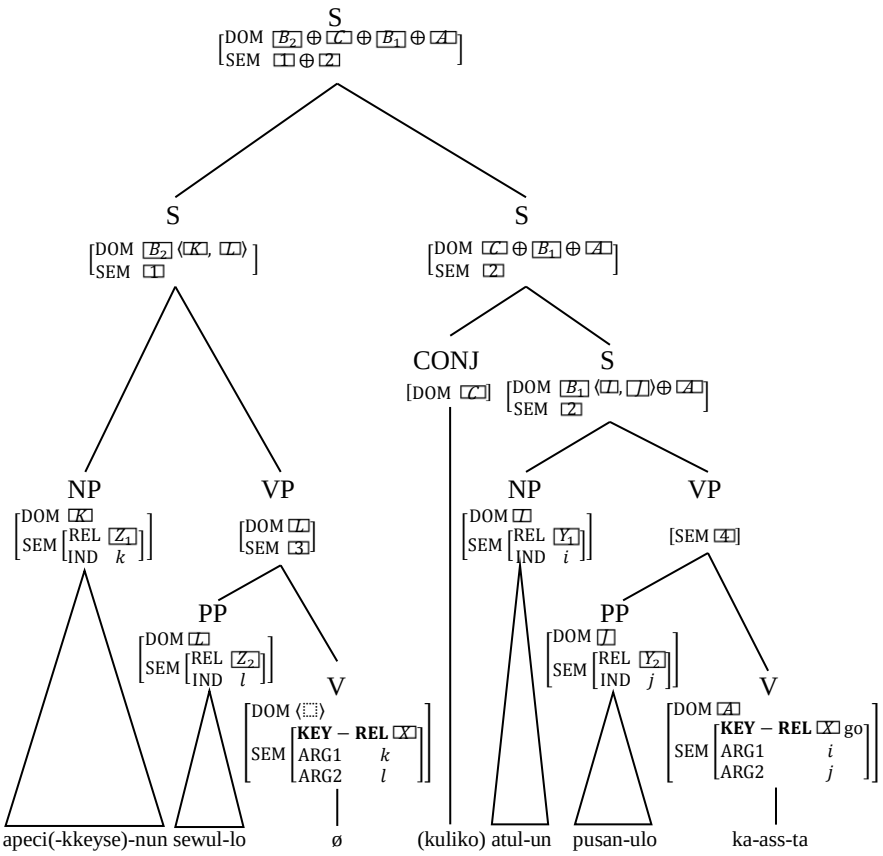
(17) *K-gapping-cxt* ⇒



As shown in (17), the domain of the mother begins with some unique material B_2 from the left conjunct. (Cf. Reape (1992)) The mother's DOM list next contains the right conjunct's coordinator, *kuliko*, (if present (C) since it is optional), some unique material B_1 from the right conjunct, and finally the material A whose corresponding material in the left conjunct's DOM list is elided and hence it is not preserved in the mother's DOM list. Note that our use of the KEY-REL(ation) value ensures that elided elements involve the same semantic relations as their licensing counterparts. In English, the form of the gapped verb in the non-initial conjunct should be almost identical to that of the verb in the first conjunct; especially, the tense values are involved in English gapping. On the other hand, in Korean, *mek-ta, tul-ta, tu-si-ta,* and *capsu-si-ta* are phonologically and morphologically distinct but have the identical semantic key-relation ('eat') so the one in the non-final conjunct can be elided when they are coordinated. In other words, the elements that are elided must share at least their KEY-REL values with the constituent in the rightmost conjunct, i.e. the predicate in the final conjunct.

In terms of *K-gapping-cxt* in (17), (4a) can be represented as in (18).

(18)



In the domain of the mother of (18), $\boxed{B_2}$ from the left conjunct consists of the NP_k *apeci(-kkeyse)-nun* and the PP_l *sewul-lo* in the non-final conjunct and the optional right conjunct's coordinator $\boxed{C}$ consisting of *kuliko* is followed by $\boxed{B_1}$ from the right conjunct which is comprised of the NP_i *atul-un* and the PP_j *pusan-ulo* in the final conjunct. The final element $\boxed{A}$ in the mother's DOM list is composed of V *ka-ass-ta* whose corresponding material in the left conjunct's DOM list is elided and thus is not preserved in the mother's DOM list. By the definition of the Verbal Gapping Principle for Korean in (16), the KEY-REL value $\boxed{X}$ of the verb in the non-final conjunct is identical to that of the verb *ka-ass-ta* in the final conjunct so the verb in the non-final conjunct can be elided.

So far, we have shown how the ConB analysis accounts for the gapping phenomenon in Korean. As discussed above, a gapping sentence as in (18) may have diverse interpretations with respect to tense and honorifics. In the following sections, we will provide explanations on how gapping

constructions may have various interpretations with respect to tense and honorifics.

4.2 Tense

To give simple explanations on how to get both symmetric and asymmetric tense interpretations of gapping constructions in Korean, we adopt Cho (2006)'s CB analysis of Non-Tensed Verbal Coordination Structure (NTC), pinpointing the fact that the tense value of the non-final conjunct of NTC can be determined by the interaction between the tense value of the verb in the final conjunct and that of the time adverbs in the non-final conjunct (Cho, 2006, p. 204), as illustrated in (19).

(19) A Hypothesis of Tense Interpretation in NTC by the Constraint-Based (CB) Analysis

1. When the conjunct contains a null Present tense morpheme *-nun*, this is an example of real TP coordination.
2. When there is no time adverb in NTC, the tense value of the predicate in the final conjunct shares with that of non-final conjuncts where the tense value should be 'default'.
3. When there is a temporal adverb in NTC, the tense value of NTC is the intersection of that of the adverb and that of the predicate in the non-final conjunct.

(Cho, 2006, pp. 204-205)

The hypothesis in (19) can be implemented in HPSG, as shown in (20).

(20) Tense Agreement Principle

Ⅰ. The TENSE value of a time adverbial and that of its head (predicate) are determined by the intersection of the two TENSE values.

Ⅱ. The TENSE value of the predicate in the non-final conjunct and that of the final conjunct are identical but the former must be 'default'.

(Cho, 2006, p. 206)

The CB analysis can account for both symmetric and asymmetric tense interpretations of the NTCs in gapping constructions. The verbs with no tense morpheme as in (6c-d) lead the NTCs as in (21b), which may deliver

a past or present event, yielding a symmetric or asymmetric tense interpretation. The verb gapping sentence in (21a) (=(4a)) can be interpreted as the NTC in (21b).

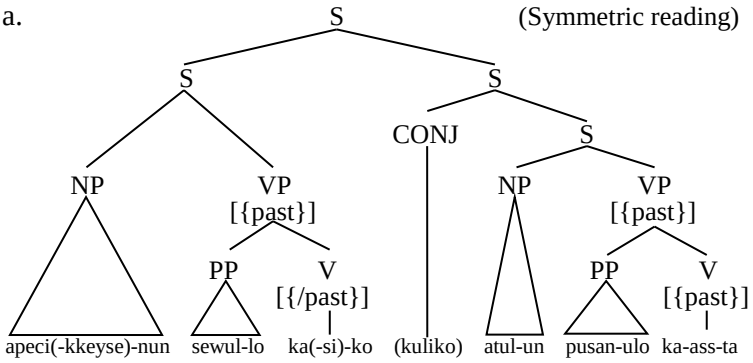
(21) a. apeci(-kkeyse)-nun sewul-lo (kuliko)
father(-HON)-NOM Seoul-LOC (CONJ)
atul-un pusan-ulo ka-ass-ta
son-NOM Pusan-LOC go-PAST-DECL
Lit. 'Father to Seoul and son went to Pusan.'

b. [apeci(-kkeyse)-nun sewul-lo ka(-si)-ko] (kuliko)
father(-HON)-NOM Seoul-LOC go(-HON)-CONJ (CONJ)
[atul -un pusan-ulo ka-ass-ta]
son-NOM Pusan-LOC go-PAST-DECL
'(The) father goes/went to Seoul and (his) son went to Pusan.'

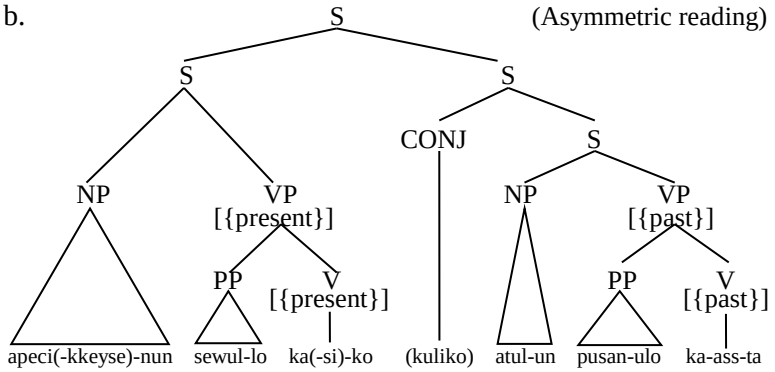
Under this CB analysis, the NTC in (21b) can be represented as in (22).

(22)

a. (Symmetric reading)



b. (Asymmetric reading)



By the definition of the Tense Agreement Principle in (20), the TENSE value of the non-final conjunct in (22a) is given by the verb in the final conjunct and hence the non-final conjunct can be construed as a past event, producing a symmetric interpretation. A present reading of the non-final conjunct in (22b) can be obtained from the hypothesis in (19-1), which yields an asymmetric interpretation.

Gapping constructions may contain time adverbs as in (23). When a time adverb occurs in the non-final conjunct of a gapping construction, the time adverb affects the interpretation of the conjunct. The NTCs containing time adverbs in the non-final conjunct can be well accounted for by this CB analysis. The verb gapping construction with time adverbs (23a) can be construed as (23b).

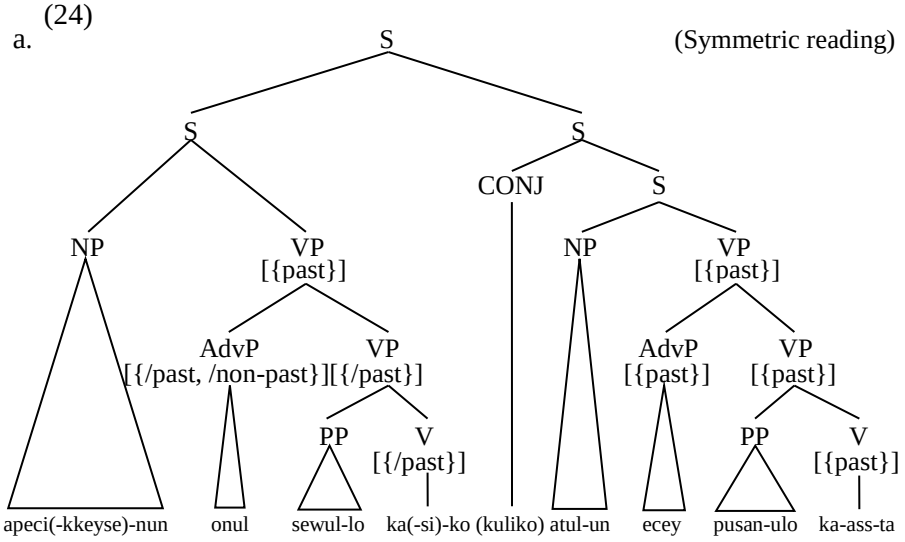
(23) a. apeci(-kkeyse)-nun **onul** sewul-lo (kuliko)
father(-HON)-NOM today Seoul-LOC (CONJ)
atul-un **ecey** pusan-ulo ka-ass-ta
son-NOM yesterday Pusan-LOC go-PAST-DECL
Lit. 'Father to Seoul **today** and son went to Pusan **yesterday**.'

b. [apeci(-kkeyse)-nun **onul** sewul-lo ka(-si)-ko]
father(-HON)-NOM today Seoul-LOC go(-HON)-CONJ
(kuliko) [atul-un **ecey** pusan-ulo ka-ass-ta]
(CONJ) son-NOM yesterday Pusan-LOC go-PAST-DECL
'(The) father goes/went to Seoul **today** and (his) son went to Pusan **yesterday**.'

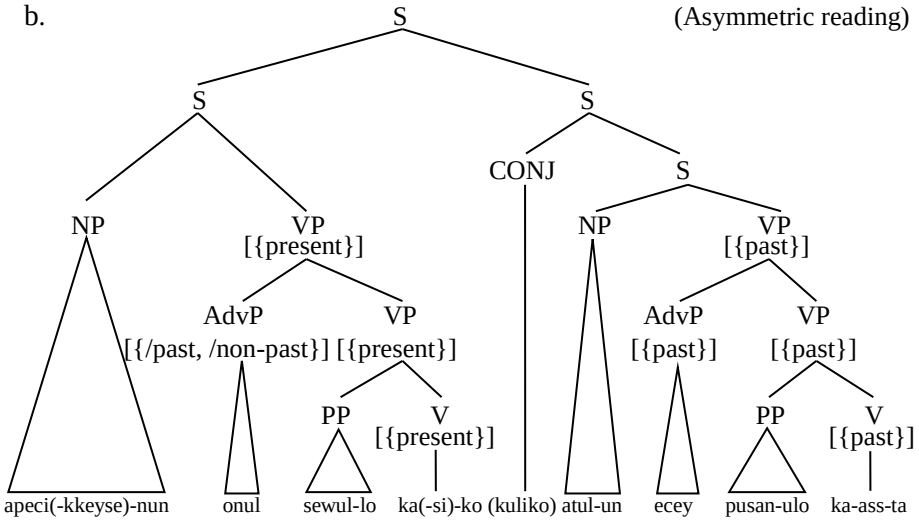
The NTC with time adverbs in (23b) can be analyzed under the CB analysis, as illustrated in (24).

(24)

a. (Symmetric reading)



b. (Asymmetric reading)



In (24a), by the definition of (20-Ⅰ), the intersection of {/past, /non-past} value of the adverb *onul* 'today' and {past} value of the head *ka-ass-ta* 'went' is {past}. This {past} value operates with {/past} of the head in the non-final conjunct in terms of the Tense Agreement Principle (20-Ⅱ); hence the non-final conjunct conveys a past reading, resulting in a symmetric past tense interpretation. In (24b), the hypothesis in (19-1) posits that the head of the non-final conjunct has {present} value, which intersects with {/past, /non-past} value of the adverb, yielding {present}

value of the non-final conjunct and thus producing an asymmetric tense interpretation.

So far, we have provided explanations on how the CB analysis can account for various interpretations that the NTCs of gapping constructions may produce. The CB analysis is preferable to the TP analysis, in that the CB analysis can account for all the readings that gapping constructions may produce while the TP analysis can account only for a subset of the tense interpretations that gapping constructions may have.

4.3 Honorifics

In order to deal with honorific interpretations of Korean gapping constructions, we argue that pragmatic approaches such as Park (1998) are more plausible than the vP analysis by Lee (2005). Various analyses have been proposed to oppose syntactic agreement-based accounts of honorification. Kim and Sells (2007) claims that Korean honorific agreement is constrained pragmatically rather than syntactically. Korean subject honorifics are encoded by the consistency of honorific information between the subject and the verb, rather than by a sort of syntactic subject-verb agreement. Choi (2003) also opposes to the syntactic analysis and instead proposes the constraint-based approach to so-called partial honorific agreement which is based on the pragmatic analysis by Pollard and Sag (1994)[6]. The honorific agreement principle proposed by Choi (2003) can be illustrated as follows:

(25) Korean Honorific Agreement Principle

The subject and the verb should specify the same honorific information in their CONTEXT feature.

$$\begin{bmatrix} \text{verb} \\ \text{SUBJ} < NP\ [\text{CONTEXT} : \text{HON}\ \square] > \\ \text{CONTEXT} : \{[\text{HON}\ \square]\} \end{bmatrix}$$

(Choi, 2003)

As shown in (25), the verb should specify honorific information which is identical to that of its subject in order to license the honorific information of the subject. Choi (2003) claims that, though the HON value of the verb is mostly provided by Morphology, it is resolved by a feature-sharing process or a pragmatic constraint unless it is assigned by Morphology. That

[6]Pollard and Sag (1994) claimed that the background information from the subject NP agrees with the background information from the verb.

is, the HON feature value of the verb which is unresolved by Morphology is shared with that of its subject by a feature-sharing process or a pragmatic rule.

Based on Choi (2003)'s CB analysis, we provide explanations of honorific interpretations of the non-final conjunct in Korean gapping constructions. The gapping sentence in (26a) can be construed as (26b)[7].

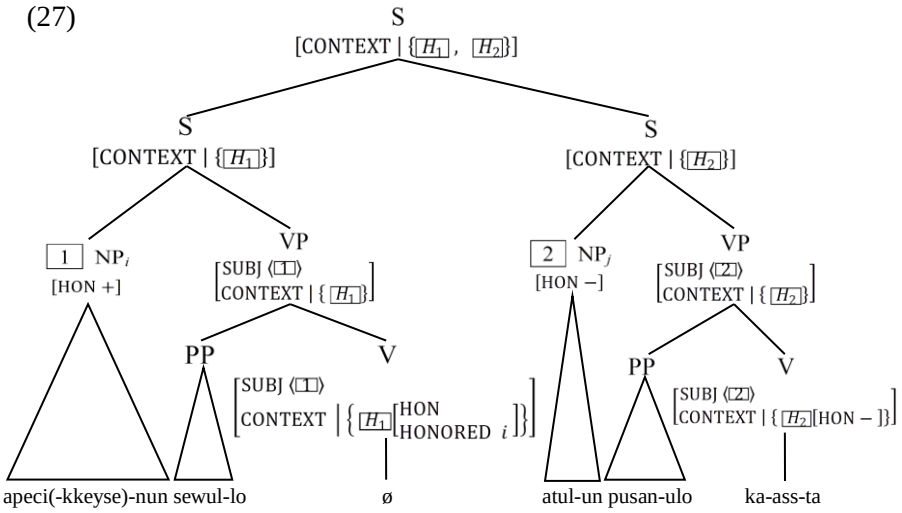
(26) a. apeci(-kkeyse)-nun sewul-lo (kuliko)
father(-HON)-NOM Seoul-LOC (CONJ)
atul-un pusan-ulo ka(*-si)-ass-ta
son-NOM Pusan-LOC go(*-HON)-PAST-DECL
Lit. 'Father to Seoul and son went to Pusan.'

b. apeci(-kkeyse)-nun sewul-lo ka(-si)(-ess)-ko
father(-HON)-NOM Seoul-LOC go(-HON)(-PAST)-CONJ
(kuliko) atul-un pusan-ulo ka(*-si)-ass-ta
(CONJ) son-NOM Pusan-LOC go(*-HON)-PAST-DECL
Lit. 'Father went to Seoul and son went to Pusan.'

The gapped verb in the non-final conjunct of (26a) is construed as either *ka-si(-ess)-ko* or *ka(-ass)-ko* with respect to honorificity. In Korean, honorific information is encoded by the verbal honorific affix *-si-*, e.g. the HON+ value of *ka-si(-ess)-ko* is provided by Morphology. But *ka(-ass)-ko* does not contain the verbal honorific affix *-si-* so it is impossible for the non-final conjunct to be assigned an HON value by Morphology. Instead, the HON value of the non-final conjunct without an honorific morpheme can be provided by a pragmatic rule, as illustrated in (27). Under this analysis, (26a) can be represented as in (27).

[7]From now on, * refers not to ungrammatical sentences but to pragmatically odd sentences in this paper.

(27)



In (27), the gapped verb in the non-final conjunct does not specify any morphological honorific information, while the verb in the final conjunct specifies HON−. The value of HONORED of the non-final conjunct is *i* whereas the final conjunct has no HONORED value because its honorific value is HON−. Since the subject of the non-final conjunct is different from that of the final conjunct, i.e. the subjects refer to different referents, the honorific features between two conjuncts cannot be shared[8]. Hence, the underspecified honorific feature $\boxed{H_1}$ is specified by neither morphology nor feature-sharing, but it is pragmatically resolved by background discourse information such that the speaker owes honor to *apeci* 'father'.

So far, we have given an account of honorific interpretations of the non-final conjunct in gapping constructions on the basis of Choi (2003)'s CB analysis where honorific information is provided not only by morphology but also by pragmatics. The pragmatic analysis is more preferable than the morpho-syntactic analysis since the honorific information of the non-final conjunct, which is unresolved by morphological or syntactic processes, can be provided by the pragmatic constraint above.

[8]Based on Pollard and Sag (1994) where there is an agreement of background information between the subject and the verb, Choi (2003) suggests the feature-sharing approach in which, if the subject referents in both conjuncts are identical, the HON feature value of the non-finite verb in the non-final conjunct is resolved by a feature-sharing process when it is not resolved by Morphology.

5 Conclusion

There have been a variety of attempts to analyze coordination constructions. One of them is the TP analysis by Chung (2001) where Korean coordination constructions containing non-final conjuncts without a tense morpheme can have asymmetric tense interpretations and are to be analyzed as TP coordination in which a null T is postulated in non-final conjuncts. Another is the vP analysis by Lee (2005) in which the verbal honorific affix *-si-* never appears in non-final conjuncts and honorific agreement occurs only in the final conjunct so the Korean gapping constructions should be analyzed as vP coordination. Though the two previous analyses are theoretically different in accounting for the linguistic phenomena at issue, they seem to fail to provide an account of tense and honorific interpretations of non-final conjuncts of coordination constructions.

To solve the problems that the previous analyses face, we claim that verbal gapping in Korean can occur in all non-final conjuncts when the predicate of the non-final conjuncts shares the identical semantic relation value with that of the predicate in the final conjunct, regardless of the consistency of the honorific and tense values of all conjuncts. To support our claim, we have proposed a constraint- and construction-based analysis within the HPSG framework, similar to Beavers and Sag (2004)'s Ellipsis-Based analysis and provided simpler explanations for a variety of tense and honorific interpretations of gapping constructions in Korean on the basis of Constraint-Based analyses by Cho (2006) and Choi (2003). The CB analysis employed in this paper enables us to integrally analyze Korean gapping constructions with respect to tense and honorifics. Therefore, we believe that it is more preferable and feasible than the previous analyses because it captures significant generalizations on the various linguistic behaviors of gapping constructions in Korean.

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Eliding the derivation: A minimalist formalization of ellipsis

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Abstract

In this paper I use the formal framework of minimalist grammars to implement a version of the traditional approach to ellipsis as 'deletion under syntactic (derivational) identity', which, in conjunction with canonical analyses of voice phenomena, immediately allows for voice mismatches in verb phrase ellipsis, but not in sluicing. This approach to ellipsis is naturally implemented in a parser by means of threading a state encoding a set of possible antecedent derivation contexts through the derivation tree. Similarities between ellipsis and pronominal resolution are easily stated in these terms. In the context of this implementation, two approaches to ellipsis in the transformational community are naturally seen as equivalent descriptions at different levels: the LF-copying approach to ellipsis resolution is best seen as a description of the parser, whereas the phonological deletion approach a description of the underlying relation between form and meaning.

1 Introduction

In the transformational grammar community, analyses of ellipsis which involve reconstructing a syntactic structure have been proposed (Lees, 1960) and reproposed (Chung et al., 1995; Merchant, 2001; Kobele, 2009). The structure reconstructed stands in some, often syntactic, relation to some other syntactic structure, its antecedent. In conjunction with canonical transformational analyses of basic sentence structure, such as a 'phrasal' (as opposed to a 'lexical') approach to passive constructions (Jaeggli, 1986), this kind of approach to ellipsis is able to present a unified theory which neatly captures some differences between elliptical phenomena in the degree to which they are sensitive to syntactic properties of antecedents (Merchant, 2007, 2008; Tanaka, 2011).

Two mechanisms for dealing with ellipsis are prominent in today's transformational literature: deletion and copying. The first views ellipsis as a process of syntactically conditioned phonological deletion (Merchant, 2001). This approach must be complemented with an appropriate 'identity condition', which allows a phrase to be deleted just in case it is identical to some other phrase. In this approach, an ellipsis site might be assigned an arbitrarily complex syntactic structure. The second approach, more in line with perspectives in other approaches to grammar, views ellipsis as involving a process of LF-copying of an antecedent syntactic structure into a syntactically atomic empty category (Chung et al., 1995).[1]

In the context of the formal framework of minimalist grammars (Stabler, 1997), a mildly context-senstitive (Michaelis, 2001) formalization of the minimalist program (Chomsky, 1995), I use the mechanism of deletion to implement a modern

[1]It may seem that the LF-copying approach is to be preferred on the grounds that it does not require a seperate 'identity condition', and is thus more parsimonious. A more uniform perspective on the deletion and copying approaches, which renders them equally complex, is had when we view the copying approach as follows. First, we build a structure with an ellipsis site (a primitive formative). Next, we replace the ellipsis site with some complex structure, under the condition that this structure is identical to some other phrase. Thus, LF-copying is here seen as LF-insertion under identity.

version of the 'derivational identity' approach to ellipsis of Lees (1960). Borrowing ideas from Kobele (2009) and Lichte and Kallmeyer (2010) I take phonological deletion to be licensed by exact identity of derivation tree *contexts* (trees with holes at the leaves). The main advantages of this approach to deletion are (1) that it is naturally implemented in a parser (whose job it is to reconstruct derivation trees), and (2) that in conjunction with a compositional semantics (as in Kobele (2012c)) it allows derivation tree contexts to be replaced by their semantic interpretations. Furthermore, in the context of this formalization, the deletion and LF-copying approaches to ellipsis can be viewed as equivalent descriptions at different levels (in the sense of Marr (1982)): the LF-copying approach describes the algorithmic realization of the deletion approach in a parser. Thus, one of the main contributions of this paper is to demonstrate that the two main proposals regarding ellipsis in the transformational literature needn't be thought of as competitors, but can be viewed instead as equivalent descriptions of the same thing.

Moving from computation to algorithm, a natural way of implementing the licensing requirement on deletion (that, namely, an identical antecedent be present) involves passing a 'context' containing information about what antecedents are present. This can be managed by using monads (Wadler, 1992) (or continuations (Strachey and Wadsworth, 2000)) to control evaluation. In particular, different hypotheses about antecedent availability can be implemented by allowing the context information to flow in different directions (e.g. the state and the reverse state monads). Antecedent choice is made by means of a choice operator, which, as in a continuation-based treatment of pronouns (de Groote, 2006), may be made sensitive to discourse and other factors.

Thus, the formal approach to ellipsis in minimalism presented here clearly separates various empirical phenomena surrounding ellipsis – factors influencing the choice of antecedent go in the choice operator, restrictions on availability of antecedents are to be accounted for in the context passing mechanism, and which antecedents exist at all is the provenance of the syntactic analysis.

The paper is structured as follows. I begin by reviewing some of the main empirical motivations of this paper (§2). Next, I introduce minimalist grammars (§3), where I explain briefly the notion of derivation tree, and introduce an operation of deletion. Then I describe how to implement this approach in a parsing algorithm in §4. Section 5 is the conclusion.

2 Empirical Foundations

One of the biggest stumbling blocks to a unified theory of ellipsis (one which treats all elliptical phenomena as being the product of a single 'ellipsis' mechanism) is the fact that different 'sorts' of ellipsis have different properties (for more information see Kobele (2012a) and references therein). Most interesting to us here, as I will in fact be advocating for a theory involving exact syntactic identity, are the differences between *sluicing* (see Merchant, 2001, and references therein) and *verb phrase*

ellipsis (vpe) (see Hardt, 1993, and references therein) with respect to the nature of the formal relation between antecedent and (supposed) ellipsis site. We focus our attention on the verbal category of voice (although Kim et al. (2011) works out a fragment in a related system allowing for mismatches along other dimensions), and in particular on whether antecedent and (supposed) ellipsis site may differ along this dimension.

2.1 VPE

Although it was initially thought that verb phrase ellipsis did not allow for voice mismatches between antecedent and ellipsis site (Sag, 1976), work culminating in Hardt (1993) made abundantly clear that at least *some*, corpus attested, examples of voice-mismatched vpe exist, and sound rather natural. Various psycholinguistic experiments (see Kim et al., 2011, and references therein) have further demonstrated that mismatched vpe examples are more acceptable than stereotypical ungrammatical sentences.

In such a situation, one can either decide to treat mismatching examples (of which at least some are unacceptable) as uniformly ungrammatical (Arregui et al., 2006), or to treat mismatching examples (of which at least some are acceptable) as uniformly grammatical (Kim et al., 2011). In either case, one ultimately needs to provide an account of why (adopting the first view) certain ungrammatical examples sound perfectly fine, or of why (adopting the second view) certain grammatical examples sound terrible.

Here (following Kim et al. (2011)) I treat voice-mismatched vpe as grammatical. There is no knock-down argument for this, as far as I am aware, but it seems more promising in terms of ultimately being able to explain both why people produce mismatching vpe sentences (they are grammatical; the other view must explain why people produce ungrammatical sentences), and why mismatch is not attested in sluicing (see below §2.2; the other view must explain why ungrammatical vpe sentences are acceptable and attested, but ungrammatical sluices of the 'same sort' are not).

2.2 Sluicing

As noted already in Merchant (2001) (see also Chung, 2006; Merchant, 2007; Tanaka, 2011), and in contrast to vpe, in (English) sluicing voice mismatches are uniformly unacceptable. To qualify this statement somewhat, there are no known sluices in English which are acceptable yet which involve voice mismatches between the antecedent and the ellipsis site.[2] As in the case of vpe, this empirical

[2]Martín González (2010) examines counterexamples to this claim in Spanish. He concludes that they all stem from underlying copular constructions, and thus that Spanish sluicing also prohibits voice mismatches. In more theory neutral terms, he observes that all acceptable examples of voice mismatched sluicing sentences in Spanish alternate with non-elliptical sentences where the sluice is replaced with a cleft, and that where this is not possible (e.g. with an active antecedent and a passive ellipsis site), the elliptical sentence is in fact unacceptable.

situation underdetermines the proper theoretical analysis; are voice mismatched sluices grammatical in English, but just hard to find? Or are they indeed ungrammatical? Because we have available to us (Merchant, 2007) a neat explanation of how voice mismatches in vpe can be grammatical, while being in sluicing ungrammatical, I choose tentatively (but following the authors cited above) to assume that the reason for the non-forthcomingness of acceptable voice-mismatched sluices is because there aren't any, and this because they are uniformly ungrammatical.

3 Minimalist Grammars

Minimalist grammars (Stabler, 1997) are a *mildly context-sensitive* grammar formalism (Michaelis, 2001). Grammar formalisms belonging to this class (such as tree adjoining grammars, combinatory categorial grammars, and multiple context-free grammars) are unable to describe an infinite number of recursively enumerable languages, and are thus restrictive in the sense of ruling out *a priori* a large number of computationally possible languages as linguistically impossible. The languages which are able to be described are all simple in a formally precise sense (Joshi, 1985), which makes it possible to build correct and efficient parsing algorithms for these grammar formalisms.[3]

A minimalist grammar has two structure building operations, binary **merge** and unary **move**, whose application to expressions is dependent on the syntactic categories of these expressions. The language of a particular minimalist grammar consists of those expressions which can be built up from lexical items by finitely many applications of the operations **merge** and **move**. I first describe categories, and then move on to a more detailed description of expressions, and the workings of the **merge** and **move** operations.

3.1 Categories

Categories are complex, as in categorial grammar, and are structured as lists of atomic *features*, which we will write as sequences $f_1 \cdots f_n$ and call feature bundles. The currently accessible feature is the feature at the beginning (leftmost) position of the list, which allows for some features being available for checking only after others have been checked. In order for **merge** to apply, the heads of its two arguments must have matching accessible features. These features are eliminated in the derived structure which results from their merger. In the case of **move**, the head of its argument must have an accessible feature matching an accessible feature of the head of one of its subconstituents' Δ. In the result, both features are eliminated. Each feature type has an attractor and an attractee variant (i.e. each feature is either positive or negative), and for two features to match, one must be positive and the other negative. The kinds of features relevant for the **merge** and **move** operations are standardly taken for convenience to be different. For **merge**,

[3] It remains, however, a programatic assumption that this sort of restrictiveness is desirable.

the attractee feature is a simple categorial feature, written x. There are two kinds of attractor features, =x and x=, depending on whether the selected expression is to be merged on the right (=x) or on the left (x=). For the **move** operation, there is a single attractor feature, written +y, and two attractee features, −y and ⊖y, depending on whether the movement is overt (−y) or covert (⊖y).

3.2 Expressions

A lexical item is a syntactic atom. Intuitively, it represents an atomic pairing of form and meaning. Here, it consists of an index (a 'lexeme') along with the syntactic information necessary to specify the distribution of these elements in more complex expressions. We write lexical items using the notation $\langle \sigma, \delta \rangle$, where σ is a lexeme, and δ is a feature bundle.

Complex expressions are written using the notation of Stabler (1997) for the 'bare phrase structure' trees of Chomsky (1995). These trees are essentially X-bar trees without phrase and category information represented at internal nodes. Instead, internal nodes are labeled with 'arrows' > and <, which point to the head of their phrase. A tree of the form $[< \alpha\ \beta]$ indicates that the head is to be found in the subtree α, and we say that α projects over β, while one of the form $[> \alpha\ \beta]$ that its head is in β, and we say that β projects over α. Leaves are labeled with lexeme/feature bundle pairs (and so a lexical item $\langle \alpha, \delta \rangle$ is a special case of a tree with only a single node). The head of a tree t is the leaf one arrives at from the root by following the arrows at the internal nodes. If t is a bare phrase structure tree with head H, then we write $t[\mathrm{H}]$ to indicate this. (This means we can write lexical items $\langle \alpha, \delta \rangle$ as $\langle \alpha, \delta \rangle[\langle \alpha, \delta \rangle]$.)

3.3 Operations

The **merge** operation is defined on a pair of trees t_1, t_2 if and only if the head of t_1 has a feature bundle which begins with either =x or x=, and the head of t_2 has a feature bundle beginning with the matching x feature. The bare phrase structure tree which results from the merger of t_1 and t_2 has t_1 projecting over t_2, which is attached either to the right of t_1 (if the first feature of the head was =x) or to the left of t_1 (if the first feature of the head was x=). In either case, both selection features are checked in the result.

$$\textbf{merge}(t_1[\langle \alpha, \texttt{=x}\delta \rangle], t_2[\langle \beta, \texttt{x}\gamma \rangle]) = \quad t_1[\langle \alpha, \delta \rangle] \quad t_2[\langle \beta, \gamma \rangle]$$

$$\textbf{merge}(t_1[\langle \alpha, \texttt{x=}\delta \rangle], t_2[\langle \beta, \texttt{x}\gamma \rangle]) = \quad t_2[\langle \beta, \gamma \rangle] \quad t_1[\langle \alpha, \delta \rangle]$$

If the selecting tree is both a lexical item and an affix (which we notate by means of a hyphen preceding/following the lexeme in the case of a suffix/prefix), then

head movement is triggered from the head of the selected tree to the head of the selecting tree.

$$\textbf{merge}(\langle \text{-}\alpha, {=}\mathtt{x}\delta\rangle, t_2[\langle \beta, \mathtt{x}\gamma\rangle]) = \begin{array}{c} \langle \beta\text{-}\alpha, \delta\rangle \\ \diagup \quad \diagdown \\ \quad t_2[\langle \epsilon, \gamma\rangle] \end{array}$$

The operation **move** applies to a single tree $t[\langle \alpha, {+}\mathtt{y}\delta\rangle]$ only if there is *exactly one* leaf ℓ in t with matching first feature $-\mathtt{y}$ or $\ominus\mathtt{y}$. This is conceptually related to (although formally quite different from) the shortest move constraint (Chomsky, 1995), and is called the SMC (Stabler, 1997) – it requires that an expression move to the first possible landing site. If there is competition for that landing site, the derivation crashes (because the losing expression will have to make a longer movement than absolutely necessary). If it applies, **move** moves the maximal projection of ℓ to a newly created specifier position in t (overtly, in the case of $-\mathtt{y}$, and covertly, in the case of $\ominus\mathtt{y}$), and deletes both licensing features. To make this precise, let $t\{t_1 \mapsto t_2\}$ denote the result of replacing all subtrees t_1 in t with t_2, for any tree t, and let ℓ_t^M denote the maximal projection of ℓ in t, for any leaf ℓ.

$$\textbf{move}(t[\langle \alpha, {+}\mathtt{y}\delta\rangle]) = \begin{array}{c} t'[\langle \beta, \gamma\rangle] \quad t[\langle \alpha, \delta\rangle]\{t' \mapsto \langle \epsilon, \epsilon\rangle\} \\ \diagup \quad\quad \diagdown \end{array} \quad (\text{where } t' = \langle \beta, {-}\mathtt{y}\gamma\rangle_t^M)$$

$$\textbf{move}(t[\langle \alpha, {+}\mathtt{y}\delta\rangle]) = \begin{array}{c} \langle \epsilon, \gamma\rangle \quad t[\langle \alpha, \delta\rangle]\{t' \mapsto t'[\langle \beta, \epsilon\rangle]\} \\ \diagup \quad\quad \diagdown \end{array} \quad (\text{where } t' = \langle \beta, \ominus\mathtt{y}\gamma\rangle_t^M)$$

An expression is *complete* just in case it has exactly one negative **selection** feature – this can be thought of as its 'category' in the traditional sense.

3.4 Derivations

A *derivation tree* is a (complete) description of how to construct an expression. (Derivation trees are presented here in the style of Kobele (2012b), which imposes useful restrictions on deletability.) A derivation tree is a labeled ordered tree with nodes labeled with lexical items, subject to the condition that the number of daughters a node with label ℓ has is the same as the number of positive **selection** features ℓ has. (The first daughter represents the first expression ℓ was merged with, the second daughter the second, etc.) The derivation trees which are *well-formed*–those which actually represent 'convergent' derivations—can be charactized directly (i.e. they form a regular set (Kobele et al., 2007)), and are the objects of primary concern in parsing (Harkema, 2001) and semantic interpretation (Kobele, 2012c).

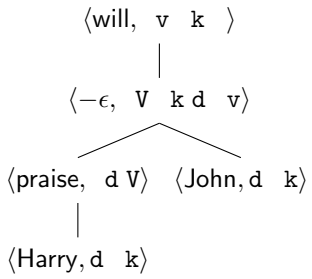

Figure 1: A derivation of the sentence "John will praise Harry"

Figure 1 presents the derivation tree for a transitive sentence given a (simplified, but fairly standard) minimalist analysis.[4] Note that each node in the tree has exactly as many daughters as it has positive selection features. For example, *will* has one positive selection feature (=v), and one daughter, whereas the 'little-v' head $\langle -\epsilon, \texttt{=V +k d= v}\rangle$ has two positive selection features (=V and d=), and two daughters.

To determine which derived object is denoted by a given derivation tree is computationally very simple (Hale and Stabler, 2005; Kobele et al., 2007), although admittedly complex to describe intuitively. Given a derivation tree (such as in figure 1) with root σ with features $\texttt{=x}_1\texttt{+}\vec{\texttt{y}}_1\texttt{=x}_2 \cdots \texttt{=x}_n\texttt{+}\vec{\texttt{y}}_n\texttt{x}\texttt{-}\vec{\texttt{y}}$ and daughters $t_1, \ldots, t_n$, the derived expression is obtained by merging σ with the expression denoted by t_1, then applying the move operation $|\texttt{+}\vec{\texttt{y}}_1|$ times (as many times as σ has positive licensing features between its first two positive selection features $\texttt{=x}_1$ and $\texttt{=x}_2$), then merging the result with t_2, then applying the move operation to that $|\texttt{+}\vec{\texttt{y}}_2|$ times, etc. Essentially, the immediate dominance relation mirrors a **merge** operation, and the left-to-right order of daughters the derivational order of these **merge** operations. The **move** operation is not explicitly represented, but is uniquely determined by the features of the root.

3.5 Deletion

Our deletion operation targets arbitrary *connected* subparts of the derivation tree.[5] Intuitively, we want to be able to 'draw a circle' around a connected subpart, which indicates that this subpart is elided, and under identity with some other subpart elsewhere in the discourse. We implement this intuition by introducing two new operations, **delete**, and **elide**. **Delete** is a lexical operation (i.e. it applies to lexical

[4]The lexical items used are exactly those at the nodes of the derivation tree.

[5]This is related to the notion of *catenae* from the dependency grammar literature. As argued by (Osborne et al., 2013), canonical minimalist analyses of eliptical constructions plausibly allow the material elided to be conceived of in such a manner.

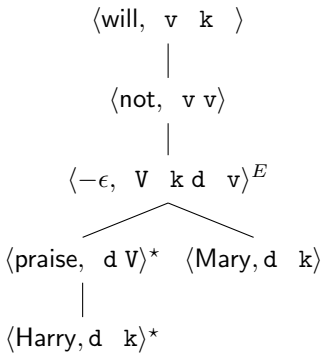

Figure 2: A derivation of the elliptical sentence "Mary will not ~~praise Harry~~"

items, not to arbitrary expressions), and we will write $\ell^\star$ instead of the more cumbersome delete(ℓ), for ℓ a lexical item. The interpretation of the operation **delete** on a lexical item is simply to delete its phonological exponent. This ensures that even discontinuous non-deleted material is treated normally by the grammar. The operation **elide** delimits a stretch of deleted elements as a single eliptical unit, and can be applied only to a derivation tree whose root is deleted. It has no other effect. We write $\ell^E(t_1, \ldots, t_n)$ for the more cumbersome elide($\ell^\star(t_1, \ldots, t_n)$).[6]

A derivation tree with a deleted node can be well-formed only if this node is dominated either by another deleted node or by a node labeled elide. A derivation tree with a node labeled elide can be well-formed only if the expanse of deleted nodes ultimately licensed by this elide node is identical (modulo deletion) to some other part of this derivation tree. (Cross-sentential ellipsis must here be dealt with by taking discourse and sentence grammar to be identical, as argued for in Webber (2004).) This provides us with a direct description of the form-meaning pairs licensed by the grammar.[7]

As a concrete example, consider the derivation in figure 2. In this sentence, the elided material is the portion of derivation consisting of 'little-v', the verb *praise*, and its object *Harry* (all three are marked for deletion), but excluding the subject *Mary*. Note that the (local) restrictions on **delete** and **elide** are respected in this

[6]This notation is inspired by the notion of an 'E' feature driving ellipsis (Merchant, 2001). Note that this is not an actual feature in the present system.

[7]The ability to represent ellipsis in the grammar comes at a computational cost – the identity condition on ellipsis (that a derivation tree with a node labeled elide is well-formed only if the expanse of deleted nodes licensed by it is identical (modulo deletion) to some other part of the derivation tree) is not representable as a regular constraint, and thus the set of well-formed derivation trees in this system is no longer regular.

This is not a result of the present system, but rather of the inherent complexity of ellipsis, which must manifest itself in any system dealing with elliptical phenomena. Perhaps one useful aspect of this paper is making this complexity explicit by putting it all into the grammar.

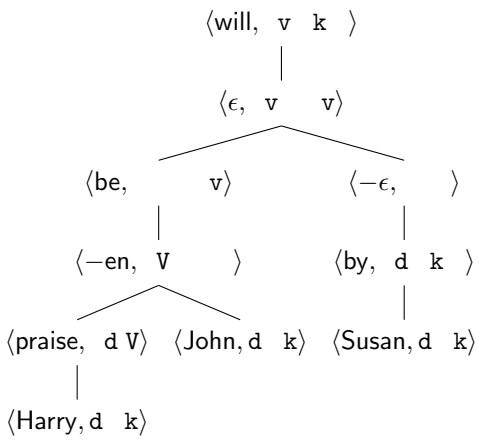

Figure 3: The derivation of "Harry will be praised by Susan"

derivation. In order for this derivation to satisfy the identity requirement on ellipsis, it must be part of a larger derivation which contains a non-elided identical subpart (such as coördinated with the derivation in figure 1).

3.6 Examples

Here I present some examples to illustrate both the minimalist grammar ellipsis system and the linguistic analysis. (For more details, the interested reader may consult Kim et al. (2011), which uses a related system – the analysis is identical.)

Let us examine the following sentences:

(1) Harry will be praised by Susan.

(2) Someone will be praised by Susan, but I do not know whom Susan will praise.[8]

Example 1 is presented in figure 3. Comparing the derivation trees in figure 3 and in figure 2, one sees that they share a common subpart, consisting of the verb *praise* and its argument *Harry* (but not the voice head immediately dominating *praise*). This common subpart (I'll call it the 'VP') suffices to license VP-deletion despite the mismatch in voice. (Kim et al. (2011) attempt to link the smaller identical subpart (VP versus vP) to the lower acceptability ratings assigned to sentences containing mismatched as opposed to matched vpe.)

It is easy to see that the passive example 1 has no subpart in common with an active sentence which includes both the main verb and the finite auxiliary. This

[8]This is an extremely marked sentence of English. It is included here for illustrative purposes, as it allows me to ignore complications associated with sprouting (Chung et al., 1995) and pied-piping.

simple fact blocks voice mismatches in sluicing, understood as ellipsis including the finite auxiliary and the main verb (and usually one or more arguments of the verb, as well). Example 2 does not permit ellipsis of the part *Susan will praise*; the present analysis is straightforwardly able to account for this.

4 Computation

I adopt a 'levels' approach to understanding complex information processing systems (a seminal work in this area is Marr, 1982). Our abilities to use language can be viewed in this context as systems for transforming sounds to meanings and vice versa. To fully understand such a system, we need describe it at (at least) three different levels. The first (what Marr calls the computational) level is a specification of the transformation effected (a description of which sounds are associated with which meanings). The second (what Marr calls the algorithmic) level is a description of an algorithm which realizes this specification.[9] The third (Marr's implementational) level is a description of how the algorithm is realized in the physical medium (our brains). The levels approach offers a natural perspective on the relation between grammar and parser; the grammar is a specification of the parser, which is the algorithm computing the form-meaning relation described by the grammar.

The above account of ellipsis is stated at Marr's computational level, which describes what is being computed but not how. The most natural way of implementing the recognition of ellipsis in this context is to separate the *detection* of ellipsis sites from their *resolution*, at least logically (Kobele, 2012a) (although this separation can and should be 'parallelized' on-line). This allows perfectly standard minimalist grammar parsing algorithms (Harkema, 2001) to be used to construct parse trees with unresolved ellipsis sites, which are written in fraktur as $\mathfrak{E}$ (upper case 'E').[10] Note that because we allow for deletion of contexts, not just subtrees, unresolved ellipsis sites take the form of relation symbols with rank arbitrary (but bound by a function of the length of the sentence), as in figure 4, which represents the derivation tree in figure 2 with its ellipsis site unresolved.

A theory neutral way of stating an ellipsis resolution algorithm is the following. We are given a type of a *context* and a *selection function* `sel` which determines

[9] Peacocke (1986) suggests that linguistic theory is actually at a mid-point between levels one and two (what he appropriately calls level 1.5), where not only the sound-meaning relation is described, but also the major data structures (Marr's representations) used in its computation.

[10] This is actually a consequence of the fact (mentioned in footnote 7) that the distributional restrictions on **delete** and **elide** operations are, modulo the identity condition, regular, together with the fact that the maximum rank of an ellipsis symbol is bounded by the number of words in a sentence. (This bound requires us to take empty lexical items into account – a better approach would be to somehow determine an *a priori* upper bound.) This also raises an interesting question about the proper place for ellipsis in a grammatical theory, one which is borne upon by data such as vehicle change (Fiengo and May, 1994) and split antecedence (Hardt, 1993). Here, my goal is to examine the relation between deletion and copying theories of ellipsis, and I will not consider this question further.

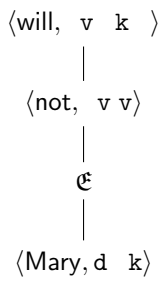

Figure 4: A derivation tree with unresolved ellipsis site for "Mary will not"

the best resolution to a particular ellipsis site given a context. We traverse a tree with unresolved ellipsis sites and use `sel` to resolve any ellipsis sites encountered based on the current context.

Two things are of particular interest about this setup. First, this is the same basic framework as the one developed by (de Groote, 2006) for pronoun resolution, and, as noted there, the selection function `sel` can be parameterized by arbitrary contextual information. Thus, the parallels between ellipsis resolution and pronoun resolution (cf. (Hardt, 1993)) are hereby partially explained by treating them in terms of the same (or a similar) mechanism. Second, taking the goal of parsing to be the recovery not of a parse tree but of a semantic interpretation, the context can simply record semantic denotations (paired with syntactic categories) instead of derivation tree contexts. This follows from the existence of a variable free interpretation scheme for minimalist grammars (Kobele, 2012c), which can assign semantic interpretations to arbitrary derivation tree contexts. Thus, although this is an implementation of a syntactic identity theory of ellipsis, we are free to 'leave syntax behind', and work at the level of meanings.

4.1 Resolving Ellipsis

As noted above, I concieve the processing of minimalist grammars with ellipsis (as described in §3) in two steps. In the first step, we ignore the difficulty of resolving ellipsis, and focus on finding structures for sentences which may contain special ellipsis symbols ($\mathfrak{E}$). The second step, which I describe briefly here, involves 'fleshing out' hypothesized ellipsis sites ($\mathfrak{E}$) with possible antecedents, which then permits a standard computation of meaning (in the sense of compositional semantics). (Note that this step can be viewed as iterated (*OI* (Engelfriet and Schmidt, 1977)) second-order language substitution.[11]) Note that this step is necessary for

[11] 'Iterated' because an $\mathfrak{E}$ may be replaced with a structure which itself contains an $\mathfrak{E}$ (a possibility which would allow a natural account of certain data (Tomioka, 2008)), and 'OI' because different $\mathfrak{E}$s may be replaced by different structures. This is second-order substitution because we are substituting

resolving the membership problem ('is this string generated by the grammar'), as a string could be accepted by the first step of the parser (i.e. the parser says 'if you can find an antecedent for this ellipsis site, the answer is yes'), yet there might be no possible antecedent (i.e. there is no derivation which actually gives rise to that string).

It is instructive to consider a naïve 'two step' approach to the ellipsis resolution problem, whereby we first traverse the derivation tree to flesh out our context, and then next replace ellipsis sites with appropriate antecedents as given by the context.[12] We first need to be a little more explicit about what, exactly, a context is. An ellipsis site $\mathfrak{E}$ occurs in a derivation as a daughter to some node c, and with immediate subtrees t_1 through t_n. Any legitimate fleshing out of this ellipsis site must therefore be by some object $C[x_1, \ldots, x_n]$ with n 'holes' (for subtrees t_1 through t_n), and moreover the hole x_i for subtree t_i must be able to be filled by something with the featural make-up of subtree t_i, for each $1 \leq i \leq n$, and the result of plugging subtrees $t_1, \ldots, t_n$ into holes $x_1, \ldots, x_n$ must be something with the appropriate featural make-up to occur in the original derivation tree as the daughter of node c. We can represent such an object as a typed lambda term $\lambda x_1^{T_1}, \ldots, x_n^{T_n}.C(x_1^{T_1}) \cdots (x_n^{T_n})$ of type $T_1 \to \cdots \to T_n \to T$, where the types reflect the featural make-up of an object.[13] A context should then be a map from types to sets of terms of that type. I define the spine $\mathtt{sp}(t)$ of a term t to be the set of second order T (excluding the identity function) such that there are some $t_1, \ldots, t_{n_T}$ such that $T(t_1) \cdots (t_{n_T}) = t$. Then the set $[\![t]\!]$ of all antecedents in a given derivation tree t (viewed as a lambda term) is simply the set $\mathtt{sp}(t)$, if t is a constant, and $[\![M]\!] \cup [\![N]\!] \cup \mathtt{sp}(MN)$, if $t = MN$.

A first option is to simply set our context to be the function from a type to the set of terms of that type in $[\![t]\!]$. This has the consequence that there are no (logical) constraints on accessibility for antecedents – an ellipsis site can take as antecedent something on its right, something above it, something beneath it, etc. Any *empirical* constraints would then need to be implemented in terms of restrictions on the

not (only) trees but contexts. Viewing this as substitution actually requires us to use different versions of $\mathfrak{E}$ depending on the categories of its arguments and the category it 'produces'. (Bringing us into a many-sorted algebra, or, more generally, a typed lambda calculus.)

[12] I will make use of the simply typed lambda calculus in this section (Hindley and Seldin, 2008). A type is either atomic a, or an implicaiton $\alpha\beta$ for types α and β. A lambda term of type α is either a constant c^α (from some set of constants), or a variable x^α, or an application (MN) of one term M of type $\beta\alpha$ to another N of type β, or, if $\alpha = \beta\zeta$ an abstraction $\lambda x^\beta.M$ of variable x^β of type β in term M of type ζ. I make use of the standard notions of α, β, η reduction and equivalence, and consider terms in η long form (those where every argument position is saturated with a variable). A term is *second order* if every variable which occurs in it is of atomic type. It is *first order* if no variable occurs in it. A first order term can be thought of as a tree, and a second order term can be thought of as a function from trees to trees. I am concerned only with terms which are *closed* (which means that every variable occuring in them is bound) and *linear* (which means that every variable occuring in them occurs exactly once as an argument). Finally, I write M^α to indicate that M is a term of type α.

[13] More precisely, the 'types' here are the (finitely many) categories of the MCFG (Seki et al., 1991) obtained by translating a MG in the manner of Michaelis (2001).

antecedent selection function `sel`.

Another option is to take the set of antecedents which are available to a particular ellipsis site to be a function of that ellipsis site's position in the derivation tree.[14] This is really a family of options, as there are a great many ways of indexing antecedent availability to position. The advantage of this is that it removes some of the burden that the previous option puts on the selection function, but of course it can only be empirically adequate if there are indeed hard restrictions on antecedent availability. The most interesting way of indexing antecedent availability to position is one which can be linked to a particular traversal of the derivation tree (Gerdemann, 1994); this can then be implemented by incrementally updating the context during a traversal, and allowing an ellipsis site to take as antecedent only those terms in the context when the ellipsis site is encountered. This would seem to lend itself naturally to an incremental parsing strategy, which resolves ellipsis sites in an online manner.

4.2 The competence hypothesis

One question which may arise at this point is the precise relation between the grammar of ellipsis (using deletion under derivational identity) and its processing (using 'LF-copying'). My claim is that this relation satisfies even the *strong competence hypothesis* of Bresnan (1982). I assume there is no doubt that the parsers (Harkema, 2001) for minimalist grammars *without* ellipsis satisfy this constraint (for otherwise MGs with ellipsis fail to satisfy strong competence for uninteresting reasons). The question, then, is whether LF-copying is reasonably thought of as an algorithmic implementation of deletion under derivational identity. As the question of when two algorithms are the same is still unresolved (Blass et al., 2009), this question can only here be answered by appeal to intuitions. The main work which needs to be done in parsing minimalist grammars with ellipsis is, once an ellipsis site has been postulated, to find an appropriate antecedent and verify that the content of the ellipsis site is identical to this antecedent (this is a side condition on the application of the operation **elide**). There are two natural ways of proceeding. One is the 'generate-and-test' method, according to which a possible fleshing out of the ellipsis site is created, and checked against the antecedent. The other option is to, making use of the constraint on the nature of the legitimate fleshings out of the ellipsis site imposed by the grammar, use the antecedent to compute an appropriate one such. This option can be seen as a *guided* version of the generate-and-test method, in a manner similar to how top-down parsing can be seen as a(n input-) guided version of a generate-and-test parsing algorithm. In fact, the copying of the antecedent is similar to *memoization* (Johnson, 1995); as we have already gone through the steps of constructing the antecedent, we can simply re-use them *en masse*.[15] Finally, the argument for strong competence comes down to this: if

[14] Position in the surface structure can be computed on the basis of position in the derivation tree.

[15] Indeed, the procedures alluded to in §4.1 for computing the possible antecedents can be thought of as constructing memo-tables of type-indexed subterms.

we do not balk at calling memoized or input-guided generate-and-test algorithms realizations of a grammar, why should we hesitate here?[16]

5 Conclusions

I have presented a formalization of some common themes in the minimalist literature regarding ellipsis, where there is a debate between proponents of a LF-copying approach to ellipsis and those of a PF-deletion approach to the same. I have shown that, under the assumption that the identity condition governing ellipsis is formulable in terms of identity of derivations, the differences between the two approaches disappear. Keeping syntactic identity at the level of the derivation (instead of the derived tree), allows for some flexibility regarding suface antecedent-ellipsis mismatches. One such which has been worked out is the differential acceptability of voice mismatches in VP ellipsis and sluicing (following Merchant, 2007). Other well-known surface mismatches (such as 'vehicle change' (Fiengo and May, 1994), or split antecedence (Hardt, 1993)) do not appear to have a natural syntactic characterization, but do nevertheless seem amenable to treatment at the algorithmic level if we 'deforest' the trees and use instead semantic terms (vehicle change by means of 'copying' the pronoun selection function instead of the pronoun and split antecedence by allowing the ellipsis selection function to choose simultaneously multiple antecedents, and then combine them semantically using either pointwise conjunction or some other operator). This move, however, takes us away from a syntactic identity theory, and is left to future work. It is hoped that this formal presentation will serve to make clear the commitments, prospects, and difficulties faced by a deletion under identity theory of ellipsis.

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[16] Although the discussion here is somewhat divorced from the literature, it pertains, I believe, just as well to the discussion between Martin and McElree (2008) and Frazier and Clifton Jr. (2001).

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Non-canonical word order and subject-object asymmetry in Korean case ellipsis

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Abstract

The dispreference for subject case ellipsis in OSV sentences has been analyzed as resulting from a violation of a structural requirement on the position of bare subject NPs (Ahn and Cho 2006a, 2006b, 2007). In this study, we present evidence from an acceptability rating experiment demonstrating that OSV sentences containing a case-ellipsed subject exhibit acceptability patterns different from ungrammatical sentences violating a core syntactic principle on case assignment and that these sentences are judged acceptable when the subject refers to expected, predictable information in context. This evidence supports the conclusion that the dispreference for subject case ellipsis in OSV sentences is due to violations of probabilistic constraints that favor case marking for rare types of subjects and such violations can be remedied by non-syntactic information.

1 Introduction

Ellipsis is the phenomenon whereby speakers omit from an utterance normally obligatory elements of syntactic structure. One common type of ellipsis in Korean is case ellipsis, whereby case markers like *-i/-ka* and *-(l)ul* are omitted.

Although case ellipsis is possible for both subjects and objects, a comparison between subject and object case ellipsis as found in corpus and acceptability data shows that in general, subject case ellipsis occurs less frequently and is also less acceptable than object case ellipsis (Kim 2008; S. Lee 2009; H. Lee 2010, 2011a). One particular case of this general subject-object asymmetry in case ellipsis is the dispreference for subject case ellipsis in sentences that have the non-canonical OSV word order. Ahn and Cho (2006a, 2006b, 2007) observe that whereas a case-ellipsed direct object can appear in the non-canonical, sentence- initial position without resulting in ill-formedness, a subject cannot appear without following case marker in sentences that have the non-canonical OSV order:

(1) a. Chelswu-lul Mary-ka manna-ss-e.
Chelsoo-Acc Mary-Nom meet-Pst-Ind
'Mary met Chelsoo.'
b. Chelswu Mary-ka manna-ss-e.
Chelsoo(-Acc) Mary-Nom meet-Pst-Ind
'Mary met Chelsoo.'
c. *Chelswu-lul Mary manna-ss-e.
Chelsoo-Acc Mary(-Nom) meet-Pst-Ind
'Mary met Chelsoo.' (Ahn and Cho 2007: 54)

The main purpose of this paper is to provide a new probability-based analysis of this particular asymmetry between subject and object in case ellipsis that can also explain the general subject-object asymmetry in case ellipsis. In section 2, we will

first show that previous syntactic accounts are problematic because OSV sentences with a case-ellipsed subject that have been predicted to be syntactically ill-formed are acceptable when the subject refers to expected, predictable information in context. Section 3 introduces the rationale behind our probability-based account of case ellipsis. In probabilistic models of grammar (Boersma and Hayes 2001; Bod, Hay and Jannedy 2003; Bresnan 2007; Bresnan and Ford 2010), grammatical constraints are defined in terms of graded preferences, weights or rankings, rather than categorical or discrete levels of grammaticality. These models are well-suited to account for case ellipsis because they can describe syntactic phenomena in terms of grammaticality that emerges from preferences that develop over phrases and constructions. In turn, such preferences can be linked to factors that affect processing difficulty, e.g., frequency/probability of use, prototypicality, etc. Section 4 presents evidence from an acceptability rating experiment demonstrating that OSV sentences containing a case-ellipsed subject exhibit acceptability patterns different from ungrammatical sentences violating a core syntactic principle on case assignment and that these sentences are judged acceptable when the subject refers to expected, predictable information in context. This evidence supports the conclusion that the dispreference for subject case ellipsis in OSV sentences is due to violations of probabilistic constraints that penalize form reduction for rare types of subjects and such violations can be remedied by non-syntactic information.

2 Ahn and Cho's Syntactic Account

Ahn and Cho (2006a, 2006b, 2007) offer an account for the subject-object asymmetry in case ellipsis found in OSV sentences as well as other asymmetries which we will not discuss here. Their analysis, couched within the structural framework of the Minimalist Program (Chomsky 1995), rests on the following key assumptions defended in their earlier research:

(2) a. An unmarked subject NP is a left-dislocated bare NP (that undergoes movement out of DP/ΦP, stranding a resumptive pronoun in Φ).[1] The landing site of this NP is the Spec-Force position where it is assigned a generalized theta-role "aboutness."[2]
b. All nominals including subject NPs in their canonical A-position must be projected to DP or ΦP and hence cannot be a bare NP.
c. Case markers on moved nominals must be pronounced unless they are left-dislocated.
d. Unmarked object NPs in their canonical complement position can be part of a syntactic complex predicate. When generated inside a VP, they are bare

[1] In Ahn and Cho's analysis, an unmarked NP is treated as a bare NP, a noun phrase that is not required to be projected to DP or ΦP. They assume three independent layers of nominal projections: NP, ΦP, and DP. They further assume that D is correlated with Case in Korean and that Φ is the projection of pronominal features such as number, person, gender, etc.

[2] Force may express the illocutionary force, modality, or the clausal type (Ahn and Cho 2006a).

NPs and are thus allowed to be caseless.

e. An object that is overtly case-marked by the accusative case markers is a purely optional counterpart of the unmarked object.

The ill-formedness of case ellipsis for the subject NP in (1c) can be accounted for by the assumption (2a). Under Ahn and Cho's account, the bare subject NP *Mary* in (1c) occupies the Spec-T position, not the sentence-initial, Spec-Force position, as shown in (3):

(3) $[FP[DP\ John\text{-}ul]_j\ [F'[TP[NP\ Mary]_i\ [T'[vP\ t_j\ ...]]T]\ F]]$

The derivation (3) is predicted to be ill-formed because the bare NP cannot occupy Spec-T, where the formal feature checking of Φ/D-features is required.

However, OSV sentences with a bare subject NP, which Ahn and Cho predict to be ill-formed, are acceptable in an appropriate discourse context. Consider the following example:

(4) A: ecey Minswu-ka i cip-ul sa-le o-ass-ta.
yesterday Minsoo-Nom this house-Acc buy-to come-Pst-Ind
haciman na-nun ku salam-hanthey nay cip an phal-a.
but I-Top that person-to my house(-Acc) not sell
'Minsoo came (here) yesterday to buy this house. But I won't sell my house to him.'

B: i cip(-ul) ku salam(-i) swipkey phoki an hay.
this house(-Acc) that person(-Nom) easily give up not do.
'He won't give up this house easily.'

In Korean, the OSV order typically marks the object as prominent information such as topic or contrastive focus, and the subject as new information (Choi 1999). This is illustrated in B's utterance in (4), where *i cip* 'this house' is the topic, and the subject *ku salam* 'that person', referring to *Minsoo*, is included within the comment (the information that is asserted about the topic), and represents the backgrounded part of the sentence, namely the part of the sentence which neither topic nor focus is assigned. In this context, unlike in Ahn and Cho's example (1c), case ellipsis for both the subject and the object is just as felicitous as case marking.

The above example is in sharp contrast to the case in which the subject in the OSV sentence is the focus:

(5) A: ney-ka Minhi-lul cohahay?
you-Nom Minhi-Acc like
'Is it you who likes Minhi?'

B: ani, Minhi-lul Minswu-ka/*Minswu cohahan-ta-ko!
no, Minhi-Acc Minsoo-Nom/Minswu(-Nom) like-Ind-QT
'No, it's Minsoo who likes Minhi!'

In B's utterance in (5), there is a clear preference for case marking for the subject.

The contrast between (4) and (5) shows that information predictability plays a crucial role in determining the acceptability of OSV sentences with a case-ellipsed subject. Such sentences, although unacceptable out of context, are judged natural by speakers when the subject represents expected, predictable information in context. In this case, both case ellipsis and case marking for the subject is felicitous.

3 Usage Probability and Subject-Object Asymmetry in Case Ellipsis

In this paper we propose a new usage-based account of the particular subject-object asymmetry in case ellipsis found in OSV sentences that can also explain other types of subject-object asymmetries in case ellipsis noted in the literature in a unified way. Our account of case ellipsis is based on the notion of 'usage probability.' We use the term 'usage probability' to refer to the probability of use of syntactic elements. One important factor that contributes to the high probability of subjecthood or objecthood is frequent associations between certain properties and grammatical functions. For example, subjects are more frequently animate than inanimate and definite than indefinite across languages; objects have the opposite default associations. In response to this, certain patterns of case marking have evolved, whereby more frequent types of objects (e.g., inanimate and indefinite objects) can be unmarked while rare types of objects (e.g., animate and definite objects) are overtly case-marked (Aissen 2003). Conversely, subjects can be unmarked when they are animate and definite, and overtly case-marked when they are inanimate and indefinite. The generalization that suggests itself here is that inanimacy and indefiniteness makes objecthood more likely because of their frequent association, and this increased probability permits zero object marking, by economy principles (6). When a direct object is animate or definite and objecthood is less likely, it is explicitly case-marked. Conversely, subjects can be unmarked when they are animate and definite and subjecthood is highly likely.

(6) a. The more predictable a sign is, the shorter it is.
b. The more frequent a sign is, the shorter it is.

Haspelmath (2008: 5) argues that any efficient sign system in which costs correlate with signal length follows the Zipfian principles in (6) (see also Bybee and Hopper (2001) and Hawkins (2004)). Evidence from syntactic reduction provides support for the pervasive effect of these principles on language use. In a study using a database of spontaneous English, Wasow, Jaeger and Orr (2011) found that speakers are less likely to mention the relativizer *that* in non-subject-extracted relative clauses (e.g., *I like the way (that) it vibrates*) when the relative clause is predictable (see also Jaeger (2006)). Further evidence comes from the optional *that*-mentioning in English complement clauses. Jaeger (2006) analyzed the same spontaneous database that was employed for the study by Wasow et al. (2011) and found that speakers are less likely to mention the complementizer *that* when the

complement clause is predictable.

In this paper, we will propose that the acceptability difference between subject and object case ellipsis in non-canonical OSV sentences reflects asymmetries in probabilistic properties of argument NPs.

In Korean, SOV is regarded as the canonical order and is also documented to be the most frequent word order. Kim (2008) has examined argument realization patterns by analyzing the use of what he calls 'zero-marking', nominative and accusative case markers and other particles such as *-(n)un* in 9,249 clausal units produced by 20 native speakers of Korean. His study found that among the various patterns of word order observed in conversational Korean, OV (51.95%), SOV (19.37%), V (19.23%) and SV (6.42%) are the most common patterns. The dominance of the OV pattern, which involves subject ellipsis and overtly realized object NPs, is due to asymmetries in the probabilistic patterns of the use of subjects and objects. Bloom (1990, 1993) argues that the tendency to omit subject NPs over object NPs may be due to discourse factors surrounding subjects, which tend to be more given than objects. Subjects are typically given information (that is, previously mentioned and already activated), while objects typically convey newly introduced information, it is not surprising that subjects tend to be omitted more than objects. Similarly, DuBois (1987) discusses why discourse factors explain why object ellipsis occurs less frequently and why transitive predicates tend to have more subject ellipsis than intransitive predicates. DuBois argues that there tends to be only one lexical argument (which contributes new information) in a clause in Sacapultec Maya. The lexical argument appears preferentially in the S (intransitive subject) or O (direct object) roles, but rarely in the A (transitive subject) role. This is because human agents (which occupy the A role) tend to be topic and given information in the sentence, while objects tend to be new information, and intransitive clauses tend to be used when new human referents are introduced. As a result, the A role tends to be reduced to an overt or zero pronoun.

Kim's study also found that OSV occurs very rarely (1.92% of 3,692 tokens of transitive clauses). This order typically marks the object as prominent information such as topic or contrastive focus, and the subject as new information (Choi 1999). The correlation between the OSV order and the new subject can lead to a particular bias toward the form of the subject NP. Because newness is a rare and unexpected property for the subject, the current probability-based account predicts that the case-marked form to be preferred over the unmarked form as the suitable form for this less probable subject type, i.e., new information subject. This explains why case ellipsis for focus subject in (5B) is not acceptable.

The acceptability of (1b), repeated below as (7), can be explained similarly. Case marking on the sentence-initial object is motivated by the fact that objecthood is less likely in the sentence-initial position than in the immediately preverbal position. However, the unmarked object form is not ruled out because it is compatible with the probabilistic property of the OSV order (i.e., marking the object as given) and with the general information status of elements occurring the sentence-initial position (i.e., high predictability and low information content).

(7) Chelswu(-lul) Mary-ka manna-ss-e.
Chelsoo(-Acc) Mary-Nom meet-Pst-Ind
'Mary met Chelsoo.'

Our probability-based account further predicts that the sentence (1c), although unacceptable out of context, is judged natural by speakers when the predictability of the subject referent increases. One such case is when the subject has a higher degree of givenness as in (4), repeated here as (8).

(8) A: ecey Minswu-ka i cip-ul sa-le o-ass-ta.
yesterday Minsoo-Nom this house-Acc buy-to come-Pst-Ind
haciman na-nun ku salam-hanthey nay cip an phal-a.
but I-Top that person-to my house(-Acc) not sell
'Minsoo came (here) yesterday to buy this house. But I won't sell my house to him.'
B: i cip(-ul) ku salam(-i) swipkey phoki an hay.
this house(-Acc) that person(-Nom) easily give up not do.
'He won't give up this house easily.'

In B's utterance in (8), the referent of *i cip* 'this house' is the topic of the sentence, and the referent of *ku saram* 'that person', *Minsoo*, is part of the relationally new information predicated about the topic, as indicated by its occurrence in the immediately preverbal position. However, it is referentially given by virtue of having been previously mentioned in context, i.e., in A's utterance. The referential givenness of the subject referent contributes to higher referential predictability (Jaeger 2006), and the increased predictability may in turn increase preference for the unmarked subject form. In this case, both case ellipsis and case marking with respect to the subject is felicitous: while the relational newness of the subject referent favors the use of case marking, use of case ellipsis for the subject in (8B) is also felicitous because of the increased predictability of the subject referent.

Using case markers to mark less probable phrases has been argued to have a processing advantage (Jaeger 2010): when speakers use case markers to mark less probable phrases, they can buy more time to produce syntactic elements that are difficult to process and spread information on the phrase's grammatical and discourse function over a longer time, thereby leading to more uniform information density compared to leaving it unmarked. Thus, from the perspective of usage probability, the presence of case markers can be interpreted as a signal to expect the unexpected, a rational exchange of time for reduced information density or a meaningful delay.

The sentence processor's preference to uniformly distribute information across linguistic signals for increased processing efficiency (by using an extra morpheme or word to mark less probable phrases) is likely to have been grammaticalized as probabilistic linguistic constraints that penalize zero marking for rare types of subject (e.g., new subjects, focused subjects, subjects occurring in the non-initial

position following the object, etc.).[3] Violations of such constraints, unlike violations of core syntactic principles, give rise to mild unacceptability and can be remedied by non-syntactic information. This explains why referential predictability improves the acceptability of case ellipsis for rare types of subjects. The predictability condition on acceptable case ellipsis may be an important component of the recoverability condition on ellipsis phenomena in general, and thus it is not surprising that satisfying it improves the acceptability of unacceptable case ellipsis induced by violations of the probabilistic constraints that penalize zero marking for rare subject types.

This view of case marking can also account for the fact that in general, subject case ellipsis occurs less frequently and is also less acceptable than object case ellipsis (Kim 2008; S. Lee 2009; H. Lee 2010, 2011a). Given the high frequency of overt realization of object NPs and the rarity of overt realization of subject NPs, it is not surprising that case ellipsis is more acceptable for the more frequent type of explicit NPs, i.e., overt objects, whereas case marking is more acceptable for the rare type of explicit NPs, i.e., overt subjects.

A similar explanation is possible for the acceptability contrast between (1b) and (1c). As noted above, the subject in OSV sentences can be considered more marked than the object. It is *doubly marked* due to its association with two rare properties for subject, i.e., overt realization and non-canonical syntactic position, whereas the object in OSV sentences is associated with only one property unexpected for object, i.e., non-canonical syntactic position. Thus, case marking is more strongly enforced for the subject than for the object, and this explains why case ellipsis for the subject in OSV sentences is not acceptable out of context.

4 Experimental Data

This section reports a rating experiment that elicits speakers' judgments on the acceptability of OSV sentences containing the case-marked or unmarked form of the transitive subject. Although acceptability judgments would probably not reflect actual performance in the same way as naturally occurring data would, the acceptability judgment task was chosen for the following reasons. First, given that the type of sentences that we are of interest in this study, i.e., OSV sentences, are not highly frequent in either written or spoken Korean, it was considered necessary to use elicitation tasks, for it was unpredictable to what extent data collection methods that use naturally occurring data would provide data rich enough for the present purposes. Second, the acceptability judgment task was used because it was considered very important to tightly control contexts and factors that are known to affect the frequency of case ellipsis in an experimental setting.

Our central hypothesis is that the degree of the acceptability of case ellipsis for the subject in such sentences is correlated with the degree of the subject referent's predictability in context. This hypothesis predicts: i) Case ellipsis is more acceptable

[3] See H. Lee (2003) for formalization of these constraints as Optimality-theoretic constraints.

in the high predictability condition than in the low predictability condition, whereas the pattern of the acceptability of case marking is reversed; and ii) In the high predictability condition, case ellipsis for the subject of OSV sentences is judged acceptable, whereas in the low predictability condition, case ellipsis for the subject of OSV sentences is judged mildly unacceptable.

Sixty undergraduate students of a university in Seoul participated in the experiment. Each participant was asked to read short conversations between speakers and indicate to what degree the two subject forms were suitable in the given context. To do this, they had to rate the acceptability of sentences containing a case-marked or unmarked subject by assigning them a grade from 1-5 on a five-point rating scale.

The predictability of the subject in OSV sentences was manipulated by means of variation in context sentences (sentences uttered by the first speaker). In the high predictability condition, the referent of the subject in the target OSV sentences is referentially given, i.e., introduced in the previous speaker's utterance. On the other hand, in the low predictability condition, the subject in the target OSV sentences is not only new to the discourse but also functions as a contrastive focus or an informational focus. Consistently with the typical information structure of OSV sentences, in both conditions, the referent of the object in the target OSV sentences is the topic of the sentence, and the referent of the subject is relationally new by virtue of being part of the comment predicated about the topic (the high predictability condition) or by virtue of being in focus (the low predictability condition). A sample stimulus translated into English is shown in (9):

(9) Example of judgment task in questionnaire

Instruction: Please read through the following conversations, then make a judgment on underlined sentences in each conversation by assigning them grades from 1-5. Use the following scale to make your judgments:

1 = Completely Unacceptable 2 = Unacceptable
3 = Just Barely Acceptable 4 = Acceptable
5 = Completely Acceptable

1) [High predictability condition]
A: ecey Minswu-ka i cip-ul sa-le o-ass-e.
yesterday Minsoo-Nom this house-Acc buy-to come-Pst-Ind
haciman na-nun ku salam-hanthey nay cip-ul an pha-l-keya.
but I-Top that person-to my house-Acc not sell-will
'Minsoo came (here) yesterday to buy this house. But I won't sell my house to him.'

B-1: i cip-ul ku salam-i swipkey phoki an ha-l-keya.
this house-Acc that person-Nom easily give up not do.
'He won't give up this house easily.' Your score: _____
B-2: i cip-ul ku salam swipkey phoki an ha-l-keya.
this house-Acc that person(-Nom) easily give up not do.
'He won't give up this house easily.' Your score: _____

To keep the influence of factors other than the predictability of the subject referent in the target sentences to a minimum, we have further controlled the items in the questionnaire in the following way:

(10) a. Only definite subjects and objects were included as the head of subject and object NPs in the target OSV sentences. The following four kinds of definite subjects were included in our stimuli: pronouns, names, kinship terms and definite descriptions.
b. Only human subjects and inanimate objects were included since they represent the most prototypical types of transitive subjects and direct objects in terms of animacy.
c. In view of the finding that the previous occurrence of a parallel structure affects speakers' use of syntactic structures (Bock 1986; Gries 2005; Szmrescányi 2005), the form of the subject and the object in the context sentences has been controlled by keeping them consistently case-marked. Furthermore, the word order of the context sentences was consistently SOV.
d. In view of the finding that longer NPs are more likely to be marked with an overt particle than shorter NPs (Ono, Thompson and Suzuki 2000; Kim 2008), the length of the subject NP has been controlled so that the subject NP in the target sentences did not contain any phrase modifying the head noun and did not exceed 4 syllables.

There were 40 items per each predictability condition, and there were two versions of the target sentences of each item: one version contained a case-marked subject and the other version an unmarked subject. These 80 items were combined with 60 fillers belonging to another experiment. The stimuli and fillers were combined in three different orders for each list, to avoid ordering effect.

Thus, the experiment followed 2 × 2 design, where the factors were 1) the subject's predictability (high vs. low) and 2) subject form (case-marked vs. unmarked). The two versions of the target sentences were presented in a factorial design so that half the participants saw 30 stimuli with a case-marked subject, and half saw 30 stimuli with an unmarked subject.

The results of the ANOVA indicate a significant main effect of subject predictability ($F1(1, 118) = 24.88$, $p = .000$; $F2(1, 38) = 5.59$, $p = .029$). As shown in Table 1, the mean judgments for case-marked subjects in the OSV sentences were higher in the low predictability condition than in the high predictability condition,

whereas the pattern of the mean judgments for unmarked subjects was reversed. This confirms our first major prediction that whereas case marking is more acceptable in the low predictability condition than in the high predictability condition, case ellipsis is more acceptable in the high predictability condition than in the low predictability condition. However, the acceptability of the OSV sentences with the unmarked form of the high-predictability subject counters to the predictions of purely syntactic accounts (e.g., Ahn and Cho (2006a, 2006b, 2007)) because such accounts predict OSV sentences with an unmarked subject to be syntactically ill-formed.

Table 1. Average ratings

	High predictability	Low predictability	Means
Subj-Nom	3.46	3.98	3.72
Subj-Ø	3.72	2.47	3.10

The results of the ANOVA also indicate a significant main effect of subject form ($F1(1, 118) = 75.47$, $p = .000$; $F2(1, 38) = 47.46$, $p = .000$). As predicted, in the high predictability condition, the mean judgments for unmarked subjects were significantly higher than those for case-marked subject. By contrast, in the low predictability condition, case-marked subjects showed higher acceptability values than unmarked subjects.

Also noteworthy is that whereas only the case-marked subject form is judged acceptable and the case-ellipsed form is judged mildly unacceptable in the low predictability condition, both forms are judged acceptable showing acceptability values higher than 3 in the high predictability condition. This supports the second major prediction tested in this experiment. As discussed earlier, case marking is felicitous because the (relational) newness of the subject referent favors the use of case marking. Use of case ellipsis for the subject in OSV sentences is also expected to be felicitous because it matches the increased expectancy of the reduced form in the high predictability condition. However, the acceptability of both forms in the high predictability condition contrasts directly with the predictions of Ahn and Cho's syntactic account (2006a, 2006b, 2007) because on their account, OSV sentences with an unmarked subject are predicted to be syntactically ill-formed.

We also found a significant interaction between subject form and subject predictability ($F1(1, 118) = 216.77$, $p = .000$; $F2(1, 38) = 78.19$, $p = .000$). As shown in Table 1, the subjects' scores of the acceptability of OSV sentences containing the unmarked subject increase from the low predictability condition to the high predictability condition, whereas the acceptability of sentences containing the case-marked subject shows the opposite pattern. Thus, the results of this analysis indicate that the degree of the acceptability of case ellipsis for the subject in OSV sentences is correlated positively with the degree of subject predictability, whereas the degree of the acceptability of case marking for the subject in OSV sentences is

correlated negatively with the degree of subject predictability.

Overall, our results clearly indicate that speakers' judgments of OSV sentences with a case-marked or unmarked subject are sensitive to the degree of the predictability of the subject referent in context. The fact that the OSV sentences containing an unmarked subject were judged not only acceptable but also more acceptable than those with a case-marked subject in the high predictability condition provides strong support for the view advocated here that speakers' judgments of acceptability are affected by satisfaction or violation of probabilistic expectations about form reduction and predictability.

However, there is one crucial methodological limitation in this experiment. In this study, acceptability data were obtained from speakers' judgments on the written sentences. This constitutes a limitation because it does not take into consideration the possible effect of the prosody of non-canonical word order on judgments of acceptability. It has been observed that scrambling has a prosodic effect of shifting the intermediate phrase boundary to the left along with the scrambled phrase. As a consequence, the post-scrambled position gets de-accented or prosodically reduced (Jun 1993; Kenstowicz and Sohn 1997). The unavailability of natural prosody is likely to have contributed to low judgments of OSV sentences, particularly those containing a case-ellipsed subject.

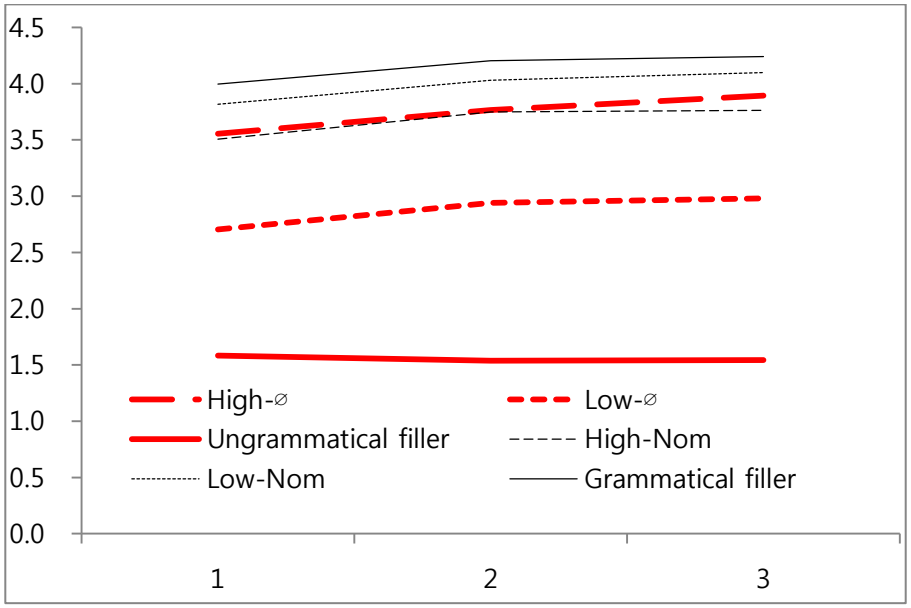
In a follow-up experiment designed to investigate this possibility, we elicited acceptability data by asking participants to listen to conversations between two speakers spoken with natural prosody. The overall results converge with the basic findings of the experiment reported in this section, showing that whereas only the case-marked subject form is judged acceptable and the case-ellipsed form is judged mildly unacceptable in the low predictability condition, both forms are judged acceptable showing acceptability values higher than 3 in the high predictability condition. Furthermore, the results also indicate that OSV sentences were judged higher in this follow-up experiment than in the experiment reported here. As Table 2 shows, this effect of increased ratings was most noticeable in the OSV sentences with a low-predictability subject that is case-ellipsed: these sentences were judged significantly higher (means: 2.87) than ungrammatical filler items (means: 1.55) where the direct object of agentive transitive verbs were marked with nominative case markers instead of accusative case markers. However, it is unexpected under purely syntactic accounts why the OSV sentences that are predicted to be ill-formed show acceptability values close to moderately grammatical level and why acceptability judgments for these sentences change with manipulation of non-syntactic information such as context and prosody.

Table 2. Average ratings

	High predictability	Low predictability	Means
Subj-Nom	3.67	3.98	3.83
Subj-Ø	3.74	2.87	3.31

Additional support for the hypothesis that the dispreference for subject case ellipsis in OSV sentences is due to violations of probabilistic constraints that favor case marking for rare types of subjects comes from an analysis of patterns of acceptability exhibited by the experimental items and filler items. As Figure 1 shows, OSV sentences in all of the four experimental conditions exhibited acceptability patterns identical to those of grammatical filler items in that acceptability judgments increase over the course of the experiment. But acceptability judgments for ungrammatical filler items violating a core syntactic principle on case assignment were not significantly affected by list position and stayed constant over the course of the experiment.

Figure 1. Patterns of acceptability judgments



This effect of increased ratings after repeated exposure to structurally similar sentences follows naturally from the perspective that the OSV sentences with an unmarked subject are hard-to-process constructions which get better with experience.[4] However, the common upward trend in acceptability judgments for

[4] Several studies suggest that only grammatical strings including moderately grammatical sentences and grammatical sentences that are difficult to process get better with repeated exposure. Hofmeister, Jaeger, Arnon, Sag and Snider (In press), for example, present evidence that Superiority violations in English, which has traditionally been considered violations of syntactic constraints, show gradient acceptability (rather than being categorically out or ungrammatical) and that judgments on certain types of Superiority violations increase with exposure while processing times decrease. Their analysis further shows that the observed gradience in acceptability is correlated with processing difficulty at the verb. Based on this evidence, Hofmeister et al. argue that Superiority effects reflect online processing costs that can be attenuated with repeated exposure.

the experimental OSV sentences and the grammatical filler items is left unexplained in purely syntactic accounts of case ellipsis.

5 Conclusion

In this paper, we have presented a new account of variable case marking that can explain the subject-object differences in case ellipsis by the interaction between grammatical constraints on the use of case ellipsis and the predictability condition on ellipsis recoverability: the unacceptability of case ellipsis for subjects in noncanonical OSV sentences and non-specific subjects, and *wh*-word subjects is caused by violations of probabilistic linguistic constraints that penalize the use of case ellipsis for rare types of subjects, which can be viewed as a grammaticalization of the speakers' preference to avoid form reduction for less frequent types of phrases for increased processing efficiency.

Violations of these constraints, unlike violations of core syntactic principles, give rise to mild unacceptability and can be remedied by manipulation of non-syntactic information. This explains why case ellipsis for rare types of subjects is judged acceptable when the subject represents expected, predictable information in context. These results provide strong support for the view that grammatical asymmetries manifested by the subject-object asymmetries in case ellipsis should be explained by asymmetries in the usage probability of the properties of argument NPs in context, not by categorical syntactic constraints. Our results also add to the growing body of evidence that native speakers' knowledge of grammar includes access to fine-grained predictability and probability (Jaeger 2006, 2010; Bresnan 2007, Bresnan and Ford 2010; H. Lee 2010, 2011a, 2011b).

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Ellipsis of case-markers and information structure in Japanese

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Abstract

This paper presents an HPSG formalisation of how the ellipsis of case-marking affects the focus of the clause in Japanese. We restrict our attention to the nominative and accusative markers *ga* and *o*, and in view of the fact that the ellipsis effects on focushood vary between 1) *ga* and *o* and 2) different argument structures of the head verb, develop an essentially lexicalist account that combines both aspects, in which the *implicit focus* argument position is specified in the predicate. We argue that if a constituent is an implicit focus it does not, while if one is not it does, require a case-marker to be focused.

1 Introduction

Postpositions are crucial building blocks of a clause in Japanese. They attach mainly to nominals, indicating their semantic, syntactic or pragmatic properties, and are projected to postpositional phrases (PostPs). Since PostPs become dependents of a verb in a clause, postpositions crucially participate in argument structure realisation. Yet some postpositions, case-marking ones among others, are frequetly dropped, giving rise to the situation where some arguments in a clause are headed by phonologically empty items. In this paper we ask under what conditions such an ellipsis occurs, in relation to the *information structure*. More specifically we argue that overt marking is required in a focal environment, although the *implicit focus* specified in the head verb is exempt from this requirement. We show an HPSG formalisation for this mechanism.

Our account is distinct from the existing accounts in that it is in essense lexicalist but still ensures the interaction with information structure. It relies on the argument structure of a lexical predicate (mainly a verb), which, coupled with its implicit focus, determines the positions where ellipsis is felicitous. In short, we write into a (type of) verb where the normal focus position is, where the case-marking is optional.

We restrict our target to case-marking postpositions (case-marker in short) in informal discourse, particularly *ga* (nominative, normally subject marker as well) and *o* (accusative, normally direct object marker), where ellipsis frequently occurs. We will *not* consider the topic marker *wa*, though it also tends to be elided. Given the background that there is little consensus on the relationship between topic and focus, let alone the notion of topic itself, we think we would be better off confining ourselves in this paper to focushood, although we will say a word or two at the end about how our analysis may be extended to cover topic as well. In order to avoid the topical influence as much as possible, we will use examples of embedded clauses, where the topic marking is normally suppressed. In practice, this is to avoid the knotty question of what an ellipsis is the ellipsis of, case-marker or *wa*, since in an embedded sentence *wa* is not expected, and an ellipsis can be regarded as that of a case-marker.

[†]I thank Chungming Lee, Incheol Choi and Shûichi Yatabe for their helpful comments at the conference.

2 Background

In this section we consider three types of existing accounts. A first type, the intuitive 'recoverability' account says that a case-marker may be dropped if the thematic role is uniquely identifiable, or, recoverable (Hinds, 1982). According to this account, in the following example, it is felicitous to drop *o* in (1a) because thanks to the argument structure of the transitive verb ijimeru coupled with the presence of the subject-marker *ga*, the objecthood of the case-dropped nominal, *Jirô*, can be recovered (the bracketed variant demonstrates that the word order swap doesn't affect the omissibility). The infelicity of (1b), then, can be attributed to the impossibility to uniquely identify subject or object (either Tarô or Jirô can be subject or object). In (2), though the thematic roles are not recoverable syntactically, they can be argued to be recovered pragmatically, because alcohol cannot be plausibly interpreted to drink Tarô.

(1) Tarô-ga Jirô-o ijimeten-no michatta.
-NOM -ACC bully-COMP saw
lit: (I) saw that Tarô was bullying Jirô. ('I saw Tarô bullying Jirô')

a. Tarô-ga Jirô-ϕ ijimeten-no michatta. (Jirô-ϕ Tarô-ga ijimeten-no michatta.)

b. ? Tarô-ϕ Jirô-ϕ ijimeten-no michatta.

(2) Tarô-ϕ sake-ϕ nonden-no michatta. ('(I) saw that Tarô was drinking alcohol')

However, recoverability cannot account for a curious asymmetry: *ga* is comparatively harder to elide than *o*, which makes most transitive cases sound bad where only *ga* is elided leaving *o* intact. Consider the following example:

(3) a. ?? Tarô-ϕ Jirô-o ijimeten-no michatta.

b. ?? Tarô-ϕ sake-o nonden-no michatta.

Notice that the first of the following set contrasts with (1a). The second example is meant to show that this is not due to pragmatic plausibility either.

Based on such examples Kageyama (1993) offers a structural constraint: that an internal argument does, while an external argument does not, allow for ellipsis. This structural account may work for most of our examples, but apart from the fact that we already have an exception, (2), where both internal and external arguments are without markers, it is the fact that the subject-marker drop is often acceptable with an intransitive verb, as in the following, that would first need to be accommodated.

(4) Tarô-ga/ϕ hashitteru-no michatta. ('(I) saw that Tarô was running')

Kageyama invokes the unergative/unaccusative distinction to address this issue, pointing out that it is difficult to elide *ga* for unergatives:

(5) Tarô-ga/??ϕ abareru-no michatta. ('(I) saw that Tarô was vandalising')

explaining that it is acceptable to elide *ga* in (4) as it really is the external argument of an unaccusative verb.

While we grant that there is an acceptability difference *in degree* between unaccusative and unergative cases, the main problem with such a binary criterion is that it makes the situation seem black-and-white, where the reality isn't. We have already seen (2) represents a counterexample. Further, under the context where the subject is de-focused, the acceptability of (3) also improves.

(6) Tarô-ga nani shiten-no mitatte? ('What did you say you saw Tarô doing?')
Tarô-ϕ Jirô-o ijimeten-no michatta.

The last example suggests the likelihood of the involvement of information structure, and in fact so does (4), because the intransitive subject tends to be focused than the transitive one. The last account to consider is indeed information-structure oriented: that a case-marking postposition cannot be elided if the nominal that it attaches to receives a narrow, argument focus interpretation Yatabe (1999).

(7) Dare-ga sake-o nonden-no mitano? ('Who did you see drinking alcohol?')
Tarô-{ga/??ϕ} sake-{o/ϕ} nonden-no michatta.

We believe Yatabe's account is on the right track, but there are some outstanding issues left unresolved. First, there does not seem to be a problem eliding marking with the focused object [(8a)].

(8) a. Tarô-ga nani-o nonden-no mitano? ('What did you see Tarô drinking?')
Tarô-{?ga/ϕ} sake-{o/ϕ} nonden-no michatta.

b. Nani-o mitano? ('What did you see?')
Tarô-{ga/??ϕ} sake-{o/ϕ} nonden-no michatta.

In fact, there is no difference between narrow focus (8a) and sentence focus (8b) contexts on *o*-marking either. Although Yatabe does not even consider the case of object marking, the question of why the same account cannot be extended to objects certainly warrants investigation. Also, the contrast in the acceptability in (non-)marking of the subject is also a curious one.

We believe that it still is possible to combine the valid insights of both accounts, ones based on argument structure and information-structure. In what follows we develop an account that says some arguments require case-marking to be focused

while others may be focused regardless of it, or put differently, case-marking determines focus for some arguments while it is inert for others. We then relate this difference —what arguments require and does not require case-marking— to information structure. Recall the dictum "*Subject is the unmarked topic*" by Li and Thompson (1976): even without context, the implicit information structure can be conventionalised in a way related to argument structure. We say *Object is the implicit focus*, while providing an analysis that accounts for all the data including the object-marker drop.

3 Focus and case-marker elidability

3.1 Overview

Our overall strategy is to specify one[1] of the arguments of a verb as the 'implicit focus,' and say it does not require a case-marker to be realised as a focus. As we shall see, we define it such that not only is a case-marker is optional, but one is not capable of making it a focus. In short, for an implicit focus, a case-marker is inert in terms of focushood.

The collorary of this is that an argument which is not the implicit focus requires a case-marker to be a focus. From the ellipsis perspective, the claim amounts to this: to be able to elide a case-marker, a PostP needs to be either a non-focus or the implicit focus.

Before proceeding to the formal analysis, it would be necessary to refer to the existing proposals on focus in general, so as to clarify what we share and do not share with them. First to be noted is the fact that, since the seminal work by Selkirk (1995), most work on focus centres around *prosody*, i.e. focus-marking ('F-marking') by accentual or intonational means. We certainly accept that focus can be influenced by these means in Japanese too (see e.g. Ohshima (2006)), but since our subject matter is case-marker ellipsis we will only discuss the syntactic aspect of focus in this connection. Furthremore, whereas the prosodic F-marking is usually considered to identify focus unambiguously (the F-marked constituent automatically gets the focus status), this does not apply to our syntactic analysis. In fact, our analysis will not include 'focus-marking' as such, that is, there is no single feature that uniquely determines focus (reflecting the absence of dedicated syntactic focus marker in Japanese). Instead it is a combination of argument structure and case-marking that does the work.

Another important issue is what 'projecion' schema we adopt for focus. On this point, what is common among differing proposals is a rule or schema that lets a mother inherit (at least) some of the daughters' focus values. We use a straightforward variant of classical 'vertical' projection rule of Selkirk (1995), which states that the focus values of the head daughter is inherited to its mother, and add our

[1]There is no theoretical reason why it should always be one, although we will discuss the data where there is only one, if any, implicit focus element.

own mechanism where focus is contributed from non-head daughters.

Furthermore, the notion of focus itself has long been a matter of contention. We will not delve deeply into this foundational issue, but confine ourselves to briefly stating the outline of our position. If we dare summarise the debate in one sentence, it concerns which domain of linguistics should be taken to be the primary determiner of focus, surface string (phonological or syntactic), semantics or pragmatics. Selkirk's position represents the first, while, for example, Rooth's (1992) position represents the second. Along with Lambrecht (1994),Breul (2004) and Erteschik-Shir (2007), our position belongs to the third stream, in taking pragmatics as the primary determiner. Thus along with these authors, we use the question-answer pair as our main diagnostic for the locus of focus. If the sentence in question is discourse-initial or answers a general 'what's happened' type of query, it is the sentence-focus articulation, while we call all of the more local articulations 'narrow focus,' where part of a sentence is focused —argument focus, predicate focus etc. We hasten to add, however, along with all those concerned with information structure to our knowledge, that focushood has effects on the other two areas —in our case, semantics and syntax. In fact, the question we address here is precisely of how focus, while it is taken as a primarily pragmatic phenomenon, affects syntax.

3.2 HPSG formalization

We start with specifying the implicit focus in the arguments of a verb. This is meant to represent the 'conventionalised' nature of the information structure of a clause onto which a verb is projected: for each verb, we way which argument position, if any, is focused by default. This setup allows for flexibility as to which argument position is normally focused, on the lexical basis, although given a limited number of argument positions in general, we proceed to the formalisation on the basis of its subtypes. For our discussion, we assume the *trans(itive)-verb* subtype to behave uniformly with respect to implicit focus: the object is the implicit focus. Along with the past HPSG literature (e.g. De Kuthy (2002)), the focus feature is a list ranging over the semantic content values, but the backslash ('\') notation points to the implicit focus.

$$\left[\begin{array}{l} \textit{trans-verb} \\ \text{FOCUS}\left\langle \backslash \boxed{1} \right\rangle \\ \\ \text{ARG-ST}\left\langle \left[\begin{array}{l} \textit{post-phr} \\ \text{PHON}\left\langle \textit{ga} \right\rangle \\ \text{SS}\,|\,\text{HD}\,|\,\text{CASE}\ \textit{nom} \end{array}\right], \left[\begin{array}{l} \textit{post-phr} \\ \text{PHON}\left\langle \textit{o} \right\rangle \\ \text{SS}\left[\begin{array}{l} \text{HD}\,|\,\text{CASE}\ \textit{acc} \\ \text{CONT}\,|\,\text{RELS}\ \boxed{1} \end{array}\right] \end{array}\right] \right\rangle \end{array}\right]$$

The meaning of this list containing an element with slash requires some explanation, because it is somewhat different from the standard use for the 'defeasible'

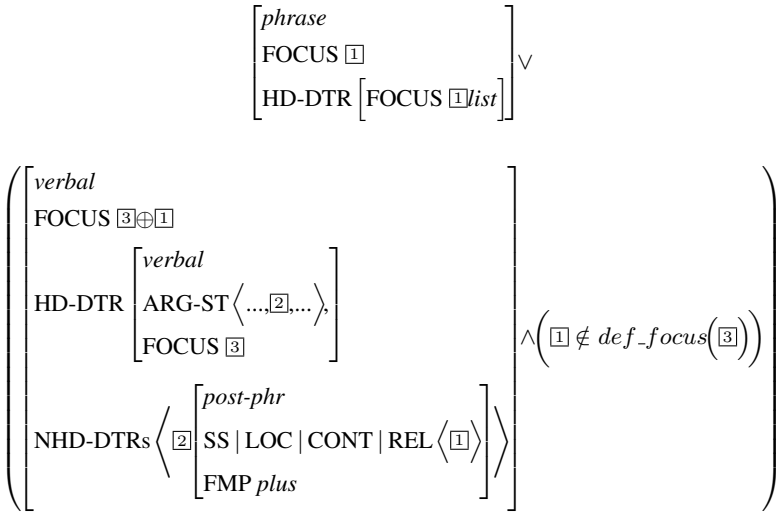

Figure 1: Focus Projection Schema

constraint. The implicit focus is by default a focus, but is not forced, at least by a syntactic means, to be a focus either. Thus the following is the meaning of the list:

$$\boxed{3}\langle \ldots, \backslash\boxed{2}, \ldots\rangle := \boxed{3} \ominus \boxed{2} \vee \langle \ldots, \boxed{2}, \ldots \rangle$$

Simply put, it represents a disjunction of lists, which says the implicit element may be either realised as a focus or not.

Now, to incorporate the effect of the presence/absence of the overt case-marker, we introduce the binary *focus-marking potential* (FMP) head feature for case-marking postpositions.[2] We simply say that any overt case-markers have this potential (value *plus*) and phonologically empty ones (zero-markers) do not.

$$\begin{bmatrix} \textit{post-case-overt} \\ \text{PHON } \textit{nelist} \\ \text{SS} \mid \text{LOC} \mid \text{HD} \begin{bmatrix} \text{CASE } \textit{case} \\ \text{FMP } \textit{plus} \end{bmatrix} \end{bmatrix} \begin{bmatrix} \textit{post-case-zero} \\ \text{PHON } \langle\rangle \\ \text{SS} \mid \text{LOC} \mid \text{HD} \begin{bmatrix} \text{CASE } \textit{case} \\ \text{FMP } \textit{minus} \end{bmatrix} \end{bmatrix}$$

Our focus projection schema is shown in Figure 1. We first adopt a simple schema where the head daughter's focus value is passed up to the mother (base case, the first disjunct in the Figure). The crucial step, then, is to add a provision for the interaction of implicit focus with FMP. The bottom AVM (second disjunct) represents this.

Generally there are three cases to consider (or more precisely two subcases with one having further two subcases), depending on (a) whether the PostP in question

[2]The term is deliberately reminiscent of De Kuthy and Meurers (2003)'s *focus projection potential*. The role it plays is rather similar, but as we shall see, our 'potential' is exerted 'vertically' to influence its mother, while DeKuthy and Meurers's is 'horizontally' to its head sister.

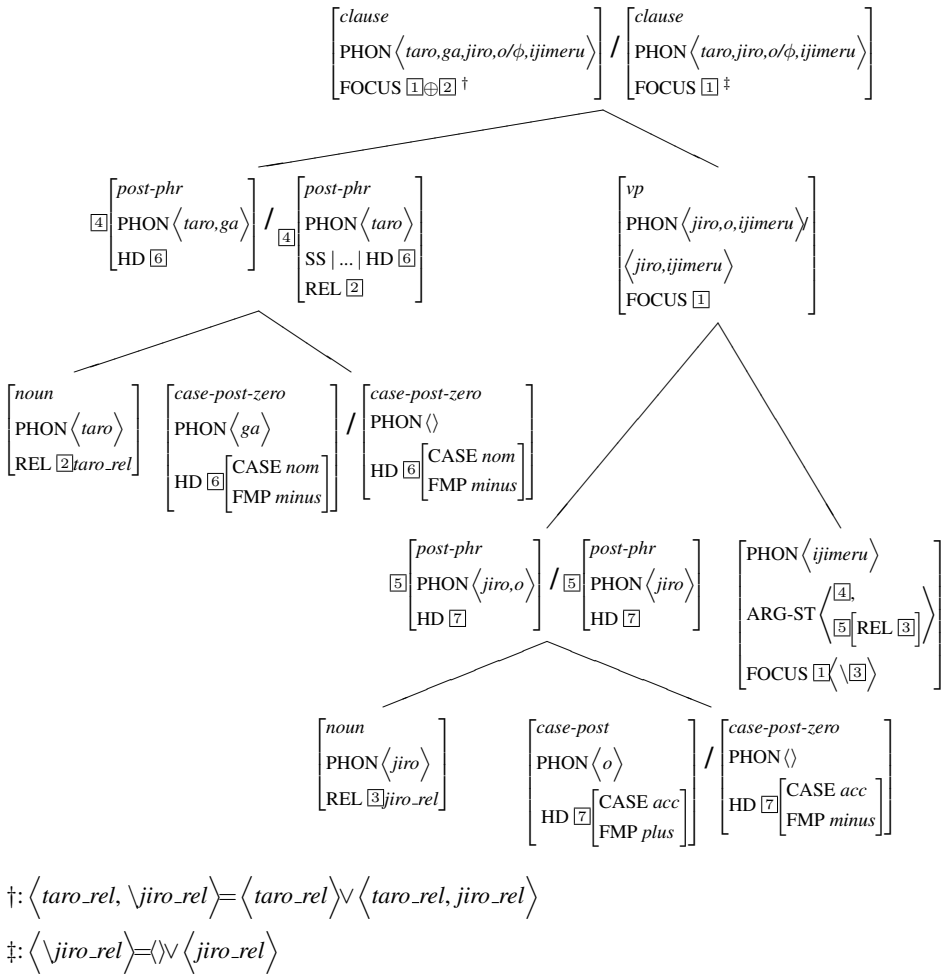

Figure 2: Focus projections for *Taro-ga/ϕ Jiro-o/ϕ ijimeru*

is an implicit focus or not, and (b) if it is not, whether it has a positive FMP (b1) or not (b2). In fact, it is only the case (b1) that is handled by our additional provision, where the focus value is contributed from the non-head daughter. This is because in (a) the implicit focus is already specified in the head, and in (b2) no focus is contributed from the daughers (*def_focus* simply extracts the implicit focus from the FOCUS list). These cases are thus handled by our base case.

Example projections are shown in Figure 2, using the 'Tarô bullies Jirô' example. In the interest of space, the reader will find both overt and ellipsis cases at some nodes: the AVM left to '/' represents the overt case, and the one on the right the elided case. The main point is the contrast between the process combining the overtly marked object PostP (*Jirô-o*) with the verb, and the process combining the overtly marked subject (*Tarô-ga*) with the VP. In the former, because it is the implicit focus, the PostP, though with its positive FMP, does not contribute a focus,

leaving the work for the base projection schema. In the latter, in contrast, because it is not the implicit focus, does contribute its REL value as the additional focus of the clause. Thus there are two possible outcomes for the focus of the clause, shown underneath the tree with their values spelt out. The first one is what obtains for the case of the overtly marked subject, where the focushood of the subject is registered unambiguously, while the second the case of the subject without an overt case-marker. For both cases, the focushood of the object is left ambiguous.

It is straightforward to extend the account to intransitive verbs, including the unaccusative/unergative contrast. All that is required is simply to set the subject to the implicit focus, at least for the unaccusative subtype, which annuls the case-marker's potential to contribute focushood, just as in the object in the previous example. If one chooses not to do so, the focusing effect of a case-marker will remain, as in the energative cases.

The mechanism proposed should be taken to generally apply to any constituent, although only PostPs have been looked at. It specifies whether any constituent, including the head predicate itself, should be an implicit. In fact for the cases considered so far, the predicate itself should be added as an implicit focus, while we will briefly mention a possible case where it should not be in the last section. If all the constituents of a sentence are then focused, the sentence focus articulation ensues. If on the other hand only some of the constituents are focused a narrow focus articulation is obtained.

4 Raminifications and possible extensions

We said that a PostP must be a focus if and only if it is not an implicit focus and is marked with a case-marker. An interesting prediction this analysis makes is that an overtly marked PostP in such a case would be infelicitous in a context in which it should be de-focused context. We contend it is the case, as shown in (8a), where overt marking is observed to be less felicitous than the null-marking case. This will lead to the view that the absence of case-marking is in some contexts obligatory and hence is not exactly 'ellipsis' but a contextually-driven decision to 'zero-mark' a nominal, as argued by Shimojo (2006).

A further issue arises when a language is equipped with explicit and unambiguous syntactic focus-marking just like the accentual F-marking. In Ryukuan, the only language known to historically related to Japanese, has the focus-marker *du*. An analysis of such a focus-marker would perhaps revert us back to the traditional focus-projection debate, but the fact that the language also has case-markers in parallel invites us to the interesting investigation as to whether a case-marker, and its ellipsis, also makes any contribution focus articulation at all. Such a contribution from case-marking would be essentially redundant but still is possible, and if one is found, it would strengthen the position that case-marking usually is involved in focus articulation.

Furthermore, and perhaps most importantly, the matrix environment needs to

be accommodated if the proposal was to be complete. In this work we have imposed on ourselves the restriction to embedded clauses for practical reasons, but obviously it is not satisfactory as it is as a general theory of focus. A particularly relevant fact is that in a matrix sentence with a stative / copula head predicate, the subject, if case-marked, becomes obligatorily narrowly focused in Japanese.

(9) a. Tarô-ga Jirô-no otooto nanda.
Tarô-NOM Jirô-GEN brother be
'It is Tarô who is the brother of Jirô'

b. Tarô-ga Jirô-no otooto dat-te shitteru
Tarô-NOM Jirô-GEN brother be-COMP know
'I know Tarô is the brother of Jirô '

There are two interesting facts about the narrow focus articulation for statives. One is the fact that no such articulation is observed if this sentence is embedded, as shown in (9b). Thus the proposed lexical account needs to be modified to somehow adapt to these two different renditions. As mentioned earlier, this may well have to do with the influence of topic, and this aspect makes the situation more complicated. This is a challenging and important task ahead for the extension of our account.

The other interesting fact, however, is one that is amenable to our lexically oriented account: a cross-linguistic variation. It seems as if the Korean counterpart of the subject case-marker, *i/ga*, does not have a narrow focus effect in statives, as in the following equivalent to the above Japanese example:

(10) Hyeonsu-ga Cheolsu-ui tongsaeng ieyo.
Hyeonsu-NOM Cheolsu-GEN brother be
'Hyeonsu is the brother of Cheolsu.'

Our account could readily accommodate this variation, by giving different specifications to the stative subtype in the two respective languages (at least in the matrix clause). Putting the predicate itself to the implicit focus list in Japanese, while not listing up anything in Korean, would do the work. We remain cautious nevertheless in view of the aforementioned complication with the topical influence in the matrix clause, but such a cross-linguistic extension could open up rich possibilities and certainly warrants a further study.

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Comparison of the ellipsis-based theory of non-constituent coordination with its alternatives

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Abstract

In this paper, I compare the ellipsis-based theory of non-constituent coordination proposed in Yatabe (2001) with three of its alternatives, namely the theory that has been widely accepted within the context of Categorial Grammar, Mouret's HPSG-based theory, and the theory proposed by Bachrach and Katzir in the framework of the Minimalist Program. It is found (i) that the CG-based theory of non-constituent coordination cannot deal with medial RNR, i.e. a subset of right-node raising constructions in which either all or a part of the right-node-raised material is realized at a location other than the right edge of the final conjunct, (ii) that Mouret's theory encounters similar difficulties when applied to RNR, and (iii) that Bachrach and Katzir's theory cannot be applied to left-node raising in English, has difficulty capturing the semantic inertness of medial RNR, and overgenerates in several ways. The ellipsis-based theory, on the other hand, appears to be consistent with all the observations.

1 Introduction

In this paper, I compare the ellipsis-based theory of non-constituent coordination that has been proposed in Yatabe (2001), Crysmann (2003), Yatabe (2003), and Beavers and Sag (2004) with three of its alternatives, namely the theory that has been widely accepted within the context of Categorial Grammar (CG) (Steedman (2000)), the HPSG-based theory of Mouret (2006), and the theory proposed in Bachrach and Katzir (2007) and Bachrach and Katzir (2009) in the framework of the Minimalist Program (MP). I will examine, among other things, a subset of right-node raising (RNR) constructions in English and Japanese in which either all or a part of the right-node-raised material is realized at a location other than the right edge of the final conjunct, and argue that the properties of such constructions favor the ellipsis-based theory.

2 Levine's criticism of the ellipsis-based theory

Before embarking on the main discussion of this paper, I will make a few brief remarks concerning Levine's criticism of the ellipsis-based theory (Levine (2011)).

First, the ellipsis-based theory of non-constituent coordination that will be defended below is one in which a linearization-related operation such as RNR-inducing ellipsis is allowed to affect semantic interpretation, namely the type of theory proposed in Yatabe (2001) and Beavers and Sag (2004). This theory is compatible with the fact that the meaning of a sentence involving non-constituent coordination (e.g. sentence (1a), from Crysmann (2003)) can be different from

[†]I would like to thank Mark Steedman, Yusuke Kubota, and the anonymous reviewers for the HPSG conference for their comments on the earlier stages of this work. I would also like to thank Aoi Shiraishi and Brendan Wilson for invaluable help.

that of its supposed counterpart involving no ellipsis (e.g. sentence (1b), also from Crysmann (2003)).

(1) a. I gave few men a book on Friday and a record on Saturday.
b. I gave few men a book on Friday and gave few men a record on Saturday.

As Levine notes, the question of under what circumstances the meaning of a sentence involving a right-node-raised or left-node-raised quantifier *must* be different from that of its counterpart involving no ellipsis is unresolved in the ellipsis-based theory. However, it is equally unresolved in other theories and thus should not be regarded as a reason to favor one theory over another.

Second, I concur with Levine (2011) that Beavers and Sag (2004) are wrong in claiming that the ellipsis-based theory of non-constituent coordination provides a solution for the problem of coordination of unlikes and the problem posed by an example like *every man and woman*. However, this observation does not constitute a reason to be skeptical of the theory, since there is no reason why a theory of non-constituent coordination has to provide a solution for these problems. (See Yatabe (2004) for an analysis of coordination of unlikes that does not rely on but is compatible with the ellipsis-based theory of non-constituent coordination.)

And third, it is possible to augment the ellipsis-based theory with a mechanism that makes it capable of delivering the correct truth conditions for sentences like (2) as well as sentences such as (3).

(2) Robin reviewed, and Leslie read, the same book.

(3) John gave Mary, and Joan presented to Fred, books which looked remarkably similar. (Abbott (1976))

In the theory to be presented in section 5 below, in which semantic interpretation is performed largely within order domains as suggested in Yatabe (2001), a sentence like (2), which is the result of right-node-raising the noun phrase *the same book* out of the two clauses whose order domains are depicted in (4) and (5) respectively, is optionally assigned an order domain like (6), where $\boxed{2+4}$ is an index whose interpretation is the sum of the interpretations of $\boxed{2}$ and $\boxed{4}$.

(4) $\left\langle \left[\text{SS} \mid \text{CN} \mid \text{EP} \left\langle \left[\begin{array}{ll} \text{HNDL} & \boxed{5} \\ \text{RELN} & \textit{name} \\ \text{NAME} & \textit{Robin} \\ \text{NAMED} & \boxed{1} \end{array} \right] \right\rangle \right], \left[\text{SS} \mid \text{CN} \mid \text{EP} \left\langle \left[\begin{array}{ll} \text{HNDL} & \boxed{5} \\ \text{RELN} & \textit{reviewed} \\ \text{AGENT} & \boxed{1} \\ \text{THEME} & \boxed{2} \end{array} \right] \right\rangle \right], \left[\text{SS} \mid \text{CN} \mid \text{EP} \left\langle \left[\begin{array}{ll} \text{HNDL} & \boxed{7} \\ \text{RELN} & \textit{the-same} \\ \text{INST} & \boxed{2} \end{array} \right], \left[\begin{array}{ll} \text{HNDL} & \boxed{7} \\ \text{RELN} & \textit{book} \\ \text{INST} & \boxed{2} \end{array} \right] \right\rangle \right] \right\rangle$

(5) $\left\langle \left[\text{SS} \mid \text{CN} \mid \text{EP} \left\langle \left[\begin{array}{ll} \text{HNDL} & \boxed{6} \\ \text{RELN} & \textit{name} \\ \text{NAME} & \textit{Leslie} \\ \text{NAMED} & \boxed{3} \end{array} \right] \right\rangle \right], \left[\text{SS} \mid \text{CN} \mid \text{EP} \left\langle \left[\begin{array}{ll} \text{HNDL} & \boxed{6} \\ \text{RELN} & \textit{read} \\ \text{AGENT} & \boxed{3} \\ \text{THEME} & \boxed{4} \end{array} \right] \right\rangle \right], \left[\text{SS} \mid \text{CN} \mid \text{EP} \left\langle \left[\begin{array}{ll} \text{HNDL} & \boxed{7} \\ \text{RELN} & \textit{the-same} \\ \text{INST} & \boxed{4} \end{array} \right], \left[\begin{array}{ll} \text{HNDL} & \boxed{7} \\ \text{RELN} & \textit{book} \\ \text{INST} & \boxed{4} \end{array} \right] \right\rangle \right] \right\rangle$

(6) $\left\langle \left[\text{SS} \mid \text{CN} \mid \text{EP} \left\langle \left[\begin{array}{ll} \text{HNDL} & \boxed{7} \\ \text{RELN} & \textit{and} \\ \text{CONJUNCTS} & \langle \boxed{5}, \boxed{6} \rangle \end{array} \right] \right\rangle \right], \left[\text{SS} \mid \text{CN} \mid \text{EP} \left\langle \left[\begin{array}{ll} \text{HNDL} & \boxed{5} \\ \text{RELN} & \textit{name} \\ \text{NAME} & \textit{Robin} \\ \text{NAMED} & \boxed{1} \end{array} \right], \left[\begin{array}{ll} \text{HNDL} & \boxed{5} \\ \text{RELN} & \textit{reviewed} \\ \text{AGENT} & \boxed{1} \\ \text{THEME} & \boxed{2} \end{array} \right] \right\rangle \right],$
$\left[\text{SS} \mid \text{CN} \mid \text{EP} \left\langle \left[\begin{array}{ll} \text{HNDL} & \boxed{6} \\ \text{RELN} & \textit{name} \\ \text{NAME} & \textit{Leslie} \\ \text{NAMED} & \boxed{3} \end{array} \right], \left[\begin{array}{ll} \text{HNDL} & \boxed{6} \\ \text{RELN} & \textit{read} \\ \text{AGENT} & \boxed{3} \\ \text{THEME} & \boxed{4} \end{array} \right] \right\rangle \right], \left[\text{SS} \mid \text{CN} \mid \text{EP} \left\langle \left[\begin{array}{ll} \text{HNDL} & \boxed{7} \\ \text{RELN} & \textit{the-same} \\ \text{INST} & \boxed{2+4} \end{array} \right], \left[\begin{array}{ll} \text{HNDL} & \boxed{7} \\ \text{RELN} & \textit{book} \\ \text{INST} & \boxed{2+4} \end{array} \right] \right\rangle \right] \right\rangle$

Assuming that the second last elementary predication inside (6) means that the denotation of $\boxed{2}$ and that of $\boxed{4}$ are the same, (6) can be seen to represent an appropriate truth condition. Thus Levine's criticism based on (2) is invalid.

3 Problems with the CG-based theory and Mouret's theory

In this section, some problems with the CG-based theory and Mouret's HPSG-based theory will be pointed out. Mouret's HPSG-based theory of what the author calls argument-cluster coordination (Mouret (2006)) and the CG-based theory are both based on the view that there are cases where a string that is not considered to be a constituent in other theories nevertheless functions as a syntactic unit and that so-called non-constituent coordination is coordination of such unconventional syntactic units. For instance, the string *a book on Friday* and the string *a record on Saturday* in (1a) are regarded as such unconventional, conjoinable syntactic units in these theories.

I will begin by recapitulating Wilder's and Whitman's findings about RNR in English (Wilder (1999); Whitman (2009)), which are potentially problematic for the CG-based theory and Mouret's theory alike. It has been noted in their respective work that English sometimes allows right-node-raised material to be realized at a location other than the right edge of the final conjunct, as in (7)–(9), where the right-node-raised expressions are shown in italics.

(7) John should fetch and give *the book* to Mary. (from Wilder (1999))

(8) After using dishes, please wash, dry, and put *them* away in the proper place. (from Whitman (2009))

(9) ... the whiskey drowns and the beer chases *my blues* away. (op. cit.)

Let us refer to the phenomenon illustrated by these examples as medial RNR. The existence of medial RNR will be problematic for any attempt to apply Mouret's theory to RNR in English, although that obviously should not be held against his theory as a theory of argument-cluster coordination. The CG-based theory, on the other hand, may not necessarily be contradicted by the existence of sentences like these. Whitman presents a CG-based theory of medial RNR in which the right-node-raised expression in each of these examples is in a sense located at the right edge of the final conjunct, but undergoes wrapping, i.e. a phonological process that inserts an expression into the phrase that it syntactically combines with. Whitman, however, goes on to point out some examples of medial RNR for which his analysis may not be applicable. Thus, it seems fair to say that it remains uncertain whether the CG-based theory can provide a comprehensive account of medial RNR in English or not.

RNR in Japanese poses related but more recalcitrant problems for these theories, especially for Mouret's theory. First of all, in Japanese, that part of a conjunct

that does not undergo RNR in an RNR construction does not have to be a sequence of sister constituents, as shown by (10), where *Taroo wa* and *Sendai* are most probably not sisters. This fact makes it difficult to apply to RNR in Japanese Mouret's theory of argument-cluster coordination, which is designed to capture the more restricted nature of argument-cluster coordination in French.[1] Again, this does not necessarily mean that Mouret's theory is incorrect as a theory of argument-cluster coordination. However, since argument-cluster coordination in French and RNR in Japanese are mirror images of each other to a certain extent, a theory that treats the two in a uniform fashion seems preferable, other things being equal.

(10) [Hanako wa] Aizu, soshite [Taroo wa] [[Sendai no] sake o] nonda.
[Hanako TOP] Aizu and [Taroo TOP] [[Sendai GEN] sake ACC] drank
'Hanako drank sake from Aizu, and Taro drank sake from Sendai.'

(Here and elsewhere, when a Japanese example is used, words belonging only to the non-final conjunct are shown in purple, words belonging only to the final conjunct are shown in blue, and words shared by the two conjuncts are shown in red. The tense morpheme in an example like this may be outside the coordinate structure, but such details of Japanese morphosyntax will be ignored in this paper.)

More significantly, as the example in (11) shows, the phenomenon of medial RNR exists in Japanese as well, and here it does not seem possible to deal with the phenomenon using the mechanism of wrapping.[2] This is problematic both for the CG-based theory and for Mouret's theory.

(11) [Too-densha wa], [ichi-ryoo-me kara roku-ryoo-me made wa] [Ebina
[this train TOP] [Car No. 1 from Car No. 6 to TOP] [Ebina
de] Hon-atsugi-iki, [nana-ryoo-me kara saki wa]
at] train bound for Hon-atsugi [Car No. 7 from beyond TOP]
[Katase-enoshima-iki ni] [Shin-yurigaoka de], sorezore
[train bound for Katase-enoshima DAT] [Shin-yurigaoka at] respectively
setsuzoku itashimasu.
will connect
'Cars No. 1 to No. 6 of this train will connect with a train bound for Hon-atsugi at Ebina Station, and the rest of the cars will connect with a train bound for Katase-enoshima at Shin-yurigaoka Station.' <5, 7, 3, 0>

In this example, the expression *Shin-yurigaoka de* 'at Shin-yurigaoka Station', which semantically belongs only to the second conjunct, is sandwitched between two strings *ni* 'DAT' and *sorezore setsuzoku itashimasu* 'will connect respectively', which are both shared by the two conjuncts. There seems to be no natural way to apply Whitman's theory to sentences of this type.

[1] Abeillé and Mouret (2011) observe that the theory cannot be applied to RNR in French either.

[2] This example, which has the adverb *sorezore* 'respectively' inside the right-node-raised material, is another illustration of the fact noted in Section 2 that the type of ellipsis that yields non-constituent coordination is allowed to affect semantic interpretation.

To demonstrate that sentences like this are actually acceptable to native speakers, a questionnaire study has been conducted. The numbers following (11) and some other example sentences below show the result of that questionnaire study; the four figures indicate 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.[3] The figures above indicate that (11) is an acceptable, if slightly unnatural, sentence.

The fact that instances of medial RNR are generally judged to be less than perfect can be interpreted as a result of the degraded parallelism between the conjuncts in such sentences, and therefore does not necessarily justify the view that medial RNR is in fact not allowed by the grammar. If instances of medial RNR were to be analyzed as acceptable but ungrammatical sentences, then there would have to be an explanation as to why such sentences are felt to be more or less acceptable in English and Japanese (and in French as well according to Mouret and Abeillé (2011)), and it is at least not obvious how such an explanation could be obtained.

It might seem possible to reconcile the CG-based theory with the existence of medial RNR in Japanese by postulating a phonological rule that says that a particle such as *ni* can be optionally dropped when it occurs at the end of a conjunct, but such a move would be problematic for the following two reasons. First, such a phonological rule is arguably not a natural rule to have in the CG-based theory. In the ellipsis-based theory, such a phonological rule, if it existed, could be interpreted as saying that, when ellipsis takes place at the end of a conjunct, an extra word can be dropped as well as long as that extra word is merely a particle. In contrast, there is no way to make intuitive sense out of such a phonological rule in the CG-based theory. Second, such a phonological rule would make an empirically incorrect prediction. For example, a sentence like (13), which is the result of dropping *ni* at the end of the first conjunct in (12), would be incorrectly predicted to be acceptable.

(12) [Reijoo o] [okyakusama-gata ni], soshite [sono ato]
[thank-you note ACC] [guests DAT] and [after that]
[shoosetsu no tsuzuki o] kaita n desu. <4, 6, 1, 1>
[novel GEN continuation ACC] wrote
'(I) wrote thank-you notes to the guests and then (wrote) the continuation of the novel.'

(13) ?*[Reijoo o] okyakusama-gata, soshite [sono ato] [shoosetsu no
[thank-you note ACC] guests and [after that] [novel GEN

[3] Let us define the *average rating* for a linguistic expression L as $(1a+2b+3c+4d)/(a+b+c+d)$, when the questionnaire result for L is $<a, b, c, d>$, and let us represent the average rating for L as $r(L)$. A linguistic expression L that is associated with a questionnaire result is shown in this paper 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 $3.5 \leq r(L) \leq 4$.

tsuzuki o] kaita n desu. <0, 2, 6, 4>
continuation ACC] wrote
'(I) wrote thank-you notes to the guests and then (wrote) the continuation of the novel.'

The fact is that a particle can be dropped at the end of a non-final conjunct only when the same particle appears somewhere inside the final conjunct, as in (14), which is another instance of medial RNR.

(14) [Reijoo o] okyakusama-gata, soshite [sono ato] [yuujin-tachi
[thank-you note ACC] guests and [after that] [friends
ni] [nengajoo o] kaita n desu. <3, 7, 2, 0>
DAT] [New Year's card ACC] wrote
'(I) wrote thank-you notes to the guests and then (wrote) New Year's cards to my friends.'

In order to account for the contrast between (13) and (14) while retaining the CG-based theory, it would be necessary to postulate a phonological rule that says that a particle such as *ni* can be optionally dropped at the end of a non-final conjunct if the same particle appears somewhere inside the final conjunct. In other words, it would be necessary to incorporate the ellipsis-based theory into the CG-based theory, if our goal were to capture the contrast in question without abandoning the CG-based theory. The resulting theory would arguably be less credible than the ellipsis-based theory, in that the latter can handle all cases of RNR in a uniform manner while the former cannot.

4 Problems with Bachrach and Katzir's theory

Let us turn our attention to the MP-based theory proposed in Bachrach and Katzir (2007) and Bachrach and Katzir (2009). This theory builds on the idea (expressed by McCawley and others) that an expression can have more than one mother, and uses that idea to deal with RNR as well as phenomena that are analyzed in terms of movement in MP-based theories. For example, in this theory, the phrase *the same book* in (2) is analyzed as having two mothers (the first VP node and the second VP node), and the phrase *which book* in *Which book did you like?* is similarly analyzed as having two mothers (the root CP node and the VP node).

This theory is disproved by the existence of examples like (15) below.

(15) Who do you think, and who don't you think, that John will see?

This sentence is incorrectly predicted to be impossible by Bachrach and Katzir's theory. In their theory, the first *who* in this sentence is taken to be multiply dominated and to exist at the beginning of the first conjunct and in the object position immediately following the verb *see* simultaneously, although it is pronounced only

at the former location. The second *who* is likewise taken to be multiply dominated and to exist at the beginning of the second conjunct and in the object position immediately following the verb *see*. The problem here is that the first *who* and the second *who* are both taken to be in the object position immediately following *see*. On one hand, two different expressions are not allowed to be present at the same location in this theory (or in any other theory), and on the other hand, the verb *see* can take at most one object, not two, so there is no coherent structure that can be assigned to this sentence.

Rather than rejecting the theory outright for this reason, I will recast their theory as a theory of RNR alone (rather than a theory of all types of *wh*-movement as well as RNR) and compare that theory with the ellipsis-based theory of non-constituent coordination.

When recast as a theory of RNR alone, Bachrach and Katzir's theory turns out to bear considerable similarities to the theory proposed in Yatabe (2001) and Beavers and Sag (2004). The *D-list* in the former theory corresponds to the order domain in the latter theory, and SpellOut that is obligatorily triggered by a "phase node" in the former theory corresponds to total compaction in the latter theory.

One notable feature of Bachrach and Katzir's theory that sets it apart from the HPSG-based theories is that their theory contains no grammatical rule that is specifically responsible for generating RNR constructions or other types of non-constituent coordination. In their theory, the order of words is determined according to some general principles including (16), (17), and (19), and the existence of RNR constructions is a consequence of the way those principles interact.

(16) The D-list for a node X has all the terminals dominated by X as members, and only them.

(17) If y is completely dominated by X, then y appears on the D-list of X exactly once.

(18) **Complete Dominance:** A node X completely dominates a node Y iff (a) X is the only mother of Y, or (b) X completely dominates every mother of Y.

(19) In ordering $A = \langle a_1, \ldots, a_m \rangle$ to the left of $B = \langle b_1, \ldots, b_n \rangle$, written $A \bullet B$, the following must hold:

  a. *Edge Alignment:* $a_1 \leq b_1$ and $a_m \leq b_n$

  b. *Conservativity:* $a_1 \leq a_2 \leq \ldots \leq a_m$ and $b_1 \leq b_2 \leq \ldots \leq b_n$

When coupled with the operation of Parallel Merge, which allows an expression to be merged with multiple expressions simultaneously, these principles automatically give rise to RNR constructions while ruling out ungrammatical strings like (20), in which an expression has been right-node-raised from a medial position inside the first conjunct.

(20) *John should give the book and congratulate that girl.

Although the theory as it is presented in Bachrach and Katzir (2009) contains a stipulation that disallows medial RNR, it is possible to construct a variant of their theory that does away with that stipulation.

This ambitious and interesting theory, however, has the following three problems. First, the theory in question cannot be applied to left-node raising in a language like English. For instance, in their theory, it is not possible to analyze a sentence like *Mary went to London on Saturday and Paris on Sunday* as involving left-node raising of the string *went to*, because the presence of the word *and* at the beginning of the second conjunct prevents the string *went to* from being multiply dominated by the two VPs. This is a weakness of the theory, unless there turns out to be some fundamental difference between LNR and RNR.

Second, the theory fails to capture the semantic inertness of medial RNR noted in Sabbagh (2012). As noted above, it is easy to construct a variant of their theory that allows medial RNR. However, the resulting theory would most likely incorrectly entail that medial RNR could affect semantic interpretation just like non-medial RNR. In the theory proposed in Bachrach and Katzir (2007), interpretation of right-node-raised material is optionally delayed until the bottom-up interpretation procedure gets to the node that completely dominates the material, i.e. the node that dominates all the mothers of that material. There is nothing else in the theory that is specifically designed to affect the interpretation of sentences involving RNR. In such a theory, there is no reason to suppose that the semantic properties of medial RNR are any different from those of non-medial RNR; it must be possible to delay the interpretation of right-node-raised material irrespective of whether the RNR involved is medial or not. Thus the theory leads us to expect, incorrectly according to Sabbagh (2012), that the quantifier *every suspected arsonist* can take wide scope over the disjunction in (21), just as it can in (22).

(21) The lieutenant will either arrest or shoot every suspected arsonist with his rifle.

(22) The lieutenant will either arrest or shoot with his rifle, every suspected arsonist.

Third, the theory presented in Bachrach and Katzir (2009) overgenerates in several ways. To start with, the theory allows the right edge of a phrase and the left edge of the immediately following phrase to be fused. Thus the theory predicts that a sentence like (23), in which the expression *Mary* serves as the final word of the first conjunct and as the first word of the second conjunct at the same time, is grammatical. This prediction is made even by the original version of their theory, which disallows medial RNR.

(23) *John met Mary laughed and Bill was surprised. (as a sentence that means 'John met Mary, Mary laughed, and Bill was surprised')

Likewise, ill-formed sentences like (24), first noted by Paul Dekker and discussed in Steedman (2000, p. 269) among other places, are not ruled out in the theory

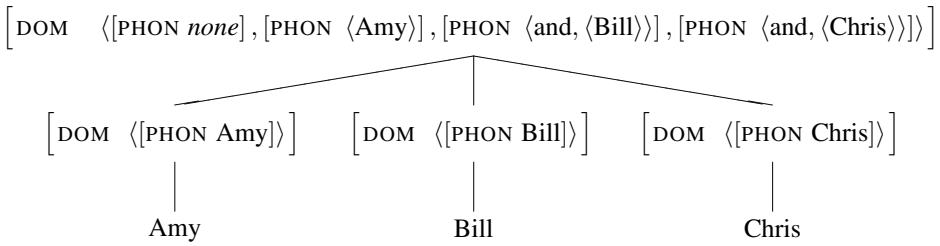

Figure 1: Part of the structure assigned to *Amy and Bill and Chris*

under discussion.

(24) *The mother of and Bill thought John arrived. (as a sentence that means 'The mother of John arrived and Bill thought John arrived')

The problem of overgeneration will be exacerbated if the stipulation that blocks medial RNR is excised from the theory. For instance, the resulting theory will even generate sentences like the following.

(25) a. *I talked to and looked at the car that I persuaded the man to purchase. (as a sentence that means 'I talked to the man and looked at the car that I persuaded the man to purchase')

b. *I looked at and the owner of the car noticed. (as a sentence that means 'I looked at the car and the owner of the car noticed')

5 Details of the ellipsis-based theory

In this penultimate section, it will be shown that the ellipsis-based theory is in fact capable of capturing all the observations mentioned above, provided that some minor modifications are made to it. I will first describe the way conjunctions such as *and* and *or* are treated in the proposed theory, and then go on to present the details of the revised version of the ellipsis-based theory. I presuppose familiarity with Linearization-based HPSG (Reape (1994)), especially the version of the theory adopted in Yatabe (2001), whose basics are presented in Yatabe (2009, section 19.2.1) among other places.

In the theory proposed here, conjunctions such as *and* and *or* are introduced into syntactic structures not by phrase-structure rules or by constructional schemas but by linearization-related constraints. Thus the phrase *Amy and Bill and Chris* is assigned a syntactic structure like the one shown in Figure 1, where the word *and* does not appear even once as a node in the phrase-structure tree.

There are two partially interrelated motivations for dealing with conjunctions in terms of linearization-related constraints. Firstly, as noted in Hudson (1988) and Mouret (2006), the position of the first conjunction in a sentence like *John gave neither a book to Mary nor a record to Bill* is difficult to account for in a

theory in which the traditional kind of constituent structure is assumed and the positions of conjunctions (such as *neither*) are dictated by phrase-structure rules. Second, while left-node raising can generally affect only strings at the left edge of a phrase, the presence of a conjunction at the left edge of a phrase does not prevent the words following it from being left-node-raised, as noted above in section 4. For instance, if the sentence above is to be analyzed as an instance of left-node raising, then the verb *gave* needs to be left-node-raised out of the two conjuncts despite the apparent presence of *neither* at the beginning of the first conjunct and of *nor* at the beginning of the second conjunct. This arguably means that there is a grammatical representation in which conjunctions like *neither* and *nor* are not part of the conjuncts.

This analysis can be implemented as follows. As part of the constraints that are applied to *coord-cx* (i.e. *coordinate-construction*), I propose to have (26).

(26) *coord-cx* $\Rightarrow$

$$\left[\begin{array}{ll} \text{MOTHER} & \left[\begin{array}{l}\text{SS} \mid \text{CONT} \mid \text{SEMHEAD} \quad \boxed{h} \\ \text{DOM} \quad \boxed{D_0}\end{array}\right] \\ \text{DAUGHTERS} & \left\langle \boxed{1}\left[\text{SS} \mid \text{CONT} \mid \text{LTOP} \quad \boxed{t_1}\right], \cdots, \boxed{n}\left[\text{SS} \mid \text{CONT} \mid \text{LTOP} \quad \boxed{t_n}\right]\right\rangle \end{array}\right]$$

where the following condition holds:

$$\left(\text{coord\_dom}\left(\left\langle \boxed{1}, \cdots, \boxed{n}\right\rangle, \boxed{D_0}, \boxed{f}\right) \vee \text{pnr\_dom}\left(\left\langle \boxed{1}, \cdots, \boxed{n}\right\rangle, \boxed{D_0}, \boxed{f}\right)\right)$$

$$\wedge \boxed{f} : \left[\begin{array}{ll} \text{SS} \mid \text{CONT} & \left[\begin{array}{ll} \text{EP} & \left\langle \left[\begin{array}{l}\text{HNDL} \quad \boxed{h} \\ \text{RELN} \quad \boxed{c} \\ \text{CONJUNCTS} \quad \left\langle \boxed{t_1}, \cdots, \boxed{t_n}\right\rangle\end{array}\right]\right\rangle \\ \text{H-CONS} & \{\} \\ \text{H-STORE} & \{\} \end{array}\right] \\ \text{PHON} \quad \textit{none} & \end{array}\right] \wedge \left(\boxed{c} = \textit{and} \vee \boxed{c} = \textit{or}\right).$$

The *coord_dom* relation, employed in (26), is defined in (27), and the *pnr_dom* relation, which is used in (26) to allow left-node raising and right-node raising, will be defined in (29).

(27) $$\begin{array}{l} \text{coord\_dom}\left(\left\langle \boxed{1}, \cdots, \boxed{n}\right\rangle, \boxed{D_0}, \boxed{f}\right) \equiv \\ \boxed{S} : \left\langle \boxed{1}\right\rangle \bigcirc \cdots \bigcirc \left\langle \boxed{n}\right\rangle \quad \wedge \quad \boxed{S} : \left\langle \boxed{s_1}, \cdots, \boxed{s_n}\right\rangle \\ \wedge \quad \text{totally\_compact}\left(\boxed{s_1}, \boxed{d_1}\right) \quad \wedge \cdots \wedge \quad \text{totally\_compact}\left(\boxed{s_n}, \boxed{d_n}\right) \\ \wedge \quad \text{add\_conjunction}\left(\left\langle \boxed{d_1}, \cdots, \boxed{d_n}\right\rangle, \boxed{D_0}, \boxed{f}\right) \end{array}$$

The *add_conjunction* relation, used in (27), needs to be defined for each language, and the English-specific version of the relation is defined, albeit incompletely, in (28). The *totally_compact* relation, also used in (27), is a relation that holds between a sign and a domain object when the latter is the result of applying the total compaction operation defined in Yatabe (2001, (24)) to the former. The symbol "$\bigcirc$" is used here to represent the non-deterministic *shuffle* operation (Reape (1994)).

(28) $\text{add\_conjunction}\left(\boxed{L},\boxed{D},\boxed{f}\right) \equiv$
$\left(\boxed{f} = \textit{none} \quad \wedge \quad \boxed{D} = \boxed{L}\right)$
$\vee \left(\boxed{f} : [\text{SS} \mid \text{CONT} \mid \text{EP} \mid \text{FIRST} \mid \text{RELN} \quad \textit{and}] \quad \wedge \quad \boxed{L} : \boxed{L'} \oplus \left\langle \begin{bmatrix} \text{SS} & \boxed{s} \\ \text{PHON} & \boxed{p} \end{bmatrix} \right\rangle \right.$
$\left. \wedge \quad \boxed{D} : \left\langle \boxed{f} \right\rangle \oplus \boxed{L'} \oplus \left\langle \begin{bmatrix} \text{SS} & \boxed{s} \\ \text{PHON} & \left\langle \text{and}, \boxed{p} \right\rangle \end{bmatrix} \right\rangle \right)$
$\vee \left(\boxed{f} : [\text{SS} \mid \text{CONT} \mid \text{EP} \mid \text{FIRST} \mid \text{RELN} \quad \textit{and}] \quad \wedge \quad \boxed{L} : \left\langle \boxed{l} \right\rangle \oplus \left\langle \begin{bmatrix} \text{SS} & \boxed{s_1} \\ \text{PHON} & \boxed{p_1} \end{bmatrix}, \cdots, \begin{bmatrix} \text{SS} & \boxed{s_n} \\ \text{PHON} & \boxed{p_n} \end{bmatrix} \right\rangle \right.$
$\left. \wedge \quad \boxed{D} : \left\langle \boxed{f} \right\rangle \oplus \left\langle \boxed{l} \right\rangle \oplus \left\langle \begin{bmatrix} \text{SS} & \boxed{s_1} \\ \text{PHON} & \left\langle \text{and}, \boxed{p_1} \right\rangle \end{bmatrix}, \cdots, \begin{bmatrix} \text{SS} & \boxed{s_n} \\ \text{PHON} & \left\langle \text{and}, \boxed{p_n} \right\rangle \end{bmatrix} \right\rangle \right)$
$\vee \quad \cdots$

In the proposed theory, peripheral-node raising, that is to say left-node raising and right-node raising, is a phenomenon that results when the relation between the daughter nodes and the order domain of the mother node conforms to the constraints specified by the *pnr_dom* relation, defined in (29), instead of constraints of the usual type, which give rise to a structure not involving peripheral-node raising. In (26) above, the relation between the daughter nodes and the order domain of the mother node is required to conform either to the constraints specified by the *coord_dom* relation or to those specified by the *pnr_dom* relation. When it conforms to the former constraints, the resulting structure is a coordinate structure involving no peripheral-node raising; when it conforms to the latter, the resulting structure is a coordinate structure involving left-node raising, right-node raising, or both.

(29) $\text{pnr\_dom}\left(\left\langle \boxed{1}, \cdots, \boxed{n} \right\rangle, \boxed{D_0}, \boxed{f}\right) \equiv$
$\left(\boxed{A_L} \neq \langle\rangle \quad \vee \quad \boxed{A_R} \neq \langle\rangle \quad \vee \quad \boxed{B_L} \neq \langle\rangle \quad \vee \quad \boxed{B_R} \neq \langle\rangle\right)$
$\wedge \quad \text{syn\_pnr}\left(\left\langle \boxed{1} \right\rangle \bigcirc \cdots \bigcirc \left\langle \boxed{n} \right\rangle, \boxed{H}, \left\langle \boxed{l_1}, \cdots, \boxed{l_n} \right\rangle, \left\langle \boxed{r_1}, \cdots, \boxed{r_n} \right\rangle\right)$
$\wedge \quad \text{phon\_pnr}\left(\boxed{H}, \boxed{G}, \boxed{B_L}, \boxed{B_R}\right)$
$\wedge \quad \text{totally\_compact\_each}\left(\boxed{G}, \boxed{F}\right)$
$\wedge \quad \text{add\_conjunction}\left(\boxed{F}, \boxed{E}, \boxed{f}\right)$
$\wedge \quad \text{fuse\_each}\left(\left\langle \boxed{l_1}, \cdots, \boxed{l_n} \right\rangle, \boxed{A_L}, \boxed{f}\right)$
$\wedge \quad \text{fuse\_each}\left(\left\langle \boxed{r_1}, \cdots, \boxed{r_n} \right\rangle, \boxed{A_R}, \boxed{f}\right)$
$\wedge \quad \boxed{D_0} : \boxed{A_L} \oplus \boxed{E} \oplus \boxed{A_R}$

When the structure involved is not a coordinate structure, the relation between the daughters $\boxed{1} \cdots \boxed{n}$ and the order domain $\boxed{D_0}$ of the mother is required to satisfy either constraints of the usual type or the following.

(30) $\text{pnr\_dom}\left(\left\langle \boxed{1}, \cdots, \boxed{n} \right\rangle, \boxed{D_0}, \textit{none}\right)$

The relations *syn_pnr*, *phon_pnr*, *totally_compact_each*, and *fuse_each*, which appear in (29), are defined in the Appendix.

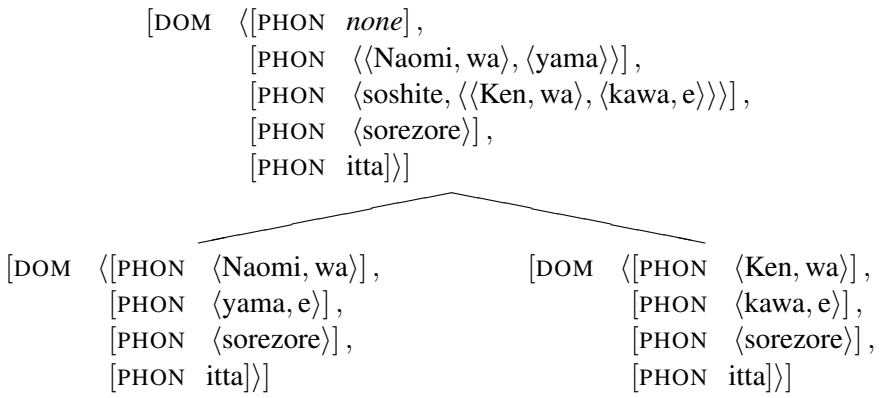

Figure 2: Part of the structure assigned to example (31)

I will illustrate the way the proposed theory works using the Japanese example in (31), whose structure is shown in a schematic format in Figure 2.

(31) [Naomi wa] yama, soshite [Ken wa] [kawa e] sorezore itta.
[Naomi TOP] mountain and [Ken TOP] [river to] respectively went
'Naomi went to the mountain and Ken went to the river.'

As in the theory proposed in Yatabe (2001), it is assumed here that there are two types of peripheral-node raising (PNR), namely syntactic PNR and phonological PNR. In (29) above, $\boxed{A_L}$, $\boxed{A_R}$, $\boxed{B_L}$, and $\boxed{B_R}$ denote syntactically left-node-raised material, syntactically right-node-raised material, phonologically left-node-raised material, and phonologically right-node-raised material, respectively. In the example in (31), the adverb *sorezore* and the verb *itta* are syntactically right-node-raised and the postposition *e* is phonologically right-node-raised.

Syntactic PNR deletes a list of domain objects at the right (or left, respectively) edge of each daughter (line 3 of (29)), fuses those domain objects item by item to create a possibly modified list of domain objects (lines 7 and 8 of (29)), and places the resulting list of domain objects at the right (or left, respectively) edge of the order domain of the mother (line 9 of (29)). In Figure 2, the two domain objects corresponding to the adverb *sorezore* and the verb *itta* are deleted at the right edge of each of the two conjuncts. Then the two domain objects deleted at the end of the first conjunct and the two deleted at the end of the second conjunct are fused pairwise to create two new domain objects whose semantic content (not shown in the figure) is altered, and the two new domain objects are placed at the right edge of the order domain of the mother. Generally, syntactically PNRed domain objects continue to exist as separate domain objects in the order domain of the mother, rather than becoming part of some larger domain objects.

Phonological PNR simply deletes some phonological material at the right (or left, respectively) edge of non-final (or non-initial, respectively) daughters, on condition that the same phonological material is contained in the final (or initial, re-

spectively) daughter (line 4 of (29)). In Figure 2, the phonological material *e*, which represents a postposition, is allowed to be deleted at the end of the first daughter, because the same phonological material is contained in the second daughter. Phonologically RNRed (or LNRed respectively) material generally becomes part of the domain object corresponding to the final (or initial respectively) daughter. In Figure 2, *e* becomes part of the domain object that is to be pronounced *soshite Ken wa kawa e*, which corresponds to the second daughter.

The semantic inertness of medial RNR follows from this theory because phonological PNR is incapable of affecting semantic interpretation and syntactic PNR is incapable of yielding medial RNR or medial LNR. For example, (21), which involves medial RNR, cannot be generated by syntactic RNR, and hence must be an instance of phonological RNR, which cannot affect the scope of the quantifier.

Those parts of each daughter node that do not undergo syntactic or phonological PNR are totally compacted and become a single domain object (line 5 of (29)), and the newly created domain objects, each corresponding to one of the daughter nodes, are placed in the order domain of the mother (line 9 of (29)), after possibly having a conjunction word added to them (line 6 of (29)). In Figure 2, the second domain object in the order domain of the mother (to be pronounced *Naomi wa yama*) is that part of the first conjunct that does not undergo PNR, and the third domain object (to be pronounced *soshite Ken wa kawa e*) is that part of the second conjunct that does not undergo PNR, with the conjunction word *soshite* added to its left edge. The first domain object, which is phonologically empty, carries the meaning of conjunction.

Phonological PNR can delete a sequence of phonological constituents at the right (or left, respectively) edge of a non-final (or non-initial) daughter node if the same phonological sequence can be found at the right (or left) edge of the order domain of the final (or initial) daughter node. If that were all that the theory said about phonological PNR, the theory would licence non-medial PNR but not medial PNR. In the proposed theory, phonological PNR is licensed not only in the situation just described but also in a situation where the phonological sequence to be RNRed (or LNRed, respectively) can be made to line up at the right (or left) edge of the order domain of the final (or initial) daughter node by removing one or more of the domain objects from that order domain. That is the effect that the definition of the *contain_right* relation in (43) has concerning RNR, and the corresponding definition of the *contain_left* relation would have concerning LNR. These are relations that are required to hold between the final or initial daughter and the material to be phonologically PNRed (lines 4 and 6 of (38)). Let us see how this works in the case of (9). At the point where the two clauses are conjoined in (9), the order domain of the second, final daughter consists of four domain objects, as shown in (32).

(32) $\langle [\textsc{phon} \ \langle \langle \text{the} \rangle, \text{beer} \rangle], [\textsc{phon} \ \text{chases}], [\textsc{phon} \ \langle \langle \text{my} \rangle, \text{blues} \rangle], [\textsc{phon} \ \langle \text{away} \rangle] \rangle$

The phonological material to be RNRed, i.e. *my blues*, will come to be at the right edge of this order domain if the rightmost domain object (*away*) is set aside. There-

fore the *contain_right* relation holds between this second daughter and the phonological material *my blues*, making deletion of *my blues* at the right edge of the first daughter licit.

In determining whether the *contain_right* relation (or the corresponding *contain_left* relation) holds between the final (or the initial, respectively) daughter and some phonological sequence, domain objects can be set aside, as we have just seen, but things that are smaller than domain objects cannot be set aside, according to (43). As a consequence, the sentence in (25a) above is correctly ruled out in the proposed account. In order for the *contain_right* relation to hold between the second conjunct in **talked to and looked at the car that I persuaded the man to purchase* and the phonological sequence *the man*, the phrase *to purchase*, which prevents *the man* from being at the right edge of the second conjunct, would have to be set aside. The phrase *to purchase*, however, does not constitute a domain object in itself at the point where the two VPs are conjoined, since the relative clause containing it has undergone compaction and the phrase has thus already become part of a larger domain object. Since this precludes phonological RNR of *the man* and syntactic RNR never gives rise to medial RNR, the impossibility of (25a) follows.

Phonological RNR (or LNR, respectively) is not allowed to elide a leftmost (or rightmost) phonologically non-empty branch or a part of such a branch in a prosodic structure. More specifically, and focusing on RNR rather than LNR, the leftmost phonologically non-empty domain object in a order domain cannot be elided by phonological RNR (due to line 8 of (41)), and it is not possible to elide even part of such a domain object (due to line 4 of (41)). Likewise, when the PHON value of a domain object is a possibly nested list, which can be construed as a representation of a tree, it is not possible to elide a leftmost branch inside it (due to line 8 of (42)) or even part of such a branch (due to line 4 of (42)). In addition, the phonological material to be elided at the right edge of non-final daughters cannot constitute a leftmost branch or part of such a branch in the prosodic structure representing the *final* daughter either (due to the way the *contain_right* relation is defined in (43)). This restriction on phonological RNR captures the ill-formedness of sentences like (24), **The mother of and Bill thought John arrived*, and (25b). Let us see here how (24) is ruled out. First of all, it is not possible to generate this sentence by right-node-raising a single phonological constituent of the form "⟨⟨John⟩, arrived⟩", because the first conjunct does not contain such a phonological constituent. At the same time, it is also not possible to generate this sentence through phonological RNR of a sequence made up of two phonological constituents, namely either "⟨John⟩" or "John" followed by "arrived", because the first element in this sequence (i.e. "⟨John⟩" or "John") constitutes a leftmost branch in the prosodic structure of the second conjunct and therefore is not deletable at the end of the first conjunct. At the point where the two clauses in this example are conjoined, the order domain of the second daughter will look like (33), although the precise predictions depend on the kinds of assumptions that are adopted concerning the construction of prosodic structures and the structure shown here is not the only possible one.

(33) $\langle [\text{PHON} \quad \langle \text{Bill} \rangle] , [\text{PHON} \quad \text{thought}] , [\text{PHON} \quad \langle \langle \text{John} \rangle , \text{arrived} \rangle] \rangle$

In this representation, "$\langle$John$\rangle$" constitutes the leftmost branch of "$\langle \langle$John$\rangle$, arrived$\rangle$", and "John" is the leftmost branch of "$\langle$John$\rangle$".

When syntactic PNR fuses n domain objects of the form shown in (34) (each coming from a different daughter) to produce a single domain object of the form shown in (35) (to be placed in the order domain of the mother), one of the three conditions shown in (36) must be satisfied, due to (46).

(34) $\left[\text{SS} \mid \text{CONT} \quad \left[\begin{array}{ll} \text{INDEX} & \boxed{a_1} \\ \text{EP} & \boxed{b_1} \end{array} \right] \right] , \cdots , \left[\text{SS} \mid \text{CONT} \quad \left[\begin{array}{ll} \text{INDEX} & \boxed{a_n} \\ \text{EP} & \boxed{b_n} \end{array} \right] \right]$

(35) $\left[\text{SS} \mid \text{CONT} \quad \left[\begin{array}{ll} \text{INDEX} & \boxed{a_0} \\ \text{EP} & \boxed{b_0} \end{array} \right] \right]$

(36) a. $\boxed{a_0} = \boxed{a_1} = \cdots = \boxed{a_n} \quad \wedge \quad \boxed{b_0} = \boxed{b_1} = \cdots = \boxed{b_n}$

b. $\boxed{b_0} = \boxed{b_1} \oplus \cdots \oplus \boxed{b_n}$

c. $\boxed{a_0}$ is $\boxed{a_1 + \cdots + a_n}$, and $\boxed{b_1} \cdots \boxed{b_n}$ all become $\boxed{b_0}$ when $\boxed{a_1} \cdots \boxed{a_n}$ that occur inside $\boxed{b_1} \cdots \boxed{b_n}$ respectively are all replaced by $\boxed{a_1 + \cdots + a_n}$.

The condition in (36a) can merge multiple quantifiers into one, producing an effect similar to that of Optional Quantifier Merger proposed in Beavers and Sag (2004). The condition in (36b) yields a representation whose semantics is not affected by PNR, as far as the EP value is concerned. And the condition in (36c) is the option that can give rise to a representation like (6).

6 Summary

The CG-based theory of non-constituent coordination cannot deal with all instances of medial RNR in English, French, and Japanese, Mouret's theory of argument-cluster coordination encounters similar difficulties when applied to RNR, and Bachrach and Katzir's theory cannot be applied to left-node raising in English, has difficulty capturing the semantic inertness of medial RNR, and overgenerates in several ways. The ellipsis-based theory, on the other hand, appears to be capable of capturing all the observations when modified appropriately.

Appendix

(37) $\text{syn\_pnr}\left(\boxed{A}, \boxed{B}, \boxed{L}, \boxed{R}\right) \equiv$

$\boxed{A} : \left\langle \left[\begin{array}{ll} \text{SS} & \boxed{s_1} \\ \text{DOM} & \boxed{l_1} \oplus \boxed{d_1} \oplus \boxed{r_1} \end{array} \right] , \cdots , \left[\begin{array}{ll} \text{SS} & \boxed{s_n} \\ \text{DOM} & \boxed{l_n} \oplus \boxed{d_n} \oplus \boxed{r_n} \end{array} \right] \right\rangle$

$\wedge \quad \boxed{L} : \left\langle \boxed{l_1}, \cdots, \boxed{l_n} \right\rangle$

$\wedge \quad \boxed{R} : \left\langle \boxed{r_1}, \cdots, \boxed{r_n} \right\rangle$

$$\wedge \quad \boxed{B} : \left\langle \begin{bmatrix} \textsc{ss} & \boxed{s_1} \\ \textsc{dom} & \boxed{d_1} \end{bmatrix}, \cdots, \begin{bmatrix} \textsc{ss} & \boxed{s_n} \\ \textsc{dom} & \boxed{d_n} \end{bmatrix} \right\rangle$$
$$\wedge \quad \boxed{d_1} \neq \langle\rangle \quad \wedge \quad \cdots \quad \wedge \quad \boxed{d_n} \neq \langle\rangle$$

(38) $\textsc{phon\_pnr}\left(\boxed{H}, \boxed{G}, \boxed{B_L}, \boxed{B_R}\right) \equiv$
$$\boxed{H} : \left\langle \boxed{h_1} \right\rangle \oplus \boxed{H'} \oplus \left\langle \boxed{h_n} \right\rangle$$
$$\wedge \quad \boxed{G} : \left\langle \boxed{g_1} \right\rangle \oplus \boxed{G'} \oplus \left\langle \boxed{g_n} \right\rangle$$
$$\wedge \quad \textsc{phon\_del}\left(\boxed{h_1}, \boxed{g_1}, \langle\rangle, \boxed{B_R}\right) \quad \wedge \quad \textsc{contain\_left}\left(\boxed{g_1}, \boxed{B_L}\right)$$
$$\wedge \quad \textsc{phon\_del\_each}\left(\boxed{H'}, \boxed{G'}, \boxed{B_L}, \boxed{B_R}\right)$$
$$\wedge \quad \textsc{phon\_del}\left(\boxed{h_n}, \boxed{g_n}, \boxed{B_L}, \langle\rangle\right) \quad \wedge \quad \textsc{contain\_right}\left(\boxed{g_n}, \boxed{B_R}\right)$$

(39) $\textsc{phon\_del\_each}\left(\boxed{C}, \boxed{D}, \boxed{B_L}, \boxed{B_R}\right) \equiv$
$$\boxed{C} = \boxed{D} = \langle\rangle$$
$$\vee \quad \left(\boxed{C} : \left\langle \boxed{c} \mid \boxed{C'} \right\rangle \quad \wedge \quad \boxed{D} : \left\langle \boxed{d} \mid \boxed{D'} \right\rangle \right.$$
$$\left. \wedge \quad \textsc{phon\_del}\left(\boxed{c}, \boxed{d}, \boxed{B_L}, \boxed{B_R}\right) \quad \wedge \quad \textsc{phon\_del\_each}\left(\boxed{C'}, \boxed{D'}, \boxed{B_L}, \boxed{B_R}\right)\right)$$

(40) $\textsc{phon\_del}\left(\boxed{c}, \boxed{d}, \boxed{L}, \boxed{R}\right) \equiv$
$$\boxed{c} : \begin{bmatrix} \textsc{ss} & \boxed{s} \\ \textsc{dom} & \boxed{D} \end{bmatrix} \quad \wedge \quad \boxed{d} : \begin{bmatrix} \textsc{ss} & \boxed{s} \\ \textsc{dom} & \boxed{F} \end{bmatrix}$$
$$\wedge \quad \textsc{elide\_left}\left(\boxed{D}, \boxed{E}, \boxed{L}\right) \quad \wedge \quad \textsc{elide\_right}\left(\boxed{E}, \boxed{F}, \boxed{R}\right)$$

(41) $\textsc{elide\_right}\left(\boxed{E}, \boxed{F}, \boxed{R}\right) \equiv$
$$\left(\boxed{R} = \langle\rangle \quad \wedge \quad \boxed{F} = \boxed{E}\right)$$
$$\vee \quad \left(\boxed{E} : \boxed{E'} \oplus \left\langle \begin{bmatrix} \textsc{ss} & \boxed{s} \\ \textsc{phon} & \boxed{p} \end{bmatrix} \right\rangle \right.$$
$$\wedge \quad \neg\left(\boxed{E'} : \textsc{list}\left(\begin{bmatrix} \textsc{phon} & \textit{none} \end{bmatrix}\right)\right)$$
$$\wedge \quad \textsc{phon\_elide\_right}\left(\boxed{p}, \boxed{q}, \boxed{R}\right)$$
$$\left. \wedge \quad \boxed{F} : \boxed{E'} \oplus \left\langle \begin{bmatrix} \textsc{ss} & \boxed{s} \\ \textsc{phon} & \boxed{q} \end{bmatrix} \right\rangle \right)$$
$$\vee \quad \left(\boxed{E} : \boxed{E'} \oplus \left\langle \begin{bmatrix} \textsc{ss} & \boxed{s} \\ \textsc{phon} & \boxed{r} \end{bmatrix} \right\rangle \right.$$
$$\wedge \quad \neg\left(\boxed{E'} : \textsc{list}\left(\begin{bmatrix} \textsc{phon} & \textit{none} \end{bmatrix}\right)\right)$$
$$\wedge \quad \boxed{R} : \boxed{R'} \oplus \langle \boxed{r} \rangle$$
$$\wedge \quad \textsc{elide\_right}\left(\boxed{E'}, \boxed{F'}, \boxed{R'}\right)$$
$$\left. \wedge \quad \boxed{F} : \boxed{F'} \oplus \left\langle \begin{bmatrix} \textsc{ss} & \boxed{s} \\ \textsc{phon} & \textit{none} \end{bmatrix} \right\rangle \right)$$

(42) $\text{phon\_elide\_right}\left(\boxed{P},\boxed{Q},\boxed{R}\right) \equiv$
$\left(\boxed{R} = \langle\rangle \;\wedge\; \boxed{Q} = \boxed{P}\right)$
$\vee \;\left(\boxed{P} : \boxed{P'} \oplus \left\langle \boxed{p} \right\rangle\right.$
$\wedge \;\boxed{P'} \neq \langle\rangle$
$\wedge \;\text{phon\_elide\_right}\left(\boxed{p},\boxed{q},\boxed{R}\right)$
$\left.\wedge \;\boxed{Q} : \boxed{P'} \oplus \left\langle \boxed{q} \right\rangle\right)$
$\vee \;\left(\boxed{P} : \boxed{P'} \oplus \langle \boxed{r} \rangle\right.$
$\wedge \;\boxed{P'} \neq \langle\rangle$
$\wedge \;\boxed{R} : \boxed{R'} \oplus \langle \boxed{r} \rangle$
$\left.\wedge \;\text{phon\_elide\_right}\left(\boxed{P'},\boxed{Q},\boxed{R'}\right)\right)$

(43) $\text{contain\_right}\left(\boxed{A},\boxed{R}\right) \equiv$
$\boxed{A} : \left[\textsc{dom} \;\; \boxed{D}\right] \;\wedge\; \boxed{D} : \boxed{D_1} \bigcirc \boxed{D_2} \;\wedge\; \text{elide\_right}\left(\boxed{D_1},\boxed{E},\boxed{R}\right)$

(44) $\text{totally\_compact\_each}\left(\boxed{C},\boxed{D}\right) \equiv$
$\boxed{C} = \boxed{D} = \langle\rangle$
$\vee \;\left(\boxed{C} : \left\langle \boxed{c} \mid \boxed{C'} \right\rangle \;\wedge\; \boxed{D} : \left\langle \boxed{d} \mid \boxed{D'} \right\rangle\right.$
$\left.\wedge \;\text{totally\_compact}\left(\boxed{c},\boxed{d}\right) \wedge \text{totally\_compact\_each}\left(\boxed{C'},\boxed{D'}\right)\right)$

(45) $\text{fuse\_each}\left(\left\langle \boxed{K_1},\cdots,\boxed{K_n} \right\rangle, \boxed{K_0}, \boxed{f}\right) \equiv$
$\boxed{K_0} = \boxed{K_1} = \cdots = \boxed{K_n} = \langle\rangle$
$\vee \left(\boxed{K_1} : \left\langle \boxed{1} \mid \boxed{L_1} \right\rangle \wedge \cdots \wedge \boxed{K_n} : \left\langle \boxed{n} \mid \boxed{L_n} \right\rangle \wedge \boxed{K_0} : \left\langle \boxed{0} \mid \boxed{L_0} \right\rangle\right.$
$\wedge \;\left(\boxed{f} : \left[\textsc{ss} \mid \textsc{cont} \mid \textsc{ep} \mid \textsc{first} \mid \textsc{reln} \;\; \boxed{\text{Conj}}\right] \;\vee\; \boxed{f} = \boxed{\text{Conj}} = \textit{none}\right)$
$\wedge \;\text{fuse}\left(\langle \boxed{1},\cdots,\boxed{n} \rangle, \boxed{0}, \boxed{\text{Conj}}\right)$
$\left.\wedge \;\text{fuse\_each}\left(\left\langle \boxed{L_1},\cdots,\boxed{L_n} \right\rangle, \boxed{L_0}, \boxed{f}\right)\right)$

(46) $\text{fuse}\left(\langle \boxed{1},\cdots,\boxed{n} \rangle, \boxed{0}, \boxed{\text{Conj}}\right) \equiv$
$\boxed{0} = \boxed{1} = \cdots = \boxed{n}$
$\vee \left(\neg\left(\boxed{1} = \cdots = \boxed{n}\right)\right.$
$\wedge \;\boxed{1} : \begin{bmatrix} \textsc{ss} & \boxed{S_1} \\ \textsc{phon} & \boxed{P} \end{bmatrix} \wedge \cdots \wedge \boxed{n} : \begin{bmatrix} \textsc{ss} & \boxed{S_n} \\ \textsc{phon} & \boxed{P} \end{bmatrix} \wedge \boxed{0} : \begin{bmatrix} \textsc{ss} & \boxed{S_0} \\ \textsc{phon} & \boxed{P} \end{bmatrix}$
$\left.\wedge \;\text{fuse\_synsem}\left(\left\langle \boxed{S_1},\cdots,\boxed{S_n} \right\rangle, \boxed{S_0}, \boxed{\text{Conj}}\right)\right)$
$\vee \left(\neg\left(\boxed{1} = \cdots = \boxed{n}\right)\right.$
$\wedge \;\boxed{1} : \begin{bmatrix} \textsc{ss} & \boxed{S_1} \\ \textsc{phon} & \boxed{P} \end{bmatrix} \wedge \cdots \wedge \boxed{n} : \begin{bmatrix} \textsc{ss} & \boxed{S_n} \\ \textsc{phon} & \boxed{P} \end{bmatrix} \wedge \boxed{0} : \begin{bmatrix} \textsc{ss} & \boxed{S_0} \\ \textsc{phon} & \boxed{P} \end{bmatrix}$
$\left.\wedge \;\text{cumulate\_synsem}\left(\left\langle \boxed{S_1},\cdots,\boxed{S_n} \right\rangle, \boxed{S_0}, \boxed{\text{Conj}}\right)\right)$

The *fuse_synsem* relation, used in (46), and the *fuse_valence* relation, used in (47), are defined in Yatabe (2003). The *contain_left* relation and the *elide_left* relation are intended to be the mirror images of the *contain_right* relation and the *elide_right* relation respectively, and are not defined here.

(47) cumulate_synsem$\Big(\langle \boxed{1}, \cdots, \boxed{n} \rangle, \boxed{0}, \boxed{\text{Conj}}\Big) \equiv$

$\boxed{\text{Conj}} = \textit{and}$

$\wedge \boxed{1} :$
$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \boxed{a} \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \boxed{b_1} \\ \text{COMPS} & \boxed{c_1} \\ \text{MOD} & \boxed{d_1} \end{bmatrix} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{LTOP} & \boxed{e_1} \\ \text{INDEX} & \boxed{f_1} \\ \text{SEMHEAD} & \boxed{g_1} \\ \text{EP} & \boxed{h_1} \\ \text{H-CONS} & \boxed{i_1} \\ \text{H-STORE} & \boxed{j} \end{bmatrix} \end{bmatrix} \wedge$

$\cdots \wedge \boxed{n} :$
$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \boxed{a} \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \boxed{b_n} \\ \text{COMPS} & \boxed{c_n} \\ \text{MOD} & \boxed{d_n} \end{bmatrix} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{LTOP} & \boxed{e_n} \\ \text{INDEX} & \boxed{f_n} \\ \text{SEMHEAD} & \boxed{g_n} \\ \text{EP} & \boxed{h_n} \\ \text{H-CONS} & \boxed{i_n} \\ \text{H-STORE} & \boxed{j} \end{bmatrix} \end{bmatrix}$

$\wedge \boxed{0} :$
$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \boxed{a} \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \boxed{b_0} \\ \text{COMPS} & \boxed{c_0} \\ \text{MOD} & \boxed{d_0} \end{bmatrix} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{LTOP} & \textit{none} \\ \text{INDEX} & \boxed{f_1 + \cdots + f_n} \\ \text{SEMHEAD} & \textit{none} \\ \text{EP} & \boxed{h_0} \\ \text{H-CONS} & \boxed{i_1} \cup \cdots \cup \boxed{i_n} \\ \text{H-STORE} & \boxed{j} \end{bmatrix} \end{bmatrix}$

$\wedge$ substitute $\Big(\boxed{h_1}, \boxed{h_0}, \boxed{f_1}, \boxed{f_1 + \cdots + f_n}\Big) \wedge$

$$\cdots \wedge \text{substitute}\left(\boxed{h_n}, \boxed{h_0}, \boxed{f_n}, \boxed{f_1 + \cdots + f_n}\right)$$
$$\wedge \text{ fuse\_valence}\left(\left\langle \boxed{b_1}, \cdots, \boxed{b_n} \right\rangle, \boxed{b_0}, \boxed{\text{Conj}}\right)$$
$$\wedge \text{ fuse\_valence}\left(\left\langle \boxed{c_1}, \cdots, \boxed{c_n} \right\rangle, \boxed{c_0}, \boxed{\text{Conj}}\right)$$
$$\wedge \text{ fuse\_valence}\left(\left\langle \boxed{d_1}, \cdots, \boxed{d_n} \right\rangle, \boxed{d_0}, \boxed{\text{Conj}}\right)$$

(48) substitute $\left(\boxed{A}, \boxed{B}, x, y\right)$ holds if and only if the feature structure denoted by $\boxed{A}$ becomes the feature structure denoted by $\boxed{B}$ when all the occurences of x in the denotation of $\boxed{A}$ are replaced by y.

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