Proceedings of the 18th International Conference on Head-Driven Phrase Structure Grammar

University of Washington

Stefan Müller (Editor)

2011

Stanford, CA: CSLI Publications

Contents

Editor's note

The 18th International Conference on Head-Driven Phrase Structure Grammar (2011) was held at the University of Washington.

The conference featured 2 invited talks and 16 papers, and 1 poster selected by the program committee (Anne Abeillé, Doug Arnold, Emily M. Bender, Philippe Blache, Olivier Bonami, Robert Borsley, Gosse Bouma, Rui Chaves, Berthold Crysmann (chair), Dan Flickinger, Danièle Godard, Lars Hellan, Anke Holler, Jong-Bok Kim, Jean-Pierre Koenig, Valia Kordoni, Anna Kupsc, Robert Levine, Rob Malouf, Nurit Melnik, Philip Miller, Stefan Müller, Gerald Penn, Adam Przepiorkowski, Frank Richter, Ivan Sag, Manfred Sailer, Jesse Tseng, Frank Van Eynde, Gert Webelhuth, Stephen Wechsler, Shuichi Yatabe).

A workshop about *Information Structure and Formal Grammar* was attached to the conference. It featured one invited talk and 8 papers and a poster, selected by the program committee of this workshop (Felix Bildhauer Daniel Büring Berthold Crysmann (chair) Kordula De Kuthy Elisabet Engdahl Claire Gardent Jonathan Ginzburg Tracy Holloway King Manfred Krifka Jean-Marie Marandin Laura Michaelis Stefan Müller Irina Nikolaeva Patrizia Paggio Arndt Riester Mats Rooth Mark Steedman Malte Zimmermann).

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

Thanks go to Emily M. Bender (chair), Joshua Crowgey, Michael Goodman, Varya Gracheva, Prescott Klassen, Naoko Komoto, Clarissa Surek-Clark, Emily Silgard, Sanghoun Song, Lisa Tittle, and David Wax, who were in charge of local arrangements.

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

The proceedings include all the papers except those by Olivier Bonami, Rui Chaves, Anna Gazdik, Tibor Kiss, Mats Rooth, and Thomas Wasow and David Clausen.

Part I
Contributions to the Main Conference

An HPSG approach to synchronous speech and deixis

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Abstract

The use of hand gestures to point at objects and individuals, or to navigate through landmarks on a virtually created map is ubiquitous in face-to-face conversation. We take this observation as a starting point, and we demonstrate that deictic gestures can be analysed on a par with speech by using standard methods from constraint-based grammars such as HPSG. In particular, we use the form of the deictic signal, the form of the speech signal (including its prosodic marking) and their relative temporal performance to derive an integrated multimodal tree that maps to an integrated multimodal meaning. The integration process is constrained via construction rules that rule out ill-formed input. These rules are driven from an empirical corporal study which sheds light on the interaction between speech and deictic gesture.

1 Introduction

The use of deixis is highly pervasive in everyday communication. Through definite referring expressions, pronouns and pointing gestures with the head and hand, people exploit the context of the communicative event in their communicative actions, and likewise interlocutors exploit this to derive an interpretation of those actions. This paper provides a formal account of deictic (pointing) gestures performed by the hand (from now on called *deixis*) and it demonstrates that standard methods from formal linguistics—namely constraint-based grammars and compositional semantics—can capture the various semantic relations between speech and deixis, and also the range of pragmatic use of deixis. To illustrate the distinct semantic relations and the distinct pragmatic uses, consider utterances (1) and (2).[1]

(1) And a as she [$_N$said], it's an environmentally friendly uh material ...
The speaker extends Right Hand (RH) with palm open up towards the other participant.

(2) I [$_{PN}$enter] my [$_N$apartment]
RH and Left Hand (LH) are in centre, palms are open vertically, finger tips point forward; along with "enter" they move briskly downwards.

The different ways the pointing hand is engaged in the communicative event to denote the speech content gives rise to distinct interpretations of deixis: the gesture in (1) can be interpreted as demarcating the spatial location of a concrete participant salient in the communicative situation, or also as pointing at an abstract object—here, the utterance introduced by the previous speaker, located at some

[1] In the utterance transcription, the speech signal that occurs at the same time as the expressive part of the gesture, the so called *stroke*, is underlined with a straight line, and the signal that temporally co-occurs with the *hold* after the stroke is underlined with a curved line. The pitch accented words are shown in square brackets with the accent type in the left corner: PN (pre-nuclear), NN (non-nuclear) and N (nuclear).

specific spatiotemporal coordinates. In comparison, the deixis in (2) can locate an object that is physically absent from the communicative situation—an apartment or an apartment entrance door—by placing it on a virtually created map. This gesture can also identify the abstract event of entering the apartment door. In the gesture community, the use of deixis to point at physically present individuals vs. individuals absent from the communicative event is what sets apart *concrete deixis* from *abstract deixis* (McNeill, 2005). This distinction is essential since it has effects on the speech-deixis integration, as we discuss in Section 3.1 and Section 5.

With this in mind, the Logical Forms (LFs) contributed by (1) and (2) reflect the distinct gesture denotations, as well as the distinct relations between speech and deixis. We begin with the formalisation of multimodal utterance (1), with its two possible interpretations exhibited in (3a) and (3b).

(3) a. $\pi_1 : \exists m(material(m) \wedge environmentally\text{-}friendly(m))$
$\pi_2 : \exists s, g(she(s) \wedge said(e_0, s, \pi_1) \wedge loc(g, x, v(\vec{p}_x)) \wedge Identity(s, x))$

b. $\pi'_1 : \exists m(material(m) \wedge environmentally\text{-}friendly(m))$
$\pi'_2 : \exists s, g(she(s) \wedge said(e_0, s, \pi'_1) \wedge classify(g, \pi'_1, v(\vec{p_s}))$
$\wedge Acceptance(\pi'_1, g))$

To fit the current research in the broader context of formal semantics of gesture (Lascarides and Stone, 2009), (3a) and (3b) make use of the language of Segmented Discourse Representation Theory (SDRT, Asher and Lascarides (2003)) for interpreting gesture. Of course, the same information can be expressed in any other model of the semantic/pragmatic interface. Following Lascarides and Stone (2009), we use the predicates *loc* and *classify* to represent the literal and metaphorical deixis use; for instance, *loc*$(g, x, v(\vec{p}_x))$ states that the deictic gesture g introduces an individual x at the physical location $v(\vec{p}_x)$ which is the proximal space projected from the tips of the fingers in the direction of the participant.[2] In comparison, *classify*$(g, \pi'_1, v(\vec{p_s}))$ conveys the metaphorical deictic use to point at an abstract object, namely, the utterance denoted by π'_1 "contained" in the spatial coordinates $v(\vec{p_s})$). Finally, distinct semantic relations can be inferred between the speech content and these two alternative gesture contents: we state that an *Identity* relation holds between the referents s and x in (3a). Thus the gesture physically locates the referent of "she" in physical space. In the metaphorical case, the semantic relation between speech and deixis is *Acceptance*(π'_1, g); in other words, the gesture's interpretation can be paraphrased as "I agree with what was just said" (note that π'_1 refers to the discourse segment whose content is "it's an environmentally friendly material").

We complete the range of deixis interpretations with the formalisation of (2) as displayed in (4a) and (4b).

(4) a. $\pi_1 : \exists a, g(speaker(s) \wedge apartment(a) \wedge enter(e_0, s, a)$
$\wedge loc(g, y, v(\vec{p}_y) \wedge VirtualCounterpart(a, y))$

[2] We postpone a more detailed discussion about $v(\vec{p}_i)$ until Section 4.

b. $\pi_1' : \exists a, g(speaker(s) \wedge apartment(a) \wedge enter(e_0, s, a)$
$\wedge loc(g, e_1, v(\vec{p}_{e_1})) \wedge VirtualCounterpart(e_0, e_1))$

Whereas the LF in (4a) exemplifies one of the possible interpretations where the deictic gesture locates the apartment in a virtual map that is just in front of the speaker (through the use of *VirtualCounterpart(a,y)*), the LF in (4b) locates the event of entering an apartment in the virtual space — hence given real world knowledge about entering events it locates the apartment door. Based on that, we establish a VirtualCounterpart relation between the abstract object y and the apartment a in (4a), and between the event of entering the apartment e_0 and the deictic event e_1 in (4b).

We construct these logical forms from the underspecified semantics of deixis, the semantics of speech and the underspecified semantic relation between speech and deixis using commonsense reasoning and world knowledge. Essentially, we argue that computing how speech and deixis are integrated should happen within the *grammar* so as to capture the fact that the integration is informed by *form*. For instance, it seems anomalous to perform the deictic gesture in (2) along with the prosodically unmarked "I", as displayed in (5), despite the multiple interpretations that can arise from this deixis use. We view utterance (5) as ill-formed where the source of ill-formedness involves the form (here, the prosodic markedness) of the linguistic signal. Ultimately in this case, we are going to capture this ill-formedness within the grammar. The alternative approach of relying only on the semantics/pragmatics interface to compute the integration of speech and deixis would involve accessing information about form disrupting thus the transition between syntax, semantics and pragmatics.

(5) * I [$_{PN}$enter] my [$_{N}$apartment]
Same gesture as in (2).

We therefore intend to provide a precise methodology for integrating speech and deixis in a single syntactic tree that maps to an (underspecified) meaning, and which also features an (underspecified) speech-deixis relation. We do this via an HPSG-based grammar of speech and deixis which defines empirically extracted construction rules for "attaching" gesture to the synchronous, semantically related speech phrase and which also introduces an underspecified $deictic\_rel(s, d)$ relation between the speech s content and the deixis d content. Resolving this relation to, say, Identity or VirtualCounterpart, is achieved at the semantics/pragmatics interface and it therefore lies outwith the scope of the grammar.

As a grammar formalism we choose HPSG because of its mechanisms to construct structured phonology in parallel with syntax (Klein, 2000), and also because the semantic composition is expressed in (Robust) Minimal Recursion Semantics ((R)MRS, Copestake et al. (2005)). (R)MRS overcomes the shortcomings of λ-calculus in that the composition is *constrained*, i.e., it does not allow a functor to pick arguments that are arbitrarily embedded in the underspecified logical form. A further advantage is that (R)MRS produces Underspecified Logical Formulae

(ULF): whereas with operations such as functional application or β-reduction, one imposes scope constraints and embeddings driven from the syntactic tree, (R)MRS produces a flat description of the possible readings without having to access the distinct readings themselves. This property is particularly useful for composing gesture meaning since even through discourse processing the semantic predications yielded by gestural form may remain unresolved as attested by the LFs in (3a), (3b) and also (4a), (4b).

We have demonstrated elsewhere that HPSG is suitable for deriving depicting gestures in parallel with speech (Alahverdzhieva and Lascarides, 2010). In this paper, we shall demonstrate that it is suitable for analysing deictic gestures as well.

2 Deixis Ambiguities

One of the major challenges for the constraint-based analysis of deixis concerns the ambiguity in form which is represented on the following two axes:

1. Gesture form features, which include the shape of the hand, its orientation, movement and location. This level of ambiguity has as an effect that the hand often underspecifies the region it points at: does an index finger (1-index) extended in the direction of a book identify the physical object book, the location of the book, e.g., the table, or the cover of the book? Despite that the region identified by the 'pointing cone' (Kranstedt et al., 2006) remains vague, it does not violate perception as speakers rely on the synchronous speech phrase to disambiguate the pointing, e.g., "the book", "the book cover", etc.

2. Attachment ambiguity, which involves the syntactic integration of the deixis daughter to the synchronous, semantically related, speech daughter. For instance, in (3a) s and x are semantically related, while in (3b) π_1' and g are related. This difference is sourced in the distinct attachments in syntax: whereas an attachment to "she" supplies an interpretation where the gesture's denotation is *identical* to the denotation of the pronoun in speech, an interpretation where the gesture signals an *acceptance* of an utterance is supported by a higher attachment in the syntactic tree. This observation is essential since the grammar needs to provide the methodology for enabling the range of possible attachment ambiguities.

Deixis displays further ambiguity with respect to the way it relates to the synchronous speech, which stems from the fact that the gesture can denote distinct features of the 'qualia structure' (Pustejovsky, 1995) of the referent. An example from Clark (1996) illustrates this: George points at a copy of Wallace Stegner's novel *Angle of Repose* and says: 1. "That book is mine"; 2. "That man was a friend of mine"; 3. "I find that period of American history fascinating". In 1., there is one-to-one correspondence between the deixis denotation and the physical artefact book, and they are thus bound by *Identity*. In 2., there is a reference

transfer from the book to the author and the gesture denotes the creative agent of the book rather than the book itself, i.e., the gesture and speech are related through an *AgentiveRelation*, and finally in 3., the transfer is from the book to the book's content, and so deixis and speech are related through a *ContentRelation*. We shall account for these ambiguities in the grammar by a construction rule that combines synchronous speech and gesture via an underspecified relation $deictic\_rel(d, s)$ between the semantic index d of deixis and the semantic index s of speech, resolvable to a concrete value in pragmatics.

We argue that these various levels of ambiguity can be captured by standard mechanisms for producing ULFs which give a very abstract representation of what the gesture means abstracted away from context. In particular, we use Robust Minimal Recursion Semantics (Copestake, 2007) to produce highly factorised, partial meaning representations that underspecify the predicate's arity and the predicate's main variable. In so doing, we remain vague as to whether the pointing signal in (1) identifies the individual denoted by a pronoun in the synchronous speech, or it is rather a metaphor of the speech act of acceptance.

Despite the ambiguities, the process of attachment is constrained, e.g., whereas attachments to "enter", "enter my apartment" or even to the entire clause "I enter my apartment" in (2) should be enabled as they support the intended meanings in context, an attachment to the subject head daughter "I" should be ruled out since it would never produce the intended meaning in context.

3 Speech-Deixis Synchrony

Due to the lack of an accepted methodology of how to establish the synchrony of two modalities,[3] Alahverdzhieva and Lascarides (2010) defined synchrony as the *attachment of gesture to the semantically related speech phrase in the syntactic tree that, using standard semantic composition rules, yields an underspecified logical form supporting the final interpretation in the context-of-use*. Our aim is thus to constrain synchrony by exploring the linguistic properties of the multimodal action, i.e., we use information from prosody (the literature offers enough evidence that the gesture performance is intertwined with the one of speech, and that the perception of gesture depends on the synchronous prosody–e.g., Loehr (2004), Giorgolo and Verstraten (2008)), syntax (why would attachment to "enter my apartment" in (2) be allowed, but one to "I" disallowed?) and also the timing of speech relative to deixis. These constraints have been established empirically though a multimodal corpora study.

[3] As demonstrated by (1) and (2) and their corresponding logical forms, the temporal performance of one mode relative to the temporal performance of the other is insufficient for deriving the possible meaning representations.

3.1 Corpus Investigation

Autosegmental-Metrical (AM) phonology (Ladd, 1996) underpins our underlying assumptions about the interaction between speech and gesture, and hence also the annotation schema and the formalisation of grammar construction rules. In AM theory, prominence is determined by the stronger (s) or weaker (w) relation between two juxtaposed units in the metrical tree. The nuclear prominent node is the one dominated by strong nodes. In the default case of broad focus, the nuclear accent is associated with the right-most word, i.e., the metrical structure is right branching as displayed in Figure 1. This can be overridden by narrow focus where the structure can also be left-branching.

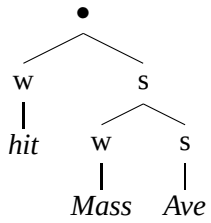

Figure 1: Metrical Tree for "hit Mass Ave"

Our choice stems from the fact that in the AM model nuclear accenting involves perception of structural prominence in relation to the metrical structure rather than to the acoustic properties of the syllable (Calhoun, 2006). In this way, we can reliably predict the gestural occurrence in relation to the metrical tree, and we can also interface the prosodic structure with the syntactic structure (Klein, 2000).

Our hypothesis about the speech-deixis interaction is as follows:

Hypothesis 1 *The relative temporal performance of deictic gesture and speech can be predicted from nuclear prominence: in case of broad-focused utterances, deixis temporally overlaps with the nuclear accent, and in case of early pre-nuclear rise, it overlaps with the pre-nuclear accent.*

The hypothesis was validated through an experimental study over two multimodal corpora: a 5.53 min recording from the Talkbank data[4] and observation IS1008c, speaker C from the AMI corpus.[5] The domain of the former is living-space descriptions and navigation giving, and the latter is a multi-party face-to-face conversation among four people discussing the design of a remote control. We augmented the corpora with annotation of prosody and of gesture. The prosody annotation was largely based on the annotation schema of the Switchboard corpus (Brenier and Calhoun, 2006) and it included an orthographic transcription, labelling of accents—nuclear, pre-nuclear (an early emphatic pitch rise), non-nuclear—and labelling of prosodic phrases. The gesture annotation included classifying the hand

[4] http://www.talkbank.org/media/Gesture/Cassell/kimiko.mov

[5] http://corpus.amiproject.org/

movements in terms of communicative vs. non-communicative, assigning them a category (depicting, deictic) and segmenting them into discrete phases. These phases are: preparation (a non-obligatory phase which involves lifting the hands from a relaxed position to the frontal space), pre-stroke hold (a non-obligatory phase, hands are held still before reaching the expressive peak), stroke (an obligatory phase, the dynamic peak of gesture that carries its meaning), a post-stroke hold (a non-obligatory phase which consists in maintaining the hands in the expressive position reached during the stroke) and retraction (a non-obligatory phase characterised by bringing the hands back to rest).

The gesture segmentation was based on formal and functional criteria. The formal ones considered the dynamic profile of the hand, i.e., the effort employed by the hand. Any sudden change in the hand dynamics signals a transition to a new phase. More specifically, preparations and retractions require minimum effort, the stroke is usually characterised by a dynamic maximum, and during the holds before/after the strokes the hand is held still (McNeill, 2005). Note that this criterion is relational — the lower or higher dynamics of a phase is determined in relation to the dynamics of the juxtaposed phase, e.g., the hand during hold is almost never absolutely still, it is still only in relation to the dynamics reached during the stroke. Further, the functional criteria involve the meaning conveyed by the gesture phase, which we established in the context of the synchronous speech: whereas the stroke and the hold after the stroke (if any) are the phases that communicate what the gesture is about, preparations and retractions are not communicative, they are the physical effort necessary to execute the stroke.

We addressed our hypothesis by searching for types of accents overlapping deixis. Since we were interested in the expressive part of the gesture, we counted the deictic strokes only. The corpora contained 87 deictic strokes (65 for the Talkbank, and 22 for AMI). 86 of them—that is, 98.85%—overlapped a nuclear and/or a pre-nuclear accented word. Deictic gestures of longer duration were often marked by a combination of a nuclear and non-nuclear and/or nuclear and pre-nuclear accented words. Essentially, the empirical analysis confirmed the expected alignment between the nuclear prominent word (not simply the nuclear accent) and the deixis stroke both in case of broad focus, and in case of narrow focus. This is attested in the broad-focused utterance (6) and in the narrow-focused utterance (7), a continuation of (6). Whereas the deixis stroke in (6) co-occurs temporally with the nuclear prominent "Mass Ave", the performance of the deixis stoke in (7) is shifted earlier to the nuclear accented "left".

(6) I keep [$_N$going] until I [$_{NN}$hit] Mass [$_N$Ave], I think
Right arm is bent in the elbow at a 90-degree angle, RH is loosely closed and relaxed, fingers point forward. Left arm is bent at the elbow, held almost parallel to the torso, palm is open vertical facing forward, finger tips point to the left.

(7) And then I [$_N$turn] *[pause]* [$_N$left] on [$_{NN}$Mass] Ave

LH is held in the same position as in (6); along with "left", RH opens vertically and sweeps to the left periphery close to the left shoulder.

For the formal rendition of this finding, we adopt the HPSG phonology model of Klein (2000) where the prosodic structure is specified within the PHON attribute in parallel with SYNSEM. The prosodic constituent is mapped from the metrical tree, e.g., the metrical tree in Figure 1 maps to the feature structure in Figure 2. The element dominated by *s* nodes maps to the *Designated Terminal Element* (DTE) (Liberman and Prince, 1977). Note also that the feature structure is typed as *mtr(full)* which reflects the fact that objects in the domain (DOM) are prosodic words of type *full*, which is in contrast to non-prosodic words such as conjunctions, pronouns and articles that usually form a single prosodic word with the neighbouring element.

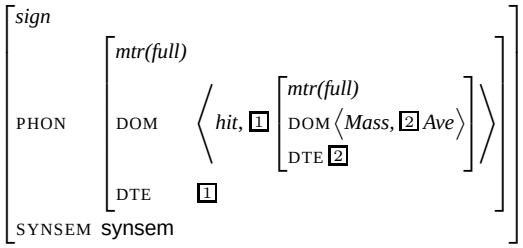

Figure 2: Feature Structure of the Metrical Tree for "hit Mass Ave"

Our results report on the interaction between speech and deixis on the level of *form*. Our overall aim is to account for syntactically well-formed trees which map to ULFs supporting the final interpretations in context. We therefore examined whether the syntactic attachments as constrained by prosody would produce the range of preferred interpretations in context. We encountered instances which, although syntactically well-formed, did not map to all intended meaning representations due to the fact that the semantically preferred speech element the gesture stroke overlapped with was not prosodically prominent. In (1), for instance, the gesture is produced along with the nuclear prominent "said" when one of the plausible denotations of the hand is that it is identical to the denotation of the unaccented pronoun "she" coming from speech. Moreover, this interpretation would still be available even if the deictic gesture was performed outwith the temporal span of the pronoun, as exemplified below.

(8) And a as she [$_N$said], it's an environmentally friendly uh material ...
Same gesture as in (1).

Essentially, the instances of misalignment between the semantically related, prosodically prominent word and the deictic stroke, and also between the temporal performance of the deixis and the temporal performance of the semantically related speech phrase concern cases where the visible space outlined by the deictic gesture is equal to the space it actually denoted, i.e., the individual/object was

present in the communicative situation at the exact spatial coordinates identified by the deixis. This observation flags up an important finding about a multimodal grammar of speech and deixis: whereas gestures pointing at concrete individuals in the real space can be attached to elements from speech that are not necessarily prosodically prominent or that are performed outside the temporal performance of the deixis, gestures identifying abstract individuals require temporal overlap with the prosodically prominent, semantically related speech phrase. In Section 5, we propose construction rules that reflect our empirical findings.

4 Mapping Form to (Underspecified) Meaning

In Section 1 we claimed that we model gestural ambiguity by re-using standard linguistic methods for meaning underspecification. We shall now demonstrate how to express gestural meaning from form.

It is now well-established in the gesture community to formally regiment gesture in terms of Typed Feature Structures (TFSs)—e.g., Johnston (1998), Kopp et al. (2004)—since they capture the non-hierarchical gesture structure. Gestures, unlike fully-fledged language systems, are constructed by equally ranked form features—such as the shape of the hand, the palm and finger orientation—which do not compose a hierarchy (McNeill, 2005). Similarly, previous HPSG approaches to sign languages, British Sign Language in particular, incorporate the information coming from the hand shape, orientation, finger direction and movement within the PHON attribute (Marshall and Sáfár, 2004). However, in contrast to sign languages, which exhibit a combinatoric potential to combine with other arguments (Cormier et al., 1999), (Marshall and Sáfár, 2004), deictic gestures do not select obligatory arguments. Still, multiple gestures can form a hierarchical structure in the same way discourse segments do.

Recording the deixis form features is essential for identifying the region designated by the pointing hand, for instance, 1-index finger projects a line or even a cone that starts from the tip of the index finger and continues in the direction of the object pointed at. In comparison, a flat open hand can project a plane that starts from the palm and extends in a direction parallel to the palm. Furthermore, there are findings in the descriptive literature that suggest that the form of the pointing hand is significant for interpreting its meaning in context, e.g., whereas an extended index finger has the abstract idea of singling out an object, an open hand with a vertical palm refers to a class of objects, rather than to an individuated object (Kendon, 2004).

In our framework, the features appropriate for gesture include the shape of the hand, its movement, location and orientation of the palm and fingers. Their values are specified within the sort hierarchy as exemplified for *hand-shape* in Figure 3. Some values, such as *open-closed*, account for change in form.

Figure 4 regiments the form of the deixis in utterance (2) as a feature structure. It is typed as $deictic\_abstract$ so as to differentiate between feature struc-

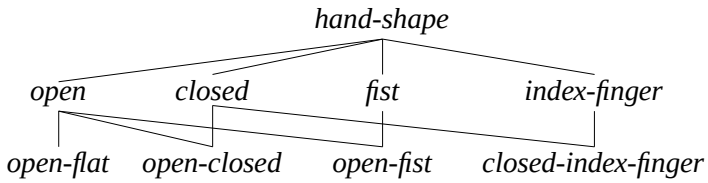

Figure 3: Fragment of the Sort Hierarchy of *hand-shape*

deictic_abstract	
HAND-SHAPE:	open-flat
PALM-ORIENTATION:	vertical
FINGER-ORIENTATION:	forward
HAND-MOVEMENT:	away-body-centre
HAND-LOCATION:	$\vec{c}$

Figure 4: Deixis Form Feature Structure Representation

tures contributed by abstract deixis and those contributed by concrete deixis (of type $deictic\_concrete$). This information is essential as it allows us to encode the necessary constraints between speech and concrete deictic gesture on the one hand, and between speech and abstract deictic gesture, on the other (recall our finding from Section 3.1 that relaxation between the prosodically prominent speech phrase and deixis, and also between the timing of the deixis and the timing of the speech word occurs with deictic gestures identifying concrete individuals but not abstract ones). Further, the values of the distinct features are taken from the sort hierarchies, similar to those demonstrated in Figure 3. Finally, following Lascarides and Stone (2009), we formalise the hand location in terms of the constant $\vec{c}$ which demarcates the exact location of the tip of the index finger and which, combined with the deixis form features, determines the spatial region $\vec{p}$ designated by the gesture, for instance, a stationary gesture of 1-index would make $\vec{p}$ a line (or a cone) that projects from $\vec{c}$ in the same direction as the index finger.

The compositional semantics of deictic gesture involves producing a set of underspecified predications in the RMRS notation; for instance, the RMRS representation of the deictic gesture in (2) is shown in Figure 5.

$l_1 : a_1 : deictic\_q(i)\ RSTR(a_1, h_1)\ BODY(a_1, h_2)$
$l_2 : a_2 : sp\_ref(i)\ ARG1(a_2, v(\vec{p}))$
$l_2 : a_3 : hand\_shape\_open\_flat(e_0)\ ARG1(a_3, i)$
$l_2 : a_4 : palm\_orient\_vertical(e_1)\ ARG1(a_4, i)$
$l_2 : a_5 : finger\_orient\_forward(e_2)\ ARG1(a_5, i)$
$l_2 : a_6 : hand\_move\_away\_body\_centre(e_3)\ ARG1(a_6, i)$
$h_1 =_q l_2$

Figure 5: Deixis RMRS Representation

Each predication is associated with a not necessarily unique label (l_n) and a

unique anchor (a_n): the label identifies the scopal positions of the predicate in the resolved LF and the anchor serves as a locus for adding arguments to the predicate, e.g., $l_2 : a_2 : sp\_ref(i)\ ARG1(a_2, v(\vec{p}))$ makes the predicate sp_ref take at least the two arguments i and $v(\vec{p})$ in the that order.

The deixis semantics accounts for the fact that the deictic gesture provides spatial reference of an individual or event in the physical space $\vec{p}$. Following Lascarides and Stone (2009), this is formalised in terms of the 2-place predicate $l_2 : a_2 : sp\_ref(i)\ ARG1(a_2, v(\vec{p}))$ where i is an underspecified variable (resolvable to an event e or an individual x) and $v(\vec{p})$ is the actually denoted space. To reflect the fact that the gestured space is not necessarily identical to the denoted space (which is basically the underlying difference between concrete deixis and abstract deixis), we are using the function v to map the physical space $\vec{p}$ identified by the gesture to the space $v(\vec{p})$ it denotes; e.g., in (1) the referent is at the exact coordinates in the visible space the gesture points at, i.e., v is equality, and also the deictic gesture is of type concrete. In contrast, in (2) the referent is not physically present, and so the deixis is abstract, and also v does *not* resolve to equality.

Further to this, for consistency with the English Recourse Grammar (ERG) (Copestake and Flickinger, 2000) where individuals are bound by quantifiers, the deictic referent is bound by the quantifier $deictic\_q$. Finally, to capture the semantic effects of the deixis form features, we map each feature-value pair to a predicate that, similarly to intersective modification in ERG, modifies the referent i.

5 Construction Rules

The rules for integrating deixis and speech envisage coverage of the full set of multimodal constructions found in our empirical study. These include rules that capture our findings about the interaction between nuclear prominence and deixis (rules for the integration of a single prosodic word and deixis, head-argument construction and deixis, head-modifier construction and deixis, noun-noun compounds/appositives and deixis). The rules are also based on the particular gesture type to account for the cases of prosodic and/or temporal relaxation.

In this section, we present three construction rules: a basic rule that attaches deixis to a single prosodic word (to derive a context-specific analysis of (1) as (3a)), a rule that integrates deixis with a larger spoken phrase (to derive an analysis of (1) as (3b)), and also a rule applicable to concrete deictic gestures that defeats the strict temporal condition between the stroke and the prosodically prominent spoken word.

Rule 1 *Deictic gesture can attach to the nuclear/pre-nuclear accented word of the temporally overlapping speech phrase.*

The formalisation of this rule is demonstrated in Figure 6. We shall now describe every aspect of it in turn. A prerequisite for the integration of the deictic (D) and the spoken (S) modalities is that they temporally overlap, that is,

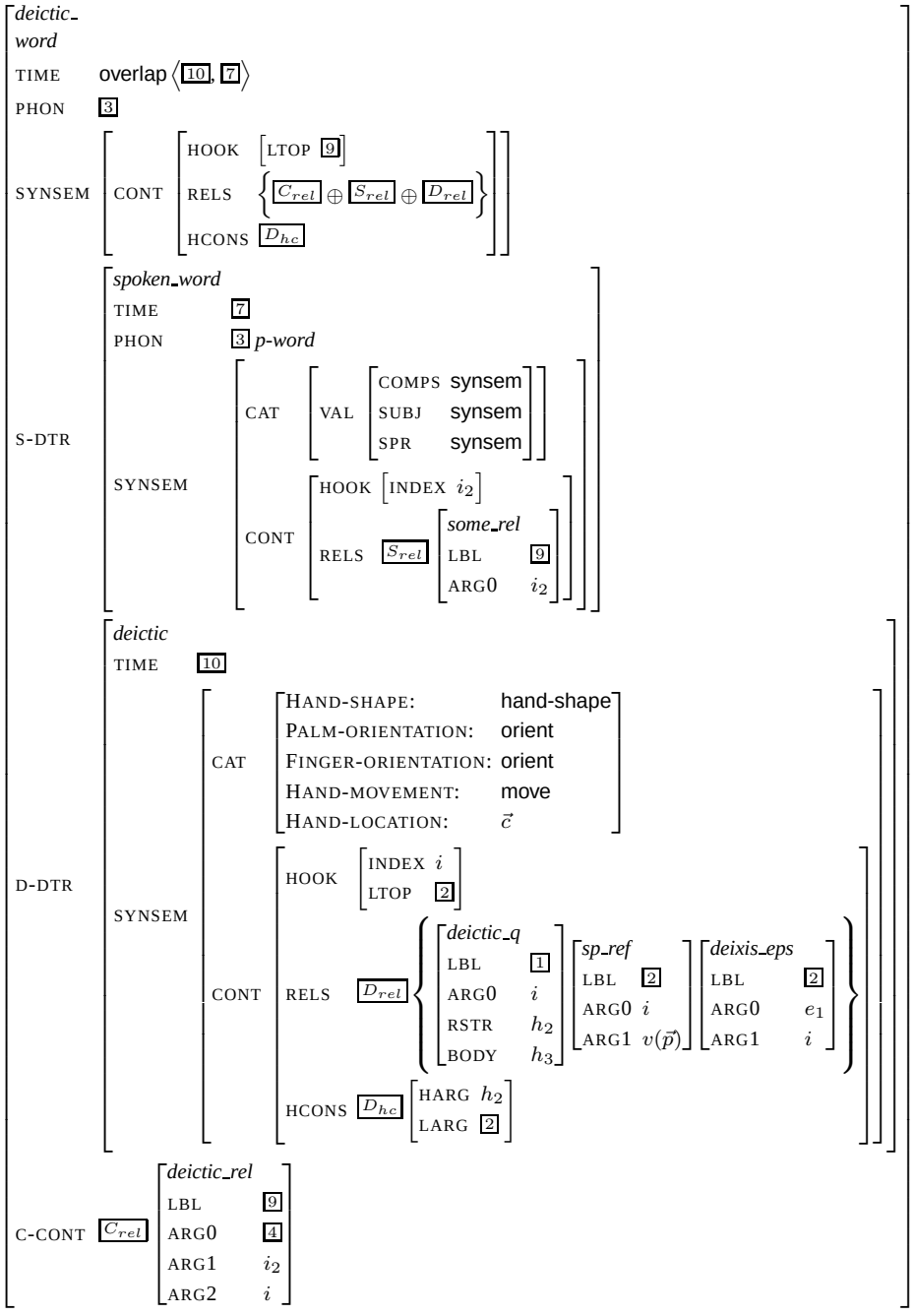

Figure 6: Deictic Prosodic Word Constraint

$end(D) > start(S)$ and $end(S) > start(D)$. Note that the application of this rule is not constrained to a particular deictic gesture type, and so it can apply to both abstract deixis and concrete deixis. The SYNSEM values of the deictic daugh-

ter (D-DTR) are encoded as detailed in Section 4: the CAT feature contains a list of deixis' appropriate attributes and the CONT component is specified in the standard way in terms of HOOK, RELS and HCONS. We defined the pointing hand as providing a spatial reference of an individual or an event i at some position in the denoted space $v(\vec{p})$ that is determined by the physical space $\vec{p}$ and the contextually resolved mapping v from physical space to gestured space. For the sake of space, we gloss over the gesture form features as $deixis\_eps$. Following ERG where the LTOP of an intersective modifier phrase is shared with the LBLs of the head daughter and the non-head daughter, $deixis\_eps$ share the same label with sp_ref which is the LTOP of the gesture daughter. Finally, the semantic index of the gesture daughter is obtained via co-indexation with the ARG0 variable i bound by the deixis main relation sp_ref.

For the speech daughter (S-DTR), we similarly record its timing, syntax and semantic information, and also its prosody. Importantly, the speech head daughter should be a nuclear/pre-nuclear prosodically prominent word of type *p-word*. We forego any details about the syntactic category of the speech daughter since it does not constrain the integration.

In Section 1 we stated that the full inventory of relations combining speech and deixis will be accounted for by an underspecified relation supporting the possible relations in context. Based on Lascarides and Stone (2009), the construction rule therefore introduces in C-CONT an underspecified relation $deictic\_rel$ between the semantic index i of the deictic gesture and the semantic index i_2 of the speech. How this relation resolves is a matter of discourse context. The treatment of this relation is similar to that of appositives in ERG of the sort "the person, the one that I am pointing to" in that it shares the same label as the speech head daughter since it further restricts the individual/event introduced in speech. In so doing, any quantifier outscoping the head would also outscope this relation.

The semantic composition of the mother node is strictly monotonic: it involves appending the relations of the speech daughter to the relations of the deictic daughter, which are then appended to the relation contributed by the rule (notated with $\oplus$). Since the PHON feature is appropriate to the speech daughter, the PHON value of the mother is co-indexed with the one of the speech daughter.

Applied to (9), this rule would produce a tree where the deixis is attached to the prosodic word "hallway".

(9) There's like a [$_{NN}$little] [$_{N}$hallway]
Hands are open, vertical, parallel to each other. The speaker places her hands between her centre and the left periphery.

For the sake of space, in Figure 7 we provide only the semantics of the multimodal utterance. Note that synchrony resolves the underspecified index introduced by the deictic gesture to an individual x. Further, the composition of the situated utterance with the intersective modifier "little", and subsequently with the quantifier "a" proceeds in the standard way where the label of the modifier is shared with

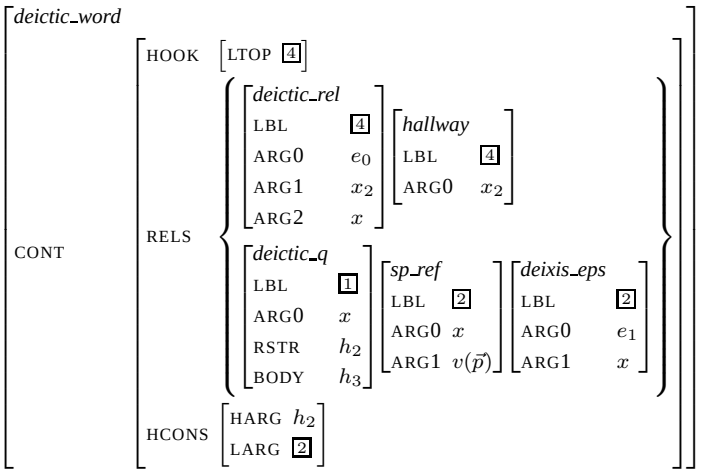

Figure 7: Semantic Composition for Deixis + "hallway"

the one of the head noun, and hence also with the label of the deictic relation, and it also appears within the restriction of the quantifier.

In Section 2 we stated that there was ambiguity with respect to attaching deixis to the synchronous and semantically related speech phrase. We therefore introduce a further rule that takes that into account.

Rule 2 *Deictic gesture attaches to a nuclear/pre-nuclear prominent head saturated with its arguments if there is an overlap between the timing of the deixis and the timing of head.*

Unlike the non-empty VAL list of the rule in Figure 6, Rule 2 presupposes attachment to a phrase with an empty [VAL|COMPS $\langle\rangle$] and/or [VAL|SUBJ $\langle\rangle$] and/or [VAL|SPR $\langle\rangle$] list. We remain as neutral as possible about the number of saturated arguments to accommodate the fact that the deixis form can map to multiple meanings in context, and these meanings persist even in the contextually resolved discourse. Applied to multimodal utterance (2), Rule 2 would allow for combining "enter my apartment" + deixis, "I enter my apartment" + deixis, and even "I enter" + deixis. Whereas the first two derivations include standard syntactic constituents, the latter violates the HPSG principles of syntactic constituency. With this in mind, one can account for the relation between "I enter" and the deictic gesture on the semantic level by restricting the scope of $deictic\_rel$ over the elementary predicates introduced by "I" and by "enter".

Finally, we introduce a rule that is applicable to concrete deictic gestures to account for the fact that prosodic prominence of the semantically related spoken word overlapping the concrete deixis is not necessary, and also that the spoken word can happen outwith the temporal performance of the gesture stroke as follows:

Rule 3 *Concrete deictic gesture attaches to a prosodically marked or to a prosodically unmarked spoken word whose temporal performance precedes or follows the*

temporal performance of the concrete deixis.

The formal rendition of this rule is demonstrated in Figure 8. This rule remains loose about the temporal relation between the spoken word and the gesture stroke — we allow for precedence and for sequence relations (the overlap relation is also possible, and it was accounted for by the rule in Figure 6). Further, the spoken word is not restricted to a particular prosodic type (it is therefore of type *pros* which subsumes prosodically marked and prosodically unmarked words) and in this way we can integrate a concrete deictic gesture into a non-prominent spoken word; in utterance (1), for instance, this condition enables the deixis attachment to "she". Moreover, the gesture is restricted to type *concrete_deixis*, and so this bars an attachment of the abstract deictic gesture to "I" in utterance (2). We forego any further details about the formalisation of this rule, since it remains the same as in Rule 1.

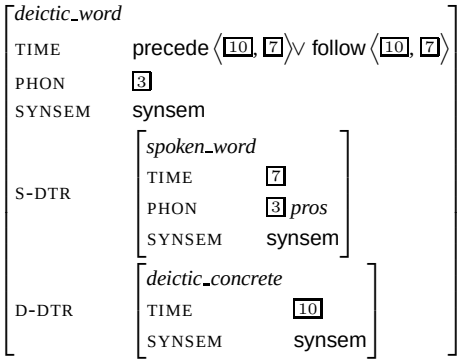

Figure 8: Concrete Deixis Prosodic Word Constraint

6 Conclusions

In this paper, we presented a constraint-based analysis of multimodal communicative signals consisting of deictic gesture signals and speech signals. Our approach re-uses standard devices from linguistics to map multimodal form to an underspecified meaning that will ultimately support reasoning on the semantic/pragmatic interface for producing a specific and context aware interpretation. We thereby account for gestural ambiguity by means of established underspecification mechanisms. To specify the form-meaning mapping, we used empirically extracted grammar construction rules which capture the conditions under which the speech-deixis signal is grammatical and semantically intended. We presented three rules: a basic rule accounting for a multimodal speech-deixis word, a rule allowing for attaching deixis to a spoken phrase, and finally, a rule that defeats the strict temporal/prosodic condition between the spoken word and the deixis stroke.

7 Acknowledgements

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Morphology in the "wrong" place: The curious case of Coast Tsimshian connectives

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Abstract

This paper examines the apparently odd location of case-marking formatives found in the Pacific Northwest language, Coast Tsimshian. It first argues that the case-marking formatives are actually affixes on the preceding words, not prosodically-dependent words. Given this morphological analysis, a syntactic analysis is proposed that utilizes the 'informationally-rich' syntactic structure of HPSG. In particular, the analysis proposed uses EDGE features and chained identities between adjacent phrasal sisters to license the clause. This enables a simple analysis of the clausal syntax of Coast Tsimshian while still accounting for the wide array of facts surrounding the connectives.

1 Introduction

Coast Tsimshian, also known as Sm'algyax, is an indigenous language of the Pacific Northwest, spoken in northwestern part of the Canadian province of British Columbia and in the extreme southeast of part of the American state of Alaska.[1] This language generally exhibits (AUX)–V–Argument(s) order in clauses and shows ergative alignment in both pronominal and non-pronominal expressions (Mulder, 1994).[2] Facilitating the interface between these word order and alignment patterns are the class of formatives that Tsimshianists have called 'connectives'. Examples of the connectives and the ergative alignment are given in (1) and (2), where the connectives of have been bolded:

(1) Yagwa hadiksa üüla.
Yagwa hadiks-[**a** üüla]
CONT swim-[ABS.CN seal]
'The seal is swimming.' (Mulder, 1994, 32)

[†]Thanks to Emily Bender, Olivier Bonami, Rui Chaves, Michael Hahn, Robert Levine, Ivan Sag, and both anonymous reviewers of my original HPSG 2011 Conference abstract for helpful comments, criticism, and pointers. The usual disclaimers apply.

Abbreviations used include: ABS/*abs* = absolutive; ACC = accusative; ADJ = adjunct; *adj* = adjective; Args = arguments; ARG-ST = argument structure; AUX/*aux* = auxiliary; CONT = continuous (aspect); CTRST.FOC = contrastive focus; *cxt* = construct; C-M = case marking; DEM = demonstrative; ERG/*erg* = ergative; FUT = future; *hd* = head(ed); HFP = Head Feature Principle; INST = instrumental; L = left; MRKD-IND = marked index; NEG = negative; PL = plural; POSS = possessive; PST = past; R = right; *sai-ph* = subject-auxiliary-inversion phrase; SEM = semantics; SYN = syntax; TOP = 'topicalized'; V = Verb; VAL = valence.

Notable or unusual aspects of Coast Tsimshian orthography are as follows: {'X}= any glottalized sonorant, {X'} = ejectives, {ɬ} = [ɬ], {ƛ} = [q], {g} = [ɢ], {kw} = [kʷ], {gw} = [gʷ], {ky} = [kʲ], {gy} = [gʲ], {x} = [χ], {ü} = [ɯ], {ẅ} = [ɯ̹], {y} = [j], {a} = [æ], {a̱}= [ɑ] or [ʌ], {o}= [o] or [ɔ], {VV} = [Vː]

[1]It is critically endangered (Moseley, 2010); numbers of speakers number is no more than a few hundred, if that. Coast Tsimshian is a member of the small Tsimshianic family, including Southern Tsimshian [Sgüüxs], Nisgha [Nisga'a], and Gitksan [Gitxsan] (Mulder, 1994, ch.1). The Tsimshianic family may be a part of the larger Penutian family (Tarpent, 1997).

[2]I gloss over some complexities of the alignment here as they are irrelevant to the point here, but see Mulder (1994, ch. 2) and Bach (2004) for some further discussion.

(2) Yagwat huumda duusa hoon.
Yagwa-t huum-[**da** duus]-[**a** hoon]
CONT-3.ERG smell-[ERG.CN cat]-[ABS.CN fish]
'The cat is sniffing the fish.' (Mulder, 1994, 32)

Because their principal function is to signal the relationship of the following expression with its predicate, I will henceforth call these 'case connectives' (cf. Stebbins' (2003) term 'dependency markers') to clearly indicate that I am discussing these elements and not any of the other elements that are also traditionally considered connectives within Tsimshianic grammar. However, in addition to signaling case, they also signal information about the nominal expression that follows them (much as determiners do in other languages). The connectives used in the colloquial style just signal whether the following noun is a common noun or not. However, the connectives in the more complex narrative style further specify visibility to the speaker, beyond noun type and case (Mulder, 1994, 32–39).

As (1) and (2) indicate, the location of the case connectives is odd. They do not appear on the head noun that they semantically/functionally go with; i.e. the marking for the function of *duus* 'cat' is not on *duus* in (2). Additionally, it appears that the case connectives don't even occur within the constituent they mark. Again looking at (2), *duus*, despite being the site of marking for *hoon* 'fish', is not even within the same noun phrase as *hoon*.

The case connectives are also not misanalyzed head-marking pronominal affixes. Head-marking pronominal affixes independently exist in Coast Tsimshian; an example with them is given in (3), where the pronominal affixes are bolded:

(3) Akadi-**t** 'nax'nuu-**t**.
NEG.CTRST.FOC-3.ERG hear-3.ABS
'They didn't hear it.' (Stebbins, 2003, 402)

These *-t* morphs are mostly distinct in form from the case connectives; a list of extant forms is provided in (4):[3]

(4) Forms of case connectives in Coast Tsimshian

-a, -s, -da, -sda, -ga, -sga, -tga, -at, -dat, -gat, -tgat, -as, -das, -dit

(Mulder, 1994, 33,39)

The connectives, additionally, are not confined just to verbs, but can appear on nouns as well, as illustrated by the marking on *duusa* 'cat.ABS.CN' in (2). Thus, it appears that this is, in fact, an instance of dependent-marking case marking.

However, the unusual location of the case connectives raises the question of what their grammatical status is: are they (perhaps prosodically-dependent) words,

[3]The presence of *t*s and *d*s in (4) does raise the possibility that some of the case connectives have been mis-segmented and the *t* or *d* is actually not a part of the connective. Even if that is so, it would not affect the point here, as the remainder of the connectives are still distinct from the pronominal affixes. It is furthermore possible, if the case connectives and the pronominal affixes both have historical sources from determiners/pronouns, that the similarities between them are due to diachronic factors.

affixes, or some kind of clitic (assuming that the definition(s) for clitic status are clear)? And furthermore, how do these grammatical elements fit into the rest of the Coast Tsimshian clause? How is their location licensed and how is their function associated with the desired noun? To answer the former question, I argue that the connectives are, in fact, affixes on the elements that precede them. Section 4 will provide morphophonological evidence in support of this claim. Given this status within Coast Tsimshian grammar, in section 5, I sketch an analysis of the syntax of Coast Tsimshian clauses that both respects this morphophonological evidence yet handles the apparent 'bracketing paradoxes' that the morphophonology gives rise to. This analysis makes crucial use of EDGE features as well as a constructional constraint enforcing matching case and index values between adjacent clausal constituents.

2 The Distribution of Case Connectives

Before moving into a discussion of the analysis of Coast Tsimshian, let me first detail more of the distribution of these elements within clauses. It does appear that the connectives are obligatory: arguably, every core argument in Coast Tsimshian is marked by a connective (though there are some instances where the marking might be understood as covert, to be discussed in section 4.1). In terms of position, examples (1) and (2) showed that the case connective can appear immediately before the head noun that it relates to. However, this is not always the case. As shown in (5), the connective *-sga* and the head noun *awta* 'porcupine' are separated by two adjectives:

(5) Ada ła dm dzaksga łgu gwe'am awta.
Ada ła dm dzak-[**sga** łgu gwe'am **awta**].
And near.FUT die-ABS.CN little poor.ADJ.CN porcupine
'And poor little porcupine was about to die.' (Stebbins, 2003, 391)

Examples like (5) indicate the the connective is just required to appear before the *noun phrase* it marks. Since adjectives in Coast Tsimshian predominantly appear prenominally, they can separate a connective from its head noun.

The examples in (1), (2), and (5) also revealed that connectives can immediately follow both verbs and nouns. It may even be possible for them to appear on words from other lexical categories. A possible additional word category is the category that postverbal adverbial element *gada* of (6) belongs to:

(6) Łat 'nisgatgit gada awtat 'niitga.
Ła-t 'nisgatg-it **gad-[*a*** awta]-[t 'niitga].
PST-3.ERG make.fun-3.ABS report-ERG.CN porcupine-ABS.CN 3SG
'It is said that porcupine made fun of him.' (Mulder, 1994, 175)

Observe in (6) that the connective (bolded and italicized) near the postverbal adverbial element (bolded) still occurs immediately before noun phrase that it marks

(consisting of *awta-* here). Thus, it appears that as long as the postverbal adverbial is in the relevant place, the marking can appear on it.[4]

It does seem, however, that there is some controversy over the treatment of this particular adverbial element. In contrast to the segmentation that Mulder provides for (6), Stebbins (2003, 398) treats instances of the form *gad* as a verbal affix. However, Stebbins does not say why she does so. In the end, the analysis proposed in this paper is not greatly affected either by treating this element as a separate word or as an affix. For the sake of concreteness and presentation, I will continue to assume that *gad* is a separate word.

Finally, the behavior of the case connective system when there is a 'missing' or unrealized argument is also illuminating. Consider (7):

(7) 'Yagay 'wii gyisiyaasg-at in-t [deentg-asga łgu alasgm yetsisk].
instead great northwind-3 TOP-3 avenge-ABS.CN little weak.ADJ.CN animal
'Instead, it was the great northwind that avenged the little weak animal.'
(Mulder, 1994, 35)

The key part of the (7) is the bracketed part, likely a subordinate clause within a larger cleft structure. The verb within this clause, *deentg-* 'avenge', has no locally-realized (i.e. a postverbal) ergative argument. The understood ergative of this verb is *gyisiyaasg-* 'northwind', which is realized before *deentg-* 'avenge'. Yet, *deentg-* does have a connective attached to it: an absolutive one, which signals the role of the next noun phrase over. Beyond reinforcing that the generalization that connectives just need to precede the relevant noun phrase, this datum shows that the actual postverbal argument—and not any more abstract representation of any argument—determines which connective appears after the verb.

The facts surrounding the Coast Tsimshian case connectives appear to be identical (or nearly so) to the slightly more well-known prenominal formatives of Kwak'wala (as first discussed by Boas et al. (1947) and discussed in the more theoretically-oriented literature by Anderson (1984, 2005) among others). The Kwak'wala elements, too, have the apparently odd property of appearing with the 'irrelevant' word that precedes them, but being relevant to the word or words that follow them. A Kwak'wala example is given in (8):[5]

[4]Whether this pattern occurs more generally with other adverbials is difficult to know, because adverbial elements in Coast Tsimshian overwhelmingly tend to occur in locations that do not interact with the marking of arguments: preverbally—between the auxiliary and the main verb—or clause-finally (Stebbins, 2003, 391–392).

[5]The text in (8) does not use the original orthography, but has been converted to the U'mista orthography.

(8) Kwix'idida bagwanamaxa k'asasis t'alwagayu.
Kwix'id- ida bagwanama- x- a k'asa- s- is t'alwagayu.
clubbed- [the man]- [ACC- the otter]- [INST- his club]

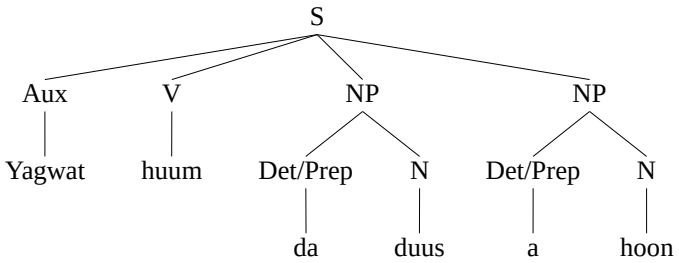
'The man clubbed the sea-otter with his club.'
(Boas et al., 1947, 282); (Anderson, 1984, 24)

The overlap in behavior in Kwak'wala and Coast Tsimshian is not surprising, since the two languages, though not genetically related, are geographically adjacent. This suggests that this property is an areal feature.[6] However, since the issue at hand has been discussed more for Kwak'wala than for Coast Tsimshian, I will use some of the analyses of Kwak'wala as a starting point for the analytical discussion.

3 One Possible Analysis

The pre-NP location of the case connectives is similar to location of determiners or prepositions other languages. This overlap in distribution suggests that the connectives might be profitably analyzed as one of these elements—the precise choice will not matter—with a fairly normal combinatorics, but with an 'adjusted' phonology. Thus, there will be two representations associated with each sentence (which could be related in a number of different ways). For concreteness, a possible representation of the combinatorics for the Coast Tsimshian sentence in (2) would be as in (9):

(9)

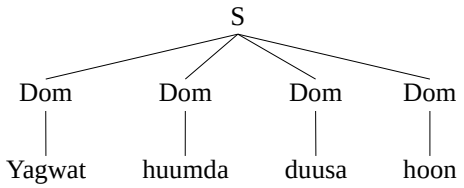


The key elements of the combinatorics are that the arguments of verbs are constituents and these constituents, in fact, include the connectives (such constituents appear as NPs in (9)). Furthermore, the verb combines with these nominal constituents in the ordinary fashion.

The second representation would represent something more like the phonological constituency of a sentence. A possible representation of this sort of structure for the Coast Tsimshian sentence in (2) would be as in (10) (I neutrally call each constituent here Dom, short for domain):

[6]However, there are also some similarities with the determiners in at least two Peruvian languages: Yagua, a Peba-Yaguan language of Peru (see Payne and Payne (1990) for primary data; Anderson (1993) for further discussion) and Chamicuro, an Arawakan language of Peru (see Parker (1999)). This suggests the issue discussed here is not merely confined to the Pacific Northwest.

(10)



In contrast to (9), the connectives are attached to their hosts in (10). Thus, they are outside of the constituents that they are semantically relevant to in (10).

This style of analysis has been explored (somewhat implicitly) for Kwak'wala by Klavans (1985, 106–107) and in a slightly different instantiation by Anderson (2005, ch. 2 & 3).[7] Additionally, an analysis in this style could be implemented in HPSG using a linearization domains approach (see Reape (1994)). On such an approach, (9) would be the tectogrammatical representation (the combinatoric tree) while (10) would be the phenogrammatical representation (the linear syntax/prosodic representation) (see Curry (1961) for discussion of these terms and possible motivations for differentiating the kinds of representations).

Provided that a domain-based approach makes certain standard lexicalist assumptions, extending it to the Coast Tsimshian data would be problematic. The problem arises at the confluence of two assumptions. The first of these is that the smallest unit that both the tectogrammar and the phenogrammar manipulate is the word. This assumption offers a clear morphology-syntax interface and, if accurate, would provide an explanation for the cohesiveness of words (see Bresnan and Mchombo (1995) for discussion why this is important). The second of these assumptions is that there is some phonological processes that are sensitive to particular domains—most crucially for this work, the word and the phrase.[8] Furthermore, the boundaries relevant for the phonology are assumed to coincide with the boundaries of the syntax: this offers a clean syntax-phonology interface. So, on these assumptions, if the tectogrammar and phenogrammar only manipulate words, the boundary between case connectives and their hosts has to be a phrasal one. This predicts that only phrasal (postlexical) phonological processes should occur between case connectives and their hosts; this prediction is false in Coast Tsimshian, as the next section will show.

4 Case Connectives As Affixes

This section considers whether phonological and morphological behavior within Coast Tsimshian supports treating the sequence of word + case connective as a sin-

[7] The analysis in Anderson (2005), however, does not suffer from the problems here because the connectives are forced to become part of prosodic words, capturing the lexical phonology-affects that I will discuss in the next section. However, this analytical move necessitates a weaker syntax-phonology interface than the one included in the analysis in section 5. Regrettably, space does not permit me a more in-depth comparison of the analyses.

[8] See Kiparsky (1982) for some discussion of why the distinction should be made. Note that this seems to be a common assumption made by quite a few phonologists; for example, it assumed by much Optimality Theoretic work, starting with Prince and Smolensky (2004).

gle word or as two parts of a larger phrase. The discussion, though not a straightforward application of the tests for wordhood vs. clitichood proposed by Zwicky and Pullum (1983), is nevertheless in the spirit of Zwicky and Pullum's work. The discussion here heavily relies on and comes to the same sorts of conclusions as Stebbins (2003) (see in particular pp. 399–402 and 405–406) and Mulder (1994) (see in particular pp. 24–25).

I will argue that the morphophonological behavior supports treating connectives as a part of the word that also includes their host. The evidence principally comes from the behavior in two phonological phenomena—*a*-deletion and stem-final lenition—although some other areas provide additional relevant data. Although this section will discuss a certain amount of Coast Tsimshian phonology, the discussion intentionally will not be couched in a particular phonological framework. In fact, the only crucial assumption I will make about the phonology is that particular phonological phenomena are found only in certain domains, an assumption that could be incorporated in different ways with different frameworks.

4.1 *A*-Deletion

The first of several telling (morpho)phonological phenomenon that support the affixal status of case connectives is what I will call *a*-deletion.[9] In *a*-deletion, the *a* of the connectives *-a* and *-as* does not appear when the preceding phonetic environment includes a vowel, *l*, *m*, or *n*. This 'deletion' occurs in (11), where the absolutive connective *-a* would follow an *l*:

(11) Gol waab-s Harry. (← *Gol-a waab-s Harry)
tumble.down house-POSS.CN (name)
'Harry's house tumbled down.' (Stebbins, 2003, 396)

However, if one considers similar phonetic environments that span word boundaries, the 'deletion' is not found. An example of this is in (12), which has the same environment (bolded) as (11) should have:

(12) Ada smga**l a**m-gooyginsg-it.
And very good-pastime-DEM
'And [it is] a good pastime.' (Mulder, 1994, 163)
(Not *smgal mgooginsgit)

This difference in the domain of occurrence of *a*-deletion suggests that it can only occur within a word. (I do not know how general or restricted this deletion process may be within words, based on the data available to me.) With *a*-deletion being a word-internal phenomenon, we therefore must in turn conclude that the connectives are a part of the preceding word in order for the 'deletion' to occur.

[9] In spite of the name I give it here, deletion may not be best analysis of this phenomenon.

4.2 Stem-Final Lenition

Another phonological phenomenon with similar results to *a*-deletion is what Stebbins (2003) calls stem-final lenition. In stem-final lenition, voiced stops appear in lieu of voiceless ones, when followed by a vowel. (In this subsection all alternating [or putatively alternating] stops will be bolded.) This phonological phenomenon occurs when the conditioning environment includes a suffix. One such example is the pronominal affix *-u* '1SG.ABS' in (13):

(13) /gɑ**p**-u/ → [gɑ**b**u] (orthographic {*gɑ̱bu*})
eat-1SG.ABS
(Stebbins, 2003, 405)

Stem-final lenition also occurs when the conditioning vowel is part of a connective. This is exemplified in (14):

(14) /ɢɑ-nuːt**k**-æ/ → [ɢɑnuːt**g**æ] (orthographic {*ganuutga*})
PL-dress.up-ABS.CN
(Stebbins, 2003, 405)

Furthermore, stem-final lenition, like its name suggests, fails to apply across a word-boundary. This is illustrated in (15):

(15) /... gaik-**t** ædæ-t ... / → [gaik**t**ædæt] (Mulder, 1994, 131)
chest-3.POSS and-3.ERG

Since stem-final lenition does not occur across words, we have to conclude that this process is word-internal. Furthermore, since the case connectives are among the elements that condition this process, they must be word-internal as well. Thus, both *a*-deletion and stem-final lenition point to treating the case connectives as part of the word in order to have an accurate and uncomplicated analysis of the phonology.

4.3 Other Considerations

In addition to *a*-deletion and stem-final lenition, there are two other phonological phenomena that support the view that case connectives are contained within a word that includes their 'host'. The evidence these data provide is less strong than *a*-deletion and stem-final lenition because some of the details have yet to be fully elucidated, but still broadly support the same conclusion.

As Mulder (1994, 25) points out, when an *s*-final stem is followed by an *s*-initial connective, just one [s] surfaces. This is exemplified in (16):

(16) Baasga sts'ool. (*baassga sts'ool)
afraid.ABS.CN beaver
'Beaver was afraid' (Mulder, 1994, 25)

It appears that there are no instances of geminate [s] within words in Coast Tsimshian. If confirmed, this *s*-simplification process would be yet another word-internal phonological phenomenon that includes connectives, like stem-final lenition. If disconfirmed, *s*-simplification would be a morphologically-specific alternation, again supporting the affixal status of the connectives. If it turns out that geminate [s] is entirely absent from Coast Tsimshian—in both words *and* phrases—then this "de-gemination" phenomenon would have to be considered a general phonological phenomenon in Coast Tsimshian and, thus, not telling about which domain the connectives belong to.

Additionally, in environments that are not currently well-understood (though impressionistically, where a large number of consonants appear), an epenthetic vowel appears between the stem and connective, as illustrated in (17), with the epenthetic vowel bolded:

(17) deentg-***a****sga* vs. ha'ligoot-*sga*
avenge-ABS.CN think-ABS.CN (Mulder, 1994, 35, 36)

As epenthesis is not reported in Coast Tsimshian between words, this would seem to be yet another word-internal phonological process. If it, in fact, is, this would be another example of a word-internal phonological phenomenon occurring due to the presence of a connective.

Finally, Dunn (1979, 131) reports that speakers always include the connective with its preceding word in pausing and hesitation phenomena. This mostly clearly supports the view that connectives group with the preceding material instead of the following material, as either affixes or as prosodically-deficient words. However, this patterning would have a very natural explanation if the connectives were affixes on the preceding word, since it is very common cross-linguistically to pause between words.

Overall, the boundary phenomena considered throughout this section strongly point to the the connectives being affixes on the words that precede them. While this conclusion may seem counterintuitive because it would make the case morphology appear outside the nominal unit that it, in some sense, goes with, the (morpho)phonological evidence nevertheless seems to strongly point towards this conclusion.

5 An EDGE-based Analysis

If we take, as a baseline, the view that the sequence Host + CaseConnective is one word that the phrasal syntax manipulates as a whole (as argued for in the previous section), the question remains how the clausal syntax of Coast Tsimshian should be accounted for. In particular, how can the apparent 'bracketing paradox' surrounding the connectives be resolved in order to license Coast Tsimshian clauses? The key idea behind the analysis presented here is that the case connectives might be viewed as a kind of edge-inflection; that is, the case connectives are affixes that

must appear within a word at the edge of some (syntactic) domain (this is a possible analysis of English possessive *'s*, for instance). This style of analysis has been pursued by some constraint-based grammarians, and in particular by members of the GPSG and HPSG community. In the GPSG and HPSG analyses the relevant feature has been called EDGE and it appeared in work by Nevis (1985); Zwicky (1987); Miller (1992); Halpern (1995); Tseng (2003, 2004); and Crysmann (2010).[10] This feature will also be a key component in the analysis of Coast Tsimshian data here.

However, because Coast Tsimshian case connectives are not realized within the constituent they mark, something more has to be said: merely adding the EDGE feature and allowing some elements to select for it is not sufficient for analyzing the Coast Tsimshian data. Thus, the analysis also includes a constructional (phrase-structural) element that will take information from the EDGE feature and ensure that it matches certain features of other expressions in the clause.

The analysis can broken down into a lexical part and a constructional part. The next two subsections will detail each in turn. I will then wrap up this section by explicating how the EDGE-based analysis that proposed here handles some of the more complex data noted in section 2.

5.1 Lexical Forms for Case Connective-Inflected Words

The grammar must have some means of licensing the connective-affixed words. I assume that this is accomplished through the following (general) lexical rule:[11]

(18)

$$\begin{bmatrix} \textit{lexeme} & \\ \text{FORM} & \langle\, \boxed{1} \,\rangle \\ \text{SEM} & X \end{bmatrix} \mapsto \begin{bmatrix} \textit{word} & & \\ \text{FORM} & \langle\, \text{F}_{casecon}(\boxed{1}) \,\rangle & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \textit{noun} \\ \text{EDGE} \mid \text{RIGHT} & \begin{bmatrix} \text{CASE-MARKING} & \textit{case} \\ \text{MARKED-INDEX} & \textit{index} \end{bmatrix} \end{bmatrix} \\ \text{SEM} & X \,\&\, Y & \end{bmatrix}$$

The lexical rule in (18) accomplishes several key things. First, it specifies the appropriate morphological form of the word, via the morphological function I call $\text{F}_{casecon}$.[12] It also specifies the value of the word's EDGE feature. Because the locus of realization in Coast Tsimshian is at the right-edge of the word, the relevant feature path (following Tseng (2003)) is EDGE|RIGHT (henceforth abbreviated EDGE|R). The value of the CASE-MARKING feature (C-M) within the EDGE

[10] Poser (1985) also includes a similar idea but his analysis pre-dates the EDGE feature as such.

[11] In the end, it is the resulting morphologically complex words and their feature structural specifications that are important, so this part of the analysis could be re-cast in any system that would allow for the desired 'outputs'.

[12] I assume that (18) is a generalized version of several specific lexical rules, so strictly speaking, there would not be one function $\text{F}_{casecon}$, but multiples ones for different case/noun/determiner combinations. Furthermore, for forms that have undergone '*a*-deletion', a portion of F_{abs} could be specified as the identity function to handle the apparent 'zero'.

feature is given generally as *case* in (18), but would, in fact, be a specific case value for a specific lexical rules. Finally, the lexical rule in (18) adds the appropriate determiner semantics (Y) to the semantic value of the word and readies the word to interact with other words to yield the desired linking of determiner and nominal semantics (via the MARKED-INDEX [MRKD-IND] feature, as will be seen).

So for the example word *duusa* 'cat.ABS.CN', the result of (18) will be (19):

(19)
$$\begin{bmatrix} \textit{word} & \\ \text{FORM} & \langle\ \textit{duusa}\ \rangle \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{CASE} & \textit{case} \end{bmatrix} \\ \text{EDGE}\,|\,\text{R} & \begin{bmatrix} \text{C-M} & \textit{abs} \\ \text{MRKD-IND} & y \end{bmatrix} \end{bmatrix} \\ \text{SEM} & cat'(x)\ \&\ the'(y) \end{bmatrix}$$

Because this word includes an absolutive connective, it is specified as EDGE|R|C-M *abs*. The added semantics (corresponding to Y of (18)) is the $the'(y)$. The y is also the value of MRKD-IND, which will ensure that the $the'(y)$ modifies the desired semantic entity.[13]

The lexical rule in (18) does not specific the value for the HEAD|CASE feature in (19) (the *case* value that appears in (19) is consistent with any specific case). However, this feature is included in (19) because it will ultimately play a role in the analysis. This CASE feature is covert; it is not directly inferred from the morphological form. However, having such a CASE feature facilitates the analysis in several ways. First, it leads to fairly ordinary verbal lexical entries (i.e. the verbs can select the case of their dependents as usual). Second, I believe it would facilitate an analysis of the 'raised' auxiliary-affixed ergative pronominals (whose analysis would take me outside the scope of this paper). Lastly, it enables a straightforward statement of the phrasal licensing of the noun phrases, a topic to which I now turn.

5.2 Licensing Phrases

In spite of the unusual location of the case morphology in Coast Tsimshian, a large portion of the phrasal side of the analysis will be quite ordinary, for a verb-initial language. The Coast Tsimshian clause (or a large subpart of it) will be combined using the general combinatoric construct I call the *head-all-valents-cxt*, given schematically in (20):[14]

[13] Likely the determiner semantics given here is too simplified, since it omits any scopal and contextual information. These elements could be easily added to present account once the requisite generalizations are understood.

[14] This combinatoric construction is identical, or nearly so, to a number of previous HPSG proposals: Schema 3 from Pollard and Sag (1994), *sai-ph* from Ginzburg and Sag (2000), and *aux-initial-cxt* from Sag (to appear))

(20) (preliminary version)
head-all-valents-cxt ⇒

$$\begin{bmatrix} \text{MTR} \mid \text{SYN} \mid \text{VAL} & \langle\ \rangle \\ \text{HD-DTR} & \boxed{1} \\ \text{DTRS} & \left\langle \boxed{1}\begin{bmatrix}\text{VAL} & \langle\ \boxed{2}, \boxed{3}, \ldots, \boxed{n}\ \rangle\end{bmatrix}, \boxed{2}, \boxed{3}, \ldots, \boxed{n} \right\rangle \end{bmatrix}$$

The construction in (20) allows a head to combine with all its valents at once and will license the head-initial order found in Coast Tsimshian clauses, as well as the generally rigid order of the postverbal arguments. The 'flat structure' analysis embedded in (20) has been a common HPSG analysis of verb-initial languages since Borsley (1989, 1995) and without any obvious evidence for a more hierarchical structure in Coast Tsimshian, the analysis will not include any.

The *head-all-valents-cxt* in (20) will be treated as a subtype of *hd-cxt*, subjecting it to all the constraints on *hd-cxt*. The constraint of *hd-cxt* that is most central to this analysis is the Head Feature Principle, which requires all HEAD features to be shared between a mother and its head-daughter (see, for example, Sag to appear, 115). Furthermore, because this analysis includes EDGE features, something must be said about the permitted information sharing surrounding them. I assume the Edge Feature Principle of Tseng (2003, 327) to handle the structure sharing of EDGE features. Supposing that the Edge Feature Principle is a constraint on all phrasal constructs, this constraint has the form given in (21):

(21)

$$\textit{phrasal-cxt} \Rightarrow \begin{bmatrix} \text{MTR} \mid \text{SYN} \mid \text{EDGE} & \begin{bmatrix}\text{LEFT} & \boxed{1} \\ \text{RIGHT} & \boxed{2}\end{bmatrix} \\ \text{DTRS} & \left\langle \left[\text{SYN} \mid \text{EDGE} \mid \text{L}\ \boxed{1}\right], \ldots, \left[\text{SYN} \mid \text{EDGE} \mid \text{R}\ \boxed{2}\right] \right\rangle \end{bmatrix}$$

Intuitively, (21) requires that the mother's left and right EDGE feature values must match the same features on its leftmost and rightmost, respectively, daughters.

As explicated to this point, the *head-all-valents-cxt* only accounts for the simpler word order and valency facts in Coast Tsimshian. To license the immediate adjacency between the word with case morphology and the marked phrase or to establish the semantic binding between the determiner semantics of the connectives and the nominal semantics they go with, additional constraints need to be added. The *head-all-valents-cxt* with the requisite additional constraints is given in (22):[15]

[15]This same intuition as (22) could be implemented in a system with just binary-branching phrase structures. In such a case, the rule in (i) could be used recursively:

(i)

$$\begin{bmatrix}\text{VAL} & \boxed{A}\end{bmatrix} \rightarrow \mathbf{H}\begin{bmatrix}\text{EDGE} \mid \text{R} & \begin{bmatrix}\text{C-M} & \boxed{1} \\ \text{MRKD-IND} & \boxed{2}\end{bmatrix} \\ \text{VAL} & \langle \boxed{3} \rangle \oplus \boxed{A}\end{bmatrix}\ \boxed{3}\begin{bmatrix}\text{CASE} & \boxed{1} \\ \text{IND} & \boxed{2}\end{bmatrix}$$

I chose the formulation in the text since there is no obvious evidence supporting a more articulated structure in Coast Tsimshian.

(22) (final version)

hd-all-valent-cxt $\Rightarrow$

$$\left[\begin{array}{l}\text{MTR}\,|\,\text{SYN}\,|\,\text{VAL}\quad\langle\ \rangle\\ \text{HD-DTR}\quad\boxed{0}\\ \text{DTRS}\quad\left\langle\boxed{0}\left[\begin{array}{ll}\text{EDGE}\,|\,\text{R} & \left[\begin{array}{ll}\text{C-M} & \boxed{C_1}\\ \text{MRKD-IND} & \boxed{i_1}\end{array}\right]\\ \text{VAL} & \langle\,\boxed{1},\boxed{2},\ldots,\boxed{n}\,\rangle\end{array}\right],\boxed{1}\left[\begin{array}{ll}\text{HEAD}\,|\,\text{CASE} & \boxed{C_1}\\ \text{SEM}\,|\,\text{IND} & \boxed{i_1}\\ \text{EDGE}\,|\,\text{R} & \left[\begin{array}{ll}\text{C-M} & \boxed{C_2}\\ \text{MRKD-IND} & \boxed{i_2}\end{array}\right]\end{array}\right],\ldots,\boxed{n}\left[\begin{array}{ll}\text{HEAD}\,|\,\text{CASE} & \boxed{C_n}\\ \text{SEM}\,|\,\text{IND} & \boxed{i_n}\\ \text{EDGE}\,|\,\text{R} & \textit{none}\end{array}\right],\ldots\right\rangle\end{array}\right]$$

($n \geq 2$)

As in (20), (22) still saturates all the valents of the head at once. However, it additionally has two sets of chains of constraints. The first deals with case and says, in essence, that the EDGE|R|C-M value must be identical with the HEAD|CASE value of the next daughter over for all the daughters in this construct. The second deals with semantic indices. It says that the EDGE|R|MRKD-IND value must be identical with the SEM|IND value of the next daughter over, again for all the daughters in the construct. Recall, in lexical descriptions of edge-marked words, the MRKD-IND value is equated with the index of the determiner in the semantic representation (as in (19)). With MRKD-IND value also being equated with the IND value of the next daughter over (per (22)), this will ensure that the desired nominal semantics is connected with the desired determiner semantics.

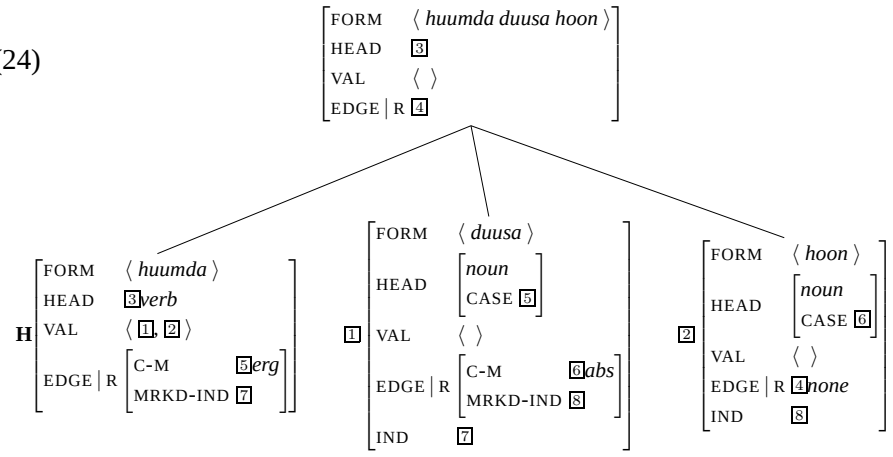
To see how (22) succinctly deals with the large collection of information that is relevant for licensing a Coast Tsimshian clause, let us consider an example. The lexical description of the verb in (23) could be the head-daughter of (22):

(23)
$$\left[\begin{array}{ll}\textit{word}\\ \text{FORM} & \langle\ \textit{huumda}\ \rangle\\ \text{SYN} & \left[\begin{array}{ll}\text{HEAD} & \textit{verb}\\ \text{VAL} & \left\langle \text{NP}[\text{HEAD}\,|\,\text{CASE}\ \textit{erg}]_i, \text{NP}[\text{HEAD}\,|\,\text{CASE}\ \textit{abs}]_j \right\rangle\\ \text{EDGE}\,|\,\text{R} & \left[\begin{array}{ll}\text{C-M} & \textit{erg}\\ \text{MRKD-IND} & i\end{array}\right]\end{array}\right]\\ \text{SEM} & \textit{smell}'(e,i,j)\ \&\ \textit{the}'(i)\end{array}\right]$$

Observe that (23) says nothing about the EDGE values of its valents (though it does specify the EDGE value of the word itself); the appropriate matching of morphological forms and feature values falls out from (22). The sisters of (23) are required, by the *head-all-valents-cxt*, to be identical to the verb's VAL list: thus, the above verb must have ergative and absolutive NPs as its sisters. The *hd-all-valents-cxt* also requires featural identity between the EDGE case-marking and the CASE value within adjacent pairs of elements on the DTRS list. So ultimately the chain of case constraints forces the CASE values in the lexical entry in (23) to have preceding expressions that are appropriately affixed.

Taking the entry in (23) and the constraints on the *head-all-valents-cxt* (including the HFP, (21), and (22)) gives the structure in (24), a structure of the relevant part of (2):

(24)



As indicated by 5, 6, 7, and 8 in the tree in (24), the three daughters in this instantiation of the *hd-all-valents-cxt* meet the chained adjacent constraints of (22)—all CASE-MARKING and MARKED-INDEX features are shared with the CASE and INDEX features, respectively, of the next daughter to the right.

5.3 The EDGE-Based Analysis and the More Complex Data

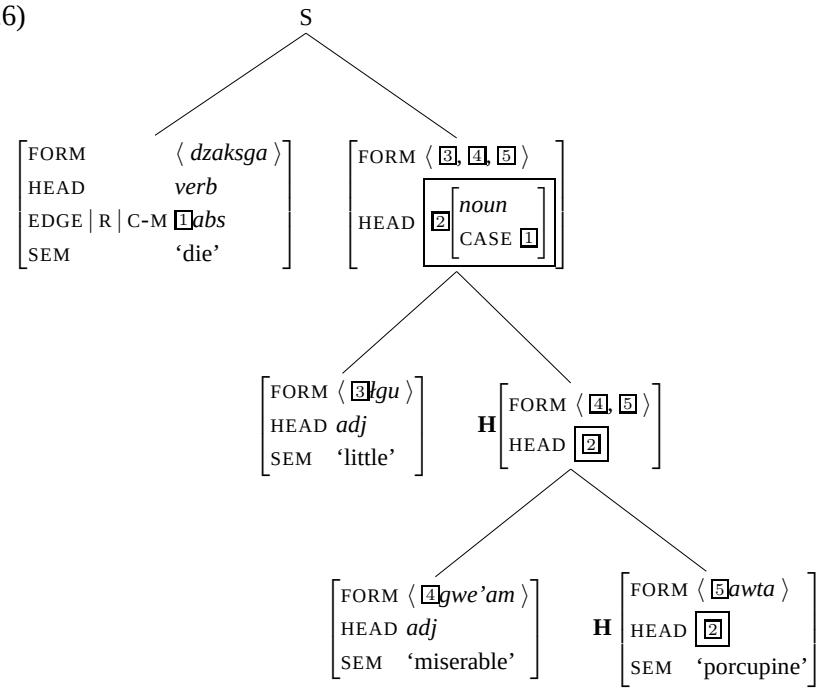
Having outlined the basics of the EDGE-based analysis in the previous subsection, I consider some of the data presented in section 2 and show how they can easily accounted for on the EDGE-based approach.

Examples like (25) indicate that adjectives can intercede between connectives and nouns:

(25) Ada ła dm dzaksga łgu gwe'am awta.
Ada ła dm dzak-[sga łgu gwe'am awta].
And near.FUT die-ABS.CN little poor.ADJ.CN porcupine
'And poor little porcupine was about to die.' repeats (5)

Sentences like this are perfectly expected on the EDGE-based analysis. On just about any analysis of adjectives, the noun will be the head of each noun-adjective unit and, by the Head Feature Principle, will share its HEAD features throughout the collection of nominal constituents. Thus, the CASE information of the noun phrase seemingly 'percolates' to the appropriate syntactic domain—adjacent to its marking word in the *hd-all-valents-cxt*—enabling (22) to license these sorts of phrases. A EDGE-based analysis tree of the relevant part of (25) is given in (26):

(26)



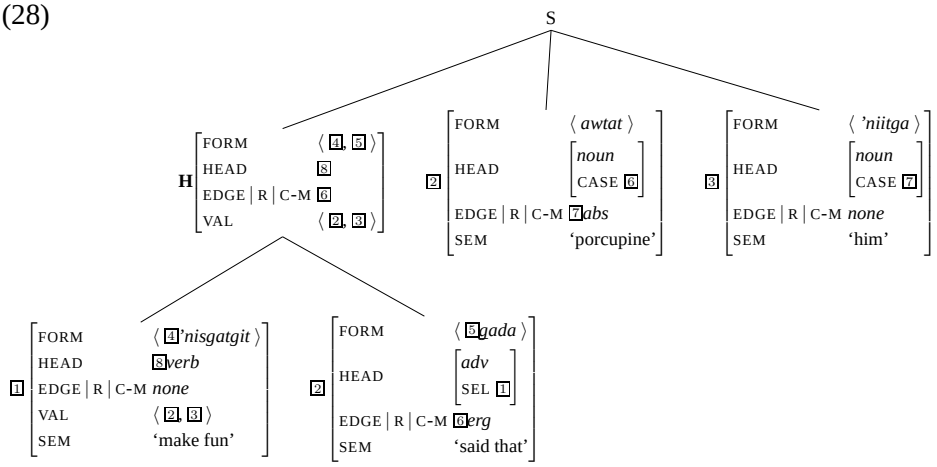
There are also the instances of case connectives on postverbal (possible) adverbs, as exemplified again in (27):

(27) Łat ’nisgatgit gada awtat ’niitga.
Ła-t ’nisgatg-it gad-[a awta]-[t ’niitga].
PST-3.ERG make.fun-3.ABS report-ERG.CN porcupine-ABS.CN 3SG

‘It is said that porcupine made fun of him.’ repeats (6)

These, too, are easily accommodated on the EDGE-based analysis, on almost any conceivable analysis of *gad-*. Let us assume, for the sake of discussion, that *gad-* selects for a fully unsaturated verb. (Other analyses where the adverbial element is either a valent of the verb or an affix are also possible; any of them will yield similar results to the analysis sketched here). Thus, the adverbial and verb will form a phrasal constituent, as shown in (28), the relevant part of (27):

(28)



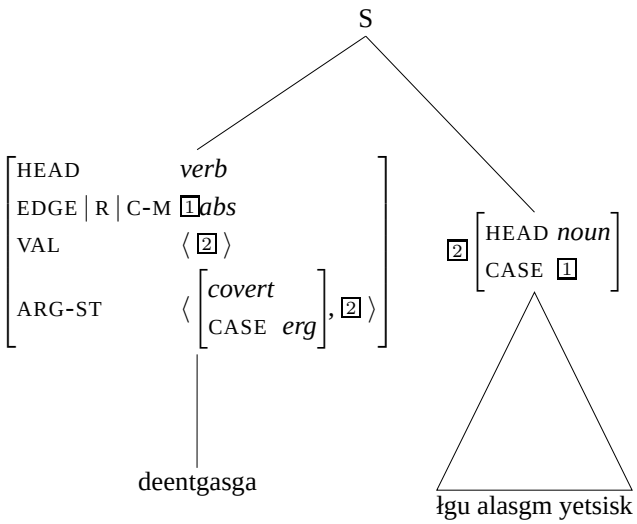
The structure in (28) contains all the required specifications of the EDGE-based analysis. Lexically specified on the adverbial element *gada* is the EDGE|R|C-M value of *erg*. By the Edge Feature Principle (21), the EDGE value of the adverb (6) must be—and is—shared with the EDGE feature of its mother. This structure-sharing allows the daughters of the S to meet the constraint from (22) As the tags labeled 6 show, the verbal constituent that is the head daughter of the S has an EDGE feature that appropriately identical to the CASE value of the next constituent over, thus licensing the phrase.

Finally, the EDGE-based analysis, augmented with the now standard HPSG analysis of non-local realization (Bouma, 1996; Miller and Sag, 1997), also can handle the absence of a postverbal argument, such as occurs in (29):

(29) ’Yagay ’wii gyisiyaasg-at in-t [deentg-asga łgu alasgm
instead great northwind-3 TOP-3 avenge-ABS.CN little weak.ADJ.CN
yetsisk].
animal
‘Instead, it was the great northwind that avenged the little weak animal.’
repeats (7)

The Bouma/Miller and Sag analysis treats the absence of such arguments via a mismatch between the ARG-ST and VAL lists: the ‘missing’ argument appears on the ARG-ST list of the governing head, but not that head’s VAL list. If ‘missing’ arguments in Coast Tsimshian are treated in the same fashion, then data like (29) can easily be accommodated in the EDGE-based analysis. With a missing ergative argument, a verb like *deentg-* ‘avenge’ has a VAL list that just contains its absolutive argument. As long as the lexical constructions permit connective-affixed verbs for all cases (and determiner types), the form *deentgasga* will be generated and have the specification EDGE|R|C-M *abs*. When such a form is combined with its one absolutive valent, it will meet all the constraints on *head-all-valents-cxt*. In particular, the EDGE values on the verb will match the CASE and IND values of the next constituent over. A tree showing this is given in (30):

(30)



In fact, this sort of example clarifies why the matching should be done within the constraint on *hd-all-valents-cxt* rather than (purely) in the lexical entries. While there is no technical hurdle to doing the matching in the lexical entries, constraints would have to be stated for every possible list of valents a verb could have (including those with missing arguments). In contrast, on the analysis sketched above, the Argument Realization Principle (the constraints on mismatches between the ARG-ST and VAL list) and the constraint on the *hd-all-valents-cxt* operate independently, yet come together to the license the appropriate structures when the two constraints interact.

Thus, in addition to the basic data outlined in section 5.2, the EDGE-based analysis also handles a wide-array of other data including the multiple adjectives, the connective-marking on (possible) adverbials, and, with slight augmentation from pre-existing analyses, the case-marking facts when verbs have a 'missing' postverbal argument.

6 Concluding Remarks

With a close examination of the behavior of the Coast Tsimshian host + case connective sequences, the evidence clearly points to the connectives being suffixes, even though what they suffix to—words lying outside their semantic/functional domain—is not 'normal' for case-marking affixes. In spite of the apparently odd location of these affixes, a fairly simple analysis of the syntactic combinatorics is available as long as the syntax is 'informationally rich'; that is, the dependency between the connective and the noun phrase it marks are 'visible' to the syntax in some way. In the EDGE-based analysis presented here, that visibility was achieved via the EDGE features on the connective-affixed words and the corresponding CASE and INDEX features on the nominal expressions. These features were then brought together by the constraint in (22), which requires words with

certain EDGE features to be linearly adjacent to the word they mark. This analysis presents a simple yet elegant means of respecting the morphological constituency while still getting the various syntactic facts correct. The constraint in (22) combines morphological information, subcategorization requirements, and syntactic location to ultimately license Coast Tsimshian clauses. This suggests that, at least in some languages, all three of these elements can be important to understanding case-marking phenomena. So, it seems that the Coast Tsimshian case connectives are not so much 'in the wrong place', but rather they can be understood as occurring in a 'normal' place once a sufficient analytical apparatus for the morphology-syntax interface is in place.

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Analyzing interacting phenomena: Word order and negation in Basque

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Abstract

We explore the interaction of sentential negation and word order in Basque using a small experimental implemented grammar based on the Grammar Matrix (Bender et al., 2002, 2010) to test the analyses. We find that the analysis of free word order (Fokkens, 2010) provided by the Grammar Matrix customization system can be adapted to handle the Basque facts, and that the constructional approach taken in that analysis supports the integration of negation. Keywords: Basque/Euskara, [eus], word order, negation, Grammar Matrix

1 Introduction

We present a case study of using grammar engineering to explore the analysis of interacting phenomena, as proposed in Bender 2008. In particular, we look at the case of Basque [ISO-639: eus] word order and negation and ask whether existing HPSG analyses of each of these can be adapted to work together. The development work was facilitated by open-source grammar engineering tools, including the Grammar Matrix customization system (Bender et al., 2002, 2010), the LKB grammar development environment (Copestake, 2002) and the [incr tsdb()] grammar profiling software (Oepen and Flickenger, 1998). The grammar and the accompanying word order and negation test suite are available for download and further development and experimentation.[1]

Although word order is a central concern for theoretical syntax,[2] no HPSG analysis of major constituent word order has been presented which attempts to account for its attested ability to interact with negation (Dryer, 1988). As for negation, Kim (2000) examines sentential negation within the HPSG framework in a small selection of both European and Asian languages. Looking to Dahl (1979) for typology, Kim describes three types of negative marking strategies: morphological marking of negation, syntactic marking through a selected adverb, and negative auxiliary verbs. Word order is not impacted by negation in any of the languages Kim considers. Thus, on the basis of the existing literature, one might expect word order and negation to be independent (orthogonal) phenomena, whose analyses could perhaps be expected to be trivially interoperable crosslinguistically.

However, descriptive linguists have reported that negation interacts with word order in Basque (Manandise, 1988; Saltarelli, 1988), with negative and positive sentences occurring in differing word order patterns. Thus word order and negation

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[1] `http://depts.washington.edu/uwcl/matrix/euskara/`

[2] At least those versions of syntax which claim to be surface-oriented.

can not be treated entirely independently in Basque. On the other hand, we find that our independently motivated analysis of the word order facts of non-negated sentences neatly sets up the machinery needed to handle the additional constraints that arise under negation. More specifically, word order patterns fall broadly into two classes and, on our analysis, each of these classes always employs a particular construction-specific rule. Because sentential negation is only compatible with one of these word order classes, we propose a HEAD feature, [NEGATED *bool*], and use it to ensure that negated and non-negated sentences can only occur with the observed major constituent orderings.

2 Basque

Basque is a language isolate spoken across the Western Pyrenees in Northern Spain and Southern France. It is an ergative-absolutive language with a rich system of agreement markers expressed on the finite element of verbal clauses. Most lexical verbs in Basque are incompatible with the morphological categories that indicate finiteness. For this reason, most Basque sentences contain an auxiliary verb which supports tense and mood markers, as well as agreement with the person and number of the verbal arguments. Thus a typical intransitive clause in Basque contains at least three elements: the subject, the lexical verb, and the finite auxiliary.[3] An example is given in (1) (Manandise, 1988, 8).[4] This example also illustrates what is often considered the basic order for Basque clauses (Saltarelli, 1988).

(1) Miren ibilli da
Mary.ABS walk.PERF 3SGO.PRES
Mary has walked. [eus]

With respect to the nearly free permutations of major constituent order, Laka (1996) points out that while there is much variation, the variants are not informationally equivalent. The position to the left of the lexical verb is singled out in Basque descriptions as the *galdegaia*, the object of inquiry, or the focus position. The importance of this notion is best illustrated with an example (2) (Manandise, 1988, 8-9). While all of the sentences in (2) are generally grammatical, only (2b) is an acceptable answer to the question in (2a). In the final section of this paper, we briefly discuss the focus position's interaction with the interpretation of negation.

(2) a. Liburu bat nork irakurri du?
book one.ABS.SG who.ERG.SG.FOC read.PERF 3SGO.PRES.3SGA
Who has read one book? [eus]

b. Liburu bat Mirenek irakurri du.
book one.ABS.SG Mary.ERG.SG.FOC read.PERF 3SGO.PRES.3SGA
Mary has read one book. [eus]

[3]Pronominal arguments may be indicated solely through agreement marking on the auxiliary.
[4]Glosses here and throughout are adapted from Manandise (1988).

c. Mirenek liburu bat irakurri du.
Mary.ERG.SG book one.ABS.SG.FOC read.PERF 3SGO.PRES.3SGA
Mary has read one book. [eus]

3 Analysis: Word order

While the ordering of major constituents in Basque is generally free, or more accurately, pragmatically determined, at least one author claims that Basque does not freely permute all combinations of the major constituents. Manandise's (1988, 15) constraint on possible orderings, is reproduced as (3).

(3) If the lexical verb is to the left of the auxiliary, then the lexical verb must be left-adjacent to the auxiliary.

(4) *Liburu irakurri Mirenek du.
book.ABS.SG READ.PERF Mary.ERG.SG 3SGO.PRES.3SGA
Mary has read a book. [eus]

Manandise further claims that this constraint holds for Basque main clauses with up to three NPs and that beyond this constraint, no further checks on major constituent order apply. The sentence in (4), for example, is ruled out by (3). In fact there are further constraints on word order: those imposed by interaction with polarity, which is discussed in the next section.

Manandise's constraint suggests a bifurcation of the data into those sentences in which the auxiliary precedes the lexical verb and those in which it follows. The patterns in (5) schematize these two (complementary) patterns. In aux-first strings, the NPs can occur freely around and between the auxiliary and the verb, as summarized in (5a). When the verb precedes the auxiliary, however, NPs may not intervene between them, as shown in (5b). First we turn our attention to achieving free word ordering amongst the first group.

(5) a. (NP) Aux (NP) V (NP)

b. (NP) V Aux (NP)

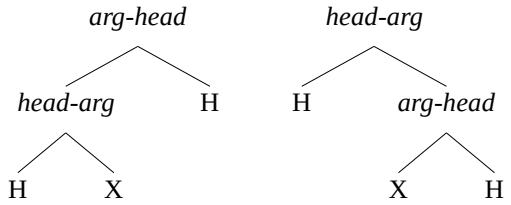
For the strings of the aux-first type (5a), we wish to allow free word order. We begin with the default analysis for free word order from the Grammar Matrix customization system (Fokkens, 2010).

Note that this analysis relies on binary branching rules. Following the English Resource Grammar (Flickenger 2000) and the Grammar Matrix, we take the somewhat pragmatic view that the role of derivation trees is in the first instance to serve as the scaffolding for mapping strings to semantic representations (while also modeling grammaticality). Accordingly, where the grammatical facts require a constituent, our grammar must posit one, but conversely, we don't make the strong claim that every constituent in our derivation trees will be motivated by

constituency tests. This is partially motivated by technical considerations: Our grammar is implemented within the DELPH-IN joint reference formalism (Copestake 2000), which requires rules to have fixed arity and fixed order of daughters. Given this, a grammar with binary branching rules needs far fewer rules than one that strives for flatter structures. In general, licensing free orders for n elements with maximally flat structure will require $n!$ rules. Grammars with fewer rules, even if they come at the cost of more complicated trees, are to be preferred for reasons of both parsimony and grammar maintainability.

Turning back to our analysis, as Fokkens notes, handling free word order entails much more than allowing unconstrained syntax. In addition to licensing all of the orders, the syntactic arguments need to be linked to the correct semantic positions. Fokkens handles this with a series of binary-branching rules of the familiar head-nexus types. However, simply providing both head-final and head-initial rule types for each phrasal rule leads to spurious ambiguity. To take a specific case, we consider auxiliaries: To handle the combination of properties between the verb and finite auxiliary in our grammar we take an argument composition approach to the auxiliaries (Hinrichs and Nakazawa, 1990). Such auxiliaries can combine with NP elements, and so can lexical verbs, so we have cases where multiple heads can compete for a given argument (with one head also taking the other as an argument). This ambiguity is schematized in (6), if *head-arg* rules have both head-final and head-initial forms, then both of these trees will be valid parses for the string *H X H* with no semantic difference between them.

(6)



Fokkens' approach constrains the space of possible analyses by requiring the grammar to apply any head-initial rules before any head-final rules.[5] In this way, left and right branching rules cannot factor across each other in the parse forest. Instead, given a [Aux, NP, Verb] sequence, only the bracketing [[Aux NP] Verb] is licensed.

The grammar must also rule out spurious ambiguity for sequences of the type [Aux, Verb, NP]. There is potential here for two parses using only head-initial rule types: [[Aux Verb] NP] and [Aux [Verb NP]]. The grammar we have designed enforces a single bracketing of these sequences automatically by taking advantage of the need for argument agreement on the auxiliary.

Auxiliaries in Basque agree with up to three arguments of the clause. We model this in the grammar by positing argument composition auxiliaries (Hinrichs and

[5] A feature ATTACH and a small value hierarchy are employed to effect this. See Fokkens (2010) for details.

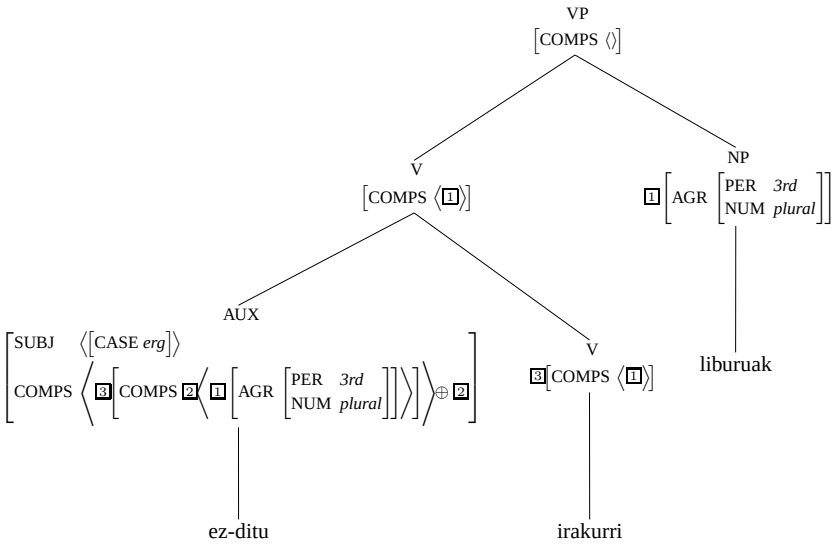
Nakazawa, 1990), and then simply having the inflected auxiliaries constrain the agreement features of all NP arguments on their valence lists. The feature structure in (7) shows some of the constraints stipulated on an auxiliary lexical type. This type inherits from Matrix core grammar type *arg-comp-aux-no-pred* (Bender et al., 2002). Note the nonempty specification for the auxiliary's first complement's first complement.

(7)
$$\left[\begin{array}{ll} \textit{trans-abssg-aux-lex} & \\ \text{SUBJ} & \left\langle \left[\text{CASE} \quad \textit{erg} \right] \right\rangle \\ \text{COMPS} & \left\langle \left[\begin{array}{ll} \text{FORM} & \textit{nonfinite} \\ \text{COMPS} & \boxed{1} \left\langle \left[\text{AGR}|\text{NUM} \quad \text{indef-or-sing} \right] \right\rangle \end{array} \right] \right\rangle \oplus \boxed{1} \end{array}\right]$$

We leverage this nonempty specification, along with the fact that in typical in HPSG grammars head-argument rules cancel elements off the valence list as the head path is projected, to constrain the analysis of sequences of the form [Aux, Verb, NP]. If the lexical verb first combines with its complement, a VP (COMPS satisfied) structure is the result. This VP is incompatible with the specification on the auxiliary's complement (as in (7) and (10)). The only licensed bracketing then, is [[Aux Verb] NP], as illustrated in (8, 9 and 10).[6]

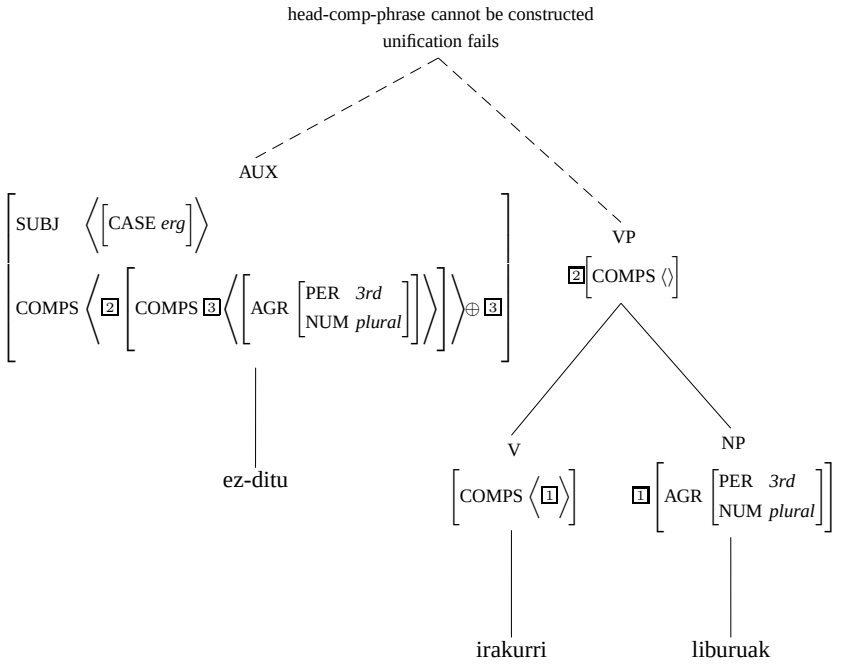
(8) ez-ditu irakurri liburuak
NEG-3PLO.PRES.3SGS read.PERF book.ABS.PL
has not read books [eus]

(9)



[6]We discuss the negation marker and provide analysis in the next section.

(10)



This analysis of the first set of data allows us to capture the flexible word order properties of Basque while avoiding spurious ambiguity. The table in (11) presents a summary of the discussion to this point. There are four rules, which combine NPs, Aux, and V in free word order patterns where the auxiliary precedes the lexical verb. We deal with potential spurious ambiguity in two patterns using the constraint on head-initial rules and valence list access.

(11)

grammar rules:	head-comp comp-head head-subj subj-head	
constraints:	head-initial rules apply low	
patterns:	H X H → [[H X] H] H H X → [[H H] X]	h-init constraint valence list access

Let us now turn to the set of examples in which the lexical verb precedes the auxiliary. Our analysis of the orders schematized in (5b) can't simply be the mirror image of those in (5a), because we need to rule out any strings in which an NP intervenes between the verb and the auxiliary. To accomplish this, the grammar is augmented with a verbal complex analysis. This option is also a part of the word-order library (Fokkens, 2010) that the Grammar Matrix customization system makes available. Rather than making the verbal complex available for all sentences, we use it only for the class of sentences schematized in (5b).

The grammar's verbal complex rule is presented in (12). This rule-type inherits from both *basic-head-1st-comp-phrase* and *head-final* types (Bender et al., 2002), which implement the Valence Principle and head-finality, respectively.

(12)
$$\begin{bmatrix} \textit{comp-aux-phrase} & \\ \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{AUX} & + \end{bmatrix} \\ \text{NON-HEAD-DTR}|\text{HEAD} & \textit{verb} \\ \text{HEAD-DTR}|\text{LIGHT} & + \end{bmatrix}$$

The feature, [VC *luk*] (mnemonic for verbal cluster), is defined in the grammar on phrasal and lexical *synsems*.[7,8] Lexical verb types are constrained to be [VC +], while auxiliaries are set to [VC −]. Head-complement rule types are then defined to inherit their VC value from their non-head daughter. These additional constraints are shown on the verbal complex rule in (13). In this way, an auxiliary which has picked up its lexical verb complement will form a phrase which is [VC +]. The value of VC on a phrase indicates whether or not the lexical verb is present in that phrase. The comp-head and subj-head rules are then made sensitive to the VC value, such that auxiliary-headed constituents cannot combine with subjects or objects unless they first combine with the main verb.

(13)
$$\begin{bmatrix} \textit{comp-aux-phrase} & \\ \text{VC} & \boxed{1} \\ \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{AUX} & + \end{bmatrix} \\ \text{NON-HEAD-DTR} & \begin{bmatrix} \text{VC} & \boxed{1} \\ \text{HEAD} & \textit{verb} \end{bmatrix} \\ \text{HEAD-DTR}|\text{LIGHT} & + \end{bmatrix}$$

To see how these types rule out phrases which contain one or more NPs intervening between the lexical and auxiliary verbs, consider the sequence [Verb, NP, Aux]. If the lexical verb first picks up the NP argument, the resulting valence list is shortened and the auxiliary will not be able to access (or constrain) case and agreement information on the NP (as described above). Thus the bracketing [[Verb NP] Aux] is ruled out. Secondly, we specify that in comp-head and subj-head rules, the head daughter must be [VC +]. In this way we avoid the bracketing [Verb [NP Aux]]. These two aspects of the grammar thus rule out the sequence under consideration, and the same facts generalize to cases with more than a single intervening NP; sequences that match the regular expression /Verb NP$^+$ Aux/ are equally unparseable.

[7] *lex-rule* types are also annotated such that they pass up the value of VC through the inflectional pipeline.

[8] *luk*, borrowed from the English Resource Grammar Flickinger (2000), is named after Polish logician Jan Lukasiewicz. It is a generalization of the type *bool* that is consistent with three values: $\{+, -, na\}$.

Turning now to grammatical strings, as with the aux-initial patterns considered above, we again confront the potential for spurious ambiguity, this time on sequences of the form [Verb, Aux, NP]. We do not wish to allow both bracketings [[Verb Aux] NP] and [Verb [Aux NP]]. The verbal complex rule we have just defined does not inherit from the *head-final-head-nexus* type which enforces that head-initial rules apply before head-final ones. This is because we use the verbal complex rule to ensure that the Verb and Aux elements appear adjacent to each other and despite the fact that the Aux element heads the phrase, we want the verbal complex rule to apply before any argument attachment in any licensed parse of the verb-first data. This is the motivation for the stipulation [LIGHT +] in the *comp-aux-phrase* presented in (13). Inspired by the LITE feature of Abeillé and Godard (2001), the feature LIGHT is defined on *synsem*s with a value *luk*. Lexical items are [LIGHT +], while phrases are [LIGHT −]. This stipulation ensures that the verbal complex rule applies before the auxiliary picks up any arguments in any successful parse.

The grammar as we have defined it thus far provides an implementation of Manandise's constraint on word order—modeling the partially free word order observed in Basque in an explicit, testable form. The table portraying information about the grammar is updated in (14) to review the grammar rules, the constraints we've defined, and ambiguous patterns that we've constrained. The next section discusses the overlay of the negation analysis onto the grammar presented.

(14)

rules:	head-comp comp-head head-subj subj-head comp-aux	
constraints:	head-initial rules apply low head-comp rules inherit VC from non-H-dtr head-final rules H is VC + comp-aux H is LIGHT +	
patterns:	H X H → [[H X] H] H H X → [[H H] X] *[V [NP Aux]] V Aux NP → [[V Aux] NP]	h-init constraint valence list access head-final rules H is VC + comp-aux H is LIGHT

4 Negation

Sentential negation in Basque is accomplished by the prefixation of a negative morpheme, *ez*, to the finite element (Manandise 1988, 12; Saltarelli 1988, 92). Manandise does not discuss the bound or free status of this morpheme, but she does present examples without whitespace between *ez* and the auxiliary—flouting typical orthographic conventions—in her introductory exposition. Saltarelli, on the other hand, explicitly calls this morpheme a particle, entailing an analysis as a free morpheme, but does not offer any argument. We follow Manandise here in treating

negation as bound for reasons analogous to those given in Kim (2000, 34) for the Korean morpheme *an*. Both Basque and Korean allow relatively free permutation of syntactic elements, but the position of *ez* is fixed to the auxiliary verb. There is no possible intervention of adverbials. These facts would have to be dealt with in the syntax if we treat *ez* as free, by treating it as bound, the Grammar Matrix's implementation of the Lexical Integrity Principle (Bresnan and Mchombo, 1995; Kim, 2000) ensures that bound morphemes cannot stray from their hosts. In our analysis, *ez* is added to *aux* types by a lexical rule.

As mentioned in the introduction, negation interacts with word order in Basque. The interaction is such that although Basque allows main clauses in which the lexical verb appears to the right or to the left of the auxiliary verb, under negation, only those constructions in which the main verb follows the auxiliary verb are licit.[9] Furthermore, in non-negated sentences, the auxiliary verb cannot appear to the left of the lexical verb, but must appear to the right (and, because of Manandise's generalization (3) it must appear immediately to the right). In this way Basque negated auxiliaries are in complementary distribution with non-negated ones with respect to their positioning on one side or the other of the lexical verb. Only those sentence-types described by the pattern in (5a) are compatible with negation, as shown in (15a), while (15b) shows patterns that can only occur without negation:

(15) a. (NP) ez-Aux (NP) V (NP)

b. (NP) V Aux (NP)

If we were to assume that negation and word order are independent—and just add the lexical rule to attach the negative morpheme to auxiliary verbs—the grammar will overgenerate, licensing strings that match the patterns in (16), even though these are uniformly ungrammatical:

(16) a. * (NP) V ez-Aux (NP)

b. * (NP) Aux (NP) V (NP)

Manandise augments her analysis with two more filters, a POS filter which rules out non-negated auxiliaries to the left of lexical verbs, and a NEG filter which rules out negated auxiliaries to their right. We formulate the specifics of these filters in terms of constraints on our analysis of word order patterns.

The analysis of word-order given above required the introduction of a construction-specific rule—a verbal complex rule which combined a left-adjacent lexical verb with a selecting auxiliary. We engineered this rule in such a way that it bisects

[9]This is only true of main clauses. In subordinate clauses, the lexical verb precedes the finite element because of an independent constraint on subordinate clauses which requires that the finite element appear finally. While the solution may rely on additional specialized rules, we believe that the approach presented here will scale as we extend our fragment to handle subordinate clauses as well.

a priori possible sentences into two groups: aux leading (5a) vs verb leading (5b). The verbal complex rule only and always appears in successful parses of the verb-leading examples. Thus, it provides a natural target for constraints that should apply to only one group or the other. We implement the constraint via a flag feature whose value is set by the negation rule and we stipulate an incompatible value for the instances of the verbal complex rule.

The grammar presented here thus defines [NEGATED *bool*] as appropriate for *head* types. We modify the lexical rule that carries out negation such that it is [NEGATED +]. The definition of a lexical verb is updated to specify [NEGATED −]. These changes ensure that the feature NEGATED encodes whether or not an auxiliary verb has been negated. Finally, we add to definition of the *comp-aux-phrase* (verbal complex rule) the stipulation [NEGATED −]. The lexical rule for negation and the updated verbal complex rule are given in (17) and (18). The interaction of these components conspires to rule out any examples in which the lexical verb appears to the left of a negated auxiliary.

(17)
$$\begin{bmatrix} \textit{neg-lex-rule} & \\ \text{HEAD}|\text{NEGATED} & + \\ \text{C-CONT}|\text{RELS} & \left\langle \begin{bmatrix} \textit{event-rel} & \\ \text{PRED} & \text{"neg\_rel"} \end{bmatrix} \right\rangle \\ \text{DTR}|\text{HEAD} & \textit{verb} \end{bmatrix}$$

(18)
$$\begin{bmatrix} \textit{comp-aux-phrase} & \\ \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{AUX} & + \end{bmatrix} \\ \text{NON-HEAD-DTR}|\text{HEAD} & \textit{verb} \\ \text{HEAD-DTR} & \begin{bmatrix} \text{LIGHT} & + \\ \text{NEGATED} & - \end{bmatrix} \end{bmatrix}$$

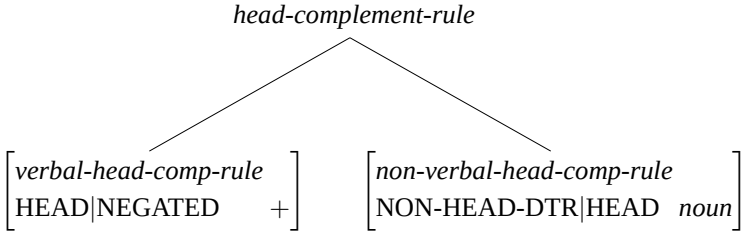
But at this point the grammar still overgenerates. We need to rule out sentence types where a non-negated auxiliary appears to the left of the lexical verb. The example in (19) is ruled out by Manandise's POS filter, but is licensed by our grammar as we've discussed it so far.

(19) *Da ibilli Miren.
3SGS.PRES walk.PERF Mary.ABS
Mary has walked. [eus]

We ruled out rightward negated auxiliaries by engineering the grammar so that all rightward auxiliaries pass through the verbal complex rule, then making this rule unavailable to negated verbs. In a similar fashion we can create a rule that all left-ward auxiliaries must pass through by creating subtypes of the head-complement

rule (20).[10] We still want to allow lexical verbs to combine with arguments without being negated, subtyping and constraining the rule in this way achieve this. Non-negated lexical verbs can pick up NP complements using the *non-verbal-head-comp-rule* and (only negated) auxiliaries can pick up their verbal complements using the *verbal-head-comp-rule*.

(20)



5 Conclusion and Outlook

We have seen that the existing analyses of (mostly) free word order and negation can in fact be adapted to work together to capture the facts of Basque. A key property of this success was the constructional approach taken by the word-order analysis, which led to the availability of specific rules on which to hang the constraints about negation.

The next step in this work is to consider the interaction of both word order and negation with focus. Focus is encoded in Basque word order, but negation also interacts with the focus position in Basque. In Basque, the element which appears just to the left of the lexical verb is focused. When this element is the negating auxiliary, Manandise (1988) treats the negation as having sentential scope. When the focused element is a NP, Manandise treats this construction as constituent negation. While a full treatment of information structure and its interaction with negation is left for future work, it seems quite likely that in fact both instances in fact involve sentential negation. It is well known that sentential negation in English is focus-sensitive (e.g., Fischer 1968 and Beaver and Clark 2008), as illustrated in (21).[11]

(21) a. Kim didn't read a long BOOK.

b. KIM didn't read a long book.

c. Kim didn't READ a long book.

[10] To achieve greater coverage with these rule types, we'll need to generalize the constraint on the head value of the non-verbal rule to be non-verbal, rather than strictly nominal.

[11] In these examples small caps indicate prosodically marked focus. Note that the default focus position for English is sentence final and focus can spread leftwards from that final position to successively larger constituents (Bolinger, 1961; Jackendoff, 1972).

d. Kim didn't read a LONG book.

Similarly, it would not be surprising to find that sentential negation is focus-sensitive in Basque. If focus is indicated through pre-verbal position, the interpretations that Manandise notes should follow.

We contend that the interfaces between information structure, syntax and semantics can only be fully understood via modeling with a precise, machine-readable grammar. We believe that the analyses presented here will form the basis of a grammar that can be extended to cover interactions with additional phenomena, including focus.

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Null conjuncts and bound pronouns in Arabic

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Abstract

This paper presents a descriptive overview and a formal analysis of the syntax of pronominal arguments, pronominal conjuncts and bound pronouns in Arabic. I argue that Arabic allows first conjuncts to be null and that this is an instance of a more general pattern of zero anaphora that may affect pronominal arguments or their first conjuncts. First Conjunct Agreement and constraints on the distribution of zero anaphora are accounted for by a new feature sharing mechanism which allows a uniform treatment without appeal to the internal structure of argument NPs. I then argue that Arabic bound pronouns should be analyzed as affixes and present an analysis of their relation to argument structure and coordination. Finally, it is shown how constraints on case marking in Arabic coordination can be formalized. The analysis is part of an Arabic grammar fragment implemented in the TRALE system.

1 Introduction

The goal of this paper is twofold. First, I will examine the structure of Arabic NP coordination and argue that it is a genuine coodination structure which allows first conjuncts to be null. An HPSG analysis will be presented which accounts for zero realization of and agreement with pronouns in a uniform way. I will then examine bound pronouns and show how their relation to argument structure and coordination can be analyzed in HPSG. The analysis presented here is part of ongoing work on a grammar fragment of Arabic implemented in the TRALE grammar development environment (Meurers et al., 2002, Müller, 2007).

The varieties of Arabic dealt with here are Classical Arabic and Modern Standard Arabic. 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. Although intuitive grammaticality judgments are not directly available for CA, as it is extinct, there is an extensive syntactic literature, starting with the seminal *Al-Kitaab* (Sibawayh, 1988) by Sibawayh (ca. 760-796). Furthermore, extensive corpus material is available for both varieties.

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Figure 1: Arabic Personal Pronouns

	Case-neutral		Accusative		Bound	
	Singular	Plural	Singular	Plural	Singular	Plural
1	’anaa	nahnu	’iyyaaya	’iyyaanaa	-ii, -nii	-naa
2 m	’anta	’antum	’iyyaka	’iyyakum	-ka	-kum
2 f	’anti	’antunna	’iyyaki	’iyyakunna	-ki	-kunna
3 m	huwa	hum	’iyyahu	’iyyahum	-hu	-hum
3 f	hiya	hunna	’iyyahaa	’iyyahunna	-haa	-hunna

2 The Data

Pronouns in Arabic Arabic has three sets of personal pronouns (Figure 1, without dual forms). The first and second group are free, the third group is bound. The second group is restricted to positions where a lexical NP would show accusative marking. Members of the first group are not restricted to a specific case, although their distribution in nonnominative, i.e. genitive and accusative, environments is restricted. I gloss their case with ∅. Bound pronouns appear in genitive and accusative positions. The cases are distinguished only in the first person singular, with *-ii* being the genitive and *-nii* the accusative form.

Subjects Arabic pronominal subjects can be realized as null subjects or by a free case-neutral pronoun (1a). Conjoined postverbal subjects usually trigger first conjunct agreement and their first conjunct can be null (1b). Without implying a specific analysis, I will refer to the implicit element as *null conjunct*. On the other hand, preverbal subjects always trigger resolved agreement and do not allow null conjunct realization (1c).

(1) a. ’atayta (’anta)
came.2SG.M (you.∅)
‘you came’

b. ’atayta (’anta) wa=Zayd-un
came.2SG.M (you.∅) and=Zayd-NOM
‘Zayd and you came’

c. * (’anta) wa=Zayd-un ’ataytum
you.∅ and=Zayd-NOM came.2PL.M
‘Zayd and you came’

Accusative Complements Pronominal accusative arguments can be marked by certain combinations of bound pronouns, free accusative pronouns and case-neutral pronouns: just by a bound pronoun (a), just by a free accusative pronoun (b), or by a bound and a free pronoun at the same time (c):

(2) a. ra'aytu-ka
saw.1SG-you.OBL

b. ra'aytu 'iyyaaka/*'anta
saw.1SG you.ACC/you.∅

c. ra'aytu-ka 'iyyaaka/'anta
saw.1SG-you.OBL you.ACC/you.∅
'I saw you'

Bound pronouns can never mark nonpronominal arguments:

(3) a. * ra'aytu-hu r-rajul-a
saw.1SG-he.OBL DEF-man-ACC
'I saw the man'

Genitive Complements Pronominal genitive arguments can be marked by bound pronouns or bound pronoun plus case-neutral pronoun. The options available are similar to those for accusative complements, but Arabic does not have free genitive pronouns:

(4) a. baytu-ka
house-you.OBL

b. * baytu 'anta
house you.∅

c. baytu-ka 'anta
house-you.OBL you.∅
'your house'

First Conjuncts of Complements Pronominal first conjuncts of complements following their head have essentially the same realization options as simple pronominal arguments: They can be realized only by a bound pronoun, only by a free accusative pronoun or by a free and a bound pronoun at the same time:

(5) a. ra'aytu-ka wa=Zayd-an
saw.1SG-you.OBL and=Zayd-ACC

b. ra'aytu 'iyyaaka/*'anta wa=Zayd-an
saw.1SG you.ACC/you.∅ and=Zayd-ACC

c. ra'aytu-ka 'iyyaaka/'anta wa=Zayd-an
saw.1SG-you.OBL you.ACC/you.∅ and=Zayd-ACC
'I saw you and Zayd'

(6) a. baytu-ka wa=Zayd-in
house-you.OBL and=Zayd-GEN

b. * baytu 'anta wa=Zayd-in
house you.∅ and=Zayd-GEN

c. baytu-ka 'anta wa=Zayd-in
house-you.OBL [you.∅ and=Zayd-GEN]
'your and Zayd's house'

Noninitial pronominal conjuncts do not allow bound or case-neutral pronouns and can only be realized by a free accusative pronoun. Thus, noninitial genitive conjuncts are never pronominal.

Opinions of Medieval Grammarians Almost all medieval grammarians considered nominative and genitive null conjuncts at most marginal (e.g. Sibawayh (1988) I 48, Ibn Al-Sarraj (1985) II 119). However, it is doubtful that these claims reflect actual CA use. The grammaticality of the (positive) examples is confirmed by corpus data (Reckendorf, 1921, 331, 344) and was accepted by the early Kufan school (Ibn Al-Anbari, 1913, 193-198). Furthermore, grammarians rejecting the constructions did give positive examples.[1]

It seems plausible that the original contrast was one between dialects, but I will leave this question open. Since no other part of the analysis is potentially dialect-dependent, it seems safe to assume that the variety of CA under consideration allowed null conjuncts.

3 Pretheoretical Analysis

3.1 Coordination or Comitatives?

Stassen (2000) shows that many languages mark coordination with an asymmetrical, comitative strategy.[2] The resulting surface pattern in pro-drop languages equals what we have called null conjuncts here. An analysis of Arabic coordination as comitatives would provide a simple account of agreement of verbs and bound pronouns, and of the possibility of (apparent) conjuncts being null, which would be a simple consequence of the avilability of zero anaphora.

In fact, the Arabic coordination clitic *wa=* can undisputably mark comitatives. However, comitative *wa=* is distinguished from the coordination marker in that it always governs accusative and appears to be semantically distinguishable in that it does not necessarily entail the corresponding version with coordination (Al-Mubarrad, 1986, II 836).

Another argument for a comitative analysis could be made based on (7), where the conjuncts seem to be inverted, which is expected under a modifier analysis. However, the distribution of this pattern, which was possible in poetic CA, differed

[1] See (9a). Other examples: *kun-naa wa='antum dhaahib-iina* 'we and you were going' Sibawayh, 1988, II 352, *'akram-tu-ka wa=Zayd-un* 'Zayd and I honored you' (Ibn Aqiil, 1962, II 187).

[2] Thanks to Emily Bender for pointing this out to me.

from standard NP coordination (Ibn Al-Sarraj, 1985, II 76). Therefore, I will assume that it should be analyzed as a specific construction rather than as a word order variant of (1b).

(7) qaam-a wa=Zayd-un ‘Amr-un
stood-3SG.M and=Zayd-NOM Amr-NOM
‘Zayd and Amr stood (Ibn Al-Sarraj, 1985 II 76)’

On the other hand, there is empirical evidence that the presumed coordination marker is a real coordination marker. A prototypical property of comitatives is that they do not form a constituent with the other NP. In Arabic, a free pronoun as a first conjunct is always adjacent to the second conjunct (8a), although a bound pronoun and a corresponding free pronoun need not be adjacent (8b):

(8) a. * ḍarab-tu ’anaa Zayd-an wa-’anta fii ddaar-i
beat.PAST-2SG.M I.∅ Zayd-ACC and=you.∅ in the.house-GEN
‘You and I beat Zayd in the house.’

b. yahtiku-haa nnaasu [hiya wa=saa’ira ’ahli-haa]
shame.3SG-she.OBL the.people [she.∅ and=rest-ACC family-she.OBL]
‘people shame her and the rest of her family’

This suggests that conjoined NPs form a constituent, from which a bound pronoun realizing the first conjunct is excluded.

Conjoined NPs with first-conjunct agreement can control the subject of clausal complements of raising verbs and subject-to-object-raising complementizers like *’inna*, as shown by dual/plural agreement on the embedded verb:

(9) a. kun-ta wa=ṣaaḥib-u-ka ḍarab-tumaa
be.PAST-2SG.M and=friend-NOM-you.SG.OBL beat.PAST-2DU
rajul-an ḍarab-a-ka
man-ACC.INDEF beat-3SG-you.SG.OBL
‘you and your friend struck a man [that] had beaten you (Ibn Al-Sarraj, 1985, II 330)’

b. ’innii wa=Zayd-an munṭaliq-aani
indeed.I.ACC and=Zayd-ACC leaving-NOM.DU.M
‘(indeed,) Zayd and I are leaving (Ibn Al-Sarraj, 1985, II 117)’

Crucially, subjects of clausal complements can only be controlled by the preceding argument of the matrix verb, but not by modifiers or by an argument and a modifier simultaneously:

(10) a. * kun-tu ma‘a Zayd-in taqaabal-naa
be.past-1SG with Zayd-GEN meet.PAST-1PL
‘Zayd and I had met’

b. * ẓanna-nii ma‘a Zayd-in taqaabal-naa
think.past.3SG-I.ACC with Zayd-GEN meet.PAST-1PL
‘He thought that Zayd and I had met’

Another strong indication that the data involve real NP coordination is that conjoined subjects can co-occur with a plural anaphor (11) and with verbs obligatorily requiring a nonsingular subject (12):[3]

(11) a. ra’ay-tu (’anaa) wa=Zayd-un ’anfusa-naa fii lmir’aati
saw-1SG I.∅ and=Zayd-NOM selves-1PL.OBL in the.mirror
‘Zayd and I saw ourselves in the mirror.’

b. ra’ay-tu (’anaa) wa=Zayd-un ba‘ḍ-a-naa-lba‘ḍ
saw-1SG I.∅ and=Zayd-NOM each.other.ACC.1PL
‘Zayd and I saw each other.’

(12) a. taqaabal-tu (’anaa) wa=Zayd-un
met-1SG I.∅ and=Zayd-NOM
‘I met with Zayd.’

b. tashaarak-a Zaydun wa=‘Amrun
cooperate.PAST-3SG.M Zayd-NOM and=Amr-NOM
‘Zayd and Amr cooperated (Ibn Aqiil, 1962, II 179)’

Incidentally, such verbs do not allow comitatives or other coordination markers than *wa=* (Ibn Aqiil, 1962, II 179). This suggests that *wa=* is not only a real coordination marker, but also the only marker of genuine NP coordination.

3.2 Pronouns and Coordination

It can be noted that there is a parallelism between null conjuncts in subject NPs and pro-drop observed with simple NPs. In both cases, the zero element is the subject pronominal which is used for verbal agreement. This suggests that subject null conjuncts are *pro*-like elements:

(13)

‘You came’		‘Zayd and you came’		
’atayta	[’anta]	’atayta	[’anta	wa=Zaydun]
’atayta	[*pro*]	’atayta	[*pro*	wa=Zaydun]
you.came	you	you.came	you	and Zayd

It is straightforward to assume the same status for nonnominative null conjuncts. This entails that oblique pronominals can be *pro* if they are accompanied by a bound pronoun. Further exploiting the analogy between simple pronominals

[3]The examples without citation were judged correct by speakers of MSA, but I have not been able to find corresponding positive or negative data from CA.

and first conjuncts, I claim that pronominal arguments which are realized by a bound pronoun without being a conjunct should also be analyzed as *pro* elements. The parallelism between the postulated *pro* element and overt pronouns in simple and conjoined NPs is illustrated by (14):

(14)

'I saw you'		'I saw you and Zayd'		
ra'aytu(-ka$_i$)	['iyyaaka$_i$]	ra'aytu(-ka$_i$)	['iyyaaka$_i$	wa=Zaydan]
ra'aytu-ka$_i$	['anta$_i$]	ra'aytu-ka$_i$	['anta$_i$	wa=Zaydan]
ra'aytu-ka$_i$	[*pro*$_i$]	ra'aytu-ka$_i$	[*pro*$_i$	wa=Zaydan]
I.saw-you	you	I.saw-you	you	and Zayd

I assume that free pronouns, conjoined NPs and the abstract *pro* element are standard ways of realizing arguments. A conjoined NP represents the entire argument including arbitrary nonpronominal conjuncts, while a bound pronoun represents only a single set of index features. Free pronouns and conjoined NPs seem to occur in exactly the same positions as other lexical NP arguments. The agreement of anaphors and embedded predicates confirms that all conjuncts semantically belong to the argument position (11, 12).

This analysis closely follows standard assumptions about the syntax of Celtic languages, where pronouns and coordination interact in a very similar way, as noted by Borsley (1995) and Harbert and Bahloul (2002). In Welsh and Irish, heads can agree with pronominal arguments or the pronominal first conjunct of an argument. While Irish does not permit the appearance of a corresponding free pronoun, this is allowed in Welsh. The usual analysis is that the markers on the head are morphological agreement markers, while the argument or conjunct they represent is a pronoun, which is allowed or (in Irish) required to be empty (McCloskey and Hale, 1984, Sadler, 1988).

4 An HPSG Analysis

4.1 Licensing Null Conjuncts

Following Manning and Sag (1998) and more recent proposals, I assume that the realization of arguments is determined by the subtyping of *synsem* into *canonical-ss* and *non-canonical-ss*. *Canonical-ss* objects are realized syntactically by a sign, while *non-canonical-ss* objects which include gaps and *pro* are not realized and do not occur as the SYNSEM value of *sign* objects. Thus, any type of zero anaphora, including null conjuncts, is 'passively' licensed by allowing synsem objects to be *non-canonical-ss*. I will now show how the distribution of zero anaphora can be constrained.

Following previous HPSG analyses of coordination phenomena such as Yatabe (2004), Mouret (2006) and Chaves and Paperno (2007), I assume that coordination phrases have, in addition to their normal DTRS list, a feature CONJUNCTS containing the *synsem* objects of the conjuncts. Following these analyses, I will assume

that it is a HEAD feature, but this is immaterial for the analysis proposed here. The noninitial conjuncts on CONJUNCTS are required to be marked by the coordination clitic *wa*=, which is enforced via the feature CRD (Beavers and Sag, 2004). *wa*= is analyzed as a marker forming a constituent with the marked conjunct and therefore is not a daughter of the coordination phrase. Note that Arabic, unlike English, requires both final and middle conjuncts to be marked by *wa*=. Hence, all noninitial conjuncts are specified as [CRD +]. The only new ingredient that is needed to license null conjuncts is that CONJUNCTS is allowed to contain *pro*-elements, which are not mapped to DTRS:

(15) *coord-phrase* →

$$\left[\begin{array}{ll} \ldots\text{HD}|\text{CONJUNCTS} & \boxed{0}\left\langle\left[\text{L}|\text{C}|\text{CRD} \quad -\right], \ldots \left[\text{L}|\text{C}|\text{CRD} \quad +\right]\right\rangle \\ \text{DTRS} & \left\langle \text{SYNSEM} \quad \boxed{1}, \ldots \text{SYNSEM} \quad \boxed{n} \right\rangle \end{array}\right]$$

$$\wedge\, \boxed{0} = \left(\text{list}(\left[\textit{pro-ss}\right]) \oplus \left\langle \boxed{1}, \ldots \boxed{n} \right\rangle\right)$$

The constraint applies to all types of coordination phrases, as there is no constraint on the syntactic categories of the conjuncts or the number of conjuncts. Since conjuncts are allowed to be *pro*, pronominal null conjuncts are possible in principle. Noninitial conjuncts have to be marked, but since the only lexical item with the relevant marking is the coordination marker, they necessarily are phrases. This means that their head, the conjunct itself, is not null and only the first conjunct can be null.

This constraint accounts for the possibility of zero anaphora including null conjuncts, but it leaves open how the agreement of bound pronouns and verbs with first conjuncts (whether null or not) can be derived, and how the distribution of zero anaphora can be constrained. The remaining part of the section will address these questions.

4.2 Deriving First Conjunct Agreement

As was argued in 3.2, there is a close analogy between arguments and first conjuncts of conjoined arguments. I will attempt to develop a formal anaysis which captures this analogy and allows an account of agreement and bound pronouns for argument NPs without appeal to their internal structure.

Subject agreement and features of bound pronouns depend on features of the first conjunct. The agreement features could come either from INDEX or from a designated HEAD feature such as CONCORD, which Wechsler and Zlatic (2001) introduce to account for agreement patterns which diverge from INDEX. Since Arabic subject-verb agreement diverges from INDEX in NUMBER and sometimes GENDER and is influenced by the morphological structure of word, in particular

plural formation (Reckendorf, 1921, 24), it seems reasonable to use CONCORD for first-conjunct agreement.

An attractive idea is to treat coordination with first-conjunct agreement as headed by the first conjunct.[4] Such an analysis was developed in HPSG by Kim (2011) for verbal coordination in Korean. Applied to Arabic NP coordination, it makes the required information about the first conjunct available via the HEAD feature of the conjoined NP and provides a uniform analysis, in which all relevant features can be accessed using the HEAD value of the argument Thus, it provides a simple and elegant account of the parallelism between pronominal arguments and pronominal first conjuncts. However, there seem to be HEAD features of the conjoined NP which should not be identified with those of its first conjunct in Arabic. As mentioned earlier, preverbal subjects trigger resolved agreement and subjects of raising verbs can trigger first-conjunct agreement and resolved agreement simultaneously (9a). If the first conjunct is the head, only the CONCORD value of the first conjunct will be available on the level of the conjoined NP and resolved agreement would be expected to come from INDEX. However, agreement with preverbal subjects does not always correspond to the expected INDEX value and is influenced by morphology, mainly the type of plural formation (Reckendorf, 1921, 27). Thus, it seems that resolved agreement should be analyzed via HEAD rather than INDEX, which is difficult to implement if one conjunct is the head.

Thus, I will adopt a non-headed analysis in which both resolved and first-conjunct CONCORD values are available on the level of the conjoined NP. If CONJUNCTS is appropriate for *head*, this is already possible. However, such an analysis will have to stipulate agreement of verbs and bound pronouns for simple and conjoined argument NPs separately, missing the basic parallelism of agreement with arguments and first conjuncts. To account for this parallelism, I introduce a feature INTERNAL-HEAD (IH) which is appropriate to *cat* and mediates agreement, case and category information of the first conjunct. For words and most phrases, HEAD and INTERNAL-HEAD are identical. Coordination phrases (usually) share INTERNAL-HEAD with the HEAD value of the first conjunct.

(16)
$$\left[\begin{array}{l}\textit{coordination-phrase}\\ \text{S|L|C}\left[\begin{array}{ll}\text{HEAD} & \left[\begin{array}{ll}\text{CONCORD} & \text{resolve}(\boxed{2},\boxed{3},\ldots)\\ \text{CONJUNCTS} & \left\langle \text{SS|L|C|H}\ \ \boxed{1}_{\boxed{2}},\ \text{NP}_{\boxed{3}},\ldots\right\rangle\end{array}\right]\\ \text{INTERNAL-HEAD} & \boxed{1}\end{array}\right]\end{array}\right]$$

Thus, the analysis simulates the structure sharing which would be automatically available if the first conjunct was treated as the head, but preserves information about the conjoined NP which would be lost under such a treatment. The use of such a feature is similar to the analysis of Portuguese single-conjunct agreement by Villavicencio et al. (2005), who introduce the head features LAGR and RAGR for concord values of conjuncts. The idea that heads are able to access features of single conjuncts has also been used in LFG to account for single-conjunct agreement

[4]Special thanks to Jong-Bok Kim for suggesting this idea and stimulating discussion.

(Dalrymple and Hristov, 2010). However, INTERNAL-HEAD is used uniformly for all NPs. Thus, it allows a modular and unified account of simple and conjoined arguments, since the head can always use the argument's INTERNAL-HEAD value to decide about agreement and bound pronouns.

4.3 Optional Resolved Agreement

The analysis can be extended to account for (17), where a conjoined NP triggers resolved index features on verbs and bound pronouns. I will refer to this pattern as 'opaque coordination'. It is possible only if the NP contains a case-neutral pronominal conjunct:

(17) a. ji'naa [Zayd-un wa='anaa]
came.1PL Zayd-NOM and=I.∅
'Zayd and I came'

b. 'alay-naa ['anaa wa='anta] 'an...
upon-us.OBL I.∅ and=you.∅ that...
'it is my and your duty to...'

I analyze them simply as conjoined NPs where the INTERNAL-HEAD value is shared with the HEAD value of the entire NP, which will have resolved index features, thus providing a uniform agreement mechanism for all NPs: agreement with a verb or a bound pronoun is established by a uniform mechanism operating on the argument NP without any recourse to its internal structure.

Opaque coordination phrases are subject to some constraints (18). They never contain a null-conjunct (a) and resemble case-neutral pronouns in that they require a bound pronoun in nonnominative positions (b):

(18) a. ra'aa-naa wa='Amran
saw.3SG-we.OBL and=Amr.ACC
'He saw us and Amr
not: He saw me and Amr'

b. * 'alaa ['anaa wa='anta] 'an...
upon-us.OBL I.∅ and=you.∅ that...
'it is my and your duty to...'

Technically, the distinction between 'transparent' coordination and the 'opaque' structure in (17) can be implemented by partitioning *coordination-phrase* into *transparent-coordination* (19) and *opaque-coordination* (20), the latter being required to have a case-neutral conjunct. This is formalized using the head feature CASE-MARKED which is − for case-neutral pronouns and + for almost all other signs. *Opque-coordination* also is [CASE-MARKED −] in order to enforce the appearance of bound pronons.

(19) *transparent-coordination* →

$$\begin{bmatrix} \text{S|L|C} & \begin{bmatrix} \text{HD|CONJUNCTS} & \left\langle \left[\text{L|C|HD} \quad \boxed{1} \right], \ldots \right\rangle \\ \text{IH} \quad \boxed{1} \end{bmatrix} \end{bmatrix}$$

(20) *opaque-coordination* →

$$\begin{bmatrix} \text{DTRS} & \left\langle \ldots \begin{bmatrix} \text{S|L|C|HEAD} & \begin{bmatrix} \textit{pronoun} \\ \text{CASE-MARKED} \quad - \end{bmatrix} \end{bmatrix} \ldots \right\rangle \\ \text{S|L|C} & \begin{bmatrix} \text{HD} \quad \boxed{1} \begin{bmatrix} \text{CONJUNCTS} & \left\langle \textit{canonical-ss}, \ldots \right\rangle \\ \text{CASE-MARKED} \quad - \end{bmatrix} \\ \text{IH} \quad \boxed{1} \end{bmatrix} \end{bmatrix}$$

In addition to CASE-MARKED, I will use a boolean-valued head feature PRO to mark HEAD values of empty pronouns. This information must be visible for heads because empty pronouns obligatorily trigger marking on the head. Since only the HEAD value will always be accessible for the head (via INTERNAL-HEAD), this information must be encoded there.

Examples The following AVMs exemplify the analysis. In all four structures, the value used for agreement or a bound pronoun is $\boxed{0}$, but its source depends on the internal structure of the NP: In (21), it comes from the pronoun, in (22) from the null conjunct, in (23) from the overt first conjunct, and in (24) from the resolved CONCORD value of the opaque coordination phrase.

(21)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \quad \left\langle \textit{'anta} \right\rangle \\ \text{SS|LOC|CAT} \quad \begin{bmatrix} \text{HEAD} \quad \boxed{1} \begin{bmatrix} \textit{pronoun} \\ \text{CONCORD} \quad \boxed{0} \end{bmatrix} \\ \text{IH} \quad \boxed{1} \end{bmatrix} \end{bmatrix}$$

(22)
$$\begin{bmatrix} \textit{transparent-coordination-phrase} \\ \text{CONJS} \quad \left\langle \begin{bmatrix} \text{L|C|HEAD} \quad \boxed{2} \begin{bmatrix} \textit{pronoun} \\ \text{CONCORD} \quad \boxed{0} \\ \text{PRO} \quad + \end{bmatrix} \end{bmatrix}, \boxed{3} \right\rangle \\ \text{DTRS} \quad \left\langle \begin{bmatrix} \text{PHON} & \left\langle \textit{wa=Zayd} \right\rangle \\ \text{SYNSEM} \quad \boxed{3} \end{bmatrix} \right\rangle \\ \text{S|L|C|IH} \quad \boxed{2} \end{bmatrix}$$

(23)
$$\begin{bmatrix} \textit{transparent-coordination-phrase} \\ \text{CONJS} \quad \left\langle \boxed{1} \begin{bmatrix} \text{L}|\text{C}|\text{HEAD} & \boxed{2} \begin{bmatrix} \textit{pronoun} \\ \text{CONCORD} \quad \boxed{0} \end{bmatrix} \end{bmatrix}, \boxed{3} \right\rangle \\ \text{DTRS} \quad \left\langle \begin{bmatrix} \text{PHON} & \langle \textit{'anta} \rangle \\ \text{SYNSEM} & \boxed{1} \end{bmatrix}, \begin{bmatrix} \text{PHON} & \langle \textit{wa=Zayd} \rangle \\ \text{SYNSEM} & \boxed{3} \end{bmatrix} \right\rangle \\ \text{S}|\text{L}|\text{C}|\text{IH} \quad \boxed{2} \end{bmatrix}$$

(24)
$$\begin{bmatrix} \textit{opaque-coordination-phrase} \\ \text{CONJS} \quad \left\langle \boxed{1} \left[\text{LOC}|\text{CAT}|\text{HEAD} \quad \textit{pronoun} \right], \boxed{2} \right\rangle \\ \text{DTRS} \quad \left\langle \begin{bmatrix} \text{PHON} & \langle \textit{'anta} \rangle \\ \text{SYNSEM} & \boxed{1} \end{bmatrix}, \begin{bmatrix} \text{PHON} & \langle \textit{wa=Zayd} \rangle \\ \text{SYNSEM} & \boxed{2} \end{bmatrix} \right\rangle \\ \text{S}|\text{L}|\text{C} \quad \begin{bmatrix} \text{HEAD} & \boxed{3} \left[\text{CONCORD} \quad \boxed{0} \right] \\ \text{IH} & \boxed{3} \end{bmatrix} \end{bmatrix}$$

4.4 Bound Pronouns

Now that we have the basic machinery for licensing null conjuncts and first conjunct agreement in place, it remains to show that the account given for pronominal arguments and coordination properly interacts with subject agreement and bound pronouns.

Subject agreement in Arabic is a complex issue, the main difficulty being that postverbal nonpronominal subjects show a special, usually reduced agreement pattern (cf. Aoun et al. (2010) for MSA, Reckendorf (1921) for CA). However, there seem to be no differences between postverbal simple and conjoined subjects other than those captured by the INTERNAL-HEAD feature. Thus, we will assume that subject agreement can be captured by an extension of usual HPSG mechanisms for morphological subject agreement, targeting INTERNAL-HEAD for postverbal and HEAD for preverbal subjects. Bound pronouns are more interesting here, since their syntactic status has not yet been established with certainty in the literature. This section will outline an analysis of bound pronouns and show how it interacts with the previous parts of the analysis.

4.4.1 Affixes or Clitics?

Bound pronouns in Arabic have been treated in previous generative studies mostly as clitics (Borsley, 1995). Similar data has been discussed in the context of several other languages, most notably Romance languages. Based on criteria by Zwicky and Pullum (1983), Miller and Sag (1997) and more recent studies argue that

French bound pronouns are best treated not as clitics, but as inflectional affixes.

If a word hosts more than one bound pronoun, several ordering constraints apply (Wright, 1896-98, Ibn Aqiil, 1962, I 94, Ibn Al-Sarraj, 1985, II 120). Usually, pronouns have to be ordered according to person and in an ordering which seems to correspond to the obliqueness hierarchy which becomes visible in binding and passivization. While it is possible to have two pronouns of the same person, it is not possible for them to agree on all index features. Although untypical for words, such ordering restrictions could be implemented syntactically as a constraint on valence lists.

Two classical affix criteria, *high degree of selection* and lack of *wide scope over coordination*, also apply to genitive NPs, which behave exactly like bound pronouns in these respects. On the other hand, bound pronouns show a wide range of morphophonological idiosyncrasies.[5]

Some can be described by conditioning the morphological form on the appearance of bound pronouns on a valence list. For instance, some prepositions do not host bound pronouns (*wa=* 'with' and *ka=* 'like') or show idiosyncratic forms (*li* 'to' and *'alaa* 'on' become *la* and *'alay*). *min* 'from' and *'an* 'from' change to *minn* and *'ann* only in front of the first person singular pronoun *ii*.

Some could described phonologically by stipulating sandhi effects between adjacent words by machinery such as that described by Tseng (2009). The conjugational suffix *-tum* 'PAST.2PL' and the bound pronoun *-kum* become *-tumuu* and *-kumuu*, respectively if followed by a bound pronoun or by a word starting with two consonants (Ibn Al-Sarraj, 1985, II 124). This approach is less attractive in some other cases: Pronouns starting with *hu-* change to *hi-* after *i* or *y*, and *-ii* is realized as *ya* after long vowels or *y*, erases preceding short vowels, and assimilates preceding *uu/w* to *iy/y*.

Furthermore, there are optional idiosyncratic forms whose description crucially requires information about the morphological structure of the host. For instance, the conjugational suffix *-ti* PAST.2SG.F can be lenghthened, stem-final *-aa* can become *ay* if the underlying root ends in *y* and *-na* IMPF.M.PL/2SG.F can be erased by a bound pronoun starting with *-n*. Notably, these rules only apply to inflected verbs, but not to phonologically similar nominal hosts. Furthermore, *-ii* I.GEN has optional variants (*-i*, *-iya*, *-aa*) after vocative nouns. Certain complementizers have optional idiosyncratic contracted forms with first person pronouns, such as *laytii* for *layta-nii* 'if only I'.

These idiosyncrasies present strong evidence for a morphological analysis of bound pronouns. However, binding theory presents a potential counterargument. According to a generalization proposed by Mohammad (2000), a bound pronoun *X* is not allowed to precede a coreferent (nonpronominal) NP *Y* if the host of X c-commands Y. It seems that a morphological analysis of bound pronouns would

[5]The discussion is based on Wright (1896-98) I 102, 285. Most of the optional ones seem not to be found in MSA. Some idiosyncrasies were dialect-specific in CA, see e.g. Ibn Aqiil (1962) I 100 for *min, 'an*, Ibn Al-Sarraj (1985) II 123-125 for *ka=* and *-kum-uu*

require that the Arabic version of Condition C 'looks into' the morphological structure of words, or else that dependents or conjuncts realized by a bound pronoun are marked as such somewhere on a valence list, which is not motivated independently. On the other hand, a syntactic analysis would require additional machinery making morphological information available to the computation of the phonology of adjacent words. Since the amount of additional machinery in this case seems to outweigh that apparently needed to formalize the binding restrictions, I take the morphological idiosyncrasies, in particular the last group, as convincing evidence that Arabic bound pronouns are best analyzed as affixes. In any case, this conclusion has no bearing on the analysis of coordination, since the access to INTERNAL-HEAD in the morphological computation of affixes can be reimplemented syntactically.

4.4.2 Bound Pronouns and Argument Structure

It seems that not all arguments which are realized or accompanied by a bound pronoun are on ARG-ST. First, adverbial modifiers like *yawma ljum'ati* 'on Friday' can be extracted, leaving a resumptive realized by a bound pronoun (Sibawayh, 1988, I 84). Second, complements of subject-to-object raising verbs, whether realized as a bound pronoun or otherwise, seem not to be locally o-commanded by the subject in CA and (earlier) MSA. This is suggested by the fact that the complement of such verbs, even if coreferent with the subject, cannot be an anaphor (Sibawayh, 1988, cf. Cantarino, 1974-5, II 424 for MSA). This contrasts with all other verbs, which require an anaphor in this case:

(25) a. ḥasib-tu Zayd-an fa'al-a kadhaa wa=kadhaa
consider.PAST-1SG Zayd-ACC do.PAST-3SG so and=so
'I thought Zayd had done this and that'

b. ḥasib-tu-nii fa'al-tu kadhaa wa=kadhaa
consider.PAST-1SG-I.ACC do.PAST-1SG so and=so

c. * ḥasib-tu nafs-ii fa'al-tu kadhaa wa=kadhaa
consider.PAST-1SG self-1SG.GEN do.PAST-1SG so and=so
'both: I thought I had done this and that (Sibawayh, 1988, II 367)'

(26) a. ḍarab-tu nafs-ii
strike.PAST-1SG self-I.GEN

b. * ḍarab-tu-nii
strike.PAST-1SG-I.ACC
'I struck myself'

Under the standard HPSG assumption that ARG-ST is the locus of binding theory (Manning and Sag, 1998), this can be accounted for easily by assuming that such complements are not on the ARG-ST list of the raising verb. This also makes

sense in that such complements do not fill a semantic role of the raising verb and can also be an expletive, the so-called *ḍamiir al-sha'n*.

Thus, I will assume that such complements are not present on ARG-ST and are added by the mapping from ARG-ST to the valence lists. I will adopt an extension of the argument structure mechanism introduced by Bouma et al. (2001). Elements of the form described are introduced by the *Argument Extension Principle* to a valence list called DEPS, which contains the members of ARG-ST and certain adjuncts. Its *canonical-ss* elements are mapped to SUBJ and COMPS (27).

Adopting this style of analysis is motivated language-internally also by the fact that case-marked adjuncts (e.g., *amaama* 'in front of', *saa'atayni* 'two hours' and cognate objects) can have nominative case in intransitive passives (Sibawayh, 1988).

This account can now be extended straightforwardly to capture Arabic bound pronouns. We briefly summarize the relevant generalizations. Whether a complement is realized by a bound pronoun depends on its INTERNAL-HEAD value: *pro* and case-neutral pronouns require a bound pronoun, other pronouns may have an optional bound pronoun, while nonpronominals are not doubled by a bound pronoun. This is formalized by constraint (28). The DEPS list can first be partitioned into the subject list $\boxed{4}$ and the remainder $\boxed{3}$, consisting of *canonical* and *non-canonical* complements and adjuncts. $\boxed{3}$ is passed to a function which adds bound pronouns to the word's morphology, following Miller and Sag (1997).

(27) **Argument Realization:** (adapted)

$$\textit{word} \rightarrow \begin{bmatrix} \text{SS}|\text{L}|\text{C} & \begin{bmatrix} \text{SUBJ} & \boxed{1} \\ \text{COMPS} & \boxed{2} \ominus \text{list(non-canonical-ss)} \\ \text{DEPS} & \boxed{1} \oplus \boxed{2} \end{bmatrix} \end{bmatrix}$$

(28) **Bound Pronoun Realization:** (new, language-specific)

$$\textit{word} \rightarrow \begin{bmatrix} \text{MORPH} & \begin{bmatrix} \text{FORM} & \mathbf{F}\text{\_PRON}(\boxed{1}, \boxed{2}, \boxed{3}) \\ \text{I-FORM} & \boxed{1} \end{bmatrix} \\ \text{SS}|\text{L}|\text{C} & \begin{bmatrix} \text{HEAD} & \boxed{2} \\ \text{SUBJ} & \boxed{4} \\ \text{DEPS} & \boxed{4} \oplus \boxed{3} \end{bmatrix} \end{bmatrix}$$

F_PRON has to account for several morphological phenomena and its precise definition is outside the scope of this paper. Nonetheless, the possible patterns of optional and obligatory realization of bound pronouns presented in (14) can be described straightforwardly using the representation for pronouns and coordination structures proposed in 4.3. Whether the function adds a bound pronoun for some argument only depends on the INTERNAL-HEAD value of the argument. Only elements whose INTERNAL-HEAD value satisfies [*pronoun*] or [C-M $-$] can give rise to a clitic. Descriptively, this corresponds to pronouns and also opaque coordination patterns. On the other hand, elements satisfying [PRO $+$] or [C-M $-$],

which correspond to empty pronouns, case-neutral pronouns and opaque coordination, obligatorily trigger the appearance of a bound pronoun. The computation of $\mathbf{F}_{\text{-PRON}}$ is nondeterministic in the sense that bound pronouns are optional for an element which satisfies [*pronoun*], [PRO $-$] and [C-M $+$], i.e. a free accusative pronoun. The choice of the appropriate bound pronoun for a certain argument is also based on INTERNAL-HEAD and depends only on the values of INTERNAL-HEAD|CONCORD and INTERNAL-HEAD|CASE.

4.5 Example: Verb Combining with Conjoined NP

The following example, repeated from (5a), illustrates the proposed analysis. It features a pronominal null conjunct in the complement and a corresponding bound pronoun on the verb:

(29) ra'ay-tu-ka wa=Zaydan
see.PAST-1SG-you.OBL and=Zayd.ACC
'I saw you and Zayd'

The conjoined NP [*pro wa=Zaydan*] and the verb *ra'aytuka* receive the structures in (30). The transitive verb *ra'aytuka* has two arguments, of which the subject is null and the complement *canonical*. The latter is a coordination phrase whose first conjunct is null. Its INTERNAL-HEAD value mediates the HEAD features of the first conjunct, which are needed by the computation of the corresponding singular affix on the verb.

(30)
$$\left[\begin{array}{l}\textit{transparent-coordination-phrase}\\ \text{PHON}\quad \text{wa=Zaydan}\\ \text{DTRS}\quad \left\langle \left[\text{PHON}\quad \text{wa=Zaydan}\right] \right\rangle \\ \text{SS}\quad \boxed{1}\left[\begin{array}{l}\textit{canonical-ss}\\ \text{L|C}\left[\begin{array}{ll}\text{HEAD} & \left[\begin{array}{ll}\text{CASE} & \textit{acc}\\ \text{CONCORD} & 2\text{PL.M}\\ \text{CONJUNCTS} & \left\langle \boxed{3}\left[\begin{array}{ll}\textit{pro\_ss} & \\ \text{...HEAD} & \boxed{2}\end{array}\right], \textit{canonical\_ss} \right\rangle\end{array}\right]\\ \text{IH} & \boxed{2}\left[\begin{array}{ll}\textit{pronoun} & \\ \text{CASE} & \textit{acc}\\ \text{CONCORD} & 2\text{SG.M}\\ \text{PRO} & +\end{array}\right]\end{array}\right]\end{array}\right]\end{array}\right]$$

$$\begin{bmatrix} \textit{word} & \\ \textsc{phon} & \text{ra'aytuka} \\ \textsc{arg-st} & \left\langle \boxed{0}\textit{pro\_ss}{:}\textsc{nom}, \boxed{1}\ \textit{canonical-ss}{:}\textsc{acc} \right\rangle \\ \textsc{morph}|\textsc{form} & \text{F\_PRON}(\ldots,\ldots,\left\langle \boxed{3} \right\rangle) \\ \textsc{ss}|\textsc{l}|\textsc{c} & \begin{bmatrix} \textsc{deps} & \left\langle \boxed{0}, \boxed{1} \right\rangle \\ \textsc{comps} & \left\langle \boxed{1} \right\rangle \\ \textsc{subj} & \left\langle \boxed{0} \right\rangle \end{bmatrix} \end{bmatrix}$$

4.6 Appendix: Case in Coordination

Up to now, most coordination examples had the same case-marking on all conjuncts. However, if the first conjunct is a case-neutral pronoun, non-initial conjuncts are allowed to have nominative marking:

(31) a. taẓaafuru-*hu* [*huwa* wa='Abuu Sa'd]
help-he.OBL [he.∅ and=Abu.NOM Sa'd]
'his and Abu Sa'd's help (Reckendorf, 1921)'

Given the architecture for coordination employed here, it is straightforward to spell out the generalizations formally:

(32) $\left[\textsc{conjuncts} \quad \text{list(nominal)}\right] \rightarrow$

$$\begin{bmatrix} \textsc{conjuncts} & \text{list}(\textsc{l}|\textsc{c}|\textsc{h}|\textsc{case} \quad \boxed{1}) \\ \textsc{case} & \boxed{1} \end{bmatrix}$$

$$\vee \begin{bmatrix} \textsc{conjuncts} & \left\langle \textsc{l}|\textsc{c}|\textsc{h} \quad \begin{bmatrix} \textsc{case} & \boxed{1} \\ \textsc{case-marked} & - \end{bmatrix} \right\rangle \\ & \oplus \text{list}(\textsc{l}|\textsc{c}|\textsc{h}|\textsc{case} \quad \text{nom}) \\ \textsc{case} & \boxed{1} \end{bmatrix}$$

Furthermore, case-neutral pronouns are not allowed to occur as non-initial conjuncts in positions where a lexical NP would show nonnominative case marking:

(33) a. *ra'aytu [Zayd-an wa=hum]
saw.1SG Zayd-ACC and=they.∅
'I saw Zayd and them'

Note that (17b) is not a counterexample to this generalization, because the first conjunct is case-neutral, i.e. allows the second conjunct to have nominative case according to (32). The generalization is formalized by the following constraint:

(34) $\left[\text{CONJS} \quad \textit{ne\_list} \oplus \left\langle \text{...HD} \quad \boxed{1}\begin{bmatrix}\textit{pronoun} \\ \text{CASE} \quad \neg\, \textit{nom}\end{bmatrix}\right\rangle \oplus \textit{list}\right]$
$\rightarrow \boxed{1}\left[\text{CASE-MARKED} \quad +\right]$

The complex antecedent and the disjunction in (32) and (34), which mirror the structure of the pretheoretical linguistic generalization, could be eliminated by splitting *coordination-phrase* into several types.

As these additional rules affect only noninitial conjuncts, whose CASE feature is irrelevant for the appearance of bound pronouns according to the analysis proposed here, (32) and (34) do not interfere with the remainder of the analysis in any undesired way and provide a straightforward formalization of the data.

5 Conclusions

I have argued that Arabic first conjuncts can be null and that this phenomenon is an instance of a more general pattern of zero anaphora. It was shown that null conjuncts can be licensed using common assumptions about coordination strutures in HPSG. First-conjunct agreement and constraints on bound pronouns suggest feature sharing via a new head feature INTERNAL-HEAD, which allows a uniform analysis of agreement and bound pronouns and of simple and conjoined argument NPs. Furthermore, I argued that Arabic bound pronouns should be analyzed as affixes and presented an analysis of their relation to argument structure and their interaction with coordination. It was also shown how constraints on case marking in Arabic coordination can be formalized. The analysis has been computationally implemented as part of an Arabic grammar fragment in the TRALE system.

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Focus particles, secondary meanings, and Lexical Resource Semantics: The case of Japanese *shika*

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Abstract

Japanese has two exclusive particles *shika* and *dake*. Although traditionally, both particles were considered to be exclusive particles like *only*, a recent proposal claims that *shika* is an exceptive particle like *everyone except* to account for the necessary co-occurrence of the negative suffix *na* and *shika*. We show that this negative suffix lacks two critical semantic properties of ordinary logical negation: It is not downward entailing, nor does it license negative polarity items. We show that both *shika* and *dake* are exclusive particles, but that *shika* encodes an additional secondary meaning. The negative suffix only contributes to the sentence's secondary meaning when it co-occurs with *shika*. We present an HPSG and LRS analysis that models the co-occurrence of *shika* and the negative suffix *na*, and their contribution to the sentence's secondary meaning.

It is widely believed that the information conveyed by sentences or utterances of sentences does not have a uniform status. Until recently, that information could be part of the "ordinary" meaning of sentences, it could be presupposed (Frege, 1891; Strawson 1950), it could be a conventional implicature (Grice, 1975), or it could be part of conversational implicatures associated with the utterances of sentences (Grice, 1975). In the last decade, there has been a flurry of ever more fine-grained distinctions in the status of information conveyed by sentences or utterances of sentences, e.g., implicitures (Bach 1994), conventional implicatures (in the sense of Potts, 2005, which is distinct from Grice's), secondary meanings (Bach, 1999; Potts, 2005), or assertorically inert propositions (Horn, 2002). In this paper, we show how HPSG and Lexical Resource Semantics (Richter and Sailer, 2004) can help model the semantic difference between two Japanese focus particles roughly paraphraseable as *only* in English, *shika* and *dake*, as well as help solve an apparent non-compositional aspect of the semantics of sentences containing *shika*. Our paper thus both solves a long-standing descriptive difficulty in Japanese lexical semantics and serves as a case study in the benefits of HPSG and LRS in modeling difficult aspects of the syntax/semantics interface. Our paper is organized as follows. Section 1 briefly describes the two particles *shika* and *dake* and the descriptive challenge that *shika* poses. Section 2 argues that a previous attempt at a solution is inadequate. Section 3 presents our analysis of the semantic difference between *shika* and *dake*. Section 4 shows that the semantic contribution that distinguishes *shika* from *dake* has the status of a secondary meaning in the sense of Bach (1999). Section 5 proposes an LRS model of the semantics of *shika*. Section 6 concludes the paper.

1 Introduction

Japanese has two exclusive particles *shika* and *dake*, which are roughly equivalent to English *only*. One important difference between them is that *shika* must co-occur with the negative verbal suffix *na*. Sentences in (1) illustrate the fact that *shika* requires the negative verbal suffix *na*. Sentence (1a), in which *shika* occurs

without the negative verbal suffix, is not grammatical. *Dake*, on the other hand, can occur in either positive or negative sentences as shown in (2).

(1) a. *Yuna-shika ki-ta.
Yuna-SHIKA come-PAST

b. Yuna-shika ko-na-katta.
Yuna-SHIKA come-NEG-PAST
'Only Yuna came.'

(2) a. Yuna-dake ki-ta.
Yuna-DAKE come-PAST
'Only Yuna came.'

b. Yuna-dake ko-na-katta.
Yuna-DAKE come-NEG-PAST
'Only Yuna didn't come.'

Typically, *shika* and *dake* are both translated in English as *only*. However, if one assumes that the phrase *Yuna-shika* corresponds to the exclusive phrase only Yuna, the rest of the sentence, *ko-na-katta* does not seem to be explained straightforwardly: It forces one to say that *ko-na-katta* means *came* and thus leaves the presence of the negative verbal suffix *na* unexplained. This is one motivation for Yoshimura's (2006) proposal that *shika* is a universal exceptive marker like English *everyone except*. According to the exceptive analysis of *shika*, *Yuna-shika* in (1b) is an exceptive phrase equivalent to English *everyone except Yuna*, and *ko-na-katta* means *did not come*, thus explaining the presence of the negative verbal suffix. Although *shika* is traditionally considered to be an exclusive marker, the fact that it must co-occur with the negative verbal suffix *na* seems to favor an analysis that assumes it is an exceptive particle. However, as we show in the next section, several semantic properties remain unexplained if one assumes that *shika* is an exceptive particle *stricto sensu*.

2 Is *shika* an exclusive or an exceptive particle?

2.1 What are exclusive and exceptive expressions

Exclusive particles like *only* express two propositions, a prejacent proposition and what we call for lack of a better term *a restrictive proposition*. For example, (3) expresses the prejacent proposition that John came and the restrictive proposition that nobody except John came, as shown in (4) and (5). Although the discussion about the status of the prejacent proposition is still controversial, there seems to be agreement that both the prejacent and restrictive propositions are entailed by a sentence containing *only* (see Atlas, 1996 and Horn, 2002, among others).

(3) Only John came.

(4) *Prejacent proposition*: came (j).

(5) *Restrictive proposition*: $\neg\exists x(x \neq \text{j} \wedge \text{came}\ (x)\ )$

Exceptive particles like *everyone except* also express two propositions. Thus, (6) expresses the (positive) proposition that John came as well as the (negative) proposition that all individuals distinct from John did not come, as represented in (7) and (8) (D stands for the domain of discourse).

(6) Everyone except John didn't came.

(7) *Positive proposition*: came (j)

(8) *Negative proposition*: $\forall x$ (($x \in D - \{\text{j}\}$) $\rightarrow \neg$ came (x))

Logically, the propositions expressed by sentences containing exclusive particles like *only* and corresponding sentences containing exceptive phrases like *everyone except* may be identical, but exclusive and exceptive expressions differ in a crucial way for our purposes, namely the polarity of the expression that they do not focus on (i.e., *came* in (3) and *did not come* in (6)). Superficially, Japanese *dake* resembles *only* in that the non-focused expression is not negated, while *shika* resembles *everyone except* in that the non-focused expression is negated. But, appearances are misleading. To show that the negative suffix that co-occurs with *shika* is not an ordinary negation, we will compare *shika* with another very similar particle, *igai*. *Igai* also expresses a positive and a negative proposition, when occurring with a negation as shown in (9).

(9) Yuna-igai ko-na-katta.
Yuna-IGAI come-NEG-PAST
'Everyone other than Yuna didn't come.'

Sentences (9) and (1b) contain the same negative verbal suffix *na*. However, the negative suffix occurring with *igai* expresses ordinary logical negation while the negative suffix co-occurring with *shika* does not.

2.2 The status of the negative verbal suffix co-occurring with *shika*

Yoshimura (2006) argues that in sentence (1b), the phrase *Yuna-shika*, and the negated predicate *ko-na-katta*, correspond to *everyone except Yuna* and *did not come*, respectively. Under such an analysis, the presence of the negative morpheme *na* receives a straightforward explanation. However, there are several semantic properties which cannot be explained if one assumes that the negative verbal suffix co-occurring with *shika* participates in the meaning of the sentence as ordinary negation would. One difference between the negative suffix co-occurring with *shika* and ordinary negation concerns entailment patterns. Negation is a downward entailing operator. As expected, the negation in sentences containing *except* or *other than* is downward entailing. (10a), for example, entails (10b).

(10) a. Everyone except/other than Yuna didn't come.
b. Everyone except/other than Yuna didn't come late.

The negative suffix present in sentences containing Japanese *igai* is also downward entailing. When sentence (11a) is true, so is (11b).

(11) a. Yuna-igai ko-na-katta.
Yuna-IGAI come-NEG-PAST
'Everyone other than Yuna didn't come.'
b. Yuna-igai okurete ko-na-katta.
Yuna-IGAI late come-NEG-PAST
'Everyone other than Yuna didn't come late.'

If the negative suffix co-occurring with *shika* functions as ordinary negation, one expects that it too is downward entailing. However, this is not the case. (12a) does not entail (12b).

(12) a. Yuna-shika ko-na-katta.
Yuna-SHIKA come-NEG-PAST
'Only Yuna came.' or 'Everyone except Yuna didn't come' (Yoshimura, 2006).
b. Yuna-shika okurete ko-na-katta.
Yuna-SHIKA late come-NEG-PAST
'Only Yuna came late.' *or* 'Everyone except Yuna didn't come late.' (Yoshimura 2006)

Exclusive markers such as English *only* and Japanese *dake* behave similarly to *shika* in that they are not downward entailing. (13a) and (14a) do not entail (13b) and (14b), respectively.

(13) a. Only Yuna came.
b. Only Yuna came late.

(14) a. Yuna-dake ki-ta.
Yuna-DAKE come-PAST
'Only Yuna came.'
b. Yuna-dake okurete ki-ta.
Yuna-DAKE late come-PAST
'Only Yuna came late.'

Another difference between the negative suffix co-occurring with *shika* and ordinary negation pertains to the negative polarity item (NPI) licensing properties of negation. *Igai*, when occurring with the negative suffix can license an NPI, as shown in (15). This is presumably because the negative suffix in (15) functions as ordinary negation.

(15) Yuna-igai nanimo tabe-na-katta.
Yuna-IGAI anything eat-NEG-PAST
'Everyone other than Yuna didn't eat at all.'

If the negative suffix co-occurring with *shika* is ordinary negation, we would expect it to license NPIs too, just as the negative suffix in (15). However, as Aoyagi and Ishii (1994) point out, *shika* cannot appear with *nanimo*, as shown in (16).

(16) #Yuna-shika nanimo tabe-na-katta.
Yuna-SHIKA anything eat-NEG-PAST

The Japanese exclusive particle *dake* cannot license the NPI *nanimo*, either, as shown in (17).

(17) #Yuna-dake nanimo tabe-ta.
Yuna-DAKE anything eat-PAST

Although the negative suffix co-occurring with *shika* can otherwise license NPIs, it does not license NPIs in sentences containing *shika*. *Shika* with the negative suffix behaves again similarly to *dake* with respect to NPI licensing: Neither *shika* with its co-occurring negative suffix nor *dake* license NPIs.

In this section, we examined the semantic behavior of the negative suffix co-occurring with *shika*. Although *shika* must co-occur with a negative suffix, this negative suffix is not downward entailing nor does it license NPIs, in contrast with ordinary negation uses of the negative suffix. In both respects, *shika* behaves like the exclusive particle *dake*, and unlike *igai* or English *everyone except* and *other than*. We conclude that *shika* behaves just as one would expect if it were an exclusive particle and if the negative suffix co-occurring with *shika* did not function as an ordinary negation.

3 The contextual meaning of shika

We have shown that *shika* is not an exceptive marker. However, if we assume that *shika* is an exclusive marker like English *only*, the presence of the negative verbal suffix *na* does not seem to make any semantic contribution to the exclusive meaning of the sentence containing *shika*: The Japanese sentence in (1b) contains a negative verbal suffix while the English translation does not contain a negation.

Probably because of the necessary co-occurrence of a negative verbal suffix, Japanese speakers have the intuition that contexts in which *shika* is appropriate are more negative than contexts in which *dake* occurs. There have been several proposals about the differences between *shika* and *dake*, and Kuno (1999), for example, argues that a (negative) restrictive proposition is contextually more prominent for *shika* than *dake*. In this section, after briefly reviewing Kuno (1999)'s proposal, we propose an analysis of the meaning of *shika* that models native speakers' intuitions about the negative character of the contextual meaning of *shika*.

3.1 Kuno (1999)

Kuno (1999) suggests that *shika* and *dake* introduce two propositions with distinct assertoric status. Those two propositions are defined in (19) for the Japanese sentences in (18). According to Kuno (1999), a sentence in which *shika* occurs primarily asserts the restrictive proposition or what Kuno (1999) calls the negative proposition, and secondarily asserts the prejacent proposition, or what Kuno (1999) calls the affirmative proposition, while a sentence in which *dake* occurs primarily asserts the affirmative proposition and secondarily asserts the negative proposition, as shown in (20), although what he means by 'primarily' and 'secondarily' is not clear.

(18) a. Eigo to huransugo -dake hanas-e-ru.
English and French only speak-can-PR.
'I can speak only English and French.'

b. Eigo to huransugo -shika hanas-e-na-i.
English and French only speak-can-NEG-PR.
'I can speak only English and French.'

(19) Propositions associated with the "W X-dake Y" and "W Xshika Ynai" Constructions
A. Affirmative Proposition: WXY E.g. The affirmative proposition of (1a, b) = "I can speak English and French."
B. Negative Proposition: not(WZY) where Z = V-X, V being the set of elements under discussion. E.g. The negative proposition of (1a, b) = "I cannot speak any other language." (Kuno 1999: 147)

(20) The semantics of *dake* and *shika*:
Dake primarily asserts its affirmative proposition, and only secondarily asserts its negative proposition.
Shika primarily asserts its negative proposition, and only secondarily asserts its affirmative proposition. (Kuno 1999: 148)

3.2 The "negative meaning" of *shika*

We agree with Kuno (1999) that the two Japanese exclusive particles, *shika* and *dake* differ in the contexts in which they occur. (21) and (22) are two constructed examples which illustrate that contexts in which *shika* and *dake* are acceptable differ.

(21) Hottokeeki-o tsukuri-ta-katta-n-dakedo,
pancake-ACC make-want-PAST-COMP-although
'Although I wanted to make pancakes,'

a. hutatsu-shika tamago-o kawa-na-katta.
two-SHIKA egg-ACC buy-NEG-PAST
'I only bought two eggs.'

b. (#)hutatsu-dake tamago-o kat-ta.
two-DAKE egg-ACC buy-PAST
'I only bought two eggs.'

(22) Hottokeeki-ga tsukur-e-ru-youni,
pancake-NOM make-can-NONPAST-in.order.to
'In order to make pancakes,'

a. #hutatsu-shika tamago-o kawa-na-katta.
two-SHIKA egg-ACC buy-NEG-PAST
'I only bought two eggs.'

b. hutatsu-dake tamago-o kat-ta.
two-DAKE egg-ACC buy-PAST
'I only bought two eggs.'

Because of the presence of the adversative suffix *dakedo* 'although' in (21), *shika* is more natural than *dake*, since the adversative suffix suggests that the speaker believes that buying only two eggs is not sufficient to make pancakes. Conversely, because of the presence of the purposive suffix *youni* 'in order to' in (22), *dake* is more natural than *shika*, since the purposive suffix suggests that the speaker believes that buying only two eggs is sufficient to make pancakes. (23) characterizes a common ground compatible with (21).

(23) Buying two eggs and no more implies that one cannot make pancakes.

More generally, contexts in which *shika* is appropriate must include a contextually determined proposition which does not hold. The contextually determined proposition for (21) is that one can make pancakes, which should have held if she bought more than two eggs but does not hold since she bought two eggs and no more. (24) is an attested newspaper example of *shika*. The context proposition which the sentence containing *shika* negates is that research on microorganisms is not interesting.

(24) a. 翠星高校は白山市にあり、生徒全員が農業クラブ員。出口さんは総合グリーン科学科で微生物を学んでいる。「イースト菌、こうじカビなど人の役に立つものもあれば、健康を害するものもある。それでもまだ全体の1%しか分かっていないところに興味がある。大学に進んで、さらに研究したい」と話す。(2009 年 12 月 15 日)

b. The high school is located in Shirayama city, and all students at the high school belong to the agriculture club. She studies microorganisms. She said 'some microorganisms such as yeast fungus and aspergillus, are useful for humans, but others are harmful. It is interesting because we know only 1% of all microorganisms. I will go to a college and continue the research.'(Mainichi Shinbun12/15/2009)

What (24) expresses pragmatically implies the negation of the contextually determined proposition that research on microorganisms is not interesting. If we already know a lot about microorganisms, research about microorganisms might

not be interesting, but the fact that we know only 1% of microorganisms and no more implies that research on microorganisms is interesting. The proposition that research on microorganisms is interesting, is explicitly stated in the text, and would be one of the more salient candidates for a contextually determined proposition that the sentence containing *shika* negates. However, this does not mean that this proposition is the only candidate, a point we return to shortly.

We just saw that *shika* requires the availability of a context proposition which the exclusive meaning it contributes negates. Contexts in which *dake* are acceptable might also contain a proposition whose truth is negated by the exclusive meaning *dake* contributes, but the presence of such a proposition is not required. *Dake* is thus the unmarked member of the pair, as it can occur in more contexts than *shika*. (22) illustrates a context in which only *dake* is acceptable: The speaker would be able to make pancakes if she bought more than two eggs, but she can still make pancakes even when she bought two eggs and no more.

To model the difference between *shika* and *dake* and the necessary presence of a proposition negated by the exclusive meaning contributed by *shika*, we hypothesize that *shika* contributes to two contents, an ordinary exclusive content of the kind English *only* and Japanese *dake* contribute and a secondary negative content (see Section 4 for a justification of these terms). The exclusive content, like that contributed by exclusive markers such as *only*, consists of the conjunction of a prejacent and restrictive proposition, as shown in (25a). (25b) is the secondary negative content, which distinguishes *shika* from *dake*. In (25), P is the meaning contributed by the sentence in which *shika* occurs minus the constituent on which *shika* focuses; f is the meaning contributed by the constituent on which *shika* focuses and Q is the contextually available proposition which the exclusive content pragmatically negates (i.e., the exclusive proposition pragmatically implies its negation). The negative suffix co-occurring with *shika* contributes to the secondary negative content and negate the proposition Q. The secondary negative content says that if the primary exclusive content holds, the contextually determined proposition does not. We assume that Q is a free variable whose value must be filled in pragmatically.

(25) a. *Primary exclusive content*: P (f) $\wedge\neg\exists x$ ($x \neq$ f $\wedge$ P (x))
b. *Secondary negative content*: (P (f) $\wedge\neg\exists x$ ($x \neq$ f $\wedge$ P (x)) $>\neg$ Q

The secondary negative content is somewhat weak, as J. Bohnemeyer and N. Asher have pointed out to us. Many propositions can be pragmatically implied by the primary exclusive content. We agree, but we believe *shika* is no different in that respect from other similarly 'pragmatically laden' particles, as a comparison betwen the secondary meaning of *shika* to the somewhat similar meaning of *but* suggests (we thank N. Asher for this suggestion). According to Anscombre and Ducrot's (1977) analysis of French *mais* or English *but*, the first conjunct of (26) expresses a proposition that pragmatically implies a proposition whose negation is pragmatically implied by the proposition expressed by the second conjunct (e.g.,

that the speaker is willing to accept an offer to go out for a walk). As is the case with *shika*, the pragmatic implication that is part of the secondary meaning of *but* is weak: There are many propositions which can be pragmatically implied by the first conjunct of (26) and whose negation can be pragmatically implied by the second conjunct. The indeterminacy of the proposition pragmatically implied by sentences containing *shika* or *but* is similar to that of the state-property contributed by the English perfect, according to Nishiyama and Koenig (2010). In all three cases, the value of the relevant pragmatic value must be determined contextually through inferences of the kind familiar in neo-Gricean work (e.g., Levinson (2001)) and there are potentially several contextually appropriate values.

(26) The weather is nice, but my feet are hurting.

To support our claim that sentences containing *shika* express the secondary negative content, we conducted a corpus study. We sampled one hundred example discourses in which *shika* occurs from two Japanese newspapers, the Mainichi Shinbun and Nikkei Shinbun. We searched through the website of the newspaper, and selected one hundred discourses in which *shika* occurred. In the selected discourses, *dake*, if it replaced *shika*, would not have been completely unacceptable. We examined these one hundred discourses and confirmed the presence of a contextually determined proposition which does not hold.

4 The multi-dimensionality of the meaning of *shika*

We have proposed that the more restricted contexts in which *shika* is acceptable is the result of its secondary negative content, and supported this hypothesis through a corpus study. This negative content, however, does not seem to have the same semantic status as the exclusive content. We show in this section that the negative content expressed by *shika* is akin to the secondary meaning expressed by English *but* or *even* in the sense of Bach (1999) and Potts (2005). Traditionally, the meanings of *but* and *even* in (27c) and (28c), respectively, were considered to be conventional implicatures. (Gx in (27c) stands for a generic quantifier roughly paraphaseable as 'It is generally true of x that'.)

(27) a. Shaq is huge but he is agile.
b. *Primary entailment*: huge (shaq) $\wedge$ agile (shaq)
c. *Secondary meaning*: Gx [huge (x) $\rightarrow \neg$ agile (x)] (Bach 1999: 347)

(28) a. Even Emma came.
b. *Primary entailment*: came (emma) $\wedge \neg \exists x$ (x $\neq$ emma $\wedge$ came (x))
c. *Secondary meaning*: it is less likely that Emma would come than other individuals would come

Grice deemed (27c) and (28c) implicatures because they do not seem part of 'what is said', as the falsity of their meanings does not affect the primary purpose

of an utterance. Grice deemed (27c) and (28c) to be conventional because they are not derived through inferences based on conversational principles, but stem from properties of specific lexical items. Bach (1999), however, argues that the meanings in (27c) and (28c) are part of 'what is said' because these meanings can be under the scope of propositional attitude verbs like *say*. Potts (2005) also distinguishes the meanings of *but* and *even* in (27c) and (28c) from conventional implicatures, and calls them secondary meanings. In this section, we argue that the negative content contributed by *shika* is similar to the secondary meaning of *even* or *but*.

4.1 Presupposition holes

Strawson (1950) treated presuppositions as backgrounded assumptions for foregrounded assertions and defined them so that sentences are neither true nor false when they are not satisfied. It follows from this approach to presuppositions that even if the negation of a statement A is true, its presupposition B is true. This property of presuppositions to survive when a statement is negated is used as a test for identifying presuppositions. Other environments in which presuppositions survive, such as antecedents of conditionals, modal contexts, and questions, are called presupposition holes. Importantly for us, the secondary meaning of *even* or *but* escapes from the scope of these presupposition holes. For example, what is negated in (29a) is not the secondary meaning in (27c), but the primary entailment in (27b). Similarly, the secondary meaning in (27c) survives in antecedents of conditionals, modal contexts, and (marginally) questions, as shown in (29b) -(29d).

(29) a. It is not the case that Shaq is huge but he is agile.
b. If Shaq is huge but he is agile, he could be a basketball player.
c. It might be the case that Shaq is huge but he is agile.
d. ?Is Shaq huge but agile?

The negative content contributed by *shika* also escapes from the scope of presupposition holes. What is under the scope of negation, question, modal and conditional operators are the exclusive content: The negative content escapes from the scope of these operators. In (30b), for example, what is negated is just the exclusive content. Since there is no specific context for examples in this section, we assume a general proposition that the denotation of the constituent being focused on is sufficient (the milk in (30a)) as the contextual proposition Q. For example, the secondary content for examples in (30a) is (31). The negative content that drinking milk and nothing other than milk is not sufficient is the same in (30b) and in the corresponding affirmative sentence in (30a).

(30) a. Miruku-shika noma-na-katta.
milk-SHIKA drink-NEG-PAST
'S/he drank only milk'

b. Miruku-shika noma-na-katta wake-jana-i.
milk-SHIKA drink-NEG-PAST COMP-NEG-NONPAST
'It's not the case that s/he drank only milk'

(31) (drink (m) $\wedge\neg\exists x($ $x \neq$ m $\wedge$ drink (x))) $>$ $\neg$ (sufficient (m))

The fact that the negative content contributed by *shika* is not under the scope of presupposition holes suggest that it is not part of the primary asserted content, because primary asserted contents are what operators like negation, modal verbs, or question markers take as semantic arguments.

4.2 Independence of truth values

Secondary meanings and presuppositions, although they both escape from the scope of presupposition holes, differ in their relationship with at-issue entailments. Potts (2005) characterizes at-issue entailments as controversial propositions or the main theme of a discourse. Presuppositions are not the primary purpose of an utterance, but background assumptions for at-issue meanings. If a presupposition is false, the truth value of the at-issue proposition is undefined. The propositions in (27b) and (27c) are both at-issue entailments of the utterance in (27a). However, there is no dependency between the primary and secondary asserted contents in (27b) and (27c), respectively. The truth or falsity of (27c) does not affect the truth of (27b).

(32) A: Shaq is huge but he is agile
B: Yes, but being huge doesn't necessarily indicate being not agile.

In (32), speaker B agrees with the primary proposition conveyed by A's utterance, but disagrees with its secondary proposition. B's utterance indicates that the primary proposition and secondary propositions conveyed by *but* can be assigned truth values independently of each other. The independence of the primary and secondary propositions' truth values is one of the reasons why we need a multi-dimensional analysis of meanings to represent secondary contents: The two meanings cannot be represented as a conjunction of the two meanings since otherwise each of the two propositions would have to be true in order for the sentence to be truthfully uttered. Like for *but*, there is no dependency between the exclusive and negative contents expressed by sentences containing *shika*. The falsity of the negative content does not affect the truth of the primary exclusive content.

(33) A: A-wa hutatsu-shika to-re-na-katta.
A-TOP two-SHIKA get-can-NEG-PAST
'I could get only two As.'
B: Un, demo, hutatu to-r-eba juubunn-da-yo.
yes but two get-NONPAST-if enough-COPULA-DM
'Yes, but it's enough to get two As.'

In (33), speaker A expresses that she has two As and no more and that two As are not sufficient for a contextually available proposition Q. Speaker B replies to A's utterance by *un* 'yes' and agrees with the exclusive content, but at the same time disagrees with the secondary content. The truth of the exclusive and negative contents conveyed by sentences containing *shika* are thus separable, as one can agree with the exclusive content and disagree with the negative content.

4.3 Cancellability

A property which distinguishes secondary meanings from conversational implicatures is cancellability. Conversational implicatures can be cancelled without contradiction, while secondary meanings are not cancellable. In (34), the conversational implicature of the first sentence that Emma drunk no more than two glasses of milk, is cancelled by the following phrase. The secondary content expressed by *but* in (35), on the other hand, cannot be cancelled.

(34) Emma drunk two glasses of milk, and maybe more.

(35) #Shaq is huge but he is agile, and being huge may not necessarily indicate being not agile.

However, in contrast to the secondary content of *but*, the negative content expressed by sentences containing *shika* appears to be cancellable.

(36) a. A-ga hutatsu-shika to-re-na-katta
A-NOM two-SHIKA get-can-NEG-PAST
'I got only two As,'

b. demo hutatsu-de juubunna-n-da-yo.
but two-with enough-COMP-COPULA-DM
'but, two As are enough.'

In (36), the secondary negative content of *shika* in (36a) that two As are not sufficient, appears to be cancelled by the following sentence in (36b). However, since the secondary negative content is context dependent, one can view the context from various perspectives, and think of more than one contextual proposition. For example, in (36), the speaker has a secondary negative content in her mind that two As are not sufficient for receiving a scholarship when uttering (36a), and then, she changes her perspective to utter (36b), implying that two As are sufficient to make her mom happy. In (36), it is not necessarily the case that the secondary negative content of *shika* is cancelled, rather, there is a shift in the speaker's perspective about whether two As are sufficient.

4.4 Anti-backgrounding

The semantic properties examined in previous sections do not characterize only secondary meanings, they also characterize conventional implicatures in Potts'

(2005) sense of the term. Both secondary meanings and conventional implicatures escape from the scope of presupposition holes, are assigned truth values independently of that of primary meanings, and are not cancellable. In this section and the next we examine two other properties of conventional implicatures to see if they hold of the negative content expressed by sentences containing *shika*. The first property pertains to the newness of the information conveyed.

It is intuitively very difficult to decide whether the negative content expressed by sentences containing *shika* is shared between the speaker and listeners or is new information. In the following conversation, for example, it is not clear if the negative content expressed by B's response is shared between the speaker and listener.

(37) A: Tamago ikutsu ka-tta?
egg how.many buy-PAST
'How many eggs did you buy?'
B: Hutatsu-shika kawa-na-katta.
two-SHIKA buy-NEG-PAST
'I bought only two eggs.'
A: Daijoubu, hutatsu a-r-eba juubunn-da-yo.
ok two have-NONPAST-if enough-COPULA-DM
'It's ok, two is enough.'

In (37), speaker B expresses that two eggs is not sufficient with a sentence containing *shika*. The negative content that buying two eggs is not sufficient appears to be new information to speaker A, who says that two eggs are enough. However, we could also say that speaker B simply assumed, wrongly, that the negative proposition was shared. It is thus not clear whether the secondary negative proposition associated with an occurrence of *shika* must be part of the common ground. Note that it is equally difficult to ascertain if the secondary meanings of English *even* or *but* are shared between speakers and hearers or constitute new information.

(38) A: Shaq is huge but he is agile.
B: Well, most basketball players are huge and agile.

In (38), although speaker B disagrees with speaker A about the secondary meaning of *but*, one could say that speaker A just assumed, wrongly, that it was shared information. However, there is a clear difference between presuppositions, and conventional implicatures or secondary meanings. While presuppositions must be accommodated, secondary meanings do not have to be accommodated since the truth of the primary and secondary contents are independent from each other. Although in (37), it is not clear whether *shika*'s secondary meaning is part of the common ground, it does not have to be accommodated and can be considered to be new information when it is not part of the common ground.

4.5 Widest scope

Conventional implicatures by default take widest scope and are speaker-oriented (in some restricted contexts, conventional implicatures can be non-speaker-oriented; see Harris and Potts, 2009)). Conventional implicatures cannot, for example, be under the scope of propositional attitude verbs such as *say*, which are known to prevent the inheritance of a presupposition conveyed by their complement.

In contrast to conventional implicatures, secondary meanings do not typically take widest scope, as Bach (1999) argued.

(39) Ed said that Shaq is huge but he is agile. But I think hugeness is not necessarily an indicator of not being agile.

In (39), the secondary meaning of *but* is under the scope of *say*. The secondary meaning is what Ed believes, not necessarily what the speaker believes. The secondary meaning associated with *shika* behaves like that of *but*, and does not typically have scope over a propositional attitude verb.

(40) a. Sensei-wa ronbunn-wo itsutsu-shika happyounasara-na-katta
teacher-TOP article-ACC five-SHIKA publish(honorific)-NEG-PAST
to ossyat-tei-ta-yo.
COMP say-PERF-PAST-DM
'The teacher said that she published only five articles.'

b. Itsutsu-mo su-r-eba juubunn-da-yone.
five-as.much.as do-NONPAST-if enough-COPULA-DM
'Publishing five articles is enough, isn't it?'

Let us suppose that (40) is an utterance in a conversation about how many articles are needed to apply for a promotion. In (40a), the secondary meaning of *shika* that the teacher cannot apply for a promotion, is not necessarily the belief held by the speaker. The speaker uttering (40a) can continue the utterance by saying (40b). In the sequence in (40), the negative content contributed by *shika* is relativized to the teacher's beliefs, and is not ascribed to the speaker. Bach (1999) and Potts (2005) argue that the non-conjunctive part of the meaning of expressions such as *but* is not a conventional implicature, because it can be under the scope of propositional attitude verbs like *say*. As we have just seen, the negative content associated with *shika* satisfies every criterion in Potts' (2005) definition of conventional implicatures except for anti-backgrounding and non-widest scope. The negative content expressed by sentences containing *shika* has therefore all the same semantic properties as the secondary meanings of *but* and *even*.

5 An LRS model of the meaning of *shika*

In this section, we outline a model of the behavior of *shika*. We show that a combination of HPSG and LRS makes it relatively easy to account for the two most

important properties of the syntax and semantics of *shika*:

(41) a. If *shika* is attached to a dependent of the verb, the predicate negation *na* must be suffixed to the verb;

b. The predicate negation that co-occurs with *shika* only contributes a secondary meaning to the sentence's meaning.

A full model of the syntax/semantics of *shika* would require incorporating within HPSG the semantics of focus particles (à la Rooth, 1985 or Krifka, 1993). This is beyond the scope of this paper (see Kubota (2003) for an early proposal). The purpose of this section is more modest: Show how HPSG and LRS affords us the descriptive tools for a straightforward model of the semantic contribution *shika* and *na* make to the meaning of sentences.

Our analysis makes the assumption that focus particles contribute a particular kind of content encoded as the value a FOC-CONT attribute, as shown in (42). We also assume that the content of sentences contains both a primary semantic content (the value of the attribute ECONT, see Richter and Sailer, 2004, for the distinction between internal and external contents) and a secondary semantic content (encoded as the value of a SEC-CONT attribute), the kind of content that *but*, *even*, or *shika*'s negative proposition contribute. There are several reasons, some practical, for these choices. First, the meaning of a sentence containing a focus particle always entails the meaning of that sentence minus the focus particle, as illustrated in (43). Thus (44) holds for all models M and assignment functions g (α and β are variables over (possibly empty) strings and F designates an arbitrary focus particle). Thus, the presence of a focus particle does not seem to affect semantic composition. By separating into two components the semantic content of sentences, semantic composition rules for the "ordinary" semantic content, which remains unaffected by the presence of focus particles, need not be altered (see Krifka, 1993, for a detailed proposal along these lines). In the absence of a complete HPSG/LRS model of the syntax and semantics of focus particles, this conservative approach is best. Second, although the additional semantic contribution brought about by the presence of focus particles is in some cases a secondary meaning (this is the case with *even*), this is not the case with *only*. We therefore cannot treat the semantic content contributed by focus particles as simply secondary content. This is why we distinguish between the focal and non-focal primary (external) contents of sentences and their secondary contents. When the additional semantic contribution of a focus particle is a secondary meaning, as it is for *even*, the focal and secondary contents are identified.

(42)
$$\left[\text{LF}\left[\begin{array}{ll}\text{ECONT} & \textit{me}\\ \text{FOC-CONT} & \textit{me}\\ \text{SEC-CONT} & \textit{me}\end{array}\right]\right]$$

(43) Only three people showed up $\models$ Three people showed up.

(44) $[\![\alpha F \beta]\!]^{M,g} \models [\![\alpha\beta]\!]^{M,g}$

A simplified entry for *shika* is given in (45). This entry treats *shika* as a clitic that takes as complement the constituent it cliticizes onto.

(45) a. *shika* ⇒
$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FPART } \textit{shika} \\ \text{CLITIC } + \end{bmatrix} \\ \text{COMPS} & \left\langle \begin{bmatrix} \text{LF} \begin{bmatrix} \text{ICONT } \boxed{3} \\ \text{ECONT } \boxed{1} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{INC} & \boxed{2} \\ \text{FOC-CONT} & \boxed{2}\textit{(only'(}\boxed{4}\textit{, }\beta\textit{))} \\ \text{ECONT} & \boxed{1} \end{bmatrix}$$
$\boxed{3} \lhd \boxed{4}$

Semantically, *shika* introduces as both its internal and focal content a proposition of the form *only (*α*,* β*)*. We assume that a proposition of the form *only (*α*,* β*)* is true in a model if and only if there is nothing except α that would satisfy β. In other words, *only (*α*,* β*)* corresponds to the restrictive proposition. The prejacent corresponds to the external content of the sentence, as per the entailment in (44) and our decision to let semantic composition of the sentence minus the focus particle work as it would if no focus particle were present. The first argument of the restrictive proposition includes the internal content of the constituent *shika* selects and cliticizes onto.[1] The second argument of this proposition is not determined within the constituent that contains *shika*.

Given this entry for *shika*, two constraints on verbs suffice to model the descriptive generalizations we listed in (41). The first constraint (46) ensures that whenever *shika* occurs, the verb is what we call a *secondary-neg-verb*. This constraints models the necessary co-occurrence of *shika* and a *na* suffixed verb. In stating this constraint, we make use of Bouma, Malouf and Sag's (2001) notion of dependents which includes not only members of the ARG-ST list, but also various adjuncts. This is necessary as *shika* can attach to adjuncts as well as arguments of the secondary negative verb it co-occurs with.

(46) a. If the focus particle *shika* is cliticized to a dependent of the verb, the verb must belong to the category of secondary negative verbs;

b. $\left[\text{DEPS}\left\langle \ldots \left[\text{HEAD}\left[\text{FPART } \textit{shika}\right]\right] \ldots \right\rangle\right] \Leftrightarrow$ *secondary-neg-verb*

The second constraint, given in (47), defines the class of secondary negative verbs.

(47) a. If a verb is a secondary negative verb, its polarity is negative and its secondary meaning consists of a (defeasible) implication between the focal content of its *shika* marked dependent and the negation of a free propositional variable (*Q* below).

[1] We require the first argument of the *only* proposition to *include* the internal content of its modified constituent rather than *be equal to* the external content of that constituent to allow the focus of *shika* to be less than the meaning of the entire constituent onto which it cliticizes.

b. *secondary-neg-verb* $\Rightarrow$
$$\begin{bmatrix} \text{HEAD} & \left[\text{POLARITY -}\right] \\ \text{ICONT} & \boxed{4} \\ \text{SEC-CONT} & \boxed{1} \rightsquigarrow \boxed{2} \neg Q \\ \text{DEPS} & \left\langle \ldots \left[\text{FOC-CONT} \boxed{1} \textit{(only'}(\alpha, \boxed{3}\textit{))}\right] \ldots \right\rangle \\ \text{PARTS} & \left\langle \ldots \boxed{2} \neg \ldots \right\rangle \end{bmatrix}$$
& $\boxed{4} \lhd \boxed{3}$

Morphologically, secondary negative verbs are required to include the suffix *na*, which means they must be marked as being of negative polarity. The rest of the definition of *secondary-neg-verb* models the two semantic effects of the co-occurrence of *shika* and a *secondary-neg-verb*.

The first semantic effect pertains to the *scope* of *shika*. The definition of secondary negative verbs in (47) simply says that the internal content of the main verb is part of the second argument of the restrictive proposition introduced by *shika*. The need to underspecify the scope of *shika* (and therefore the weak constraint that the internal content of the verb be, again, *included* in the second argument of the *only* proposition rather than *equal to* it), is best illustrated by the English sentences in (48).

(48) a. Mary also drinks GREEN TEA very rarely.
b. Very rarely does Mary also drink GREEN TEA.

The most salient interpretation of (48a) is one which is supported by situations in which Mary drinks at least two liquids very rarely, green tea and some other alternative liquid. In others words, the scope of *also* includes the adverbial phrase *very rarely* in the most salient interpretation of (48a) and the alternatives to green tea (in Rooth's sense) are the liquids Mary drinks very rarely. The most salient interpretation of (48b), on the other hand, is one which is supported by situations in which it is rare for Mary to drink two liquids. In this case, *very rarely* is not within the scope of *also* and the alternatives to green tea are the set of liquids Mary drinks. The range of operators that lead to distinct possible scopes for focus particles includes not only adverbial phrases like *very rarely*, but also propositional attitude verbs (when focus particles occur within their complement clauses). We know of no systematic study of the range of scope possibilities of the kind illustrated in (48). Our analysis therefore merely requires the second argument of the restrictive proposition to include the internal content of the main verb. Since the existence of various possible scopes is not a property specific to *shika*, but is part and parcel of the semantics of focus particles, the constraint $\boxed{4} \lhd \boxed{3}$ would not be included in the definition of *secondary-neg-verb* in a more comprehensive treatment of focus particles in Japanese.

The second semantic effect of the co-occurrence of *shika* and *na* is that the focal content contributed by the *shika*-marked constituent pragmatically implies that a proposition Q is false. As mentioned above, we incorporate a multi-dimensional approach to meaning into LRS through the introduction of the attribute SEC-CONT into the logical form of signs and the secondary negative content contributed by

secondary-negative-verb is encoded as the value of this new attribute. It is this secondary meaning which, we claim, distinguishes the meaning of *shika* and *dake*.

Before concluding, let us note that our more complex architecture for semantic contents clearly requires a slight revision to LRS semantic principles to ensure that all of the focal, external, and secondary contents end up being part of the semantic information contributed by sentences. Since this revision is relatively easy and our analysis is preliminary, we leave its precise formulation to another venue. We merely point out that the inclusion of a secondary content in the entry of *secondary-neg-verb*s requires us to reinterpret the EXCONT principle formulated in Richter and Sailer (2004) in (49). Since the external content of sentences consists now of both a primary and secondary content, the EXCONT principle must apply to the *conjunction* of the primary and secondary external contents.

(49) 'In every utterance, every subexpression of the EXCONT value of the utterance is an element of its PARTS list, and every element of the utterance's PARTS list is a subexpression of the EXCONT value.'

A simplified representation of the meaning composition for sentence (1b) is given in Figure 1.

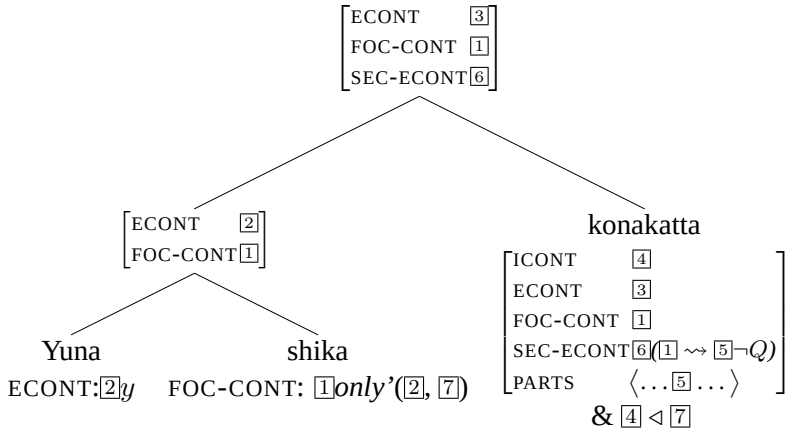

Figure 1: The semantic content of sentence (1b)

6 Conclusion

Recent research has shown that the information conveyed by sentences and utterances is not monolithic; it can include various kinds of semantic content. But, the semantic judgments on which some of these distinctions rest are sometimes subtle and the sheer number of categories raises a further issue: Why is there a need for natural languages to make such subtle distinctions in the status of information our utterances convey? Our paper does not provide an answer to this latter, bigger question. But, it provides an interesting example of the descriptive use of some

of these subtle distinctions. Adequately characterizing the intuitive difference between the two Japanese exclusive particles *shika* and *dake* has proved difficult. So, has explaining the necessarily presence of the negative suffix *na* for the first particle, as the negation does not seem to contribute to its meaning, at least according to a 'traditional' exclusive particle analysis. Although Yoshimura's (2006) analysis of *shika* as an exceptive marker explains the presence of the negative verbal suffix *na*, there are several difficulties with her analysis, as we have shown. Based on previous proposals such as Kuno (1999) that *shika* expresses some negative meaning, we hypothesize that *shika* introduces both a primary meaning (similar to that of English *only* and Japanese *dake*) and a secondary meaning (that the exclusive content pragmatically implies that some contextually determined proposition is false). The secondary negative meaning of *shika* is the source of the intuition that *shika* is acceptable in more negative contexts than *dake* and explains compositionally the presence of the negative suffix. Furthermore, the independence of this negative secondary meaning from the primary meaning expressed by sentences containing *shika* is critical in explaining two apparently incompatible facts, the required presence of *na* and the semantic equivalence of the exclusive meaning carried by *dake* and *shika*. *Dake* and *shika* share the same primary, exclusive meaning, but *shika* carries an additional secondary meaning that the negative suffix *na* contributes solely to.

Our model of the necessary co-occurrence of *shika* and *na* and its semantic effects requires *shika*-marked constituent to be dependents of members of the class of *secondary-neg-verb*. The fact that *na* contributes to the secondary meaning of verbs only when these verbs select for a *shika* dependent is modeled via constraint on the type *secondary-neg-verb*. Finally, the dependency between the primary exclusive meaning and the secondary negative implication of sentences containing *shika* is modeled through token-identity between what we call wordfocal content and the relevant part of the secondary external content of verbs of type *secondary-neg-verb*. Our analysis accounts for the fact that Japanese suffix *na* has two uses, a use that encodes ordinary logical negation of primary meanings and a second use, restricted to sentences in which one of the verb's dependents contains the clitic *shika*, where the negation is part of the sentence's secondary meaning. Whereas the presence of an additional secondary meaning is reflected in a different lexical item in English pairs such as <*and, but*>, the presence of an additional secondary meaning is represented by the combination of the contrast between <*dake, shika*> and the two uses of the negative suffix *na* in Japanese.

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The English binominal NP construction: A construction-based perspective

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Abstract

English Binominal NPs (BNP) (e.g., *a hell of a problem*) are of empirical and theoretical interest due to their complex syntactic and semantic properties. In this paper, we review some basic properties of the BNP construction, focusing on its headedness, semantic relations, and the role of the preposition *of*. We argue that these properties suggest an account in the spirit of construction grammar. In particular, we show that English BNP is a nominal juxtaposition construction whose special syntactic constraints are linked to semantic relations like a subject-predicate relation.

1 Introduction

As attested in naturally occurring data in (1), English Binominal NPs (BNPs) with the structure 'Det1 N1 *of* Det2 N2' display complex syntax and semantics.

(1) a. It's been [**a** hell of a day] at the office.

b. And you won't be saying anything to [**that** ponce of a boss] you've got, Howard?

c. Rune nodded [his shaven dome of a head].

d. She had [a skullcracker of a headache].

e. [**Some** dragon of a receptionist] refused to let him see her boss without an appointment.

f. I suspect she'd been following [**that** fool of a carrier].

g. And she was old, antique. Deep lines grooved [**her** prune of a face].

In this paper, we show that the regular and idiosyncratic properties of the BNP construction lead us to an account in the spirit of construction grammar; we specifically argue that the English BNP is a nominal juxtaposition construction linked to a special semantic relation.

2 Previous Analyses

In dealing with the BNP, the first puzzle is what is the head of the overall structure. The headedness issue is central in three different approaches to the preposition *of*: as a preposition selecting the following NP headed by N2 in ((2a), Abney 1987, Napoli 1989), as a pragmatic marker forming a unit with the preceding N1 and following *a/an* ((2b), Aarts 1998, Keizer 2007), and as a prepositional complementizer F selecting a small clause ((2c), Kayne 1994, Den Dikken 2006):

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(2) a. $[_{NP}$ a $[_{N}$ hell $[_{PP}$ of a problem]]

b. $[_{NP}$ a $[_{MP}$ hell of a] problem]

c. that $[_{D/PP}$ $[_{NP}$ idiot$_j$] $[_{FP}$ of $[_{IP}$ a doctor I^0 t_j]]] ...

Each of these three approaches has its own merits, but is not fully satisfactory to capture the BNP's regular as well as idiosyncratic properties. The obligatoriness of the PP may support N1 being the head, but the semantic locus of the overall structure seems to be the second noun N2. For example, N1 in (1a) can be paraphrased as an adjectival modifier as *a hellish day*, and further Det1 and a pre-N1 modifier can scope over the remote N2 as in *[that] fool of a [doctor]* or *that [little] bastard of a [chaplain]*. However, the N2-as-head approach in (2b) is also forced to assume the string "N1-of-a" as a constituent, sacrificing the traditional constituency. The third main analysis in (2c), reflecting the subject-predicate meaning relation between N1 and N2 as shown from the paraphrases in (3) for the examples in (1), assumes that the N1 *idiot* is originated as the predicate of the N2 and then undergoes predicate inversion within a small clause.

(3) a. a hell of a day – the day is a hell

b. a jewel of a city – the city is a jewel

c. a martinet of a mother – the mother is a martinet

Successful though this analysis seems to be in capturing the semantic relation, the analysis does not provide an answer to what motivates the movement operations involved here.

Furthermore, none of these three approaches properly addresses the freedom of the selectional restrictions or that of the semantic head:

(4) a. She doesn't want to talk to { this idiot of a prime minister. / this idiot. / a prime minister. }

b. I met { a colourless little mouse of a woman. / *a colourless little mouse. / a woman. }

c. I detest { that rotten little fig of a human being. / that rotten little fig. / *a human being. }

As illustrated here, in terms of the selectional restriction, the semantic head in (4a) can be either N1 or N2. But the one in (4b) is only N2 while the semantic

head in (4c) is N1. In addition, the three approaches address the issue of morphosyntactic constraints on the BNP in a precise way. For example, Det2 must be the indefinite article *a/an* as in (5). In addition, there are syntactic freezing effects: the *of*-tagged PP cannot be extraposed or *wh*-questioned as shown in (6a) and (6b), respectively.

(5) a. a hell of **a**/*some/*any/*one day

b. this chit of **a**/*her/*that/*this/*some/*any/*the/*one girl

(6) a. [A monster of a machine] was delivered/*A monster was delivered of a machine.

b. She had [a skullcracker of a headache.]/*What did she have a skullcracker of?

Further, neither the PP nor the NP2 can be coordinated as given in (7).

(7) a. *I had a hell [of a day] and [of a time].

b. *Into the assessment room stepped a giant of [a man] and [a woman].

3 A Proposal

Turning to our account of the BNP, we take a slightly different approach from any of the previous approaches, aiming to account for the general as well as the idiosyncractic properties of the construction.

- There are two nominals in contiguity with each other though the preposition is intervening.
- Neither nominal can clearly be identified as the head of the whole phrase.
- Elements in the BNP are frozen in the sense that neither N1 nor N2 can be involved in a displacement structure. They observe island constraints like the Coordinate Structure Constraint.
- The two NPs are parallel in many respects. The two nominals agree in number, semantic gender, and selectional restrictions.
- Det2 can be marked only with the indefinite article *a/an*.
- The two NPs are in a predication relation in which N1 has an evaluative function of N2.

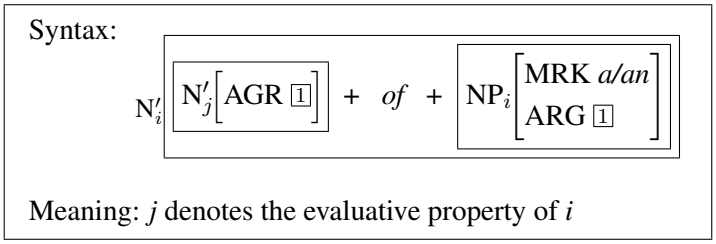
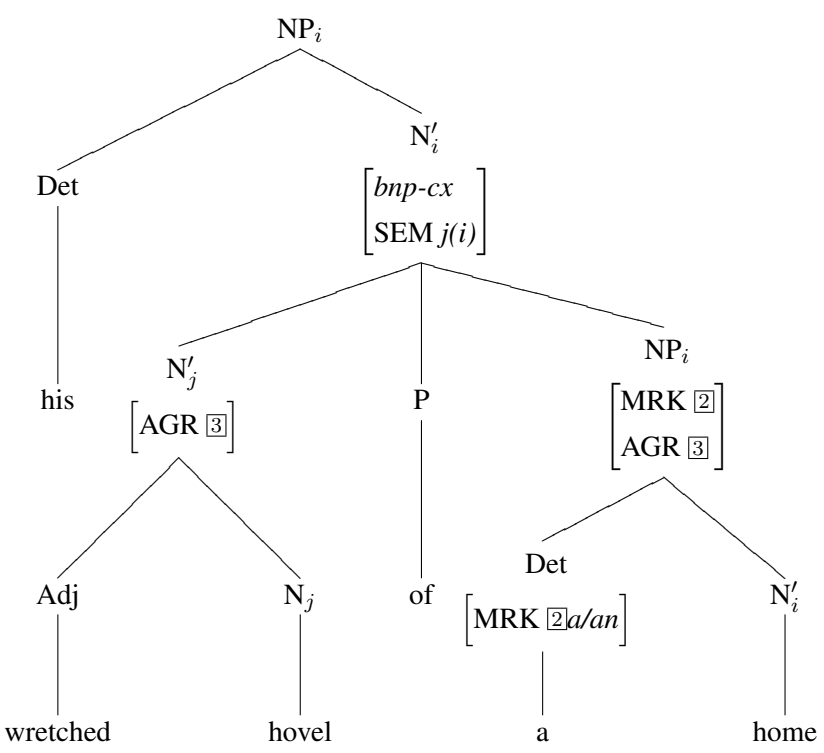


Figure 1: BNP Construction in English

These properties and others indicate that the BNP is really a fixed construction subject to high-level morpho-syntactic constraints. We propose that the BNP is a type of nominal juxtaposition construction whose syntactic form is associated with a specific semantic relation, as represented in Figure 1.

The constructional constraint in Figure 1 specifies that the BNP is a juxtaposition of two nominal expressions N′ and NP, linked by *of*. The result of juxtaposing the two nominal phrases with identical agreement (AGR) features induces a predication relation in which the first nominal (*j*) denotes an evaluative property of the second nominal (*i*) (cf. Kim 2004). Note that this juxtaposition does not assign any syntactic headedness property to either noun, similar to the behavior of asyndetic coordinate constructions. The constructional constraint says that the index value of the composite N'_i is identical to the second NP_i, implying that N2 is the semantic head. Consider the structure that our analysis generates:

(8)



As shown in the structure, the two nominal phrases *wretched hovel* and *a home* are linked by the preposition. The constructional constraint in Figure 1 ensure that these two nominal phrases have the identical AGR (number and gender) value, and further that the second NP is marked with the indefinite article *a/an*. The index value of the whole NP structure (*i*) is identical with the second NP, ensuring its semantic headedness. The semantic value (SEM) also shows that the two nominals are in a subject-predicate relation.

This proposal departs from traditional analyses but captures numerous constructional properties that otherwise remain as puzzles. The present analysis views the BNP as directly having two nominals parallel in many respects including number, gender, and selectional restrictions. Multiple coordination is not possible because the construction is strictly binary like *neither/nor*. The two nouns enter into a predication relation in which N1 has an evaluative function on N2, which follows from the purely form-function mapping in the spirit of construction grammar. Note that though the second NP is subject to rather stricter constraints such as having to be marked with the indefinite article, there is no constraint on NP1 other than the AGR value. This will license more complex examples like (9).

(9) a. that [destroyer of education] of [a minister]

b. this [manipulator of people] of [a mayor]

c. my [true defender in need] of [a husband]

The nouns *destroyer* and *manipulator* require their own complements *of education* and *of people*. Such an N′ is juxtaposed with a following indefinite NP. However, the analysis does not license examples like (10), violating the indefiniteness requirement on Det2.

(10) a. *that [destroyer of education] of [the minister]

b. *my [true defender in need] of [the husband]

As long as this constraint is satisfied, NP2 can also be complex as in (11).

(11) a. Don't forget we've both done this a hell of a lot more times than you have!

b. There was a hell of a lot of smoke.

Also, observe that the BNP can be recursive as in (12a). The generation of such a recursive BNP is straightforward within the juxtaposition approach proposed here. However, it would not generate (12b), due to the constraint on the BNP construction that Det2 is indefinite.

(12) a. [that asshole of [an idiot of a doctor]] (data from Den Dikken 2006)

b. ??/*that asshole of that idiot of a doctor

This leaves *that asshole of an idiot* as the only possible constituent. The freezing effects also follow from the juxtaposition in a straightforward manner: the two elements in the BNP are frozen in the sense that neither N1 nor N2 can be involved in a displacement operation like extraposition, as further attested in (13):

(13) a. *[Of a lawyer], he was a fool _ .

b. *[A little slip _] came in [of a girl].

In the present analysis, these are also expected from the coordination-like properties of the juxtaposition BNP construction. The linker *of* has two dependents N1 and N2 and an extraction of an element from only one of these two will violated the juxtaposition properties.

4 Conclusion

This paper shows that once we accept the view that the English BNP construction is a type of nominal juxtaposition construction (cf. Jackendoff 2008), many distinctive properties of the construction follow in a simple and straightforward manner.

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Converting CCGs into typed feature structure grammars

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1 Introduction

In this paper, we report on a transformation scheme that turns a Categorial Grammar (CG), more specifically, a Combinatory Categorial Grammar (CCG; Baldridge (2002)) into a derivation- and meaning-preserving typed feature structure (TFS) grammar. We describe the main idea which can be traced back at least to work by Karttunen (1986), Uszkoreit (1986), Bouma (1988), and Calder et al. (1988). We then show how a typed representation of complex categories can be extended by other constraints, such as modes, and indicate how the Lambda semantics of combinators is mapped into a TFS representation, using unification to perform α-conversion and β-reduction (Barendregt, 1984). We also present first findings concerning runtime measurements, showing that the PET system, originally developed for the HPSG grammar framework, outperforms the OpenCCG parser by a factor of 8–10 in the time domain and a factor of 4–5 in the space domain.

2 Motivation

The Talking Robots (talkingrobots.dfki.de) group here at the LT Lab of DFKI uses categorial grammars in several large EU projects in order to communicate with robots in spoken language. The grammars for English and Italian are written in the OpenCCG dialect of CCG. The overall goal of our enterprise amounts to an implementation of a (semi-)automatic method which, given a hand-written CCG, generates a derivation- and meaning-preserving TFS grammar. The motivation for doing this is at least threefold:

1. **Faster Parser**
   The main rationale for our transformation method is driven by the need that we are looking for a reliable and trainable (C)CG parser that is faster than the one which comes with the OpenCCG system. People from the DFKI LT group have co-developed the PET system (Callmeier, 2000), a highly-tuned TFS parser written in C++, which originally grew out of the HPSG community. In order to use such a TFS parser in a CG setting, the (combinatory) rules and lexicon entries need to be transformed into a TFS representation.

2. **Structured Language Model**
   Another major rationale for the transformation comes from the fact that the CCG grammars are used for spoken language, operating on the output of a speech recognizer. Although speech recognizers are based on trained statistical models, modern recognizers can be further tuned by supplying an

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additional structured language model. Given a TFS grammar for the transformed CCG grammar, we would like to use the corpus-driven approximation method described in Krieger (2007) to generate a context-free approximation of the deep grammar. This approximation then serves as our language model for the recognizer. Again, as is the case for PET, software can be reused here, since the method described in Krieger (2007) is implemented for the external chart representation of the PET system.

3. **Cross-Fertilization**
   We finally hope that our experiment provides insights on how to incorporate descriptive means from CG (e.g., direct slash notation for categories) into the HPSG framework, even though they are compiled out in the end. Thus, specification languages for HPSG, such as $\mathcal{TDL}$ (Krieger, 1995), might be extended by some kind of macro formalism, allowing a grammar writer to state such extended rules. However, we will not speculate on this in the paper.

In the midst of our implementation effort, a fourth reason became equally important:

4. **Uncover Implicit Constraints**
   Derivations in the OpenCCG system are guided not only by the explicit constraints of the linguist (CCG grammar and lexicon), but also by hidden, non-documented settings, hard-wired in the program code. Our implementation makes them explicit in that they became declaratively represented in the TFS grammar.

3 Categorial Grammar

Categorial grammar started with Bar-Hillel's work in 1953 who adapted and extended Ajdukiewicz's work by adding directionality to what Ajdukiewicz (by referring to Husserl) called "Bedeutungskategorie". The grammatical objects in Bar-Hillel's system are called *categories*. The set of *complex* categories C can be defined inductively by assuming a set of *atomic* categories A (e.g., s or np) and a set of binary functor symbols F_2 (usually $/$ and $\backslash$ for one-dimensional binary grammar rules):

1. *if* $\mathsf{a} \in \mathsf{A}$ *then* $\mathsf{a} \in \mathsf{C}$
2. *if* $\mathsf{c}, \mathsf{c}' \in \mathsf{C}$ *and* $\mathsf{f} \in \mathsf{F}_2$ *then* $\mathsf{cfc}' \in \mathsf{C}$

The system of categories in its simplest form is usually equipped with two very fundamental binary rules (or better, rule schemes), viz., forward ($>$) and backward ($<$) *functional application*—this is called the AB calculus (for Ajdukiewicz & Bar-Hillel). Here and in the following, we use the notation from Baldridge (2002), originating from the work of Mark Steedman:

$(>\mathbf{A})$ $\mathsf{X/Y}\ \ \mathsf{Y} \Rightarrow \mathsf{X}$
$(<\mathbf{A})$ $\mathsf{Y}\ \ \mathsf{X\backslash Y} \Rightarrow \mathsf{X}$

Depending on the kind of slash, complex category symbols in these rules look to the right (forward) or to the left (backward) in order to derive a simpler category. Such a framework is in the truest sense *lexicalized*, since the categories in these rules are actually category schemes: there is no category $\mathsf{X/Y}$, only instantiations, such as, for instance, $\mathsf{(s\backslash np)/(s\backslash np)}$ for modal verbs.

Furthermore, and very importantly, concrete categories are only specified for lexicon entries (the operator $\vdash$ maps the word to its category):

defeat $\vdash \mathsf{(s\backslash np)/np}$

Not only are lexical entries equipped with a category, but also with a semantics. Since Montague, categorial grammarians have often used the Lambda calculus to make this explicit. Abstracting away from several important things such as tense, we can define what is meant by the transitive verb *defeat* (: is used to separate the syntactic category from the semantic of a lexicon entry):

defeat $\vdash \mathsf{(s\backslash np)/np} : \lambda x.\lambda y.\mathbf{defeat}(y, x)$

The above two rules for functional application in fact indicate how the semantics is supposed to be assembled, viz., by *functional application*:

$(>\mathbf{A})$ $\mathsf{X/Y} : f\ \ \mathsf{Y} : a \Rightarrow \mathsf{X} : fa$
$(<\mathbf{A})$ $\mathsf{Y} : a\ \ \mathsf{X\backslash Y} : f \Rightarrow \mathsf{X} : fa$

f in the above two rules actually abbreviates $\lambda x.fx$, so that the resulting phrase on the right-hand side is in fact fa as a result of applying β-reduction to $(\lambda x.fx)(a)$.

Given these two rule schemes, we can easily find a derivation for sentences, such as *Brazil defeats Germany*:

$$\dfrac{\mathsf{np}{:}\mathbf{Brazil} \quad \dfrac{\mathsf{(s\backslash np)/np}{:}\lambda x.\lambda y.\mathbf{defeat}(y,x) \quad \mathsf{np}{:}\mathbf{Germany}}{\mathsf{s\backslash np}{:}\lambda y.\mathbf{defeat}(y,\mathbf{Germany})}}{\mathsf{s}{:}\mathbf{defeat}(\mathbf{Brazil},\mathbf{Germany})}$$

A lot of linguistic phenomena can be perfectly handled by the two application rules. However, many researchers have argued that the AB calculus should be extended by rules that have a greater combinatory potential. CCG, for instance, employs rules for forward/backward (harmonic & crossed) composition, substitution, and type raising (we only list the forward versions):

3.0.1 Forward Harmonic Composition

$(>\mathbf{B})$ $\mathsf{X/Y}\ \ \mathsf{Y/Z} \Rightarrow \mathsf{X/Z}$

3.0.2 Forward Crossed Composition

$(>\mathbf{B}_\times)$ $\mathsf{X/Y}\ \ \mathsf{Y\backslash Z} \Rightarrow \mathsf{X\backslash Z}$

3.0.3 Forward Substitution

$(>\mathbf{S})$ $(\mathsf{X}/\mathsf{Y})/\mathsf{Z}\ \ \mathsf{Y}/\mathsf{Z}\ \Rightarrow\ \mathsf{X}/\mathsf{Z}$

3.0.4 Forward Type Raising

$(>\mathbf{T})$ $\mathsf{X}\ \Rightarrow\ \mathsf{Y}/(\mathsf{Y}\backslash\mathsf{X})$

Related to these rules are the three combinators (e.g., higher-order functions) for *composition* **B**, *subsitution* **S**, and *type raising* **T** (see Steedman (2000)):

- $\mathbf{B}fg \equiv \lambda x.f(gx)$
- $\mathbf{S}fg \equiv \lambda x.fx(gx)$
- $\mathbf{T}x \equiv \lambda f.fx$

In a certain sense, even functional application can be seen as a combinator, since argument a can be regarded as a nullary function:

- $\mathbf{A}fa \equiv \lambda x.fx(a)$

The three combinators above indicate how semantics should be assembled within the categorial rules. Semantics construction is addressed later when we move to the TFS representation of the CCG rules.

4 Idea

The TFS encoding below distinguishes between atomic and complex categories. Atomic categories such as s do not have an internal structure. However, atomic categories in CCG are usually part of a structured inheritance lexicon, quite similar to HPSG. Atomic categories here do have a flat internal structure, encoding morpho-syntactical feature-value combinations. Thus, atomic categories in our transformation will be realized as typed feature structures to fully exploit the potential of typed unification.

Contrary to this, the most general functor category type has two subtypes / (*slash*) and \ (*backslash*) and defines three appropriate features: 1ST (FIRST), 2ND (SECOND), and MODE (for modalities, explained later). This encoding is similar to the CUG encoding in Karttunen (1986) and Uszkoreit (1986). However, the DIR (direction) feature is realized as a type, and the ARG (argument) and VAL (value) features through features 1ST and 2ND. Our encoding is advantageous in that it

1. makes a complex functor hierarchy possible, even multi-dimensional functors;

2. allows for functors of more than two arguments, thus going beyond the potential of binary rules; and

3. need not look at the directionality of the functor in order to specify the proper values for ARG and VAL (as is the case in Lambek's notation).

Underspecified atomic categories in the CCG rules above are realized through logic variables (coreferences) in the TFS rules below. Moreover, a distinguished list-valued feature DTRS (daughters) is employed in the TFS representation to model the LHS arguments of CCG rules.

5 Examples

We start with the TFS encoding of a proper noun, a transitive verb, and a modal verb, followed by the basic representation of the forward versions of the CCG rules, including a form of Lambda semantics in order to show how the compositional semantic approach of categorial grammars translates into a TFS grammar.

5.1 Lexicon Entries

A proper noun entry, such as

$$\mathit{Germany} \vdash \mathsf{np} : \textbf{Germany}$$

is mapped to a flat feature structure with distinguished attributes CAT and SEM:

$$\begin{bmatrix} \mathit{germany} \\ \text{CAT } \mathit{np} \\ \text{SEM } \textbf{Germany} \end{bmatrix}$$

Actually, **Germany** is represented as a nullary function (i.e., a function with zero arguments)

$$\begin{bmatrix} \mathit{germany} \\ \text{CAT } \mathit{np} \\ \text{SEM } \begin{bmatrix} f \\ \text{NAME } \textbf{Germany} \\ \text{ARGS } \langle\,\rangle \end{bmatrix} \end{bmatrix}$$

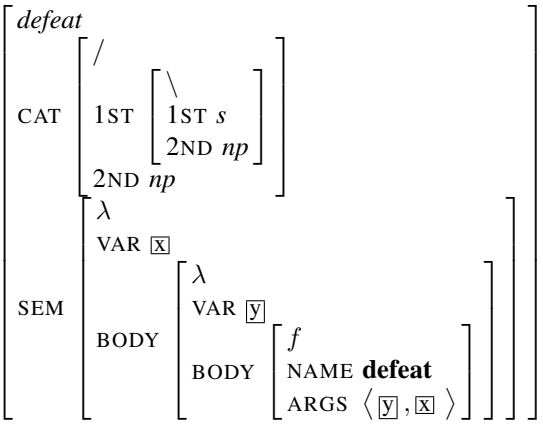
but this does not matter here, and we usually use the abbreviation further above.

The value of SEM is either a function specification (type f) with NAME and ARGS features, or the representation of a Lambda term (type λ), encoded through VAR and BODY. The body of a Lambda term might again be a Lambda term or a function specification. Functional composition is encoded through an embedding of function specifications.

The representation of transitive verbs is a straightforward translation of the one-dimensional CCG specification, e.g.,

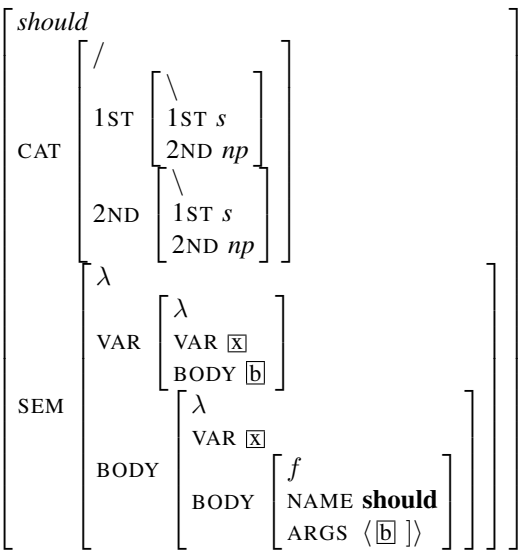
$$\mathit{defeat} \vdash (\mathsf{s} \setminus \mathsf{np})/\mathsf{np} : \lambda x.\lambda y.\mathbf{defeat}(y, x)$$

Note that the de-curried representation suggests that β-reduction for x happens *before* y. Note further that even though x is bound first, it is the second argument of **defeat** (see SEM|BODY|BODY|ARGS):



The representation of modal verbs is more complicated because P in the complex Lambda term below is not an argument like x (or x and y above), but instead a function that is *applied* to x—it might even be a Lambda term as the example *Brazil should defeat Germany* shows. Here is the categorial representation, followed by the TFS encoding:

$$\mathit{should} \vdash (\mathsf{s} \setminus \mathsf{np})/(\mathsf{s} \setminus \mathsf{np}) : \lambda P.\lambda x.\mathbf{should}(Px)$$



5.2 Rules

Next comes the rule for **Forward Functional Application**:

$(>\mathbf{A})\quad \mathsf{X/Y} : f \quad \mathsf{Y} : a \;\Rightarrow\; \mathsf{X} : fa$

$$\begin{bmatrix} >\mathbf{A} \\ \text{CAT}\ \boxed{\text{X}} \\ \text{SEM}\ \boxed{\text{f}} \\ \text{DTRS}\ \left\langle \begin{bmatrix} \text{CAT} & \begin{bmatrix} / \\ 1\text{ST}\ \boxed{\text{X}} \\ 2\text{ND}\ \boxed{\text{Y}} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \lambda \\ \text{VAR}\ \boxed{\text{a}} \\ \text{BODY}\ \boxed{\text{f}} \end{bmatrix} \end{bmatrix}, \begin{bmatrix} \text{CAT}\ \boxed{\text{Y}} \\ \text{SEM}\ \boxed{\text{a}} \end{bmatrix} \right\rangle \end{bmatrix}$$

Given this rule and the entries for *should*, *defeat*, and *Germany*, the twofold application of $(>\mathbf{A})$ yields the correct semantics for the VP *should defeat Germany*, viz., $\lambda x.\mathbf{should}(\mathbf{defeat}(x, \mathbf{Germany}))$, or as a TFS, constructed via unification:

$$\begin{bmatrix} \lambda \\ \text{VAR}\ \boxed{\text{x}} \\ \text{BODY} & \begin{bmatrix} f \\ \text{NAME}\ \mathbf{should} \\ \text{ARGS} & \left\langle \begin{bmatrix} f \\ \text{NAME}\ \mathbf{defeat} \\ \text{ARGS}\ \langle \boxed{\text{x}}, \mathbf{Germany} \rangle \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

The TFS representation of the four rules to follow are **Forward Harmonic Composition**, **Forward Crossed Composition**, **Forward Substitution**, and **Forward Type Raising**. The motivation for such kind of rules, can, e.g., be found in Baldridge (2002).

$(>\mathbf{B})\quad \mathsf{X/Y} : f \quad \mathsf{Y/Z} : g \;\Rightarrow\; \mathsf{X/Z} : \lambda x.f(gx)$

$$\begin{bmatrix} >\mathbf{B} \\ \text{CAT} & \begin{bmatrix} / \\ 1\text{ST}\ \boxed{\text{X}} \\ 2\text{ND}\ \boxed{\text{Z}} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \lambda \\ \text{VAR}\ \boxed{\text{x}} \\ \text{BODY}\ \boxed{\text{f}}\ \left[\ \text{ARGS}|\text{FIRST}\ \boxed{\text{g}}\ \right] \end{bmatrix} \\ \text{DTRS}\ \left\langle \begin{bmatrix} \text{CAT} & \begin{bmatrix} / \\ 1\text{ST}\ \boxed{\text{X}} \\ 2\text{ND}\ \boxed{\text{Y}} \end{bmatrix} \\ \text{SEM}|\text{BODY}\ \boxed{\text{f}} \end{bmatrix}, \begin{bmatrix} \text{CAT} & \begin{bmatrix} / \\ 1\text{ST}\ \boxed{\text{Y}} \\ 2\text{ND}\ \boxed{\text{Z}} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{VAR}\ \boxed{\text{x}} \\ \text{BODY}\ \boxed{\text{g}} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

$(>\mathbf{B}_\times)$ $\mathsf{X/Y}:f \;\; \mathsf{Y\backslash Z}:g \;\Rightarrow\; \mathsf{X\backslash Z}:\lambda x.f(gx)$

$$\left[\begin{array}{l} >\mathbf{B}_\times \\ \textsc{cat} \left[\begin{array}{l} \backslash \\ 1\textsc{st}\ \boxed{\mathsf{X}} \\ 2\textsc{nd}\ \boxed{\mathsf{Z}} \end{array}\right] \\ \textsc{sem} \left[\begin{array}{l} \lambda \\ \textsc{var}\ \boxed{\mathrm{x}} \\ \textsc{body}\ \boxed{\mathrm{f}}\left[\,\textsc{args}|\textsc{first}\ \boxed{\mathrm{g}}\,\right] \end{array}\right] \\ \textsc{dtrs} \left\langle \left[\begin{array}{l} \textsc{cat} \left[\begin{array}{l} / \\ 1\textsc{st}\ \boxed{\mathsf{X}} \\ 2\textsc{nd}\ \boxed{\mathsf{Y}} \end{array}\right] \\ \textsc{sem}|\textsc{body}\ \boxed{\mathrm{f}} \end{array}\right], \left[\begin{array}{l} \textsc{cat} \left[\begin{array}{l} \backslash \\ 1\textsc{st}\ \boxed{\mathsf{Y}} \\ 2\textsc{nd}\ \boxed{\mathsf{Z}} \end{array}\right] \\ \textsc{sem} \left[\begin{array}{l} \textsc{var}\ \boxed{\mathrm{x}} \\ \textsc{body}\ \boxed{\mathrm{g}} \end{array}\right] \end{array}\right] \right\rangle \end{array}\right]$$

$(>\mathbf{S})$ $\mathsf{(X/Y)/Z}:f \;\; \mathsf{Y/Z}:g \;\Rightarrow\; \mathsf{X/Z}:\lambda x.fx(gx)$

$$\left[\begin{array}{l} >\mathbf{S} \\ \textsc{cat} \left[\begin{array}{l} / \\ 1\textsc{st}\ \boxed{\mathsf{X}} \\ 2\textsc{nd}\ \boxed{\mathsf{Z}} \end{array}\right] \\ \textsc{sem} \left[\begin{array}{l} \lambda \\ \textsc{var}\ \boxed{\mathrm{x}} \\ \textsc{body}\ \boxed{\mathrm{f}}\left[\,\textsc{args}|\textsc{rest}|\textsc{first}\ \boxed{\mathrm{g}}\,\right] \end{array}\right] \\ \textsc{dtrs} \left\langle \left[\begin{array}{l} \textsc{cat} \left[\begin{array}{l} / \\ 1\textsc{st}\ \left[\begin{array}{l} / \\ 1\textsc{st}\ \boxed{\mathsf{X}} \\ 2\textsc{nd}\ \boxed{\mathsf{Y}} \end{array}\right] \\ 2\textsc{nd}\ \boxed{\mathsf{Z}} \end{array}\right] \\ \textsc{sem} \left[\begin{array}{l} \lambda \\ \textsc{var}\ \boxed{\mathrm{x}} \\ \textsc{body}\ \boxed{\mathrm{f}} \end{array}\right] \end{array}\right], \left[\begin{array}{l} \textsc{cat} \left[\begin{array}{l} / \\ 1\textsc{st}\ \boxed{\mathsf{Y}} \\ 2\textsc{nd}\ \boxed{\mathsf{Z}} \end{array}\right] \\ \textsc{sem} \left[\begin{array}{l} \lambda \\ \textsc{var}\ \boxed{\mathrm{x}} \\ \textsc{body}\ \boxed{\mathrm{g}} \end{array}\right] \end{array}\right] \right\rangle \end{array}\right]$$

$(>\mathbf{T})$ $\mathsf{X}:x \;\Rightarrow\; \mathsf{Y/(Y\backslash X)}:\lambda f.fx$

$$\left[\begin{array}{l} >\mathbf{T} \\ \textsc{cat} \left[\begin{array}{l} / \\ 1\textsc{st}\ \boxed{\mathsf{Y}} \\ 2\textsc{nd}\ \left[\begin{array}{l} \backslash \\ 1\textsc{st}\ \boxed{\mathsf{Y}} \\ 2\textsc{nd}\ \boxed{\mathsf{X}} \end{array}\right] \end{array}\right] \\ \textsc{sem} \left[\begin{array}{l} \lambda \\ \textsc{var}\ \boxed{\mathrm{f}} \\ \textsc{body} \left[\begin{array}{l} f \\ \textsc{name}\ \boxed{\mathrm{f}} \\ \textsc{args}\ \langle\, \boxed{\mathrm{x}} \,\rangle \end{array}\right] \end{array}\right] \\ \textsc{dtrs} \left\langle \left[\begin{array}{l} \textsc{cat}\ \boxed{\mathsf{X}} \\ \textsc{sem}\ \boxed{\mathrm{x}} \end{array}\right] \right\rangle \end{array}\right]$$

6 Extensions

In this section, we outline several extensions of the basic CG system and show how their TFSs representation look like.

6.1 $-Convention and Generalized Forward Composition

The VP *should defeat Germany* from the rule section can not only be analyzed by a twofold application of $(>\mathbf{A})$, but also by applying $(>\mathbf{B})$ to *should* and *defeat*, followed by $(>\mathbf{A})$. Now, $(>\mathbf{B})$ must be generalized in case we are even interested in ditransitive verbs, or even VPs with further PP attachments. Instead of describing every possible alternative, Steedman (2000) devised a compact notation using $-schemes to characterize functions of varying numbers of arguments, or as Baldridge (2002) puts it: *In essence, the $ acts as a stack of arguments that allows the rule to eat into a category.* For example, the schema $\mathsf{s}/\$$ is a representative for the infinite set $\{\mathsf{s}, \mathsf{s}/\mathsf{np}, (\mathsf{s}/\mathsf{np})/\mathsf{np}, \ldots\}$.

Formally, the expansion of a $-category can be inductively defined as follows. Let C be the set of complex categories, as defined earlier, F_2 the set of binary functor symbols, and let $c \in \mathsf{C}$ and $\mathsf{f} \in \mathsf{F}_2$. Define

$$\mathsf{C}_\epsilon := C \cup \{\epsilon\}$$

$$\mathsf{cf}\epsilon := \mathsf{c}$$

$$\mathsf{cfC}_\epsilon := \{\mathsf{cfd} \mid \mathsf{d} \in \mathsf{C}_\epsilon\}$$

Then

$$\mathsf{cf}\$:= (\mathsf{cfC}_\epsilon)\mathsf{fC}_\epsilon$$

Let us move on to the rule for generalized forward composition $(>\mathbf{B}^n)$ which employs $ and its TFS counterpart:

$(>\mathbf{B}^n)$ $\mathsf{X/Y}$ $(\mathsf{Y/Z})/\$$ $\Rightarrow$ $(\mathsf{X/Z})/\$$

$$\left[\begin{array}{l} >\mathbf{B}^{n>1} \\ \textsc{cat} \left[\begin{array}{l} / \\ 1\textsc{st}^{n-1} \left[\begin{array}{l} / \\ 1\textsc{st}\ \boxed{\mathsf{X}} \\ 2\textsc{nd}\ \boxed{\mathsf{Z}} \end{array}\right] \\ 2\textsc{nd}\ \boxed{\$} \end{array}\right] \\ \textsc{dtrs} \left\langle \left[\textsc{cat} \left[\begin{array}{l} / \\ 1\textsc{st}\ \boxed{\mathsf{X}} \\ 2\textsc{nd}\ \boxed{\mathsf{Y}} \end{array}\right]\right], \left[\textsc{cat} \left[\begin{array}{l} / \\ 1\textsc{st}^{n-1} \left[\begin{array}{l} / \\ 1\textsc{st}\ \boxed{\mathsf{Y}} \\ 2\textsc{nd}\ \boxed{\mathsf{Z}} \end{array}\right] \\ 2\textsc{nd}\ \boxed{\$} \end{array}\right]\right] \right\rangle \end{array}\right]$$

The above TFS uses a "coordinated" path expression 1ST^{n-1} at two places inside the rule structure and is, in a certain sense, even worse than *functional uncertainty* (Kaplan and Maxwell III, 1988), since it involves counting. To the best of our knowledge, we are not aware of TFS formalisms which offer such descriptive means. We thus understand the above structure as a schema that can be compiled into $k-1$ different concrete rules for $1 < n \leq k$.

Another way to carry over the meaning would be to add helper rules for each \$-rule which together simulate the expansion of a \$-category. The efficiency of the second solution, however, is questionable since it generates a lot of intermediate edges, bearing the potential to blow up the search space of the parser.

We have thus opted for the first solution For the OpenCCG grammars that we are using, k is set to 4, especially, since \$ is used only in lexical type-changing rules.

We finally note that $>\mathbf{B}^1$ is equivalent to the original rule $>\mathbf{B}$. In case we define $1\text{ST}^0 := \epsilon$ and assume that $2\text{ND} \doteq \boxed{\text{Z}} \wedge 2\text{ND} \doteq \boxed{\$}$ leads to $\boxed{\text{Z}} = \boxed{\$}$ (features are functional relations!), there is no need to specify $>\mathbf{B}^1$ separately.

In principle, other rule schemata might be generalized in such a way, but at the expense of further uncertainty and overgeneration during parsing.

6.2 Atomic Categories & Morpho-Syntax

As indicated earlier, atomic categories in CCG usually do have a flat internal structure. For instance, the category s_i refers to an inflection phrase (Baldridge, 2002). The TFS representation then uses s_i as a type, having the following definition:

$$\mathsf{IP} \equiv \begin{bmatrix} s_i & \\ \text{SPEC} & \textit{boolean} \\ \text{ANT} & \textit{boolean} \\ \text{CASE} & \textit{case} \\ \text{VFORM} & \textit{fin} \\ \text{MARKING} & \textit{unmarked} \end{bmatrix}$$

Words in CCG usually refer to these more specialized categories; for instance, the ECM verb $\textit{believe} \vdash (\mathsf{s}_i \backslash \mathsf{np})/\mathsf{s}_{fin}$. Given such specific category information, TFS unification takes care that the additional constraints are "transported" throughout the derivation tree.

6.3 Modes & Modalized CCG

Besides having more control through specialized atomic categories as is shown above, *multi-modal CCG* incorporates means from *Categorial Type Logic* to provide further fine-grained lexical control through so-called *modalities*; see Baldridge and Kruijff (2003) for a detailed description. For example, the complex category of the coordination particle $\textit{and} \vdash (\mathsf{s}_i \backslash \mathsf{s}_i)/\mathsf{s}_i$ which can lead to unwanted analyses is replaced by the modalized category $(\mathsf{s}_i \backslash_\star \mathsf{s}_i)/_\star \mathsf{s}_i$.

In principle, modes can be "folded" into subtypes of the very general complex category types / and \. We have, however, opted for an additional feature MODE which takes values from the following atomic mode type hierarchy:

There are further modalities, represented as subtypes of $\diamond$ and $\times$, which are not of interest to us here. Let us finally present the TFSs for *and* and the multi-modal CCG forward type raising rule rule ($>\mathbf{T}$) which even enforces modes to be identical between the embedded and the outer slash.

$$\left[\begin{array}{ll} \textit{and} & \\ \textsc{cat} & \left[\begin{array}{ll} / & \\ 1\textsc{st} & \left[\begin{array}{ll} \backslash & \\ 1\textsc{st} & s_i \\ 2\textsc{nd} & s_i \\ \textsc{mode} & \star \end{array}\right] \\ 2\textsc{nd} & s_i \\ \textsc{mode} & \star \end{array}\right] \end{array}\right]$$

$$\left[\begin{array}{ll} >\mathbf{T} & \\ \textsc{cat} & \left[\begin{array}{ll} / & \\ \textsc{mode} & \boxed{\textsc{M}} \\ 1\textsc{st} & \boxed{\textsc{Y}} \\ 2\textsc{nd} & \left[\begin{array}{ll} \backslash & \\ \textsc{mode} & \boxed{\textsc{M}} \\ 1\textsc{st} & \boxed{\textsc{Y}} \\ 2\textsc{nd} & \boxed{\textsc{X}} \end{array}\right] \end{array}\right] \\ \textsc{dtrs} & \langle [\,\textsc{cat}\ \boxed{\textsc{X}}\,] \rangle \end{array}\right]$$

7 First Measurements

We have compared the performance of the CCG parser and the PET system on a MacBook Pro (2GHz Core Duo, 32 bit architecture). The measurements were carried out against a hand-crafted artificial test corpus of 5,000 sentences with an average length of 7 and a maximal length of 12 words, including sentences with heavy use of different kinds of coordination, such as *Brazil will meet and defeat Germany* or *Brazil should defeat Germany and Italy and England*.

We have switched off the semantics and have only compared the syntactic coverage, using categorial information, including modes. We have also switched off the type raising rules in both parsers, since the OpenCCG parser seems to ignore them in analyses licensed by the grammar theory. Packing in both parsers has been switched on, supertagging switched off because PET does not provide a supertagging stage, but also no models were available for the grammar at hand of the OpenCCG parser.

We further note that we have obtained about twice as much analyses for PET (approximately 15,000 analyses) as the OpenCCG system, the reason for this currently unclear. For instance, the CCG parser produces only **one** analysis for the sentence *Brazil should defeat Germany*, even though a careful inspection of the rules shows that **two** analyses are possible (as is the case for PET), viz.,

$[(<\mathbf{A})\ \mathit{Brazil}\ [(>\mathbf{A})\ \mathit{should}\ [(>\mathbf{A})\ \mathit{defeat}\ \ \mathit{Germany}\ ]\ ]\ ]$

$[(<\mathbf{A})\ \mathit{Brazil}\ [(>\mathbf{A})\ [(>\mathbf{B})\ \mathit{should}\ \ \mathit{defeat}\ ]\ \mathit{Germany}\ ]\ ]$

Even though we have doubled the number of analyses, PET is about one magnitude faster (overall 2.67 vs. 28.9 seconds for the full set of 5,000 sentences).

Both PET and the OpenCCG system have implemented standard CYK parsers. We believe that the difference in the running time is related to the choice of the programming language (C++ vs. Java), but also to optimization techniques (Kiefer et al., 1999), maintenance effort, and the still ongoing development of the PET system by an active community, whereas the evolution of the core parsing engine in the OpenCCG library seems to have ended several years ago.

To some extend, the above mismatch is related to the fact that certain "settings" in the CCG are realized through *program code*, but **not** *declaratively* stated in the lingware. For instance, the type raising rules can in principle be applied to arbitrary categories, but, by default, the OpenCCG code limits them to NPs only. Given our treatment, such a restriction can be easily stated in the TFSs for the type raising rules, and we think that this is the right place to do so:

$$\left[\begin{array}{ll} >\mathbf{T} & \\ \textsc{cat} & \left[\begin{array}{ll} /\ & \\ 1\textsc{st} & \boxed{Y} \\ 2\textsc{nd} & \left[\begin{array}{ll} \backslash & \\ 1\textsc{st} & \boxed{Y} \\ 2\textsc{nd} & \boxed{X} \end{array}\right] \end{array}\right] \\ \textsc{dtrs} & \langle\, [\,\textsc{cat}\ \boxed{X}\ \mathit{np}\,]\,\rangle \end{array}\right]$$

Other "adjusting screws" in OpenCCG, e.g., the specification of the atomic mode hierarchy (see last subsection) are also "casted" in program code (deeply nested *if-then-else* statements that behave different from the mode hierarchy described in the CCG papers), whereas our treatment uses a type hierarchy, helping to better understand and manipulate the parser's output. Given these remarks, explaining missing analyses in OpenCCG has required a deep inspection of the program code. Besides the MODE dimension, we found a further orthogonal binary ABILITY dimension with values *inert* and *active* that was hidden in the program code (Java classes) for each categorial rule. The PET version of CCG still overgenerates (to a lesser extent), so it is very likely that we still overlooked some of the "traps".

8 Moving Further

The transformation schema described in this paper has been manually constructed for the rules, the lexical types, and a small set of lexicon entires. In order to automatically transform the OpenCCG grammars from our Lab for English and Italian, we have implemented code that operates on the XML output of the `ccg2xml` converter for CCG's WebCCG input format. This includes files for rules, general types, and so-called families which are collections of lexical types and corresponding lexical entries.

Contrary to traditional CG and CCG, OpenCCG does not use Lambda semantics, but instead comes with a kind of Davidsonean event semantics, comparable to MRS, building on Blackburn's hybrid modal logic: Hybrid Logic Dependency Semantics or HLDS (Baldridge and Kruijff, 2002). Looking more closely on the seemingly different notation, it becomes quite clear that HLDS formulae can be straightforwardly translated into a TFS representation. We can only throw a glance on a small example at the end of this paper.

Originally, the HLDS representations were built up in tandem with the construction of the categorial backbone (Baldridge and Kruijff, 2002), comparable to the construction of Lambda semantics in our rules before. White and Baldridge (2003) has improved on this construction by attaching the semantics, i.e., the elementary predications (EPs), directly to the atomic categories from which a complex category is built up; see Zeevat (1988) for a similar treatment in UCG.

Consider the sentence *Marcel proved completeness* from Kruijff and Baldridge (2004). Subscripts attached to atomic categories (the nominals) can be used to access them. The satisfaction operator @ that is equipped with a subscript e indicates that the formulae to follow hold at a state named e:

proved $\vdash (\mathsf{s}_e \backslash \mathsf{np}_x)/\mathsf{np}_y$:
$@_e\mathbf{prove} \wedge @_e\langle \text{TENSE} \rangle \mathbf{past} \wedge @_e\langle \text{ACT} \rangle x \wedge @_e\langle \text{PAT} \rangle y$

Marcel $\vdash \mathsf{np}_m$: $@_m\mathbf{Marcel}$

completeness $\vdash \mathsf{np}_c$: $@_c\mathbf{completeness}$

By *conjoining* the EPs during the application of $(>\mathbf{A})$ and $(<\mathbf{A})$, we immediately obtain

Marcel proved completeness $\vdash \mathsf{s}_e$:
$@_e\mathbf{prove} \wedge @_e\langle \text{TENSE} \rangle \mathbf{past} \wedge @_e\langle \text{ACT} \rangle m \wedge$
$@_e\langle \text{PAT} \rangle c \wedge @_m\mathbf{Marcel} \wedge @_c\mathbf{completeness}$

Exactly these effects can be achieved through unification in our framework. The CCG nominals are realized through logic variables (coreference tags), atomic categories, such as s or np are assigned a further feature INDEX, cospecified with the semantics, and the nominals are realized through ordinary features. In theory, SEM is a set-valued feature whose elements are combined conjunctively (as in HLDS or MRS). Since $\mathcal{TDL}$ (and PET) does not provide sets, the usual list implementation is used. This gives us the following TFSs (we have omitted the explicit

representation of the name of the event variables e, m, and c in the individual EPs below):

$$\left[\begin{array}{l} \textit{proved} \\ \textsc{cat} \left[\begin{array}{l} / \\ \textsc{1st} \left[\begin{array}{l} \backslash \\ \textsc{1st} \left[\begin{array}{l} s \\ \textsc{index} \ \boxed{e} \end{array}\right] \\ \textsc{2nd} \left[\begin{array}{l} np \\ \textsc{index} \ \boxed{x} \end{array}\right] \end{array}\right] \\ \textsc{2nd} \left[\begin{array}{l} np \\ \textsc{index} \ \boxed{y} \end{array}\right] \end{array}\right] \\ \textsc{sem} \ \boxed{e} \langle \textbf{prove}, [\textsc{tense} \ \textit{past}], [\textsc{act} \ \boxed{x}], [\textsc{pat} \ \boxed{y}] \rangle \end{array}\right]$$

$$\left[\begin{array}{l} \textit{marcel} \\ \textsc{cat} \left[\begin{array}{l} np \\ \textsc{index} \ \boxed{m} \end{array}\right] \\ \textsc{sem} \ \boxed{m} \langle \textbf{Marcel} \rangle \end{array}\right]$$

$$\left[\begin{array}{l} \textit{completeness} \\ \textsc{cat} \left[\begin{array}{l} np \\ \textsc{index} \ \boxed{c} \end{array}\right] \\ \textsc{sem} \ \boxed{c} \langle \textbf{completeness} \rangle \end{array}\right]$$

Alternatively, the list representation of EPs might be replaced by a single complex feature structure. However, the list implementation makes it easy to implement relational information, e.g., the representation of several modifiers. Given the above encoding, there is no longer a need to specify semantics construction in each of the categorial rule schemata: semantics construction simply "happens" here when categorial information is unified. In a certain sense, this is easier and more elegant than representing the effects of the different combinators **A**, **B**, **S**, **T** in the different kinds of rule schemata, as we have described in the beginning of this paper. More complex constructions involving, e.g., coordination particles, suggest that the list under SEM is in fact a difference list in order to ease the implementation of a list append that is not required in the example above.

9 More Measurements and Outlook

The measurements reported in section 7 involved a hand-written TFS PET grammar that we have compared against an equivalent OpenCCG grammar. This experiment did not involve any kind of **Lambda** semantics.

The measurements described here are related to the hand-written **HLDS**-based OpenCCG grammar that is used in the robots to interact with humans. We have almost managed to automatically transform the medium-size English grammar with some minor manual interaction.

Again, both PET and the OpenCCG parser used packing, but did not involve a supertagging stage. We used a small test corpus of 246 sentences coming with

the grammar. We were able to reproduce the same number of passive edges in both parsers, so we are pretty sure that the translation, described in the previous section, is in fact correct. For the MacBook Pro from section 7, we obtained the following numbers (startup times taken out):

- **PET**: 9.5 seconds, 170 MB RAM
- **OpenCCG**: 75.6 seconds, 780 MB RAM

Overall, this gives us a speedup factor of about 8, compared to 10 in section 7.

After having almost finished the translation process, we hope to address item 2 from section section 2 in the very near future. This involves the application of the approximation method (Krieger, 2007) and the use (of parts) of the approximated grammars as structured language models in the speech recognizers (Sphinx, Julius, Loquendo), used by the Talking Robots group at DFKI.

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Linearization and its discontents

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Abstract

Much recent work on coordination in the HPSG framework seeks to deal with some of the most intractable issues this phenomenon poses for a constraint-based phrase structure architecture by appealing to the linearization mechanism introduced in Reape 1993. The research in question utilizes the mismatch between linear phonological sequences on the one hand and phrasal configuration on the other to underwrite a particular interpretation of ellipsis in which multiple structural objects with identical or near-identical descriptions are mapped to a single *dom-object* token. This mapping apparently allows a variety of problematic cases, such as right node raising, dependent cluster coordination, and unlike category coordination to be reinterpreted as instances of ordinary coordination in which structurally present elements receive no prosodic expression, creating the impression that strings which do not correspond to constituents of the same category have nonetheless been conjoined or disjoined. I argue in this paper that such linearization-based ellipsis (LBE) analyses, though plausible when confined to a narrow class of simplest-case data, prove untenable in the face of data sets in which the LBE approach must account for the interaction of nonconstituent coordination and quantification or symmetric predication, symmetrical modification of nominal heads, and a large and varied class of unlike category coordinations that do not admit of any ellipsis-based solutions. I show in addition that various objections offered in the LBE literature to categorial grammar treatments of the problems posed by noncanonical coordinations do not take into account techical resources available to CG which permit straightforward and unproblematic solutions to these problems. One must conclude that despite the general poplularity of LBE accounts of conjunction, there is at the moment no satisfactory HPSG treatment of noncanonical coordinations.

1 Coordination via Linearization-Based Ellipsis

The simplest story about coordination is very simple indeed: only constituents belonging to the same category can coordinate. Unfortunately, this characterization of the possibilities cannot be maintained, in the face of examples such as (1):

(1) a. I gave Robin a book and Terry a pair of pliars.
b. I gave Robin, and Leslie offered Terry, a pair of pliars.
c. That man and woman are arguing again.
d. Robin is a Republican and proud of it.

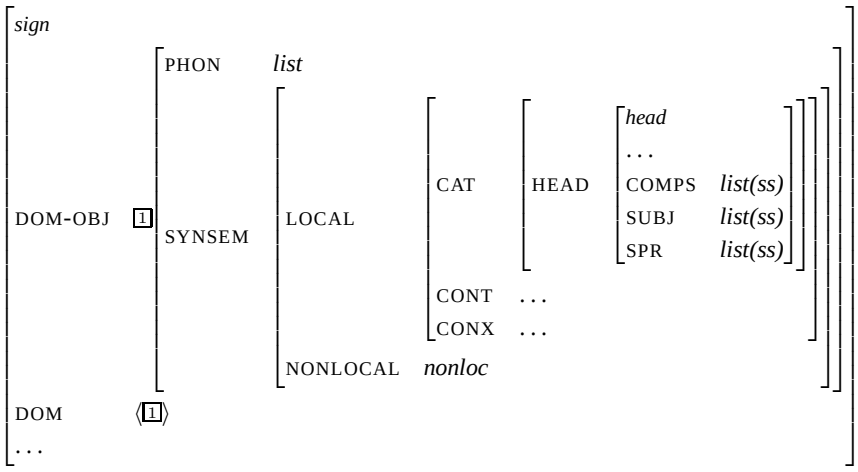
In (1)a-b, non-constituents are conjoined. In (1)c, the problem is not that there is any evident conjunction of nonconstituents, but rather that the coordination seems to have mutually incompatible specifications for number: singular so far as agreement with the specifier *that* is concerned, but plural for purposes subject/verb agreement. In (1)d, the conjuncts are of different categories.

The HPSG literature on difficult coordination phenomena over the past decade contains a particular strand of analysis based on a kind of data structure first introducted in

[†]The work reported below has been incorporated into a large-scale joint research project with Yusuke Kubota, to whom I am greatly indebted for extremely perceptive comments on earlier drafts of this paper and closely related manuscripts. I wish to thank in addition Bob Borsley, Carl Pollard and Mike Reape for very useful feedback on many of the analyses, arguments and examples offered below. None of them bear any responsibility for errors or shortcomings in the following discussion.

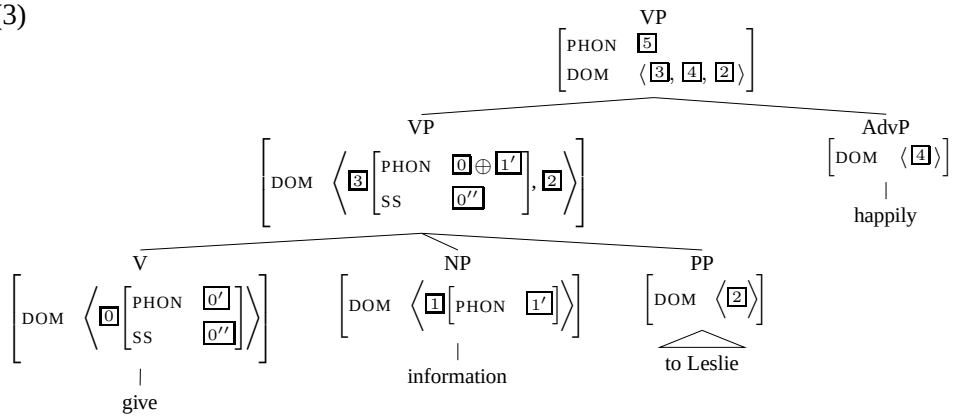
Reape 1993, Reape 1996, and later widely adopted in studies of conjunction, based on the DOM attribute as per the feature architecture in (2):

(2)



Lexical items contribute their phonology and synsem properties to a dedicated list, the DOM specification. Crucially, the DOM specification of a sentence, and of phrases in general, need not represent a simple concatenation of the DOM values of its parts, but rather may represent the shuffling-together of its daughters' own DOM values. Thus, elements belonging to different constituents may correspond to pronunciations in which prosodic expression of those elements are intermixed. Thus, while constituency itself is never discontinuous, the phonological instantiation of constituents may well be. As a consequence of the rules determining under what conditions DOM lists may be shuffled together, and the principles regulating what ordering relations hold amongst different phrasal types, the following kind of representation receives a legal description in an HPSG grammar of English, where $\oplus$ denotes the append operator:

(3)



By separating out constituency on the one hand from the formation of domains in which word order is defined on the other, we can reconcile the hierarchical representation in 3) with the pronunciation *I gave information happily to Leslie*. This crucial decoupling of prosody and constituency which raises the possibility of a more general approach to form/meaning mismatches: components of an interpretation which are unpronounced now have a place in the architecture of syntactic representation. The

approach alluded to above, which offers a unitary treatement of the phenomena in (1), rests on an extension of the linearization framework playing heavily on this treatment of misalignments between the apparent structure and the manifest interpretation of coordinations such as those in (1).

One influential proposal implementing the linearization approach to such data takes the form of a condition on coordination given in (4).

(4)

$$\left[\begin{array}{ll}\textsc{dom} & \boxed{X} \oplus \boxed{A}_{nelist} \oplus \boxed{Y}\left[\textsc{cat} \quad \textit{conj}\right] \oplus \boxed{B}_{nelist} \\ \textsc{cat} & \boxed{0}\end{array}\right]$$

$$\left[\begin{array}{ll}\textsc{dom} & \boxed{X}\left\langle\left[\textsc{rels}\ R_1\right]\ldots\left[\textsc{rels}\ R_n\right]\right\rangle \oplus \boxed{A} \\ \textsc{cat} & \boxed{0}\end{array}\right] \qquad \left[\begin{array}{ll}\textsc{dom} & \mathrm{Y} \oplus \left\langle\left[\textsc{rels}\ R_1\right]\ldots\left[\textsc{rels}\ R_n\right]\right\rangle \oplus \boxed{B} \\ \textsc{cat} & \boxed{0}\end{array}\right]$$

This principle—which in essence tells you that for a given input, different parses of the domain in the two conjuncts permit the ellipsis of different substrings—is subject to the condition in (5), dictating that when coordination syntactically links two or more clauses, the meaning of the coordination must be the yield of the logical operation corresponding to coordination taking as its arguments the semantics specifications of each daughter:

(5) **Principle of Semantic Compositionality:** for all structures,

$$\left[\textsc{cont|rels} \quad \bigoplus_{j=1}^{n} \boxed{R_j}\right]$$

$$\left[\textsc{cont|rels} \quad \boxed{R_1}\right] \qquad \cdots \qquad \left[\textsc{cont|rels} \quad \boxed{R_n}\right]$$

Thus we can get, from two sentences whose *tectogrammatical* form (following the terminology in Curry 1963) would be realized as *Robin gave a book to Terry* and *Robin gave some flowers to Pat*, a domain object on the mother of the conjunction of these two sentences which corresponded to *Robin gave a book to Terry and Robin gave some flowers to Pat*. But we could equally well assign $\boxed{X}$ as in (6)a. In that case, the coordination rule schematically stated in (4) will yield the structure in (6)b:

(6) a. $\boxed{X}$ = ⟨*I, gave*⟩

b.

$$\begin{array}{c}\textsc{s} \\ \left[\textsc{dom} \quad \langle\ \textit{I, gave, Robin, a, book, on Thursday, and, Leslie, a, book, on Friday}\rangle\right]\end{array}$$

$$\begin{array}{cc}\textsc{s} & \textsc{s} \\ \left[\textsc{dom} \quad \langle \textit{I, gave}\rangle \oplus \langle \textit{Robin}, a, \textit{book}, \textit{onThursday}\rangle\right] & \left[\textsc{dom} \quad \langle \textit{and}\rangle \oplus \langle \textit{I, gave}\ \rangle \oplus \langle \textit{Leslie}, a, \textit{book}, \textit{onFriday}\rangle\right]\end{array}$$

c. I gave Robin a book on Thursday and ~~I gave~~ Leslie a book on Friday.

In short, it turns out that we do not have non-constituent coordination, but rather coordination of ordinary, structurally canonical constituents, where part of the second syntactically coordinated constituent is concealed in the form of prosodic silence—thereby giving the impression of not actually being there. We henceforth adopt a

convention on the notation of ellipsis whereby the analysis in (6)b is abbreviated as (6)c. Similarly, the other cases exemplified in (1)b–d can be treated as ellipses along the lines in (7):

(7) a. [$_{S}$ I gave Robin ~~a pair of pliars~~] [$_{S}$ and [$_{S}$ Leslie offered Terry, a pair of pliars]].
b. [$_{NP}$ That man] and [$_{NP}$ ~~that~~] woman are arguing again.
c. [$_{S}$ Robin is a Republican] and [$_{S}$ ~~Robin is~~ proud of it.]/Robin [$_{VP}$ [$_{VP}$ is a Republican] and [$_{S}$ ~~is~~ proud of it.]]

In all these cases, the linearization-based solution uses the same fundamental technique: ellipsis is made responsible for concealment of material which is structurally present and which combines with the audible elements to yield a canonical constituent of the same type as the other conjunct.

Unsurprisingly, the linearization-based ellipsis (LBE) approach's apparent reduction of a diverse range of problem coordinations to a single factor, and its ability to motivate that factor, has earned it something close to default status in certain parts of the HPSG research community—but, as I argue directly, quite prematurely. The examples in (1) prove to be strikingly unrepresentative of the full range of data in this empirical domain, and the LBE account has only highly stipulative technology at its disposal to handle any but the simplest-case difficulties exhibited above. When elements corresponding to negations appear in the ellipsis environments illustrated in (6)–(7), LBE analyses entail nontrivial mispredictions unless strikingly unprincipled escape hatches are adopted—and even more so in the case of symmetrical predicates in such evironments, e.g. *same/equal/different/ill-suited/mutually hostile*. It turns out that it is precisely the assumption that structural real but inaudible material exists in these syntactic contexts which leads to the difficulties alluded to—difficulties which the LBE analysis can only overcome by in effect stipulating operations which undo the effect of assuming such material.

2 LBE: major contraindications

2.1 Nominal head coordination under a singular determiner

Consider first examples such as (8)–(13), based in part on data in Heycock & Zamparelli 2005, §6.3:

(8) a. That ill-matched man and woman are fighting again.
b. *That ill matched man and that ill-matched woman are fighting again.

(9) a. That mutually hostile judge and defense attorney were constantly sniping at each other during the trial.
b. *That mutually hostile judge and that mutually hostile defense attorney were constantly sniping at each other during the trial.

(10) a. Supose an entangled particle and antiparticle are created in the vicinity of a mass singularity as a vacuum fluctuation in a region subject to an extreme gravitational potential.
b. #Supose an entangled particle and an entangled antiparticle are created in the vicinity of a mass singularity.

(11) a. In unusual cases, a reciprocally antagonistic primary and secondary infection give rise to a completely asymptomatic presentation.
b. *In unusual cases, a reciprocally antagonistic primary and a reciprocally antagonistic secondary infection give rise to a completely asymptomatic presentation.

(12) a. *That creep$_i$ and friend of his$_i$ are not welcome in this house.
b. That creep$_i$ and that friend of his$_i$ are not welcome in this house.

(13) a. *Some $\left\{ \begin{array}{l} \text{man and women} \\ \text{women and man} \end{array} \right\}$ were having an awful argument.
b. $\left\{ \begin{array}{l} \text{Some man and some women} \\ \text{Some women and some man} \end{array} \right\}$ were having an awful argument.

In (8)–(11), the non-ellipsed versions are themselves ill-formed, showing, among other things, the futility of trying to handle the standard difficulty posed by symmetrical predicates in peripheral node-raised constructions by means of some 'integration' mechanism associated with displacement, as has been suggested occasionally in recent work; the problem in the cases illustrated is of the same sort, and no displacement can be even remotely plausible as the source. (12), based on Heycock and Zamparelli's example (125), and (13), present a problem for the LBE account of a rather different order: here the question is one of blocking an ellipsis which, on purely structural grounds, does not appear to provide any basis for such a block, other than that the result is ill-formed.

The moral is that once the data to be explained under an ellipsis-based analyses include anything beyond simplest-case examples such as (1)c, the empirical advantage routinely claimed for such analyses in the literature arguing for LBE accounts of coordination largely vanishes. The phenomena illustrated above make clear the need to consider other possibilities, e.g., that structures in which nominal structures *appear* to be conjoined under a singular determiner are best analyzed along precisely those lines. Thus, if *That ill-suited man and woman have never been civil to each other in public* cannot be represented as

(14) That ill-suited man and ~~that ill-suited~~ woman have never been civil to each other in public.

then the source of *that man and woman have never been civil to each other in public* cannot plausibly be taken to be

(15) That man and ~~that~~ woman have never been civil to each other in public.

2.2 Nonconstituent coordination

2.2.1 Negative quantification

Consider next the data in (16) in light of the analysis demanded by the LBE analysis of nonconstituent coordination:

(16) Terry said nothing about Robin on Thursday or (about) Leslie on Friday.

Such examples are intepretable exclusively as a coordination of negations: (16) is true just in case Terry said nothing about Robin on Thursday and Terry said nothing about Leslie on Friday. We note further that the strings *Robin on Thursday or Leslie on Friday* and *about Robin on Thursday or about Leslie on Friday* are nonconstituents. Hence they *must* arise, on the LBE view, by ellipsis.

(17) a. [$_{\zeta}$ Terry said nothing about Robin on Thursday] or [$_{\varrho}$ ~~(Terry) said nothing about~~ Leslie on Friday]. [$\neg\zeta \vee \neg\varrho$]
b. [$_{\zeta}$ Terry said nothing about Robin on Thursday] or [$_{\varrho}$ ~~(Terry) said nothing~~] [$\neg\zeta \vee \neg\varrho$] about Leslie on Friday.

But while the interpretation of these sentences permits only the conjunction-of-negations reading (as indicated in the formulæ attached to each of the abbreviated DOM representations), the denotation of the 'source' sentences, corresponding the meaning of (17) without the strikethroughs is precisely the *dis*junction of negations which we identified as unavailable for the meaning of (16). The intrerpretation of (16) reflects something very much like the De Morgan equivalence $\neg(\zeta \vee \varrho) \equiv \neg\zeta \wedge \neg\varrho$, which of course would follow if the negation operator were both able and required to scope directly over some grammatical object corresponding to the disjunction of the PP PP or NP PP sequences in (16). But of course, the LBE approach exists precisely in order to deny that such coordination is the source of this and similar examples.

We note in the first place that the proposal in Crysmann 2003 imposing token identity on ellipsed dependents (as vs. ellipsed heads) gets no traction at all in dealing with the problem posed by (16). Crysmann motivates this asymmerical treatment on the basis of the data he gives in his examples (18)–(20) (my renumbering):

> Thus, in semantic terms, sharing of heads differs quite drastically from sharing of dependents, where token-identity of cont values is necessary to derive the correct interpretation:
>
> (18) a. Few men drink and smoke.
> b. $\not\supset$ Few men drink and few men smoke.
> (19) a. Few men gave Mary a book on Friday and a record on Saturday.
> b. $\not\supset$ Few men gave Mary a book on Friday and few men gave Mary a record on Saturday.
> (20) a. I gave few men a book on Friday and a record on Saturday.
> b. $\not\supset$ I gave few men a book on Friday and I gave few men a record on Saturday.
>
> Without token-identity of CONT values, we would give the above sentences in a. an interpretation equivalent to b., whereas structure-sharing will ensure that the sets denoted by few men are identical across the two conjuncts in the a. sentences, while they may be disjoint in the corresponding sentences in b...[Dependents] observe a stronger restriction [than heads], involving token-identity of the domain objects across all conjunct daughters. This latter requirement is sufficient to derive the effect of obligatory coreference of shared dependents.

(pp. 51, 62). Since the denotion of the null quantifier *nothing* is constant to exactly the same degree as that of *a book* in *I gave a book to Robin on Tuesday and to Terry*

on Thursday on the reading in which the book Robin received is distinct from the one that Terry received, it is difficult to see how Chrysmann's restriction on identity of content can possibly account for the unavailability of the 'disjunction of negatives' interpretation. Chrysmann's own efforts to handle this kind of *give a book* example of NCC involves recourse to a semantically extremely vague concept of 'abstract notion' or 'abstract referent', with not even a preliminary characterization of what class of semantical objects is denoted by such labels, and hence no way of determining the substantive *content* of Chrysmann's proposal. It seems sufficiently self-evident, however, that in whatever sense *a book* is 'token-identical' in the two different conjuncts in this kind of example, the tokens of *nothing* in the required source for(16) are a fortiori, a point that Beavers and Sag (2004) themselves make.

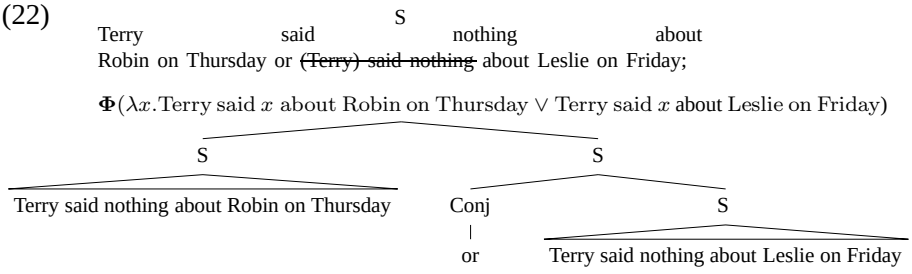
Beavers and Sag certainly do not ignore the problem posed by Crysmann's examples, but neither do they adopt his proposals as I've cited them. Rather, in connection with the seemingly obligatory nature of their Quantifier Merger operation in (18)–(20), they comment that 'we tentatively suggest that this can be regarded simply as a preference for constituent coordination'. But that hardly be the solution for the obligatory wide-scoping of negation over disjunction (with the attendant De Morgan intepretation) in (16), since there *is* no constituent coordination available, as already discussed. It has been suggested that the Beaver & Sag operation of 'Quantifier (Q-) Merger' might be able to save the ellipsis analysis here. Formally, Q-Merger is defined in AVM notation as follows:

(21)

$$
\textit{cnj-cxt} \Rightarrow \left[\begin{array}{l}
\textsc{mtr}|\textsc{sem}|\textsc{rels}\ \ \boxed{X_1} \oplus \ldots \oplus \boxed{X_i} \oplus \boxed{Y} \oplus \boxed{Z} \\
\textsc{dtrs}\ \left\langle \left[\begin{array}{l}
\textsc{dom}\ \left\langle \left[\begin{array}{ll} \textsc{frm} & \boxed{P^1} \\ \textsc{hd} & \boxed{Q^1} \\ \textsc{sem} & \boxed{S^1}\left[\begin{array}{ll} \textsc{ind} & \textit{ref-index} \\ \textsc{rels} & \boxed{X_1} \end{array}\right] \end{array}\right], \ldots, \left[\begin{array}{ll} \textsc{frm} & \boxed{P^m} \\ \textsc{hd} & \boxed{Q^m} \\ \textsc{sem} & \boxed{S_m}\left[\begin{array}{ll} \textsc{ind} & \textit{ref-index} \\ \textsc{rels} & \boxed{X_m} \end{array}\right] \end{array}\right] \right\rangle \circ \mathit{nelist} \\
\textsc{sem}\ \ \boxed{X_1} \oplus \ldots \oplus \boxed{X_m} \oplus \boxed{Y}
\end{array}\right], \\
\qquad\qquad \left[\begin{array}{l}
\textsc{dom}\ \left\langle \left[\begin{array}{ll} \textsc{frm} & \boxed{P^1} \\ \textsc{hd} & \boxed{Q^1} \\ \textsc{sem} & \boxed{S_1}\left[\begin{array}{ll} \textsc{ind} & \textit{ref-index} \\ \textsc{rels} & \boxed{X_1} \end{array}\right] \end{array}\right], \ldots, \left[\begin{array}{ll} \textsc{frm} & \boxed{P^i} \\ \textsc{hd} & \boxed{Q^i} \\ \textsc{sem} & \boxed{S_i}\left[\begin{array}{ll} \textsc{ind} & \textit{ref-index} \\ \textsc{rels} & \boxed{X_1} \end{array}\right] \end{array}\right] \right\rangle \circ \mathit{nelist} \\
\textsc{sem}\ \ \boxed{X_1} \oplus \ldots \oplus \boxed{X_i} \oplus \boxed{Z}
\end{array}\right] \right\rangle
\end{array}\right]
$$

The problem that Q-Merger faces can be schematically summarized in (22):

(22)



In a nutshell, Beaver and Sag would need to posit some variable-like element corresponding to the quantifier in the two conjuncts and then let the conjunction take scope

and then bind the variables over the whole coordinate structure either by an analog of the lambda operator or by somehow binding the variable(s) directly by the quantifier. There is not the faintest hint within the MRS markup language that Beaver and Sag assume about how to implement such a translation, because there is nothing analagous to lambda abstraction in MRS. But that particular difficulty is only the beginning of the trouble facing OQM. Let's assume that something along those lines could be worked out. Certainly in an algebraically well-defined representation language such as RSRL, lambda abstraction can be simulated, and in the associated syntax/semantics interface definition, aka Lexical Resource Semantics, lambda abstraction is the default formalism for set definition. So we may assume, for the sake of argument, that something like the Beaver/Sag analysis could be reconstructed as in LRS. Then this analysis at the very least requires that quantifiers appearing within conjuncts be able to scope out of conjuncts, a very dubious assumption. Consider the example from Sabbagh 2007:

(23) a. Some nurse gave a flu shot to, and administered a blood test for, every patient who was admitted last night.
b. Some nurse gave a flu shot to ~~every patient who was admitted last night~~, and administered a blood test for every patient who was admitted last night.

(24) Some nurse gave a flu shot to every patient who was admitted last night, and administered a blood test for every patient who was admitted last night.

Right Node Raising, as in (23)a, allows the quantifier in the 'raised' material to outscope the coordination; but when the quantifiers are overt, this scoping is not available. Any proposal in which phonologically covert quantifiers reflected scoping possibilities unavailable in the corresponding cases with phonetically realized quantifiers would be suspicious in the extreme, but that is what the situation would have to be for there to be any chance of 'Quantifier Merger', however implemented, to account for the negative quantifier scope data in (16).

More generally, Quantifier Merger 'kicks in' only when quantifier meanings are not just identified across conjuncts, but one of the corresponding quantifiers is ellipsed as well. Examination of this claim reveals a remarkable coincidence: in just those cases where a quantifier appears *phonetically* outside a coordination, it is allowed, by a special 'handwritten' specification of the mother's SEM value, to act combinatorially as though it were indeed outside that coordination. This is of course completely fortuitous on the assumption that the quantified NP occurs within both conjuncts, since there is no structural reason, no functional linkage whatever in HPSG's feature architecture, between the phonological form of the quantifier on the one hand and its scoping possibilities on the other.[1] But Q-Merger in effect builds that massive cooincidence into the grammar, as a kind of 'last resort stipulation', since if two distinct generalized quantifiers were to structure-share the same BODY specification, we would wind up with a kind of multidominance in the MRS tree structure—a violation of the principle constraint imposed on such MRS scoping configurations. The burden of proof inherently assumed by such a proposal makes it considerably less attractive than the

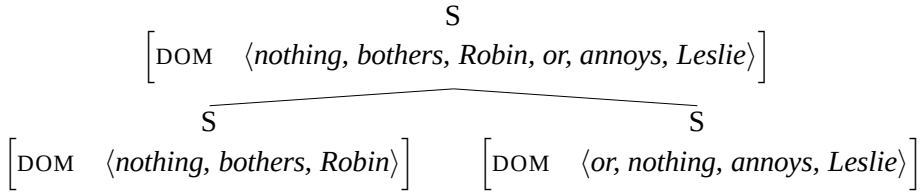
[1] There is no reason in principle, for example, why one could not have written Q-Merger so that the SEM on the mother was the same even in the absence of ellipsis, so that *I said nothing to Robin on Friday or I said nothing to Leslie on Sunday* had the same reading as (16), which is manifestly *not* the case.

position which motivates the scoping in the two different cases on the assumptions that the structures involved are, indeed, fundamentally different.

But the most problematic aspect of any account of (16) along these lines is that it fails completely to account for the fact that, in the absence of signficant informed introspection, this sentence appears to *preclude* an interpretation reflecting the structural components which are the input to the coordination—that is, where the sentence is interpreted as a disjunction of negated propositions. Q-merger, at least on the most recent version of LBE, in Chaves and Sag 2009, would have to be optional, since ellipsis is completely nondeterministic, the result of altenrative assignments of substrings of the input daughters' COM lists to variables in the coordination construction schema. So what happened to this interpretation? One suggestion that came to my attention in the feedback on the abstract submission for the Conference presentation version of this paper was based on the possibility that this essentially unavailable reading was somehow 'preempted', along the following lines. In the case of a sentence such as

(25) a. Nothing bothers Robin or annoys Leslie.
b. $\neg\exists x.\mathbf{bother}(\mathbf{robin})(x) \vee \mathbf{annoy}(\mathbf{leslie})(x)$
c. $\neg\exists x.\mathbf{bother}(\mathbf{robin})(x) \vee \neg\exists w.\mathbf{annoy}(\mathbf{leslie})(w)$

we have in principle two sources, which should give rise to two different readings. On one of them, *nothing* outscopes the the disjunction, as per (25); on the second, *or* outscopes negation, yielding a reading along the lines of (25)b. As it happens, however, the second of these readings is for most, if not all speakers, simply unavailable; there is no ambiguity, and the only reading (on the quantificatory interpretation of *nothing* is (25)a. On the structure

(26)


we expect to get a reading of the form $\neg\varphi \vee \neg\psi$, given the semantics of the input sentences. The suggestion I want to respond to here is that this missing reading is 'preempted for performance reasons', with the following interesting comment:

> I for one find it quite reasonable that when a conjunction can be parsed by direct coordination, without ellipsis, then that parse is highly preferable when compared to an elliptical parse UNLESS there are contextual or semantic factors that make the direct parse odd.

giving as an example

(27) a. Two trees were cut down by me in 1986, and by my wife in 1999.
b. Two trees were cut down by me in 1986, and by my wife in 1999.

But the point is that (16) *has no other source than ellipsis on the assumptions in the literature I'm speaking to.* If, as assumed in this literature, coordination only combines constituents as defined by the various schemata, or type constraints on headed

structures, then (16) *must* be derived from a sole source of the form (17)b. Hence, in contrast to (25)a, there is in principle *no* way to obtain the virtually exclusive reading for the examples (16) from the semantics of any candidate input structures. In order to obtain the different reading associated with the input disjunction of negations, it would be necessary first of all to carry out ellipsis, and then apply a rule of Q-Merger which, as I've already discussed, has a very obscure formal basis for the necessary logical algebraic operations, and which moreover contradicts the observed pattern of quantified NP interpretation from within conjuncts. But even this isn't enough: a convincing, independently motivated account must be given to make it plausible that the disjunction-of-negations reading is somehow pragmatically so inaccessible that it is suppressed by virtually every ordinary speaker of English I've consulted. Finally, it should be noted that none of this will account for the fact that for many speakers, (28) is perfectly well formed, but literally unlicensable on ANY reading, from (4)a:

(28) a. I said nothing to Robin on Thursday nor (to) Leslie on Sunday.
b. I said nothing to Robin on Thursday nor ~~(I) said nothing to Leslie on Sunday~~

The source of (28)a, (28) be, corresponds to a completely impossible string when supposedly optional ellipsis occurs. Nor is there any way to use (4) to obtain (28) on the basis of the acceptable version of (28)b incorporating neg-fronting (*I said nothing to Robin on Friday nor did I say anything to Leslie on Sunday*, with a host of completely ad hoc item-by-item replacements requiring a special construction that would have, I think, minimal credibility. Moreover, treating *nor* as a 'prosodic variant' of *or* under the circumstance, another possible story within the LBE approach, demands that the conditions on this variation be fully spelled out, at a level of detail I have yet to see in any LBE analysis.

I therefore think it fair to say that the burden of proof in this case very clearly rests on the shoulders of whoever actually believes that there is a coherent, explicit LBE story about examples such as (16) that accounts for the facts.

2.2.2 Symmetrical predicates

The fundamentally inadequacy of Optional Q-Merger to handle data such (28) emerges clearly when we turn from negative quantification to what *appears* to be a comparable phenomenon involving symmetrical predicates quantification. In the case of (29), for example, we find a flagrant mismatch between the meaning of (29)a on the one hand and that of its non-ellipsed 'sources' in (29)b–c on the other:

(29) a. I said the same thing to Robin on Thursday and (to) Leslie on Friday.
b. I said the same thing to Robin on Thursday and ~~(I) said the same thing to~~ Leslie on Friday.
c. I said the same thing to Robin on Thursday and ~~(I) said the same thing~~ to Leslie on Friday.

To the extent that a context can be provided in which the source sentences in (29)b–c make sense, synonymy between these examples on the one hand and (29)a on the other is in no sense entailed, though it might be inferred if, coincidentally, *the same thing* in the first clausal conjunct and *the same thing* in the second clausal conject happen to be identical to each other. But given a situation in which you met twice with Robin, once

on Monday and once on Thursday, and twice with Leslie, once on Tuesday and once on Friday, we can easily take (29)b–c to mean that you said X to Robin on Monday and then said X to him or her on Thursday, and you said Y to Leslie on Tuesday and then said Y to him or her on Friday, with $[\![X]\!] \neq [\![Y]\!]$. In (29)a, on the other hand, there is no other interpretation apart from the one in which $[\![X]\!] = [\![Y]\!]$. Here again, the predictions of the ellipsis approach fall wide of the mark.

Things are no better when we consider cases such as (1)b. On the ellipsis approach, we need to analyze (30)a along the lines of (30)b:

(30) a. Robin reviewed, and Leslie read, the same book.
b. Robin reviewed ~~the same book~~, and Leslie read the same book.

Consider the following situation: ten years ago, Robin reviewed some book B_1 and Leslie read some book B_2. Robin's job reviewing dozens of books a year, and Leslie's habits as an avid reader with a poor memory, has brough about a situation in which Robin writes a second review of B_1, and Leslie rereads B_2. Under these circumstances, the 'source' sentence reflected in (30)b would be appropriate—but (30)a would not be. The latter can only mean that there was a particular book such that Robin reviewed that book and Leslie read it. Again, the ellipsis analysis fails to capture the facts.

The obvious move in this case is to take the position that 'in for a penny, in for a pound', and extend the OQM analysis, flawed as it may be, to these cases as well. But that move is blocked under Beaver and Sag's own assumptions, which include the (well-motivated) caveat that OQM can only apply to generalized quantifiers. It turns out that this restriction prevents any application of OQM to the cases in (29).

Barker 2007, whose semantics for *same* represents the most explicit and fully developed analysis of symmetrical predicates to day, notes a proof given in Keenan 1992 which provides an immediate test for generalized quantifier status. As Barker summarizes Keenan's analysis, the crucial concept in the proof is reducibility, where the reduciblity relation *Reducible* holds between an NP sequence and some generalized quantifier(s) just in case the former can be decomposed into (some combination of) the latter 'an NP sequence is REDUCIBLE if it can be decomposed into separate generalized quantifiers that accurately reflect the truth conditions on the original' (p.412). The probe that Keenan proves works as follows: if both E_1 and E_2 are generalized quantifiers, where each contains a transitive verb V, and if whenever $[\![V]\!] = A \times B$ for two arbitrary sets A, B, then $[\![E_1]\!] = [\![E_2]\!] = \mu \in \mathfrak{2}$, then, iff E_1 has the same truth conditions as E_2 under *all* valuations of $[\![V]\!]$, *Reducible*$(E_1) \wedge$ *Reducible*(E_2). Since for

(31) a. Robin and Leslie read the same two books.
b. (Both) Robin and Leslie read exactly two books

we have, for $\langle R(obin), L(eslie), \ldots\rangle \times \langle b_1 \ldots b_n\rangle = \langle R, b_1\rangle, \ldots, \langle R, b_n\rangle = \langle L, b_1\rangle, \ldots, \langle L, b_n\rangle$, a valuation of $\mathfrak{o}$ for both of the sentences in (31) when $n \neq 2$ and a valuation of $\mathfrak{1}$ when $n = 2$. Therefore, to be reducible, the same result must hold when $[\![read]\!] = \{\langle R, b_1\rangle, \langle R, b_2\rangle, \langle L, b_3\rangle, \langle L, b_4\rangle\}$, but obviously it does not: (31)b is true, but (31)a is false. It follows (31)a cannot be represented as a logical expression

via any generalized quantifier or combination of generalized quantifiers. In the case of an example such as (32), therefore, we must assume semantic identity between two tokens of a scoping element which does not have the semantics of a generalized quantifier:

(32) I told the same joke to Robin on Friday and Leslie on Sunday.

Recall, however, that Beavers and Sag explicitly restrict OQM to generalized quantifiers. The motivation they provide for this restriction is the existence of examples such as

(33) a. The waiter managed to evict the customers diplomatically and ~~evict~~ the staff authoritatively.
b. [The waiter forced the customers ~~to leave quietly~~] and [the manager persuaded the staff] to leave quietly.

The point of such examples can be seen by considering what the effect of optional semantic identity in the ellipsed token of *evict* in (33)a would be. According to the Beavers and Sag 2004 statement of OQM, the EPs in the SEM|RELS specification in (34)a and b would be equated. The two separate tokens of *evict* in *The waiter managed to evict the customers diplomatically and to evict the staff authoritatively* would have a partial partial description

(34) a.
$$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HD} & \textit{verb} \\ \text{FRM} & \text{evict} \\ \text{ARG-ST} & \langle \boxed{3}:\boxed{1},\boxed{4}:\boxed{2} \rangle \end{bmatrix} \\ \text{SEM|RELS} & \left\{ \begin{bmatrix} \textbf{evict\_rln} & \\ \text{ARG1} & \boxed{1} \\ \text{ARG2} & \boxed{2} \end{bmatrix} \right\} \end{bmatrix}$$
b.
$$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HD} & \textit{verb} \\ \text{FRM} & \text{evict} \\ \text{ARG-ST} & \langle \boxed{3}:\boxed{1},\boxed{4}:\boxed{2} \rangle \end{bmatrix} \\ \text{SEM|RELS} & \left\{ \begin{bmatrix} \textbf{evict\_rln} & \\ \text{ARG1} & \boxed{1} \\ \text{ARG2} & \boxed{3} \end{bmatrix} \right\} \end{bmatrix}$$

where the lexical entries for *customers* and *staff* respectively are, in simplified but adequate representation, given in (35):

(35) a.
$$\begin{bmatrix} \textbf{customers\_rln} & \\ \text{LBL} & \boxed{0} \\ \text{ARG0} & \boxed{2} \end{bmatrix}$$
b.
$$\begin{bmatrix} \textbf{staff\_rln} & \\ \text{LBL} & \boxed{0'} \\ \text{ARG0} & \boxed{3} \end{bmatrix}$$

The only way that we can equate the [SEM|RELS] values of the ellipsed and nonellipsed versions of *evict* in (34) is if $\boxed{2}=\boxed{3}$ — in other words, if the waiter evicted just those indviduals corresponding to the two descriptions 'staff' and 'customers'. The result would be paraphrasable as something like 'The waiter managed to diplomatically and authoritatively evict those of the customers who were also employees of the restaurant', clearly not an available reading. If we alter the adverb in the conjunct subject to ellipsis so that *rudely* replaces *authoritatively*, we obtain a reading paraphrasable as 'The waiter managed to diplomatically and rudely evict those of the customers who were also employees of the restaurant', containing a contradiction again absent from the interpretation of *The waiter managed to evict the customers diplomatically and*

the staff rudely. Nor can we rule out such intersective identifications of indices, since clearly they are necessary on the most natural reading of *Robin is my friend and colleague*.

We see this not only with VPs; predicative NPs present the same problem:

(36) Robin's house is $\left\{ \begin{array}{c} \text{a real bastard} \\ \text{the worst place in the world} \end{array} \right\}$ for people with cars to find parking around and people on foot to get to safely.

Here, the semantic analysis defended in Levine and Hukari 2006 for *easy* adjectives extends directly to members of the class of NPs which has a similar semantics and argument/gap relation between subjects and an internal object position. In terms of this analysis, *people with cars* is an argument of the head noun *a real bastard*, which denotes the relation that holds between people with cars on the one hand and those people's task of finding parking around Robin's house on the other. Clearly, the same semantic issues that arise in connection with (33) cannot be avoided here either, unless optional semantic identity is restricted to generalized quantifiers.[2]

It follows that if *same* is part of an ellipsis target T' under (partial) identity with a DOM substring T, the SEM values of the two tokens of *same* do not have the option of semantic identity under OQM. Thus, the only alternative is that the semantics of the overt token of *the same joke* and that of the ellipsed version are nonidentical. But this alternative fails also, predicting as it does that (32) has the same meaning as (37):

(37) I told the same joke to Robin on Friday and I told the same joke to Leslie on Sunday.

In the terminology of Carlson 1987, this sentence has access only to the *external* sense of *same*, reflected in the sentence *I told the same joke to Robin on Friday*, in which the interpretation requires there to be some salient joke in the discourse background which is identical to the one I told Robin. This sense of *the same* is fundamentally different from that of the 'internal' reading reflected in (33). The difference emerges clearly in examples like (38):

(38) a. I'll tell the same joke to Robin on Thursday and (I'll) tell the same joke to Leslie on Sunday.
b. I'll tell the same joke to Robin on Thursday and to Leslie on Sunday.

[2]Note that these considerations also have a bearing on just how we are to interpret the ontological status of the DTRS specifications given in the OQM template in (21). The content of the SEM specifications assumed in Beavers and Sag 2004 is represented by MRS structures, of the sort described in Copestake et al. 2006, and hence could, in principle, correspond to either (i) underspecified objects, where the tokens of generalized quantifiers in each of the conjuncts have not been scope-resolved (Copestake et al. 2006, p. 293), or to (ii) fully scope-resolved MRSs, in which the LBL, ARG0, RESTR and BODY values are equated. The critical issue is what happens when BODY specifications are equated. It would *appear* that if in the case of an unellipsed conjunction *I said something nice to Leslie and I said something critical to Terry*, we equate the HANDLE value of the body of *something* in the first conjunct to the LBL value of *said* (as would be the case in the sentence *I said something nice to Leslie*), and likewise for the second conjunct, then equating the two BODY values would also require equating the arguments in the two EPs corresponding to the different tokens of *said*, leading again to a completely incorrect interpretation. Apparently, then, we must take the representations in the SEM|RELS specifications on each of the conjunct daughters to not have undergone scope-resolutions.

Assme that there no reference in prior discourse has been make to any joke. Then (38)a is distinctly anomalous, illustrating the fact that an existential presupposition accompanies *the same joke* when there are overt tokens of this NP. No such presupposition holds in the case of (38)b. It places an unacceptable burden on credulity to claim any kind of plausibility for a claim that somehow the simple fact of prosodic silence in place of an overt pronunciation has the effect of cancelling a presupposition introduced by both tokens of some lexical item which undergoes ellipsis.

There are other strong reasons noted by Barker for keeping the semantics of internal and external *same* NPs separate. Unifying the two, as in Dowty 1985, requires that one introduce two free variables, one identifying a salient relation R and the other a 'comparison class', so that, on the external reading, with $[\![same]\!] = \lambda N \lambda x \exists f \forall c\{x\} = f(N) \wedge c < C : R(x)(c)$. Thus, in the case of *Robin read the same book*, C is the prominent set of individuals identified in previous discourse, with $[\![N]\!] = [\![book]\!] = \mathbf{book}$ and f a choice function that picks out a member of the set of books, and $R = [\![read]\!] = \mathbf{read}$. *The same book* is then the (singleton) set containing the individual that f maps **book** to such that every member of the comparison set—whatever it is—is in the R (in this case, **read**) relation to that individual. In the case of *Robin and Leslie read the same book*, the comparison set is $[\![Robin\ and\ Leslie]\!] = \mathbf{robin} \oplus \mathbf{leslie}$, and so on. But what such an analysis at first appears credible, even elegant, Barker shows that it cannot be sustained.

In the first place, as Barker notes, if a comparison set and a particular relation are available from context for the interpretion of *same*, then we would expect that any relevant comparison sets and relations which were salient in prior discourse should yield a reading; but this is not the case; e.g. we have *The men discussed a house. John read the same book*, where if $C =$ **men** and $R =$ **discuss**, then there should be a reading in which John read a certain book which each of the men had discussed; but this reading is not available. Thus, the idea that *same* implicates some contextually determined relation is dubious in general. Crucially, however, while R can be contextually determined when the comparison set C differs from the denotation of the relevant constituent K in the sentence that is a coargument of the verb that *the same* N is an argument of (e.g., we can have *The men discussed a book, and John had read the same book*), this is not possible when the comparison class is defined by K. For example, in the case of *Everyone discussed a book, and Robin and Leslie read the same book*, the sentence can only mean that there was some book that everyone discussed, but when the comparison class is *Robin and Leslie*, the relation R is not the book that everyone discussed, but some book that both Robin and Leslie had both read. There is in other words, as Barker notes, a correlation between R and C when C is the comparison set that is certainly not logically necessary , but which always appears to hold.

We must conclude, then, that we cannot obtain the semantics of (32) by ellipsis under semantic non-identity between the ellipsed and non-ellipsed tokens of *the same joke*, while, under Beavers and Sag's own hypothesis—itself reflecting the conditions imposed by data such as (33) and (36)—we cannot account for (32) by Optional Quantifier Mergers. But the specific mismatch in meanings available between ellipsed and non-ellipsed variants of NCC involving symmetrical predicates such as *same* is precisely the same as that involving negative generalized quantifiers such as *nothing*; in both cases, we have a scopal operator of some sort scoping over the coordination to

yield an interpretation which correspnds to a fundamental set of truth conditions from what we encounter in the non-ellipsed version. It is thus clear that Optional Quantifier Merger represents a misguided approach to solving the problem posed by NCC, and that the evidence strongly suggests that we looks elsewhere for a solution.

2.3 Unlike category coordination

The use of ellipsis to eliminate the unlikeness of apparent unlike category coordination (UCC), as discussed above in connection with (7)c, again leads to severe mispredictions once one looks beyond the very narrow class to which the LBE literature restricts itself, as in e.g. Beavers and Sag 2004, Chaves 2007, Chaves and Sag 2009. Interestingly, the recognition of difficulties with an approach based exclusively on (4) was the apparent basis of the analysis in Chaves 2006, in which the coordination of unlikes in absolutive constructions is treated as an instance of a network of special constructions which in effect mimic the effect of (4), but avoid certain mispredictions which would otherwise attend a straightforward application of the usual LBE technology (e.g., the problem posed by *Neither tired nor in a hurry, I decided to walk and save the bus fare*, where the source for the ellipsis, *Neither tired ~~I decided to walk and save the bus fare~~ nor in a hurry I decided to walk and save the bus fare*, yields ill-formed results.) Chaves' key idea is that the effect of these interacting constructional possibilities supplies an inaudible copula to convert two apparently distinct category descriptions in a structure [XP Conj YP] into a coordination of VPs $[_{VP}\ [_{VP}\ \sout{be}\ \text{XP}]\ \text{Conj}\ [_{VP}\ \sout{be}\ \text{YP}]]_{VP}$, an approach similar in spirit to (4) but relying instead on stipulated inaudibilia. Apart from this minor (and, as I argue directly, ineffective) addendum to the elliptical analysis of UCC, however, the basic account of such phenomena is just what is summarized in (7)c.

In fact, there is an impressive range of constructions which highlight the empirical inadequacy of the ellipsis approach. I present a brief survey of these cases in this section; below, we show how they can be captured in a fully general way using a particular TLCG formalism.

Ellipsis-incompatible topicalized coordinations In order to account for cases such as (39)a via LBE, something like a RNR analysis is required:

(39) a. Rich and a Republican, Robin definitely is t.
b. Rich ~~Robin definitely is~~ and a Republican Robin definitely is t.

Such cases are amenable to the LBE analysis, however, only because the elements of the coordination are independently sortable over the two tokens of the extraction source clause, *Robin definitely is* (39). This state of affairs does not hold generally:

(40)
a. (Both) poor and a Republican, you can't possibly be t.
b. (Both) [poor ~~you can't possibly be~~ t] and a Republican you can't possibly be t.
c. (Both) poor you can't possibly be t and a Republican you can't possibly be t.

The 'source' sentences for the coordination correspond, under *and* conjunction, to a very different meaning, where the crucial intepretation of *poor and a Republican* as a sum of properties is literally unavailable. Another example displaying the same

analytic problems is given in (41)a, with the forced analysis in (41)b under the Chaves and Sag 2009) RNR scenario:

(41) a. Dead drunk $\left\{ \begin{array}{c} \text{but} \\ \text{and yet} \end{array} \right\}$ in complete control of the situation, no one can be t.

b. Dead drunk ~~no one can be~~ t $\left\{ \begin{array}{c} \text{but} \\ \text{and yet} \end{array} \right\}$ in total control of the situation, no one can be t.

The only practical solution within the assumptions of the LBE literature for the difficulty these data present—in particular, the axiom that unlike categories do not actually coordinate—appears to be a brute-force analysis in which one simply declares the coordination of AP and PP an AP—the sort of approach which, as illustrated in Chaves 2006, is increasingly typical for constructional approaches. Whatever one thinks of this approach—which essentially generalizes the kind of rule letting an NP dominate both an NP and an S from Sag et al. 1985, and which Bayer (1996) has I think effectively shown to be empirically quite unsatisfactory—the LBE approach on its own does a very poor job of addressing the full range of unlike category coordinations which appear in extraction contexts.[3]

One approach that might be taken, of course, is that these data, though apparently good to a large number of speakers, really are ill-formed, and indeed the reduced acceptability of topicalized UCCs has been asserted in Beavers and Sag 2004. But there is no reason to suppose that this assessment reflects the actual status of such examples generally. UCC examples of the sort that Beavers and Sag claim to be defective are cited as unexceptionble in articles appearing in journals of record, e.g., Peterson 2004, and I personally have yet to encounter a native speaker of English who registered the slightest discomfort in the of a 'spontaneous' utterance of any of these examples, or expressed negative judgments on, say, *You can be poor and healthy, and someone who's very clever or very good could wind up being poor and highly respected—but poor and a* REPUBLICAN, NO ONE *can be.*

Ellipsis-incompatible pseudocleft coordinations We turn now to the English pseudocleft construction—a somewhat mysterious pairing of what seems to be a headless relative with a predicate, linked syntactically by a copula:

(42) What$_i$ Robin wanted t$_i$ was a new outboard motor.

For present purposes, the importance of the pseudocleft is that the complement of the copula—the focal constituent, as it is often called—can take the form of an unlike category conjunction:

(43) a. What you cannot become (simultaneously) is highly intelligent and yet a raving fundamentalist.

b. What you cannot become is both highly intelligent and yet a raving fundamentalist.

[3] *Become* takes AP but not PP as a complement. But if [AP and PP] can be analyzed as AP, we incorrectly predict that **John became totally irrational yet in complete control of the situation.* is grammatical. This kind of example seriously undercuts the viability of the stipulative approach to UCC in question.

A standard LBE analysis for such cases based on (4) corresponds to semantically incongruous interpretations arising from the source sentences:

(44) a. What you can't (simultaneously) become is highly intelligent and yet ~~what you can't simultaneously become is~~ a raving fundamentalist.
b. What you can't simultaneously become is highly intelligent and (yet) ~~is~~ a raving fundamentalist.
c. What Robin was, clearly, was both highly intelligent and ~~was~~ a raving fundamentalist
d. What Robin was, clearly, was highly intelligent yet ~~was~~ a raving fundamentalist

The first of these simply does not mean what the ellipsed version means, along lines already discussed. The second, third and fourth just seem severely ill-formed in some way unless the notated ellipsis occurs. It is, moreover, straightforward to show that no application of Chaves' 'ghost copula' solution can work in for such data. Pseudoclefts thus constitute yet another major empirical challenge to the LBE approach and its extensions.

Ellipsis-incompatible posthead nominal modifier coordinations Posthead nominal modifiers constitute yet another predictive failure for the LBE.

As a example, consider cases such as (45):

(45) a. [$_{NP}$ Politicians [$_{VP}$ keeping a low profile] and [$_{PP}$ with plenty to hide]] are the ones we should be investigating.
b. [$_{NP}$ People [$_{PP}$ totally into themselves] and [$_{VP}$ only thinking of their own careers]] seem to be in the vast majority these days, I fear.

Examples such as these are extremely common, but it's not at all clear how an LBE account of them can be given. The obvious sources are structures such as (46):

(46) Politicians keeping a low profile and ~~politicians~~ with plenty to hide are the ones we should be investigating.

But this approach clearly will not work in cases such as

(47) a. [$_{NP}$ Novels [$_{AP}$ full of dramatic conflict] but [$_{PP}$ with meticulously accurate historical detail]], such as this one, are quite unusual.
b. [$_{NP}$ Novels [$_{AP}$ full of dramatic conflict] but ~~novels~~ [$_{PP}$ with meticulously accurate historical detail]], such as this one, are quite unusual.
c. *Novels full of dramatic conflict but novels with meticulously accurate historical detail, such as this one, are quite unusual.

(47)c is out-and-out impossible, but the analysis in (48)a, while giving rise to an acceptable form, is no more satisfactory:

(48) a. Novels full of dramatic conflict ~~are quite unusual~~, but ~~novels~~ with meticulously accurate historical detail, such as this one, are quite unusual.
b. Novels full of dramatic conflict ~~are quite unusual~~, but novels with meticulously accurate historical detail, such as this one, are quite unusual.

And even the expedient of creating a completely novel construction with the AP and PP 'coerced' into clausal shells, as in (49), fails:

(49) a. Novels [$_S$ $\varnothing_{\textit{which are}}$ full of dramatic conflict but $\varnothing_{\textit{which are}}$ with meticulously accurate historical detail], such as this one, are quite unusual.
b. *Novels which are full of dramatic conflict but which are with meticulously accurate historical detail, such as this one, are quite unusual.

Again, none of the various expedients.that LBE routinely appeals to correspond to anything remotely like the correct representations for the sentence in (47)a. And obviously, things only get worse in the case of a slightly more elaborate coordination such as *Novels both full of dramatic conflict and with meticulously accurate historical detail, such as this one, are quite unusual.*

2.4 A putative CG misprediction

Finally, something should be said about the much-invoked datum (50) due to Crysmann (2003) often taken to undermine decisively any categorial account based on coordination of 'partial constituents':

(50) John gave Mary a book, and to Peter a record.

(p.52). Beavers and Sag argue that

> In CCG the composed categories Mary a book and to Peter a record would not be acceptable candidates for coordination since they have two related but distinct categories (S\ NP)\(S\NP/NP/NP) and (S\ NP)\(S\NP/NP/PP) respectively. But an ellipsis-based approach again reduces these to simple VP (or S) coordination, predicting their acceptability. (p.57)

Whatever may have been the case so far as 1980s-style CCG is concerned, however, there is no basis for taking (50) to be a challenge for contemporary type-logical avatars of categorial grammar.[4]. The key element in the proof, proposed in Morrill 1994 and expanded and applied in Bayer 1996, is the enrichment of the inference rules of the type logic with meet and join combinators—independently justified *outside* any applications to coordination, as Bayer shows, by cases where a single item reflecting morphological neutralizations of feature conflict appear in extraction 'landing sites' which are incompatible with the requirements imposed by connectivity on the gap sites to which that item is linked. This technology was imported into HPSG as the type-lattice in Levine et al. 2001 to handle case mismatch in parasitic gaps—an application which has no competing treatment via LBE in any HPSG theory of filler/gap connectivity I'm aware of. Given these independently motivated category constructors, the story about (50) is simple: the verb give belongs to a set of verbs whose category description in the lexicon is the meet, notated as $\wedge_m$, of ((S\ NP)/NP)/NP and ((S\ NP)/PP)/NP, i.e., simultaneously satisfies both descriptions. Simple proofs utilizing hypothetical reasoning, in conjunction with the theorem in (51)a—which is a strict analogue of 'strengthening the antecedent' in propositional logic and provable using completely

[4] A complete proof for (50) was presented at the 2011 Colloque de Syntax et Semantique at Université Paris 8

cognate inference steps—establish as the syntactic description of both *Mary a book* and *a record to Peter* the category label in (51)b:

(51) a. $W\backslash Z \vdash (W \wedge_m U)\backslash Z,\ U\backslash Z \vdash (W \wedge_m U)\backslash Z$
b. (((S\ NP)/NP)/NP $\wedge_m$((S\ NP)/PP)/NP)\VP

and therefore the category of their conjunction. This conjunction, combining with the unitary lexical item *gave*, yields (50) by straightforward left slash elimination, and nothing further need be said. So no special categories, constructions or rules need to be introduced apart from those sanctioned by the completely general inference rules of the natural deduction proof theory that Kubota's approach shares with the formalisms assumed in the work of Morrill, Bayer, Muskens, Pollard and several other versions of TLCG, along with an independently well-motivated category description (semi)lattice. Seen in the light of the motivated resources of TLGC, Crysmann's example turns out to be trivially compatible with the framework's predictions.

3 Summary

Notwithstanding its apparently wide acceptance in much recent literature, the use of linearization to resolve a number of persistent empirical challenges to phrase-structure-theoretic approaches faces serious difficulties that have not been confronted. Much of this literature displays cases that represent unproblematic mappings amongst syntactic structure, linear order and meaning; but the range of evidence is remarkably small, and at present far from sufficient to give LBE the status of anything more than an interesting possibility, rather than the default role it seems to have acquired as a way to deal with unlike category and nonconstituent coordination. What the foregoing discussion has shown is that none of the linguistic phenomena represented by the cases listed in (1) are amenable to an LBE treatment once the latter is held accountable for a fuller data range for each of these respective constructions. Given the foregoing, there is no reasonable basis for viewing ellipsis-based accounts within HPSG's linearization framework as a successful general theory of coordination phenomena.

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Reanalysis of semantically required dependents as complements in the Chinese *ba*-construction

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Abstract

This paper aims at a formulation of semantic constraints on the productivity of the *bǎ*-construction and their representation at the syntax-semantics interface. It builds on the observation that requirements on the surface form of the construction may be altered by the choice of the verb. I propose that the semantics of the *bǎ*-construction can be treated in terms of a scalar constraint: a *bǎ*-sentence must come with a scale and a difference value that holds of the described event. The satisfaction of this constraint largely relies on the lexical semantics of the sentence. Not all verbs are inherently associated with scalar relations; those that are not must combine with an additional dependent which satisfies the scale requirement. Due to the obligatory presence of the additional dependent for some verbs, it is reanalyzed as a complement of *bǎ*: being optional on their level of combination with the verb, it becomes obligatory once the verb is used in the *bǎ*-construction.

1 Introduction

In theoretical linguistics, the *bǎ*-construction has been approached mainly from the syntactic perspective: a large number of accounts focus on the issue of the syntactic status of *bǎ* and naturally relate to the syntactic structure of *bǎ*-sentences. However, given the rather restricted syntactic flexibility of *bǎ*-sentences, the actual challenge seems to stem from semantics and usage; the construction is rather uncooperative when it comes to establishing a common semantic core, and still more if we try to find analogous phenomena in other languages. As Li (2001) puts it, "vagueness and uncertainty are in the nature of the constraints on this construction". In this paper, I attempt to formulate a semantics that, though at a rather schematic level, provides an interface at which these constraints can be accommodated. I take the semantics of the lexical instantiation as starting point and show that it interacts with requirements on the surface form of the construction. Specifically, I argue that the *bǎ*-construction can be analyzed in terms of a scalar relation which requires the saturation of a degree argument. The source of the scale and the degree argument is underspecified: they can stem from the verb, from the theme argument or from the whole event. Thus, verbs which do not lexicalize a scale must combine with an additional scale-contributing element. The syntactic structure of the *bǎ*-construction naturally follows if we want to capture this constraint.

The paper is organized as follows: in Section 2, I describe the basic properties of the *bǎ*-construction along with a short survey of previous studies and a delimitation of the scope of my analysis. In Section 3, I give a more detailed description of the considered problem, namely the variation of behavior for different verb classes in the *bǎ*-construction. In Section 4, I introduce the relevant notions of scalar semantics and show how they can be used to characterize the semantics of the *bǎ*-construction. Finally, in Section 5, I propose a syntactic analysis which allows to incorporate this semantic constraint and captures its interaction with the surface form of the construction.

2 The *bǎ*-construction: basic facts

In its canonical form, the *bǎ*-construction is formed from an SVO sentence by preposing the object into the preverbal position, where it is marked by *bǎ*:

(1) a. SVO word order:
Tā chī le píngguǒ.
he eat PFV apple
'He ate apples.'

b. *bǎ*-construction:
Tā bǎ píngguǒ chī le.
he BA apple eat PFV
'He ate the apple(s).'

This move mainly impacts on the referential properties of the object NP. Thus, whereas the object is underspecified with respect to definiteness or specificity in (1a), it obligatorily receives a definite or specific interpretation in (1b); in the above example, this also leads to a telic interpretation of the event. Furthermore, the preverbal position presupposes contextual givenness of the object NP. The increased prominence of the object NP has led authors to an explanation of the construction in information-structural terms. Tsao (1986) recognizes that the *bǎ*-NP fulfills most of the conditions on topic NPs; a treatment as topic or secondary topic is also proposed in Bender (2000), Hsueh (1989), Ding (2000) and Li (2001).

Diachronically, *bǎ* has been grammaticalized from a verb with the meaning "hold, manipulate". At present, the part of speech of *bǎ* is not identified. Its behavior and the constraints on the construction are used to argue for analyses as verb (Hashimoto, 1971; Bender, 2000), light verb (Huang et al., 2009), preposition (Chao, 1968; Travis, 1984; Cheng, 1998; Li, 1990), case marker (Huang, 1982; Koopman, 1984; Goodall, 1986) and functional head (Zou, 1993; Sybesma, 1999). The part of speech issue is beyond the scope of the analysis proposed here; nevertheless, we will find that *bǎ* has to be analyzed as a head if we want to capture the semantic constraints and obtain an appropriate representation of the syntax-semantics interface. With respect to the previous proposals, my analysis structurally relates to the light verb account in Huang et al. (2009).

Semantically, the discussion around the construction is centered around two issues, namely the variety of possible argument distributions and a set of interacting and vague productivity constraints. The presented analysis targets the latter problem; yet, as my formulation of the constraints will be largely independent from argument structure, the proposal is also apt to an extension to other subtypes of the construction.

Subtypes of the *bǎ*-construction can be characterized in terms of argument structure. The pattern presented so far ([Subj *bǎ* Obj V]) is the "canonical" form; the following examples show some other possible argument distributions:

(2) a. *Causative*:

Zhè jiàn shì bǎ tā kū-lèi le.
this cl affair BA he cry-tired.RESULT PFV

'This affair made him cry to the extent of becoming tired.'

b. *Theme subject*:

Zhè píng jiǔ bǎ tā hē-zuǐ le.
this bottle wine BA he drink-drunk PFV

'This bottle of wine made him drink to the extent of getting drunk.'

c. *Additional "retained" object*:

Tā bǎ júzi bō le pí.
he BA orange peel PFV skin

'He peeled the skin off the orange.'

A comprehensive account faces the choice between positing multiple lexical entries for *bǎ* and identifying common properties of the different forms which would ideally provide sufficient and necessary conditions for all types in an underspecified representation.

The second problem turns around formulating constraints on the productivity of the *bǎ*-construction: not every SVO sentence has a *bǎ*-counterpart. For example, the choice of the verb may yield a contrast in grammaticality:

(3) Tā bǎ píngguǒ chī / *zhǎo / *xiǎng le.
he BA apple eat / *look.for / *think PFV
'He ate / *looked for / *thought about the apple(s).'

Multiple levels have been exploited for the formulation of constraints: in terms of lexical semantics and event structure, it has been found by and largely acknowledged thereafter that the *bǎ*-construction typically expresses disposal (Wang; check Syb), affectedness (Tenny, 1987; Hashimoto, 1971), causation (Sybesma, 1999) and high transitivity (Hopper and Thompson, 1980). Aspectually, the event described by the *bǎ*-construction must be temporally bounded (Liu, 1997; Rhys, 1996; Tenny, 1987). With respect to nominal reference, the *bǎ*-NP must be marked or interpretable as definite, specific or generic (Bender, 2000; Liu, 1997; Hashimoto, 1971), which in turn interacts with aspectual boundedness. Finally, a constraint has been posited with respect to the observation that the verbal domain of *bǎ* must contain further elements besides the main verb:

(4) **Verbal complement constraint** (henceforth VCC): the *bǎ*-construction cannot be formed with a bare verb; the verb must combine with an additional element:

*[. . .[bǎ NP V]]

The following illustrates:

(5) a. Ta bǎ píngguǒ chī *(le).
he BA apple eat PFV
'He ate the apple(s).'

b. Ta bǎ wǒ qì-*(sǐ le).
he BA me annoy-dead.RESULT PFV
'He annoyed me to death. '

Again, accounts focussing on different levels have led to different justifications of this constraint. Li and Thompson (1981) come up with a semantic explanation: "the reason that *bǎ*-sentences always have verbs with those elements (adverbs and postverbal elements) preceding or following them is that such elements serve to elaborate the nature of disposal." (Li and Thompson 1981, p. 489) Structurally, the VCC has been given syntactic and prosodic explanations. Li (1990) claims that the number of elements in postverbal position in Chinese is confined to one.[1] Prosodically, Feng (2001) claims that the *bǎ*-construction cannot be formed with a bare monosyllabic verb; this constraint seems to hold for the considered data (stipulation).

In the following section, I will proceed to a reexamination and differentiation of the VCC and conclude that the proposed structural explanations are insufficient: prosody and syntax cannot save sentences which do not satisfy the semantic constraints of the construction. The primary motivation seems to be semantic, in that additional information must be specified about the event, which leads to a potential requirement of extra lexical material.

3 Problems with the VCC

The VCC was first stated by Lü (1995), who also proposes a detailed classification of the 18 possible additional dependents to the verb. Less differentiated versions have been proposed by Sybesma (1999), Liu (1997) and Li (2001). For instance, Li states that the required additional element can be one of the following:

[1]This claim undergenerates under a surface-oriented view of syntax: certain combinations of dependents are indeed possible in postverbal position, as shown in the following examples:

(i) a. double object:
Tā sòng Lǐsī huā.
he offer Lisi flower
'He offered Lisi flowers.'

b. direct object + locative complement:
Tā fàng huā zài zhuōzi shàng.
he put flower LOC table on
'He put the flowers on the table.'

Various strategies have been proposed to reanalyze multiple dependents in postverbal position as one single complement in order to maintain the above hypothesis, e. g. Sybesma (1999); Li (1990).

1. Resultative complement
2. Adverb of duration, frequency or manner
3. Verb reduplication, indicating short duration
4. "Outer" object: NP whose referent stands in a part-whole or inalienable possession relation to the *bǎ*-NP
5. Aspect marker: perfective *le*, durative *zhe*

This list contains adjunct-like dependents, complements and grammatical markers. Along with other existing expositions of the VCC, it suffers from an insufficient differentiation of the set of possible types of dependents. On the one hand, the categories seem to be rather disparate to allow for a generalization: grammatical aspect markers are mixed with lexical dependents, such as adverbs of degree and frequency, result complements etc. These two classes of elements are to be distinguished here: as will be shown, verbs that can be used with lexical dependents in the *bǎ*-construction may become unacceptable once the lexical dependent is replaced with a simple aspect marker. On the other hand, the list does not differentiate between optional dependents and elements that can actually make a grammaticality contrast. In the following, I focus on those kinds of lexical dependents that can trigger contrasts in acceptability.

The structural explanations of the VCC capture the tendency for *bǎ*-sentences to be formed with informationally and prosodically "heavy" predicates. In the following, we will see that verbs differ in their requirements of additional dependents; thus, the "heaviness" criterion apparently relates not to the quantity of lexical material, but rather follows from the requirement of specific semantic components that license the construction.

First, we find verbs which are acceptable in the *bǎ*-construction in bare[2] form:

(6) a. Incremental theme verbs:
Tā bǎ píngguǒ chī le.
he BA apple eat PFV
'He ate the apple(s).'

b. Achievements:
Zhāngsān bǎ zhè jiàn shì wàng le.
Zhangsan BA this CL affair forget PFV
'Zhangsan forgot about this affair.'

c. Some verbs of physical impingement (following Beavers: semelfactives):

[2]I use "bare form" to refer to VPs which may contain aspect markers, but no additional lexical dependents.

Zhāngsān bǎ gǒu dǎ le.
Zhangsan BA dog hit PFV
'Zhangsan hit the dog.'

Second, we find verbs which are not acceptable in bare form; however, they can be used in the *bǎ*-construction in combination with specific, semantically constrained types of dependents. This class contains verbs of perception, cognition and directed movement, as well as psych verbs and degree achievements derived from open scale adjectives:

(7) a. V + manner adverb modified for degree:
Zhāngsān bǎ zhè shì xiǎng *(de tài bēiguān).
Zhangsan BA this affair think DE too pessimistic
'Zhangsan thinks too pessimistically about this affair.'

b. V + punctualizer:
Tā bǎ gǒu kàn le *(yī yǎn).
he BA dog look PFV one eye
'He caught a glimpse of the dog.'

c. V + resultative complement:
Zhāngsān bǎ Mǎkè fán-*(sǐ) le.
Zhangsan BA Mark annoy-dead.RES PFV
'Zhangsan annoyed Mark to death.'

d. V + goal argument:
Āmíng bǎ zìxíngchē qí *(huí jiā) le.
he ba bike ride back home PFV
'He rode the bike back home.'

e. V + source argument:
Wáng lǎoshi bǎ shǒu líkāi le *(ménba).
Wang teacher ba hand leave PFV door
'Teacher Wang took his hand from the door handle.'

f. V + directional complement:
Āmíng bǎ qián yìng le *(huí-lái).
Aming BA money win PFV back-come
'Aming "won the money back".'

As shown in the examples, the following kinds of dependents can make a grammaticality contrast:

- Resultative complements
- Expressions indicating short duration (punctuality) of the event

- Degree modifier + manner adverb
- Source/goal arguments

Finally, we have a class of verbs which do not occur in the construction; this class mainly contains stative verbs (8) and a small set of verbs that are classified as verbs of "social interaction" by Levin (1993) (9):

(8) a. * Zhāngsān bǎ Mǎlì xǐhuān le (XP).
Zhangsan BA Mary like PFV
'Zhangsan liked Mary.'

b. * Zhāngsān bǎ Mǎkè xiàng (XP).
Zhangsan BA Mark resemble
'Zhangsan resembles Mark.'

(9) a. * Āmíng bǎ qiúsài cānjiā le (XP).
Aming BA ball game participate PFV
'Aming participated in the ball game.'

b. * Wǒ bǎ nà ge xuéxiào bǎifàng le (XP).
I BA this CL school visit PFV
'I visited that school.'

Descriptively, we observe that the acceptability of verbs in the *bǎ*-construction decreases with the degree of semantic transitivity in the sense of Hopper and Thompson (1980) and Tsunoda (1985); this leads us back to the long-standing characterization of the *bǎ*-construction in terms of high transitivity. However, we do not have at hand an operative notion of semantic transitivity which would allow for a neat classification of verbs according to transitivity degrees. The transitivity classification by Tsunoda is based on observations about the crosslinguistic acceptability of verbs in transitive case patterns. Hopper and Thompson identify ten sublexical semantic components that make a predicate more or less transitive; they propose that the transitivity degree be determined based on the number of transitivity features in a given predicate. However, on the one hand, their characterization heavily relies on the referential properties of the NP arguments in a sentence, which is not a relevant criterion for the above data. On the other hand, comparing counts of disparate primitive components seems not to be a formally reliable criterion, as the features and feature combinations cannot be weighted and evaluated against each other.

In the following, I propose a treatment of the semantics of the *bǎ*-construction in terms of scalarity. Scales and measure functions have been used for the analysis of affectedness and variable telicity phenomena; they allow for a uniform representation of different classes of verbs that accommodates shared abstract features such as extents, endpoints, degrees etc.

4 The semantics

In this section, I first introduce the basic distinctions on scales that will be relevant for the analysis. Then, I show how scales have been used for the analysis of events and, specifically, of changes of state; the formalization mainly follows Kennedy and McNally (2005), Kennedy (2010) and Beavers (2011). Finally, I show how the semantics of the *bă*-construction can be captured by a scalar constraint.

4.1 Scales

In the following, I adopt the formalization of scales proposed in Beavers (2011): scales are series of states of type $< d, < e, t >>$, where d is the type of degrees. Each state "tells" us that a property obtains of an individual to a certain degree. The degrees stand in an isomorphic relation with the numbers between 0 and 1. Three distinctions on scales are relevant:

1. open vs. closed scales
2. binary vs. multi-valued scales
3. scales with fixed vs. context-dependent standard values.

Scales can be open or closed; closed scales have edge values that define the minimal or maximal possible degrees to which a property can be possessed; these values correspond to 0 or 1. Open scales do not have such values; they have degrees that approach 0 or 1. However, there are no unique degrees that are lower or higher than all other degrees in the set. A scale may be open in one direction and closed in the other; thus, we get the following four possibilities:

- open scale, e. g. *long*: s_1 : long$(x)(d_1) \oplus \ldots \oplus s_n$: long$(x)(d_n)$
- totally closed scale, e. g. *full*: s_1 : full$(x)(0) \oplus \ldots \oplus s_n$: full$(x)(1)$
- lower-closed scale, e. g. *awake*: s_1 : awake$(x)(0) \oplus \ldots \oplus s_n$: awake$(x)(d_n)$
- upper-closed scale, e. g. *straight*: s_1 : straight$(x)(d_1) \oplus \ldots \oplus s_n$: straight$(x)(1)$

Scales can be binary or multi-valued; the distinction roughly parallels the distinction between gradable and non-gradable adjectives in English. It can be captured by Krifka's formulation of atomic, simplex and complex structures (Krifka, 1998):

- Points on scales are atoms:
  $\forall x(atom(x) \leftrightarrow \neg\exists y(y <_X x))$
- Binary scales are simplex objects that consist of two parts (endpoints):
  $\forall x(simplex(x) \leftrightarrow \exists y, z(y \oplus_X z = x \ \wedge \ atom(y) \ \wedge \ atom(z)))$

- Multi-valued scales are complex objects, consisting of three parts (endpoints plus middle):
  $\forall x(complex(x) \leftrightarrow \exists y(y <_X x \ \wedge \ simplex(y) \ \wedge \ atom(z)))$

In a given use, a scalar expression is evaluated against a standard value on the associated scale. Standard values may be context-dependent or fixed. Context-dependent standards are computed based on a comparison class which consists of objects similar to the one described by the argument of the scalar predicate:

(10) Mark is a **tall** basketball player. ($\rightarrow$ *Mark is taller than basketball players usually are.*)

A fixed standard corresponds to an absolute value on the scale which is independent of the denotation of the argument; it may relate to the minimal or maximal value of a predicate:

(11) a. *maximum standard*:
#The paper is complete, I just have to write the conclusion.
b. *minimum standard*:
#The shirt is not dirty, there is just some mud on it.

The distinction between fixed and context-dependent standards correlates with the open/closed scale criterion. Kennedy and McNally (2005) make the following generalizations: open scales have context-dependent standards, whereas closed scales have fixed standards by default. The default standard of a closed-scale adjective is associated with the minimal value if the scale is lower-bound, and with the maximal value if the scale is upper-bound or bound at both ends:

(12) a. *lower-bound scale + minimum standard*:
#The spot is not visible, but I can see a bit of it.
b. *upper-bound scale + maximum standard*:
#The paper is complete, I just have to write the conclusion

4.2 The analysis of scalar expressions

As already observed by Sapir (1944) and Bolinger (1972), the categories of scalarity and grading are not restricted to adjectives; verbs, nouns and prepositions may also denote scalar relations. This section describes the semantics of nouns, verbs and adverbs formed from gradable adjectives; they are analyzed via measure functions taking objects and returning the degrees to which a property holds of the arguments. A distinction is made between static scalar properties and properties that change over time. If a change happens, the relation must be additionally parametrized for times or be tied to an event argument.

Each scalar predicate comes with a degree argument d that must be saturated by additional semantic material specifying degrees/measures. This material can be

overt, as for example with degree morphology for adjectives. It can also be covert: in this case, d is instantiated by a default standard or via existential boundedness.

Static measure functions apply to adjectives, Kimian states and nominal predicates. These expressions have the following form:

(13) $[\![P]\!] = \lambda d \lambda x.m_P(x) \geq d$

The measure function m_P is lexically defined by the predicate. Thus, for a stative predicate like *resemble John*, we get the following representation:

(14) $[\![\text{resemble John}]\!] = \lambda d \lambda x.\text{resemble}(\text{John})(x) \geq d$

In the sentence *Mark resembles John*, the degree argument is not overtly saturated; the following covert operator is applied by default and yields the positive form:

(15) $[\![pos]\!] = \lambda P \lambda x \exists d.\text{stnd}(d)(P)(\mathbf{C}) \ \wedge \ P(x) = d$

The function 'stnd' outputs a default degree d which is above the degree to which resembling applies to the comparison class **C** which contains individuals that are judged "similar" to the arguments of the predicate wrt the scalar property. The representation of our sentence is as follows:

(16) $[\![\text{[Mark resembles John]}]\!] = \exists d.\text{stnd}(d)(\text{resemble}(\text{john}))(\mathbf{C}) \wedge \text{resemble}(\text{john})(\text{mark}) = d$

Similarly, when the predicate is combined with degree morphology, the overt degree modifier saturates the degree argument:

(17) $[\![\text{ resemble John closely}]\!] = \lambda x.\text{resemble}(\text{john})(x) \geq \text{closely}$

In the case of nominal predicates, the degree corresponds to the quantity or size of the referent:

(18) $[\![\text{ apples}]\!] = \lambda d \lambda x.\text{apples}(x) \wedge \text{NU}(\text{apples})(x) \ \geq \ d$

"Apples" takes a referent x and returns d, which corresponds to the quantity of apples represented by the referent. The function NU ("natural units") returns an appropriate measure (Krifka, 1989). For instance, apples are naturally measured by pieces, water by liters etc.

If no quantity measure is specified, the default options for the degree argument of nominal predicates are "1" or existential boundedness. *Apples* then yields the following interpretation:

(19) $[\![\text{ apples }]\!] = \lambda x \exists d.\text{apples}(x) \wedge \ \text{NU}(\text{apples})(x) \ \geq \ 0$

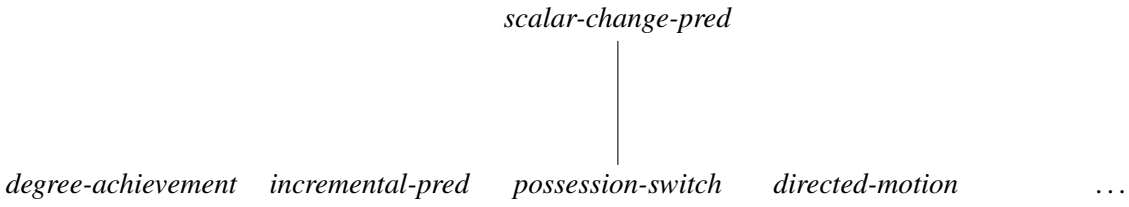
The degree argument may be instantiated via overt lexical material, e. g. by measure phrases:

(20) $[\![\text{ half an apple }]\!] = \lambda x.\text{apples}(x) \wedge \text{NU}(\text{apples})(x) = 0,5$

Events and measures of change We have seen how a static measure function returns the absolute degree to which an object possesses the property denoted by a scalar predicate. In the following, I will show how the function can be parametrized for times in order to represent changes in the degree to which an object possesses a property. Changes are conceptualized as events; the measure of change function $m_{\triangle}$ takes an object and an event and returns the difference between the degrees of the property on the object at the beginning and the end of the event:

(21) $[\![scalar\text{-}change\text{-}pred]\!] = \lambda d \lambda x \lambda e.m_{\triangle}(x)(e) \geq d$

Different types of change predicates have different types of degrees and sources of the scale; the type $scalar\text{-}change\text{-}pred$ is further differentiated in the lexicon:



The measure of change may stem from the verb or from its arguments. Degree achievements, which are built from gradable adjectives, lexicalize a measure of change function:

(22) $[\![degree\text{-}achievement]\!] = \lambda x \lambda d \exists e.\textsc{th}(e) = x \ \wedge \ m_{\triangle}(x)(e) = d$

(23) $[\![$ warm the soup 5 degrees $]\!] = \exists e.\textsc{th}(e) =$soup $\wedge$ warm$_{\triangle}$(soup)$(e) =$ 5 degrees

The degree achievement verb combines with a theme argument; it outputs the degree to which the theme referent changes with respect to 'warmness'.

Incremental theme verbs do not lexicalize measures of change; their measure of change is contributed by the theme argument. We have seen that nominal predicates are associated with measure functions; once a nominal fills the theme argument position of an incremental theme verb, its measure function is converted into a measure of change function:

(24) $[\![$eat half of the apple$]\!] = \lambda x \exists e.eat(e) \wedge \textsc{th}(e) = x \wedge$ apple$(x) \wedge \textsc{nu}_{\triangle}$(apple)$(x)(e) = -0.5$

The verb takes a theme argument whose referent has the 'apples' property. The function $\textsc{nu}_{\triangle}$ returns the natural measure for objects of sort 'apples' and outputs the degree to which the quantity of the object changes along this measure.

Verbs of change of possession come with a binary measure function; the degree corresponds to 1 for acquisition and to -1 for loss of possession. The function is defined for the recipient/former possessor:

(25) $[\![receive]\!] = \lambda d \lambda x \lambda y \exists e.\text{EXP}(e) = x \wedge \text{TH}(e) = y \wedge \text{possess}_{\triangle}(y)(x)(e) = 1$

(26) $[\![loose]\!] = \lambda d \lambda x \lambda y \exists e.\text{EXP}(e) = x \wedge \text{possess}_{\triangle}(y)(x)(e) = -1$

4.3 The *bǎ*-construction: scale and difference value

In this section, I describe the semantics of the lexical entry for *bǎ* and show how it captures the variation in behavior for different classes.

4.3.1 Lexical entry for *bǎ*

I posit the following semantic constraint for *ba*:

(27) $[\![ba]\!] = \lambda e \lambda s \lambda d. \ldots scale(s)(e) \ \wedge \ extent(s)(d)(e)$

Bǎ requires an event argument e, a scale s that is associated with this event and a difference value d on this scale.

In the following sentence, *ba* is licensed by a possession switch:

(28) Lǎowáng bǎ zìxíngchē diū le.
Laowang BA bike loose PFV
'Laowang lost the bike.'

The scale is the closed, binary scale of possession:

(29) possession $= s1 : have'(x)(\text{Laowang})(0) \oplus s2 : have'(x)(\text{Laowang})(1)$

The constraint of *ba* is satisfied as follows:

(30) $\exists e. \ldots scale'(\text{possession})(e) \ \wedge \ extent'(\text{possession})(-1)(e)$

If the verb is not of the appropriate type, it must combine with additional elements in order to satisfy the semantic requirement. The additional elements must contribute a scale; this scale, however, is not necessarily a scale of change. This creates an apparent asymmetry: bare verbs in the *bǎ*-construction have to contribute scales of change, whereas combinations of verbs with additional dependents can have both static and dynamic scales. The asymmetry is resolved by the requirement of an event argument: we find that only verbs of change have an event argument; "static" scalar verbs, e. g. emotion verbs, do not contribute an event argument and are thus disallowed.

The following example shows a resultative complement which licenses a scale:

(31) Āmíng bǎ zìxíngchē qí-huài le.
Aming BA bike ride-broken.RES PFV
'Aming rode the bike and as a result it broke.'

The scale is a lower-bound multi-valued scale:

(32) $s_{broken} = broken'(\text{bike})(0) \oplus broken'(\text{bike})(d_{min}) \oplus \ldots$

The semantic requirement of *bǎ* is satisfied as follows:

(33) $\exists e. \ldots scale'(\text{broken})(e) \ \wedge \ extent'(\text{broken})(+d_{min})(e)$

In the following example, the use of *ba* is licensed by a manner adverb modified for degree:

(34) Āmíng bǎ zhè shì xiǎng de tài bēiguān.
Aming BA this affair think DE too pessimistic
'Aming thinks too pessimistically about this affair.'

The scale is an open multi-valued scale:

(35) $s_{pessimistic} = \ldots \oplus pessimistic'(P)(d_{accept.}) \ \oplus \ \ldots \ \oplus$
$pessimistic'(P)(d_{too}) \ \oplus \ \ldots$

Under the canonical treatment of the degree modifier *too* as referring to a degree that is higher above some contextually acceptable degree, the difference value is defined by two degrees, namely the acceptable and the actual degree. Thus, the difference value is existentially bound:

(36) $\exists e. \ldots scale'(\text{pessimistic})(e) \wedge extent'(\text{pessimistic})(\text{diff}(d_{accept.})(d_{too}))(e)$

Instantiation of the difference value The instantiation of the difference value required by *ba* is dependent on the open vs. closed property of the scale. In the case of an open scale (e. g. *pessimistically*), the difference value must be overtly specified. For closed scales, overt specification is optional:

(37) Ta bǎ píngguǒ chī le (bàn ge).
he BA apple eat PFV half CL
'He ate (half of) the apple.'

Default interpretations arise if the difference value is not overtly specified: for upper-closed scales, we get an interpretation of total traversal (-> $\forall$). Lower-closed scales are interpreted via existential boundedness: a state on the scale obtains that has a higher degree than the initial state with degree 0.

Excluded verb classes The presented account automatically excludes Kimian statives (emotion, knowledge verbs) from appearing in the *bǎ*-construction. Stative verbs do not introduce an event argument, which also makes them inaccessible for scalar manner adverbs[3] and other licensing dependents.

Besides statives, verbs of social interaction (e. g. *visit, participate*) are also not acceptable in the construction; it is not clear which semantic features make these verbs different from the large class of verbs that are allowed in the *bǎ*-construction. Obviously, the verbs come with event arguments. A possible explanation could be that these verbs describe closed, conventionalized events which do not allow to accommodate scalar relations in the sense of the *bǎ*-construction. Thus, similarly to statives, these verbs, if at all, are modifiable by manner adverbs in restricted ways, and it is not clear whether the manner adverbs modify the event denoted by the verb or subevents that are associated with this event.

5 The syntax-semantics interface

5.1 Arguments for *bǎ* as head

As shown in Section 2, the syntactic status of *bǎ* is a matter of discussion. The following analysis aims at modelling a transparent syntax-semantics interface which captures the interaction between the two levels. *Without going into syntactic details Some arguments are still in place to explain my view of the category of* bǎ. I view *bǎ* as the head of its clause; this option has been adopted in some previous accounts: Zou (1993) analyzes *bǎ* as a functional head. Sybesma (1999) starts out with causative sentences ([CAUSER bǎ CAUSEE V], cf. (2a)), in which *bǎ* acts as an argument-selecting head; he extends this analysis to "canonical" *ba*-sentences and claims that *bǎ* always heads a causative projection[4]. Bender (2000) analyzes *bǎ* as verbal head selecting for a subject, an object and a verbal complement; semantically, *bǎ* determines the topic-comment packaging of the sentence. My arguments for *bǎ* as head are partly linguistic and partly stem from analytical ease. First, the head status is in accord with diachronic facts: in Ancient Chinese, *bǎ* was a lexical verb denoting physical manipulation and thus a head in earlier stages of development of the language. As illustrated in (2), there are still instances of the construction in which *bǎ* acts as a causative head. Second, we have seen that the *bǎ*-construction is associated with a number of constraints that may alter its surface form depending on the choice of the verb. An analysis of *bǎ* as head of NP (preposition or case marker) would run into difficulties when expressing the co-occurrence restrictions between verbs, *bǎ*-marked NPs and potentially required

[3] Some stative verbs apparently combine with manner adverbs (e. g. *love passionately, resemble closely*). However, these manner adverbs are interpreted rather as degree modifiers than as "true" manner adverbs (Katz, 2003); besides, they modify not the state itself, but rather associated events that are recovered by coercion.

[4] It is not clear what contributes the causative semantics in *bǎ*-constructions which do not describe causative events. ...

additional verbal dependents. Finally, we have seen that the *bǎ*-construction can be used with different argument distributions (2); in some of the forms, *bǎ* selects arguments (e. g. causatives) or creates additional argument positions (e. g. retained objects).

5.2 Type constraint and complement attraction

I focus on the canonical argument distribution of the *bǎ*-construction. In this argument distribution, the use of *bǎ* does not make an additional contribution to the event structure of the sentence. Of course, this is not to say that *bǎ* has no semantic import: it impacts on the referential properties of the *ba*-NP and on the overall information packaging of the sentence and changes. Information packaging is not considered here; the switch in referential properties is relevant inasmuch as it changes the event structure of the sentence, eventually yielding a reading of telicity, "holistic" affectedness etc.

Thus, abstracting from referential and information-structural properties, *bǎ* seems to be a vacuous head that does not contribute relations of its own. The semantic constraint for *ba* is as follows:

(38)
$$\begin{bmatrix} \textsc{phon} \langle ba \rangle \\ \textsc{subcat} \left\langle \ldots \left[\textsc{content} \mid \textsc{rels} \langle \ldots \boxed{1} \textit{scale-rel} \ldots \rangle \right] \ldots \right\rangle \end{bmatrix}$$

The satisfaction of the semantic constraint hinges on the composition of the SUBCAT list of *bǎ*. I use the complement attraction mechanism proposed initially by Hinrichs and Nakazawa (1989) and largely adopted in analyses of verbal complexes and complex predicates. *Ba* is a head that selects for a verbal complement and attracts the arguments of the verb; the index of *bǎ* is identified with the index of the verb, restricting the range of possible verbs to verbs contributing event arguments:

(39)
$$\begin{bmatrix} \textsc{phon} \langle ba \rangle \\ \textsc{subcat} \boxed{0} \oplus \left\langle \textsc{v} \begin{bmatrix} \textsc{arg-st} \boxed{0} \langle \textsc{np}, \textsc{np} \rangle \\ \textsc{content} \mid \textsc{index} \boxed{3} \textit{event} \end{bmatrix} \right\rangle \\ \textsc{content} \mid \textsc{index} \boxed{3} \end{bmatrix}$$

Here, if the verb already is a scalar-change predicate, it contributes a scale relation that licenses the use of *ba*.

5.3 Satisfying the semantic constraint

We have seen how *bǎ* attracts the semantic arguments of the verb and realizes them in syntax. In the following, I will use a similar approach for additional dependents of the verb which will allow them to satisfy the semantic requirement of *bǎ*.

The proposed feature architecture relates to the adjuncts-as-complements approach, which targets the observation that adjuncts and complements should receive a unified treatment for certain phenomena (e. g. case assignment: Przepiórkowski

(1997), extraction: Bouma et al. (2001), diachronic adjunct-to-complement change: Bender and Flickinger (1999)). Bouma et al. assume three levels for the representation of dependency relations. Besides distinguishing between gaps and locally realized dependents, the more differentiated architecture formalizes two kinds of relationships between head and dependent:

- Selection: the head combines with a dependent in order to achieve well-formedness.
- Dependency: the head does not select for the element. It is optional and may be attached to the head in a given projection.

The following three levels of combinatorial representation are stated:

- DEPS: all dependents incl. gaps
- VAL: all locally realized dependents (excl. gaps)
- ARG-ST: only selected (required) elements

The correlations between the three features are shown in the following:

(40) $$\textit{verb} \rightarrow \begin{bmatrix} \text{ARG-ST } \boxed{1} \\ \text{DEPS } \boxed{1} \oplus \boxed{2}\textit{list(adjuncts)} \\ \text{SUBCAT } (\boxed{1} \end{bmatrix}$$

In the *bǎ*-construction, inherently optional dependents of the verb may become obligatory once the verb is used with *bǎ*: if the *bǎ*-construction is instantiated with non-scalar verbs, additional dependents are required that fulfill the semantic requirements of *bǎ*. These dependents are normally not selected by the verb. Thus, a straightforward solution would be to code them on the DEPS value of the verb, thereby keeping their status as lexically optional dependents. The DEPS value of the verb is then inherited onto the ARG-ST value of *bǎ*, which renders the dependents necessary for the well-formedness of the sentence:

(41) $$\begin{bmatrix} \text{PHON} \langle \textit{ba} \rangle \\ \text{SUBCAT } \boxed{0} \oplus \left\langle \text{V} \begin{bmatrix} \text{HEAD } \boxed{5} \\ \text{DEPS } \boxed{0} \left\langle \ldots \begin{bmatrix} \text{MOD} \mid \text{HEAD } \boxed{5} \\ \text{CONT} \mid \text{KEY } \boxed{1} \end{bmatrix} \right\rangle \\ \text{KEY } \textit{non-scalar-change-pred} \end{bmatrix} \right\rangle \\ \text{CONTENT} \mid \text{RELS} \langle \ldots \boxed{1}\textit{scale-rel} \ldots \rangle \end{bmatrix}$$

The following structure shows the analysis of example (7a), repeated here as (42):

(42) Zhāngsān bǎ zhè shì xiǎng *(de tài bēiguān).
Zhangsan BA this affair think DE too pessimistic
'Zhangsan thinks too pessimistically about this affair.'

(43)
$$\left[\begin{array}{l}\textsc{phon}\left\langle ba\right\rangle \\ \textsc{subcat}\ \boxed{0}\oplus\left\langle \textsc{v}\left[\begin{array}{l}\textsc{head}\ \boxed{5}\\ \textsc{deps}\ \boxed{0}\left\langle \ldots\left[\begin{array}{l}\textsc{mod}\mid\textsc{head}\ \boxed{5}\\ \textsc{content}\left[\textsc{key}\ \boxed{1}\ \textit{pessimistic}\right]\end{array}\right]\ldots\right\rangle\\ \textsc{content}\mid\textsc{key}\ \textit{think-rel}\end{array}\right]\right\rangle \\ \textsc{content}\left[\begin{array}{l}\textsc{index}\ \boxed{3}\\ \textsc{rels}\left\langle \ldots\boxed{1}\ldots\right\rangle\end{array}\right]\end{array}\right]$$

6 Conclusions

We have seen that the *bǎ*-construction has an event structure that cannot be exhaustively captured in terms of aspectual properties or the often used criterion of affectedness. I have proposed an account of the semantics in terms of a scalar constraint; such an analysis is more flexible in that it allows for different scalar properties (manner scales, temporal changes, paths) to license the *bǎ*-construction. The different acceptability conditions for verbs and the potential requirement of additional dependents on the verb naturally follow from the constraint.

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Positional expletives in Danish, German, and Yiddish

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Abstract

This paper deals with expletives that are inserted into clauses for structural reasons. We will focus on the Germanic languages Danish, German, and Yiddish. In Danish and Yiddish expletives are inserted in preverbal position in certain *wh* clauses: For Danish such an insertion is necessary when the subject is locally extracted from an SVO configuration in non-assertive clauses. In Yiddish *wh* clauses are formed from a *wh* phrase and a V2 clause. If no element would be fronted in the embedded V2 clause, an expletive is inserted in non-assertive clauses in order to meet the V3 requirement. In addition to the embedded *wh* clauses, declarative V2 clauses also allow the insertion of an expletive. In Danish the expletive fills the subject position and is not necessarily fronted. In German and Yiddish the expletive has to occur in fronted position. In contrast to Danish and Yiddish, German does not insert expletives in *wh* clauses. They are inserted only into declarative V2 clauses in order to fulfill the V2 requirement without having to front another constituent. In this paper we try to provide an account that captures the comonnalities between the three languages while being able to account for the differences.

1 Introduction

This paper deals with expletives that are inserted into clauses for structural reasons. We will focus on the Germanic languages Danish, German, and Yiddish. In Danish and Yiddish expletives are inserted in preverbal position in certain *wh* clauses: For Danish such an insertion is necessary when the subject is locally extracted from an SVO configuration in non-assertive clauses. In Yiddish *wh* clauses are formed from a *wh* phrase and a V2 clause. If no element would be fronted in the embedded V2 clause, an expletive is inserted in non-assertive clauses in order to fill the V3 requirement. In addition to the embedded *wh* clauses, declarative V2 clauses also allow the insertion of an expletive if no other element is fronted. In contrast to Danish and Yiddish, German does not insert expletives in *wh* clauses. They are inserted only into declarative V2 clauses in order to fulfill the V2 requirement without having to front another constituent. In this paper we try to provide an account that captures the comonnalities between the three languages while being able to account for the differences.

The paper will be structured as follows: Section 2 discusses the phenomenon in detail. Each language is described in a separate subsection with special discussion of *wh* clauses in Danish. Section 3 discusses the analyses: we suggest a lexical rule for the introduction of an expletive that accounts for expletive insertion in all three languages. We will show that Danish expletive insertion is more restrictive than the one in Yiddish since the expletive is inserted in cases of local subject extraction

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only. The distribution of the expletive in German follows from its SOV character without any further assumption. Section 4 draws a conclusion.

2 The Phenomenon

The following three subsections deal with Danish, Yiddish, and German, respectively. Each subsection comes with a part that gives some background information on the respective language and a second part in which the positional expletives are described.

2.1 Danish

2.1.1 Background

In Danish, the finite verb is either in first (V1) or in second position (V2). We call the V1 and V2 serialization inverted and the VP serialization uninverted. Examples for an uninverted and an inverted serialization are given in (1a) and (1b) respectively.

(1) a. fordi [$_S$ Max [$_{VP}$ ikke [$_{VP}$ læser bogen]]]
because Max not reads book.DEF
'because Max is not reading the book'

b. [$_S$ Max [$_{VP}$ læser [$_{VP}$ ikke [$_{VP}$ $\__i$ bogen]]]].
Max reads not book.DEF
'Max is not reading a book.'

The position of the finite verb relative to the sentential negation provides evidence for verb fronting. In the non-fronted example in (1a) the finite verb follows the sentential negation. In the fronted example in (1b) the finite verb precedes the sentential negation which left-adjoins to the VP.

The two positions correlate roughly with root and embedded clauses, but both verb positions can occur embedded and non-embedded as shown for a non-fronted verb in (2b) and (2c).[1]

(2) a. Hvem havde egentlig placeret bomben?
who had after.all placed bomb.DEF
'Who had placed the bomb after all?'

b. Politiet ved ikke, hvem der egentlig havde placeret bomben.[2]
police.DEF knows not who EXPL actually had placed bomb.DEF
'The police doesn't know who had placed the bomb after all.'

[1] Examples with (DK) are extracted from *KorpusDK*, a corpus of 56 million words documenting contemporary Danish (http://ordnet.dk/korpusdk).

[2] DK

c. Hvem der var så heldig at bo der.[3]
who EXPL was so lucky to live there
'Wish I was so lucky as to live there.'

2.1.2 Positional Expletives

In this subsection, we first discuss expletives in *wh*-clauses. Danish *wh*-clauses consist of a fronted *wh*-element and a uninverted clause from which the *wh*-element is extracted. In non-assertive clauses (interrogatives or exclamatives) without verb fronting, a *wh*-subject requires the presence of the expletive *der* ('there') in subject position:[4] In comparison to (2b) the sentence in (3) is ungrammatical:

(3) Politiet ved ikke, hvem egentlig havde placeret bomben.
police.DEF knows not who actually had placed bomb.DEF
'The police doesn't know who had placed the bomb after all.'

This phenomenon is also observed in other V2 languages with head-initial VPs such as Swedish, Norwegian (Taraldsen, 1978; Engdahl, 1985), and Yiddish (Diesing, 1990).

The expletive has been analyzed as the relative *der* ('there') occurring as a subject relativizer in relative and free relative clauses (Vikner, 1991; Mikkelsen, 2002). But the *wh*-clauses in (2b) and (2c) are not relative clauses. They are indeed clauses and not NPs with a nominal *wh*-head and a relative clause as we show in the following.[5]

Embedded *wh*-clauses occur in S-positions and not NP-positions and like other clausal complements they trigger the default, neuter ending *-t* on agreeing predicative adjectives (4a) instead of the common gender ending ∅ that we see in (4b):

(4) a. Hvem der kommer, er usikkert.
who EXPL comes is uncertain.SG.NEUT

b. Hvem er usikker?
who is insecure.SG.COMM

If *hvem edr kommer* would be an NP we would expect the common gender agreement like in (4b). Since this is not the case an analysis as interrogative clause with an expletive element rather than a relative pronoun is the only viable analysis.

Additional evidence for this analysis is provided by the fact that embedded *wh*-clauses can be extraposed and subject *wh*-clauses are anticipated by the pronoun *det* ('it') like other clausal subjects (see also Bresnan and Grimshaw, 1978 for English):

[3] DK

[4] The expletive does not occur in *wh-in-situ*-questions: *han fortæller, HVEM kommer?* ('he is telling WHO comes?'). This confirms that the expletive signals dislocation of the *wh*-subject in non-reprise questions.

[5] Free relatives in Danish can be shown to be NPs headed by the *wh*-word and not clauses dominated by an NP as suggested for German in Müller, 1999.

(5) . . . , da [det] blev opklaret, hvem der havde malet billedet,[6]
when it was discovered who EXPL had painted picture.DEF
'. . . when it was found out who had painted the picture,'

Extraposed NPs are impossible or highly marked.

Furthermore embedded *wh*-clauses allow pied-piping of a PP. This is expected since the *wh*-constituent is a complement of the embedded verb and not of the matrix predicate. Note that Danish allows clausal complements of prepositions (the *wh*-clause is the complement of the preposition *om* ('about')).

(6) Man var aldrig i tvivl om, for hvem hans hjerte slog.[7]
you were never in doubt about for whom his heart beat
'You never had any doubts for whom his heart was beating.'

In addition *hvem* ('who') does not occur in free subject relative clauses (Hansen, 1967), but *hvem* ('who') is possible as a subject in embedded *wh*-clauses.

(7) a. ??/* Hvem der ryger, får en bøde.
who EXPL smokes gets a ticket
'Whoever smokes, gets a ticket.'

b. Hvem der ryger, vides ikke.
who EXPL smokes is.known not
'Who is smoking, is not known.'

Finally, the expletive only occurs in non-assertive *wh*-clauses. It does not occur in assertive *wh*-clauses such as relative clauses modifying a non-*wh*-head.[8]

(8) De to ungdomsveninder, hvis børn nu giftede sig med
the two school day friends whose children now married REFL with
hinanden.[9]
each other
'The two school days friends whose children now were marrying each other.'

Thus we conclude that the clauses containing *der* ('there') in (2b) and (2c) are not relative clauses with a relative pronoun *der* but rather interrogative and exclamative clauses with an expletive.

Having established that the *der* is an expletive pronoun, the question remains under what circumstances such expletives may be or have to be inserted. The generalization appears to be that the subject position must be filled in non-assertive clauses without verb fronting. On the analysis in Erteschik-Shir, 1984 the expletive

[6] DK

[7] DK

[8] The data is slightly more complex. The *wh*-word *hvad* ('what') is exceptional in always requiring the expletive, also in appositive relative clauses (Theilgaard, 2009). In addition, Vikner (1991) also accepts an optional expletive in relative clauses such as the one in (8). We have found no authentic examples of this.

[9] DK

signals that the subject has to be found elsewhere. But this cannot be entirely correct. As (9) shows, no expletive occurs after an adverbial *wh*-constituent,[10] and the expletive is only optional when the *wh*-subject is extracted into the matrix clause as in (10).[11]

(9) Hvem ved du ikke hvor (*der) bor?
who knows you not where EXPL lives
'Who don't you know where he lives?'

(10) Hvem påstår politiet (der) havde placeret bomben?
who claims police.DEF EXPL had placed bomb.DEF
'Who does the police claim had placed the bomb?'

The clause *påstår politiet* ('claims the police') in (10) is no parenthetical clause as claimed by Erteschik-Shir (1984). As (11) shows, it allows adverbial modification, which is disallowed by parenthetical clauses (see Reis, 1996).[12]

(11) Hvem påstår politiet [egentlig] havde placeret bomben?
who claims police.DEF actually had placed bomb.DEF
'Who does the police after all claim had placed the bomb?'

The expletive is thus only obligatory in local extraction. For that reason the expletive cannot be an element in C ensuring proper government of the subject trace as proposed by Engdahl (1985). If this were the function of the expletive, it should be obligatory in non-local extraction as well. The correct generalization appears to be that the expletive is obligatory to avoid string-vacuous extraction in non-assertive clauses without verb fronting. Without the expletive, a *wh*-clause as the one in (2b) is structurally ambiguous.

(12) a. $[_S$ hvem$_i$ $[_{S/np}$ $\__i$ kommer]]
who comes
b. $[_S$ hvem kommer]

This ambiguity does not arise in (9), since *hvor* ('where') as an adverbial *wh*-word can never be a subject, and no ambiguity arises when the *wh*-constituent is extracted into the matrix clause, since the matrix clause is either a clause with verb fronting as in (11) or an embedded clause with a filled subject position as in (13).

[10]The present account actually predicts the expletive to be optional here, contrary to fact. It appears that the optional expletive can only be clause-initial, see footnote 11.

[11] An optional *der* ('there') is also observed with extracted *non-wh*-subjects:

(i) Ham tror jeg (der) vinder
him think I EXPL wins
'As for him, I think he is going to win.'

[12]This pattern is also observed with the verbal particle *mon* ('I wonder'). This is unexpected if *mon* is an adverbial and no C-element as claimed in Erteschik-Shir (2010): *hvem mon der turde det* (DK) ('who MON DER dared that'). Here the expletive is also optional.

(13) Han spurgte, hvem [de] troede (der) vandt.
he asked who they thought EXPL won
'He asked who they thought was going to win.'

Thus, the presence of the subject expletive shows that the *wh*-constituent is not in subject position (see footnote 4) and that the verb is non-fronted.

While we have been discussing expletives mainly in the context of interrogatives, they are not restricted to interrogatives: it is possible to have them in normal V2 sentences, as the examples in (14) demonstrate:

(14) a. Der kom nogle klovne ind
EXPL came some clowns PART

b. Så kom der nogle klovne ind ...[13]
then came EXPL some clowns PART
'Then some clowns entered ...'

(14a) shows that the *der* can fill the position before the finite verb and (14b) shows that it is also possible to keep the expletive in the postverbal area.

2.2 Yiddish

In the following section we want to compare Danish with Yiddish which also features an expletive in local *wh*-extraction in non-assertive clauses. A comparison with Yiddish is interesting since Yiddish is a West Germanic language with embedded topicalization and a dominant VO order. Thus it differs from German in being VO and it differs from Danish in having embedded topicalization (which is restricted in Danish).

2.2.1 Background

Yiddish is a V2 language just like Danish (Prince, 1989; Diesing, 1990, 2004). The first position can be occupied by almost any constituent, but canonically it is occupied by the subject (Prince, 1989, p. 3). This is also the position of the *wh*-word in a *wh*-main clause (examples from Diesing (2004), her examples (1b), (1c) and (5b)).[14]

(15) Maks vet zingen a lidl
Max will sing a song
'Max will to sing a song.'

(16) Nekhtn hot maks gezungen a lidl
yesterday has Max sung a song
'Yesterday, Max sang a song.'

[13] KorpusDK

[14] Diesing (2004) shows that Yiddish also allows multi frontings of *wh*-constituents in *wh*-main clauses. We will not be concerned with that here, but our account can accommodate these structures by allowing head-filler structure to have another head-filler-structure as the head-daughter.

(17) Ver hot gegesn a brukve
who has eaten a turnip
'Who ate a turnip?'

According to Diesing (1990, p. 41–42), Yiddish is an SVO language. Diesing assumes that the finite verb moves for interrogative verb inital and V2 sentences. This is motivated by considering particle verbs: The infinitive form of particle verbs looks like the German form, that is, the particle is serialized to the left of the verb (18a). As in German, the particle is stranded in declarative clauses with a finite verb (18b), it cannot be linearized leftadjacent to the verb as in (18c).

(18) a. Ikh vel avekshikn dos bukh.
I will away-send the book
'I will send away the book.'

b. Ikh shiki avek vi dos bukh.
I send away the book

c. * Ikh avekshik dos bukh.
I away-send the book

In contrast to Danish, Yiddish also exhibits the V2 order in embedded clauses, that is, any constituent can be fronted, also in the presence of a complementizer (19a) or a *wh*-word in an interrogative clause (19b).

(19) a. Ikh meyn az haynt hot Max geleyent dos bukh.[15]
I think that today has Max read the book
'I think that Max read the book today.'

b. Ikh veys nit [vos Max hot gegesn].[16]
I know not what Max has eaten
'I don't know what Max has eaten.'

2.3 Positional Expletives

Embedded interrogative clauses differ from main clauses in that *wh*-words do not occur in the position immediately before the finite verb. *wh*-words are combined with V2 clauses, giving rise to V3-clauses as in Diesing's example in (19b). In (19b) the preverbal position is filled by the subject *Max*. If the subject is a *wh*-word itself or if the subject stays in post-verbal position (either within the S or in an extraposed position), the preverbal position has to be filled by another constituent. If no other constituent is fronted, the expletive *es* ('it') occurs (Prince, 1989; Diesing 1990, Section 5.1, 2004). Compare the following examples from Prince (1989) (her examples (2b), (3b) and (6b)).

(20) a. ver es iz beser far ir iz beser far mir
whoever EXPL is better for her is better for me
'Whoever is better for her is better for me.'

[15] Diesing, 1990, p. 58.
[16] Diesing, 1990, p. 68.

b. ikh hob zi gefregt ver es iz beser far ir
I have her asked who EXPL is better for her
'I have asked her who is better for her.'

c. ikh hob im gefregt vemen es kenen ale dayne khaverim
I have him asked whom EXPL know all your friends
'I asked him whom all your friends know.'

The only exception are subject-relative clauses where the topic position is allowed to be empty. Compare example (21) from Prince (1989) (her example (1a)).

(21) der melamed vos iz beser far ir (is beser far mir).
the teacher that is better for her is better for me
'The teacher that is better for her is better for me.'

The generalization is the same as in Danish: an embedded *wh*-clause is always V3 (except for subject relative clauses). The difference between Danish and Yiddish is that the position of the subject is fixed in Danish *wh*-clauses: The subject can only occur to the left of the finite verb. Therefore the expletive only occurs in subject-extraction which would otherwise result in a V2 structure. In Yiddish, the subject can also occur postverbally.

The insertion of expletives is not restricted to *wh*-clauses. Example (22) shows that the insertion of an expletive is possible if the speaker does not want to front another element:

(22) Es geyn mentshn.
EXPL walk people
'There are people walking.'

In contrast to Danish, the expletive has to be fronted, though:

(23) * Mentshen geyn es.
people walk EXPL

2.4 German

2.4.1 Background

Like Danish and Yiddish, German is a V2 language. However it differs from these two languages in beeing an SOV language. Like in Yiddish the particle of a particle verb is serialized to the left of the verb for non-finite verbs and finite verbs in final position. In V1 and V2 clauses however, the particle remains in final position and the verb is linearized initially.

2.4.2 Positional Expletives

Interestingly, unlike Danish and Yiddish, German does not allow positional expletives in verb-final clauses at all. So clauses with a complementizer, embedded

interrogative clauses, and relative clauses do not allow for positional expletives, as the respective examples in (24a–c) show:

(24) a. * dass es ein Mann hereinkommt
that EXPL a man into.comes
'that a man entered'

b. * Ich frage mich, wer es hereinkommt
I wonder SELF who EXPL into.comes
'I wonder who entered.'

c. * der Mann, der es hereinkommt
the man who EXPL enters

However, like in Yiddish it is possible to have an expletive in the preverbal position in a V2 clause. This expletive can be used to get the V2 sentence type without having to front another constituent of the sentence. (25) shows an example:

(25) Es kamen drei Männer zum Tor herein.
EXPL came three man to.the door in
'There were three man entering the door.'

Like in Yiddish, the expletive is restricted to the position before the finite verb. Sentences with the expletive in the Mittelfeld are ungrammatical:

(26) * Drei Männer kamen es zum Tor hinein.
three man came to.the door in

3 The Analysis

This section consists of three subsections: Subsection 3.1 is concerned with linking, Subsection 3.2 with clause structure, Subsection 3.3 discusses the lexical licensing of expletives, Subsection 3.4 gives example analyses of interrogative clauses and Subsection 3.5 specifies constraints on the distribution of expletives.

3.1 Linking

We assume that all grammars of natural languages contain a feature called ARG-ST that describes the valents that depend on a certain head. This list is mapped to valence features like SPR and COMPS. The mapping can differ from language to language or rather from language class to language class. For instance, English, Danish and Yiddish map the subject of a verb onto SPR and all other arguments onto COMPS, and German maps all arguments of finite verbs onto COMPS, the value of SPR being the empty list.

Lexical items for transitive verbs with their arguments mapped to valency lists are given in (27):

(27) a. Danish and Yiddish (SVO):

$$\begin{bmatrix} \textsc{spr} & \left\langle \text{NP}[\textit{str}]_i \right\rangle \\ \textsc{comps} & \left\langle \text{NP}[\textit{str}]_j \right\rangle \\ \textsc{arg-st} & \left\langle \text{NP}[\textit{str}]_i, \text{NP}[\textit{str}]_j \right\rangle \end{bmatrix}$$

b. German (SOV, free constituent order):

$$\begin{bmatrix} \textsc{spr} & \langle\rangle \\ \textsc{comps} & \left\langle \text{NP}[\textit{str}]_i, \text{NP}[\textit{str}]_j \right\rangle \\ \textsc{arg-st} & \left\langle \text{NP}[\textit{str}]_i, \text{NP}[\textit{str}]_j \right\rangle \end{bmatrix}$$

str stands for structural case. For Danish and Yiddish the arguments are mapped onto SPR and COMPS. The specifier head schema together with the head complement schema licences classical NP VP structures (see Section 3.2 and for a concrete example Figure 2 below). For German, we assume that subjects of finite verbs are represented in the same valence list as complements, that is, they are members of the COMPS list (Pollard, 1996). The difference in linking that is reflected in (27) corresponds to the difference between VO and OV langugaes and accounts for a number of differences between the respective languages. See Haider, 2010 for details.

A formalization of the mapping constraints for verbs is provided in (28):

(28) a. Danish and Yiddish:

$$\begin{bmatrix} \textsc{spr} & \left\langle \boxed{1} \right\rangle \\ \textsc{comps} & \boxed{2} \\ \textsc{arg-st} & \left\langle \boxed{1} \right\rangle \oplus \boxed{2} \end{bmatrix}$$

b. German:

$$\begin{bmatrix} \textsc{spr} & \langle\rangle \\ \textsc{comps} & \boxed{1} \\ \textsc{arg-st} & \boxed{1} \end{bmatrix}$$

(28a) spplits the ARG-ST list into two lists. The first list has to contain exactly one element: the subject. This element is the sole element of the SPR list. In Danish all finite verbs have to have a subject. In German all elements from ARG-ST are mapped to COMPS. German differs from Danish in allowing subjectless constructions.

3.2 Clause Structure

Clause structures are licenced by schemata for head-specifier-phrases and head-complement-phrases. We assume a non-cancellation approach to valence, that is, realized arguments are not taken off from the valence list but marked as realized (Meurers, 1999; Przepiórkowski, 1999; Bender, 2008; Müller, 2008a).

The tree languages under discussion differ from each other in various respects: German is verb final (OV), while the other two languages are verb-initial (VO). This is captured by assigning Danish and Yiddish verbs the INITIAL value '+' and German verbs the value '−'. An LP statement ensures that heads with an inital value '+' are lineraized before there complements and heads with the value '−' are linearized after their complements. Specifiers are linearized to the left of their heads in all three languages.

We assume the following schema for head complement combinations:

Schema 1 (Head Complement Schema)
head-complement-phrase ⇒

$$\left[\begin{array}{l}\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{COMPS } \boxed{1} \oplus \left\langle \left[\begin{array}{ll}\text{ARGUMENT} & \boxed{2}\\ \text{REALIZED} & +\end{array}\right] \right\rangle \oplus \boxed{3} \\ \text{HEAD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{COMPS } \boxed{1} \oplus \left\langle \left[\begin{array}{ll}\text{ARGUMENT} & \boxed{2}\\ \text{REALIZED} & -\end{array}\right] \right\rangle \oplus \boxed{3} \\ \text{NON-HEAD-DTRS} \left\langle \left[\text{SYNSEM } \boxed{2} \left[\begin{array}{l}\text{LOC}|\text{CAT}|\text{COMPS } \textit{list of spirits}\\ \text{LEX } -\end{array}\right]\right] \right\rangle\end{array}\right]$$

Arguments are represented together with a binary REALIZED feature. Arguments that have not been realized (REALIZED value '−') can be realized as the non-head daughter. The respective argument is marked as REALIZED+ at the mother node. German is a language with rather free constituent order. This is captured by allowing the Head Argument Schema to combine a head with an arbitrary element from the COMPS list. For languages like English or Danish, we assume that $\boxed{1}$ is the empty list and hence a fixed order results (Müller, In Preparation). A parallel schema is assumed for head specifier phrases.

(29) shows a general constraint on Head Filler Phrases:

(29) *head-filler-phrase* ⇒

$$\left[\begin{array}{ll}\text{HEAD-DTR} & \left[\begin{array}{ll}\text{LOC}|\text{CAT} & \left[\begin{array}{ll}\text{HEAD} & \left[\begin{array}{l}\text{VFORM } \textit{fin}\\ \textit{verb}\end{array}\right]\\ \text{COMPS } \textit{list of spirits}\end{array}\right]\\ \text{NONLOC} & \left[\begin{array}{l}\text{INHER}|\text{SLASH } \langle \boxed{1} \rangle\\ \text{TO-BIND}|\text{SLASH } \langle \boxed{1} \rangle\end{array}\right]\end{array}\right]\\ \text{NON-HEAD-DTRS} & \left\langle \left[\begin{array}{l}\text{LOC } \boxed{1}\\ \text{NONLOC}|\text{INHER}|\text{SLASH } \langle\rangle\end{array}\right] \right\rangle\end{array}\right]$$

Both the V2 clauses in all three languages and the interrogative clauses are subtypes of this general constraint. V2 clauses in all three languages require the verbal projection to contain a verb in intial position, that is, an inverted verb order.

Sentences with the finite verb in initial position are analyzed with a special lexical item for the inverted verb that selects a verbal projection from which the

verb is missing (Borsley, 1989; Kiss and Wesche, 1991; Meurers, 2000; Müller, 2005).

The lexical rule that licences an inverted verb is given in (30):

(30) Lexical Rule for Inverted Verbs:

$$\left[\text{SYNSEM}|\text{LOC}\ \boxed{1}\left[\text{CAT}|\text{HEAD}\ \begin{bmatrix}\text{VFORM} & \textit{fin}\\ \text{INV} & -\\ \textit{verb}\end{bmatrix}\right]\right] \mapsto$$

$$\left[\text{SYNSEM}|\text{LOC}\ \left[\text{CAT}\ \left[\begin{array}{ll}\text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{fin}\\ \text{INV} & +\\ \text{INITIAL} & +\\ \text{DSL} & \textit{none}\\ \textit{verb}\end{bmatrix}\\ \text{COMPS} & \left\langle\left[\text{LOC}\ \left[\begin{array}{ll}\text{CAT} & \left[\begin{array}{ll}\text{HEAD} & \begin{bmatrix}\text{DSL} & \boxed{1}\\ \textit{verb}\end{bmatrix}\\ \text{COMPS} & \textit{list of spirits}\end{array}\right]\\ \text{CONT} & \boxed{2}\end{array}\right]\right]\right\rangle\end{array}\right.\right.\right.$$

$$\left.\left.\left.\text{CONT}\ \boxed{2}\right]\right]\right]$$

This lexical rule maps an uninverted verb onto an inverted one. The inverted verb selects for a projection of a verbal trace, that is, a verbal projection with a *local* object as value of DSL (DOUBLE SLASH). The properties of the trace are projected along the head path and identified with the local value of the input of the lexical rule (1). Together with the trace in (31) we get the analysis in Figure 1 for the German sentence in (32):

(31) Trace for Head Movement:

$$\left[\begin{array}{ll}\text{PHON} & \langle\rangle\\ \text{LOC} & \boxed{1}\left[\text{CAT}|\text{HEAD}|\text{DSL}\ \boxed{1}\right]\end{array}\right]$$

(32) Liest$_i$ er das Buch $\_i$?
reads he the book
'Does he read the book?'

Due to space limitations the analysis cannot be discussed in more detail. The interested reader is referred to the references cited above or to Müller, 2008b.

The analysis of the Danish analogue of (32) is given in Figure 2.

A verb second sentence can be analyzed as a verb first sentence with one constituent extracted. So V2 sentences in all three languages are instances of head filler phrases with the additional requirement on the head daughter to be INVERTED+.

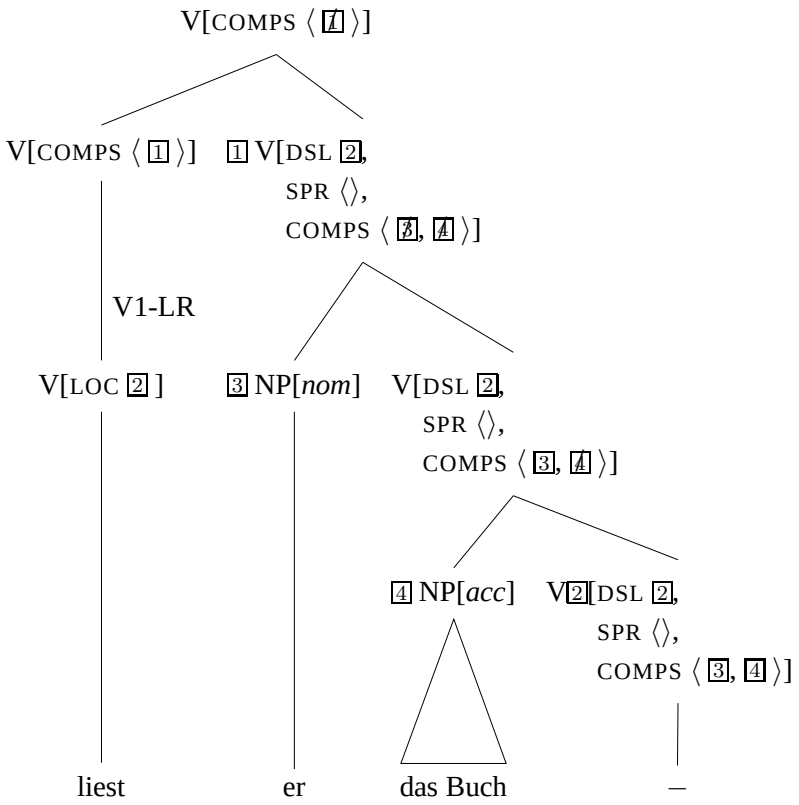

Figure 1: Analysis of the German sentence *Liest er das Buch?*

3.3 Lexical Licencing of Expletives

As we showed above the positional expletives are licensed in different phrase structural positions in the languages under discussion: The expletives are found in the subject position in Danish SVO structures, but in preverbal position in Yiddish and German V2 clauses. The commonalities are captured by an analysis that assumes that these expletives are licenced lexically by a lexical rule that introduces the expletives into the ARG-ST list:

$$(33)\quad \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{ARG-ST} & \boxed{1} \end{bmatrix} \mapsto \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{ARG-ST} & \langle\, \text{NP}[\textit{lnom}]_{expl} \,\rangle \oplus \boxed{1} \end{bmatrix}$$

This lexical rule adds an expletive pronoun at the first position of the ARG-ST list. The case of this NP is marked to be lexical nominative. Case assignment operates on ARG-ST and assignes nominative to the first NP with structural case and accusative to all other NPs with structural case (Przepiórkowski, 1999; Meurers, 1999; Meurers, 2000, Chapter 10.4.1.4; Müller, 2002, Section 1.4). Since the presence of positional expletives does not influence case assignment, the case of such expletives has to be lexically assigned.

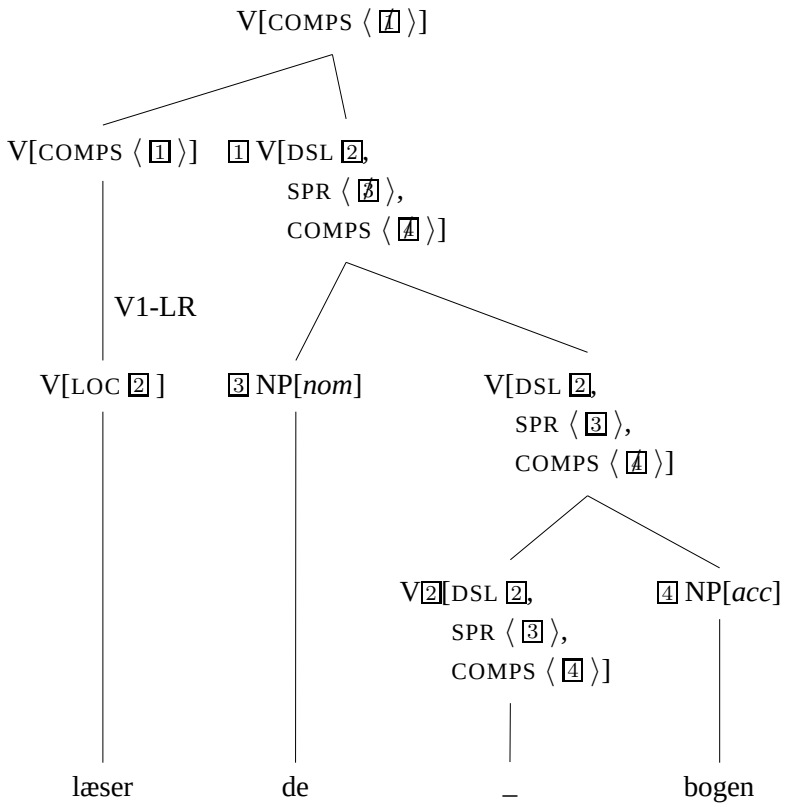

Figure 2: Analysis of the Danish sentence *Læser de bogen?* ('Does he read the book?'

Apart from case assignement, agreement refers to the first NP with structural case (Müller, 2008b, p. 212). By assuming that the case of the expletive is lexical, we make correct predictions as far as agreement is concerned.

The iterative application of this rule is blocked by a constraint that requires that the elements of the ARG-ST list are referential. This also excludes the application of the rule to lexical items like weather verbs that inherently select for an expletive argument.

3.4 Interrogatives

The schemata for interrogative clauses in Danish, Yiddish, and German are variants of the Head Filler Schema: a *wh* element is combined with a sentence with a gap. For Danish, the sentence is in SVO order (INITIAL+, INVERTED−), for German it is in SOV order (INITIAL−, INVERTED−), and for Yiddish it is in V2 order (INITIAL+, INVERTED+). The feature combination for Yiddish would also apply to V1 sentences as they are used in yes/no questions. Hence an additional marking of the V2 status is needed, which is not discussed here.

The analyses of interrogative clauses in Danish, German, and Yiddish are given

in the Figures 3, 4, and 5, respectively.

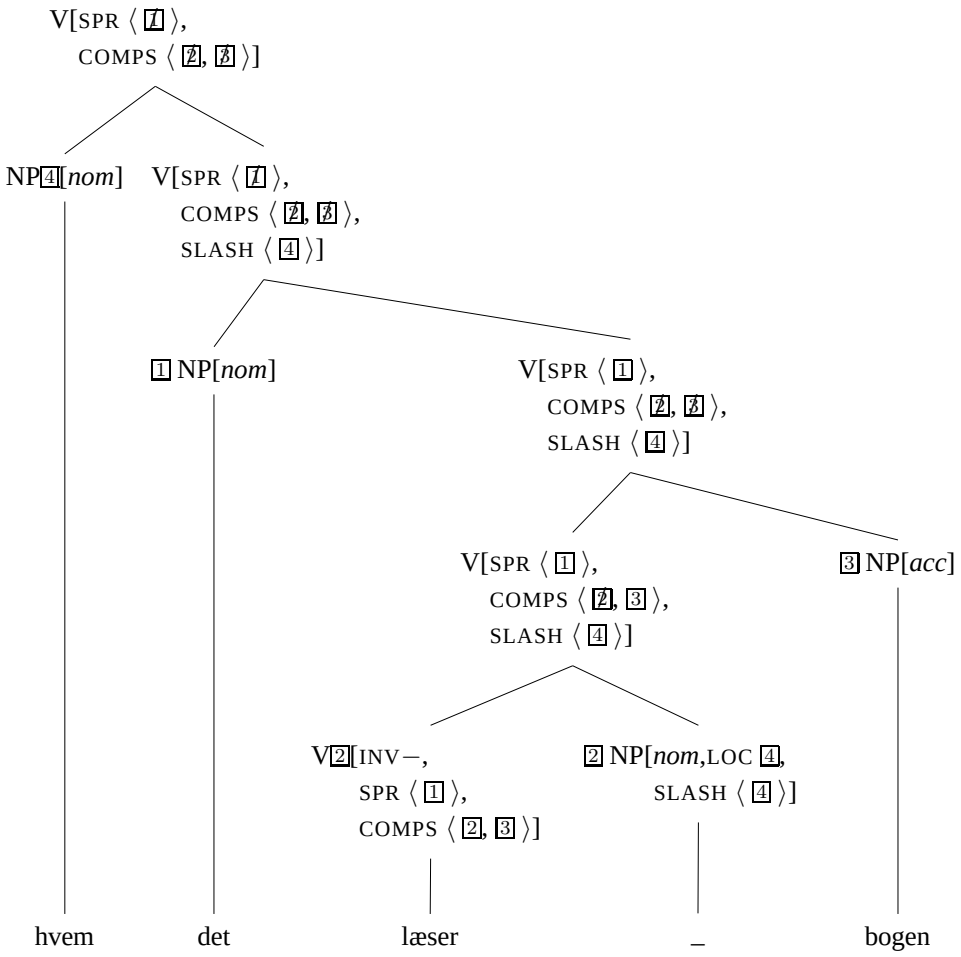

Figure 3: Analysis of the Danish sentence *hvem det læser bogen*

3.5 Constraints on the Distribution of Expletives

With the lexical rule in (33) we capture the commonalities between the languages, but how are the differences explained? In Danish, an expletive is inserted, if the subject is extracted. In Yiddish and German the expletive is inserted in the filler position if nothing else is extracted. German and Yiddish differs from Danish in not allowing expletives in embedded clauses (see (23) and (26)). This can be explained by the following language specific constraints on expletive insertion:

(34) Constraint on lexical rule output in German and Yiddish:

$$\left[\text{ARG-ST}\ \left\langle \left[\begin{array}{l}\text{LOC}\ \boxed{1}\\ \text{NONLOC}|\text{INHER}|\text{SLASH}\ \boxed{1}\end{array}\right] \right\rangle \oplus \square\right]$$

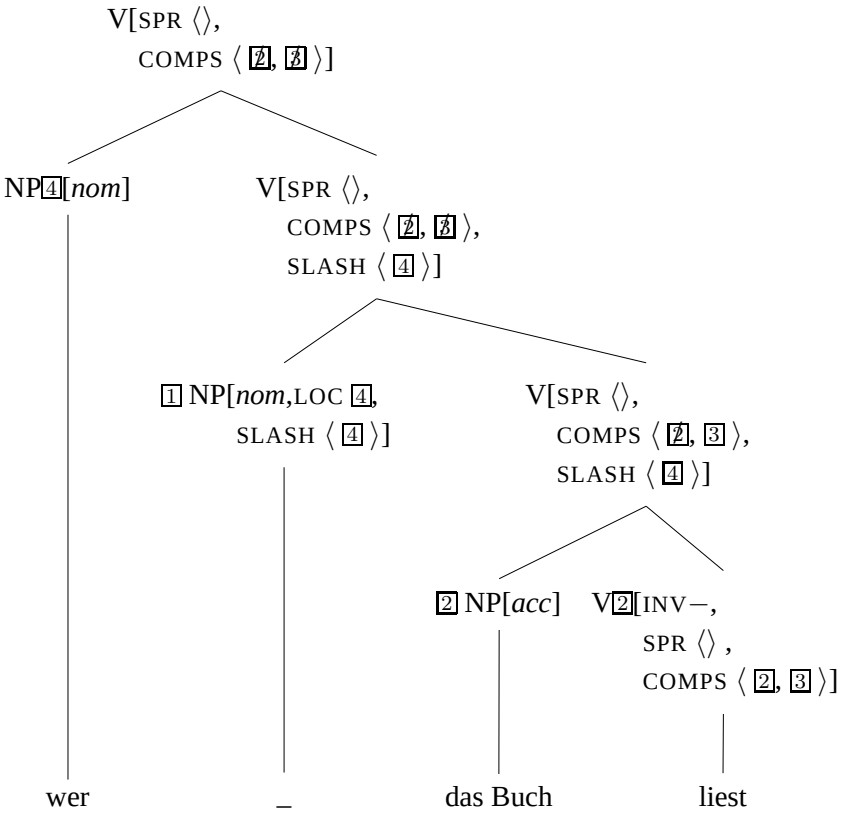

Figure 4: Analysis of the German sentence *wer das Buch liest*

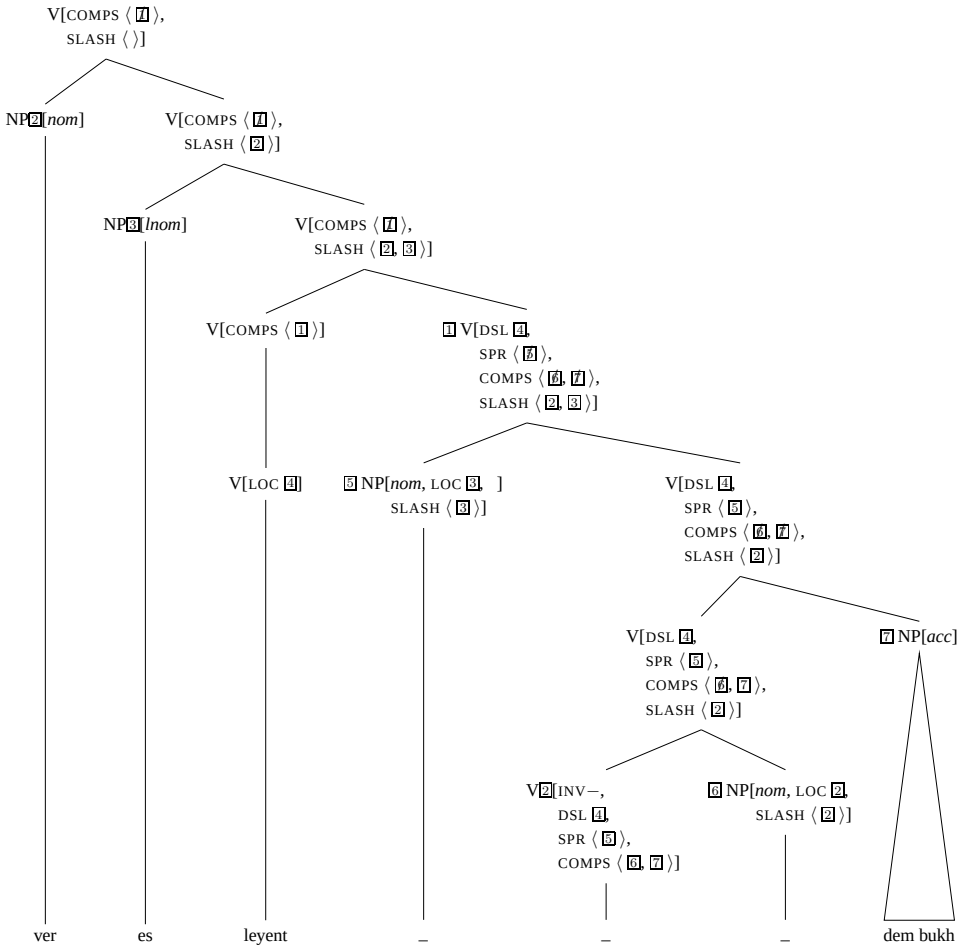

Figure 5: Analysis of the Yiddish sentence *ver es leyent dem bukh*

While Danish allows the expletives to be realized in the subject position even in V2 sentences (see (14b)), this is excluded in Yiddish and German: In these languages the first element of the ARG-ST list is extracted. The first element is the expletive. The expletive element is in the SLASH-Liste and hence part of a nonlocal dependency that has to be bound off by the head-filler-schema. The respective structures are V2 sentences that can be used as root clauses in German and Yiddish and as part of embedded clauses in Yiddish. Since German embedded interrogatives, relative clauses, and complementizer clauses do not involve nonlocal dependencies, it is explained why positional expletives are not allowed in embedded clauses.

While German and Yiddish allow the extraction of subjects, Danish forbids the local extraction of subjects. The respective structure is given in Figure 6. Such structures can be ruled out by the following constraint:

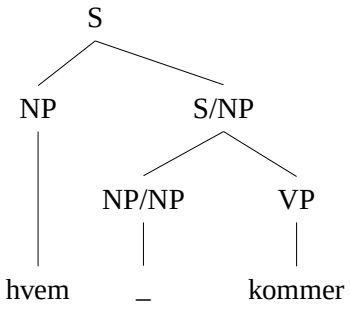

Figure 6: String vacuous movement is forbidden in Danish.

(35) Constraint for Blocking local extraction of the subject (Danish):

$$\left[\begin{array}{l}\textsc{hd-dtr}\ \left[\textsc{ss|loc|cat|head}\ \left[\begin{array}{l}\textsc{inv}\ -\\ \textsc{stype}\ \textit{non\_assertive}\end{array}\right]\right]\\ \textsc{n-hd-dtrs}\ \left\langle\left[\textsc{ss}\ \left[\begin{array}{l}\textsc{loc|cat|head}\ \left[\begin{array}{l}\textsc{case}\ \textit{nom}\\ \textit{noun}\end{array}\right]\\ \textsc{nlc|inher|wh}\ \langle\square\rangle\end{array}\right]\right]\right\rangle\\ \textit{head\_filler\_phrase}\end{array}\right]\rightarrow$$

$$\left[\textsc{head-dtr|ss|loc|cat|spr}\ \langle\ [\ \textsc{arg|nonloc|inher|slash}\ \langle\rangle]\ \rangle\right]$$

This constraint says that the element in SPR may not be extracted if the filler of the head filler structure is the subject and a *wh* element. By assuming a raisng spirits approach it is possible to formulate this constraint since information about the specifier is still accessible although the specifier is realized in a position internal to the head daughter. The same effect could be reached with the feature XARG that was used by Sag (2007) to make an external argument accessible for porpuses similar to the one under discussion here (see also Bender and Flickinger, 1999). However, since the raising spirits approach is used for other phenomena as well (Müller, 2008a), we do not introduce the XARG feature but use the information that is available in the spirits.

If the *wh*-element is nonlocally extracted, this constraint does not apply as in (11) or it is satisfied by the matrix subject as in (13). Therefore the embedded clause can either be headed by a verb with a subject trace or by a (non-fronted) verb subcategorizing for the expletive *der* ('there') and an extracted argument. This accounts for the optionality of the expletive in non-local extraction (ex. (10)). The expletive observed with the colloquial use of a pleonastic complementizer (Vikner, 1991) *hvem at *(der) kommer* ('who that EXPL comes') follows from the lexical rule and an independently needed *that*-trace filter (TRACE PRINCIPLE).

4 Conclusion

This paper discusses positional expletives in Danish, Yiddish, and German. A lexical rule is suggested that introduces an expletive into the ARG-ST list of verbs. Constraints were formulated that ensure that the expletive is extracted in Yiddish and German and that block local extractions of subjects in Danish.

The analyses are implemented in the TRALE system. The grammar fragments for Danish, German, and Yiddish can be downloaded from http://hpsg.fu-berlin.de/Projects/core.html.

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Remarks on sluicing

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Abstract

Sluicing is widely regarded as requiring an analysis via deletion operations. We examine critically and reassess the motivation for a deletion analysis of Sluicing, offering cross-linguistic and language-internal evidence in support of a fundamentally semantic constructional alternative like the one proposed by Ginzburg and Sag (2000).

1 Introduction

Sluicing, one of the most discussed ellipsis phenomena in natural languages, presents interesting challenges for nontransformational theories of grammar like HPSG. The *wh*-expression isolated in Sluicing (the Sluicing 'remnant'), which may function as either a main or embedded interrogative clause, typically appears with a corresponding element in the immediate linguistic context (the 'correlate'), as illustrated in (1)–(2):

(1) a. **Someone** left the room yesterday, but I don't know **who**.

b. **Someone** left the room yesterday. I wonder **who**.

(2) A: **Someone** left the room yesterday.

B: **Who**?

But Sluicing remnants sometimes appear without correlates, a phenomenon dubbed 'sprouting' by Chung et al. (1995):

(3) a. They gave away the farm, but I don't know **to whom**.

b. They gave away the farm. I don't know **to whom**.

(4) A: They gave away the farm.

B: **To whom**?

There are three theories of Sluicing that have been discussed in the literature. The first of these is the **Deletion** theory (Ross 1969, Sag 1976, Merchant 2001), where a transformational operation deletes a redundant S (or IP) that immediately follows an interrogative *wh*-expression that has been fronted, as sketched in (5):

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(5) a. ...but I don't know [$_{CP}$ [$_{+Q}$] [$_{IP}$ Kim likes **[who]**]]. $\rightsquigarrow_{Wh\text{-}Movement}$

b. ...but I don't know [$_{CP}$ [$_{+Q}$ **who**$_i$] [$_{IP}$ Kim likes __ $_i$]]. $\rightsquigarrow_{Sluicing}$

c. ...but I don't know [$_{CP}$ [$_{+Q}$ **who**$_i$] [$_{IP}$ *e*]].

(where deletion of IP is possible just in case '[**someone i** [Kim likes **i**]]' is '*e*-GIVEN'.)

In the second approach to Sluicing, usually referred to as 'LF Copying',[1] LF (LOGICAL FORM) is taken to be a level of syntactic representation that contributes to the determination of linguistic meaning. In LF-Copying theories, the antecedent clause provides an LF representation that is copied into the skeletal LF of the remnant structure, as indicated in (6):

(6) **[Someone x]** [$_{IP}$ **x** left the room yesterday] .

but I don't know [$_{CP}$ **[who x]** [$_{IP}$ *e*]].$\rightsquigarrow$

but I don't know [$_{CP}$ **[who x]** [$_{IP}$ **x** left the room yesterday]].

Finally, there is a 'Direct Interpretation' approach to Sluicing,[2] where the remnant clause is generated 'as is' and assigned an interpretation on the basis of the surrounding context. In the GS00 analysis, which is the basis for the analysis we adopt here, Sluicing remnant clauses are licensed by a construction that fits into a broader family of ellipsis constructions, including those responsible for sentence fragment and short answers to *wh*-questions and others that license reprise uses of Sluicing and non-*wh* fragments. This construction, which can be informally rendered as a 'S $\rightarrow$ XP[*wh*]' production, is discussed further in section 8 below.

As of this writing, there seems to be broad agreement among ellipsis researchers that some version of Merchant's deletion theory must be correct for Sluicing, if not for ellipsis phenomena in general. This conclusion, if correct, could be deeply troubling for researchers in HPSG, since the transformational operations (movement, deletion) that are essential to Merchant's theory seem broadly inconsistent with HPSG theory. Indeed, they are an anathema to any theory based squarely on principles of linguistic models as solutions to sets of constraints, i.e. the foundations of model-theoretic grammar.

In this paper, we sketch a line of argument (which we develop in more detail elsewhere) to the effect that:

1. Merchant's particular assumptions about the nature of the redundancy precondition for Sluicing are problematic, but can be corrected by appeal to the identity condition proposed in Sag and Hankamer (1984).

[1] See Williams 1977 and Chung, Ladusaw, & McCloskey 1995, among others.

[2] See Ginzburg and Sag 2000 (henceforth GS00) and Culicover & Jackendoff 2005.

2. The arguments in the literature for deletion-based theories of Sluicing are flawed, including, for example, Merchant's 'P-Stranding Universal'.

3. There is syntactic and semantic evidence against deletion-based theories of Sluicing, but consistent with Direct Interpretation models.

4. A minor update of GS00's proposal in order to incorporate incremental context restrictions can explain new data that is inconsistent with competing models.

The proposal we adopt, based on GS00, but cast within a construction-based conception of HPSG that is also known as SIGN-BASED CONSTRUCTION GRAMMAR (SBCG), provides a principled account of the wide range of data we examine.

2 The Semantic Basis of Ellipsis

Ellipsis is fundamentally semantic in nature: the content of an elliptical utterance is determined by the content of an appropriate linguistic antecedent. Deletion provides a seemingly simple account of the interpretation of elliptical utterances. But what is the identity condition licensing ellipsis? The syntactic form of the remnant and the antecedent may differ in ellipsis, as Sag (1976) observed for VP-Ellipsis and Merchant (2001) for Sluicing:

(7) a. Kim doesn't want anything, but Lee does ~~want something~~.

b. These people have gall bladders, but I don't ~~have a gall bladder~~.

c. I went home when they wouldn't ~~go home~~.

d. I can't play quarterback. I don't even know how ~~to play quarterback~~.

e. I remember meeting him, but I don't remember when ~~I met him~~.

Facts like these are reconciled with ellipsis theory by Sag and Hankamer (1984), who discuss further related VP-Ellipsis data like (8):

(8) A: Do you think they'll like **him**$_C$?
B: Of course they will __ . [__ $= \lambda x[like(x, C)]$]

(9) A: Do you think they'll like **me**?
B: Of course they will __ . [__ $= \lambda x[like(x, A)]; \neq \lambda x[like(x, B)]$]

Sag and Hankamer offer a purely semantic identity condition as part of their treatment of VP-Ellipsis, which is sketched in (10):[3]

[3]Sag and Hankamer were following Sag (1976) in assuming that gaps could not be rebound in ellipsis, an assumption that is now known to be false. We will continue to make this simplfying assumption, though nothing hinges on it.

(10) Delete VP_e in S_e only if:

1. c_e is the Kaplan-context of S_e,
2. c_a is the Kaplan-context of some sentence S_a not subsequent to S_e in discourse, and
3. there is some VP_a in S_a s.t. for all assignments f, $[[\text{VP}_e]]^{c_e f} = [[\text{VP}_a]]^{c_a f}$.

The deletion theory of VP-Ellipsis offered by Merchant (2001) is similar, but weaker:

(11) a. An expression E counts as *e*-GIVEN iff E has a salient antecedent A and, modulo $\exists$-type shifting,

1. A entails F-clo(E), and
2. E entails F-clo(A)

b. Focus condition on VP-ellipsis:

VP_e can be deleted only if VP_e is *e*-GIVEN.

In particular, his approach weakens the identity condition from identity of sense (the meaning of a linguistic expression fixed in a given context, as shown in (10)), to a condition requiring that the deletion target be '*e*-GIVEN', where this notion is defined as in (11a).

If we 'update' Merchant's (2001) analysis so that it is consistent with the data discussed in Sag and Hankamer (1984), we arrive at the modified theory of Sluicing shown in (12):

(12) a. A VP_e can be deleted only if VP_e is *e*-GIVEN.

b. A VP_e can be deleted only if there is a (salient) VP_a in the surrounding context s.t. for all assignments f:

1. $[[\text{F-clo}(\text{VP}_e)]]^{c_e f} \vdash [[\text{F-clo}(\text{VP}_a)]]^{c_a f}$ and
2. $[[\text{F-clo}(\text{VP}_a)]]^{c_a f} \vdash [[\text{F-clo}(\text{VP}_e)]]^{c_e f}$.

c. i.e. only if $[[\text{F-clo}(\text{VP}_e)]]^{c_e f} = [[\text{F-clo}(\text{VP}_a)]]^{c_a f}$

In familiar cases like (13), Merchant's analysis would then license ellipsis:

(13) Kim will visit Lee, and then Sandy will ~~visit Lee~~.
$\exists$-clo(VP_a) = F-clo(VP_a) = $\exists$x.x visit Lee.
$\exists$-clo(VP_e) = F-clo(VP_e) = $\exists$x.x visit Lee.

Mutual entailment holds, so VP-ellipsis is possible.

But a serious problem for Merchant's *e*-GIVEN identity condition has been isolated by Hartman (2009), who observes the 'Relational Opposites Puzzle' exemplified in (14):

(14) *John will beat someone at chess, and then Mary will ~~lose to someone at chess~~.

Here the predicate in the antecedent (*beat*) and the predicate in the ellipsis site (*lose*) are relational opposites. Because of this, the following facts hold:

(15) a. $\exists$-clo(VP$_a$) = F-clo(VP$_a$)
= $\exists$x.x will beat someone at chess.

$\exists$-clo(VP$_e$) = F-clo(VP$_e$)
= $\exists$x.x will lose to someone at chess.

b. VP$_a$ and VP$_e$ satisfy mutual entailment modulo $\exists$-type shifting. (If someone will beat someone at chess, then someone will lose to someone at chess, and vice versa.)

Thus in (15), VP$_e$ is *e*-GIVEN, which would license ellipsis in (14) under Merchant's proposal. But ellipsis in (14) is clearly impossible.

This Relational Opposites Puzzle is problematic for Merchant's (2001) account of VP-Ellipsis, but Sag & Hankamer's (1984)'s semantic theory of VP-Ellipsis solves the puzzle straightforwardly. Since only the VP sense is relevant to the possibility of deletion, the in-context mutual entailment of the existential closures of distinct VP-senses is simply irrelevant to determining the possibility of deletion.

It should also be noted that the facts considered in this section are problematic for LF-Copying theories of ellipsis, e.g. the VP-Ellipsis theory of Williams (1977) and the theories of Sluicing developed in Chung et al. (1995, 2011)... Copying a piece of LF into a new syntactic context will lead to its being semantically interpreted in the new context. Hence LF-Copying theories, without some arbitrary and otherwise unmotivated codicil, also predict the wrong interaction of ellipsis and indexical interpretation. This point will prove to be relevant later, when we consider the direct interpretation theory of Sluicing in more detail.

3 Arguments against Deletion

There are two powerful arguments against deletion-based theories of Sluicing whose significance has, in our view, been insufficiently appreciated.

Sluices without Sources: As has been argued by GS00 and Culicover and Jackendoff (2005), there are numerous examples to be found which have no plausible source in a deletion-based analysis of Sluicing:

(16) a. What floor? Where to? How many more? What else? WTF?

b. Guess who!,[4] ...

c. A: Would you like a drink? B: Yeah, how about scotch?

d. A: I saw it. B: You saw WHAT? [Nonechoic Reprise Use]

Merchant (2004) seeks to rebutt this argument by correctly pointing out that the question of what should be regarded as Sluicing, as opposed to an instance of some other kind of nonsentential utterance, is indeed complex (for discussion, see GS00, Stanley 2000, Merchant 2004, Culicover and Jackendoff 2005, and Stainton 2006). However, if even one example of this kind is an instance of Sluicing, then the deletion-based analysis, at least in any current form, will be hard-pressed to accommodate it.

Island Amnesty: The deletion-based analysis of Sluicing crucially involves the application of *wh*-fronting prior to deletion. Since the hallmark property of *wh*-fronting that has taken center-stage in thousands of pages and several decades of syntactic research is their being subject to island constraints, the natural prediction would of course be that Sluicing obeys island constraints. But it is well known, ever since Ross's (1969) discussion, that this is not the case:

(17) a. Bo talked to the people who discovered **something**, but we don't know what (*Bo talked to the people who discovered). [CNPC/Subjacency]

b. Terry wrote an article about Lee and a book about **someone else from East Texas**, but we don't know who (*Terry wrote an article about Lee and a book about) [CSC (Element Constraint)]

c. He wants a detailed list, but I don't know how detailed (*he wants a list). [Left Branch Condition]

This obvious wild misprediction of deletion-based accounts has led researchers to propose (often with little or no independent motivation) non-Sluicing analyses for examples that otherwise share all relevant properties with uncontroversial instances of Sluicing. Other researchers (see, e.g. Merchant 2001, 2004) have attempted to rework the entire account of island constraints so as to circumvent the Sluicing dilemma, e.g. by localizing these constraints at the level of phonetic form (PF). We note in passing that the empirically correct observation about the Sluicing data, that they obey none of the grammatically imposed constraints on filler-gap dependencies, follows immediately from a direct theory like that of GS00, where Sluicing remnants are generated without appeal to filler-gap constructions. There

[4]It is interesting to note that this example, which is the title of Ross's (1969) seminal article on Sluicing, is an allusion to the introduction to the Woody Woodpecker cartoon show (available at http://www.youtube.com/watch?v=apLe_iB0V_U), where (16b) appears without a linguistic antecedent. Hence the example is a counterexample to deletion-based theories of Sluicing.

are a variety of interacting factors, of course, including considerations of complexity, pragmatic plausibility, and prosody, some of which are discussed below.

Thus the deletion-based approach of Sluicing has an air or implausibility from the outset, which makes it somewhat surprising that this approach has become the analysis of choice within the syntactic community. In the next two sections, we consider putative arguments providing independent support for deletion, arguing that the relevant data in fact support the opposite conclusion.

4 Case Matching Effects

The first and oldest argument for a deletion-based analysis of Sluicing was made by Ross (1969) in his discussion of German contrasts like the following:

(18) a. Er will jemandem schmeicheln, aber sie wissen nicht, wem/*wen.
he wants someone.D to.flatter but they know not who.D/who.A
'He wants to flatter someone, but they don't know who.'

b. Er meinte, er hätte geholfen, aber wir wüssten nicht, wem/*wen.
he thought he had helped but we knew not who.D/who.A
'He claims he had helped, but we couldn't say who'

The argument is simply that the verb has to be there at an underlying level in order to assign case to the remnant prior to deletion. In Merchant's theory, the Sluicing transformation does not require syntactic identity between the deletion target and its antecedent. Rather, case matching is explained indirectly by assuming derivations where case marking feeds *WH*-Movement, which feeds Sluicing. That is, E-Givenness must be mediated by verb identity, which has object case identity as a side effect.

The indirect analysis of case matching, where the identity condition is purely semantic, works for German because the elided verb governs a unique case. However, if there were a language with a verb whose object allowed a case alternation, then the prediction of the deletion-based analysis is clear: the remnant object and its correlate should be able to realize distinct cases.

Hungarian is such a language. As examples like the following show, the verb *segít* 'help' allows either a dative or an accusative object:[5]

(19) Mari segített egy fiunak/fiut
Mary helped.IND a boy.D/boy.A
'Mary helped some boy.'

But Sluicing examples like the following, which exhibit the critical case mismatch, are unquestionably ungrammatical, unlike their non-elliptical counterparts, which

[5]This importance of this test case for evaluating indirect theories of ellipsis was first pointed out by Polly Jacobson (see Jacobson 2009 and various earlier oral presentations).

are merely degraded, presumably due to parallelism pressures on repeated expressions in contexts such as these:[6]

(20) a. Mari segített egy fiunak de nem tudom, hogy kinek/*kit
Mary helped.IND a boy.D but not I-know.DEF Q who.D/who.A

b. Mari segített egy fiut de nem tudom, hogy kit/*kinek
Mary helped.IND a boy.A but not I-know.DEF Q who.A/who.D
'Mary helped a boy, but I don't know who'

In sum, case matching in Sluicing is not an indirect effect, as entailed by the deletion-based analysis. Rather, a grammatical constraint must dictate directly that there be identity of (category and) case between the remnant and its correlate.

5 The P-Stranding Universal

In numerous publications, Merchant has defended a universal generalization that he calls the P-Stranding Generalization (PSG):

(21) A Language *L* will allow preposition-stranding under Sluicing just in case *L* allows preposition stranding under regular *WH*-Movement. (Merchant 2001, 107)

In support of PSG, Merchant argues that human languages are bifurcated as shown in (22):

(22) **Preposition-Stranding Languages**

English:
Peter was talking with someone, but I don't know (with) who.
Who was he talking with?

Frisian, Swedish, Norwegian, Danish, Icelandic

(23) **Non-Preposition-Stranding Languages**

German:
Anna hat mit jemandem gesprochen, aber ich weiss nicht *(mit) wem.
Anna has with someone.D spoken, but I know not *(with) whom.D
*Wem hat sie mit gesprochen?

Greek, Yiddish, Czech, Russian, Slovene, Polish, Bulgarian, Persian, Serbo-Croatian, Hebrew, Moroccan Arabic, Basque.

[6]Special thanks to Polly Jacobson, Donka Farkás, Jula Horvath, and (indirectly) Zoltán Szabó, for their help in sorting out the Hungarian data.

The PSG follows in a deletion-based theory that assumes derivations where *WH*-Movement feeds Sluicing. By contrast, the PSG is potentially problematic for theories, like those of GS00 and Culicover and Jackendoff 2005, where the analysis of Sluicing does not involve a filler-gap dependency, and hence the behavior of the two phenomena are not predicted to be correlated.

The literature abounds with challenges to the PSG. Potentially problematic data have been noted in all the following languages: English (Chung et al. 1995, Fortin 2007), Spanish (Vicente 2006, 2008, Rodrigues et al. 2009), Polish (Szczegielniak 2008, Nykiel and Sag 2009), Czech (Caha 2011), Bahasa Indonesia (Fortin 2007), Amis (Wei 2011), Serbo-Croatian (Stjepanović 2008), Farsi (Toosarvandani 2008), and Brazilian Portuguese (Almeida and Yoshida 2007, Lasnik 2007, Rodrigues et al. 2009). Some researchers (e.g. Vicente 2008, Rodrigues et al. 2009, Szczegielniak 2008, van Craenenbroeck 2010) have tried to reconcile these data with the PSG by proposing that the relevant examples in a particular language are not derived via Sluicing, but rather through a process of 'Pseudo-Sluicing' (Merchant, 2001), an independent deletion transformation formulated to derive the Sluicing-output doppelgangers from a different source, e.g. a cleft or cleft-like clause such as (24):

(24) Kim spoke to someone, but I don't know who ~~it was~~.

The details of this alternative analysis, as well as its independent motivation (beyond the observation that the cleft construction allows NP pivots in languages that don't allow P-stranding), are seldom supplied.

Other researchers (e.g. Stjepanović 2008) have tried to salvage the PSG by invoking a P-Deletion Transformation whose existence would give rise to derivations like the following:

(25) a. ..., but we didn't know [[+Q] they spoke [to *whom*$_i$]].$\rightsquigarrow$

b. ..., but we didn't know [[to *whom*$_i$] they spoke to __$_i$].$\rightsquigarrow$

c. ..., but we didn't know [[to *whom*$_i$] ~~they spoke to __~~].$\rightsquigarrow$

d. ..., but we didn't know [[~~to~~ *whom*$_i$]].

P-Deletion would be specific to the output of the Sluicing transformation and, as far as we are aware, is not independently motivated in any language. If the P-Deletion proposal is accepted under these circumstances, then it is plain that any set of data could be made consistent with the PSG. That is, without independent motivation for P-Deletion, e.g. its existence in some context other than Sluicing, the PSG becomes devoid of empirical content. Thus, as Rodrigues et al. (2009) oberve in their discussion of putative Spanish Pseudo-Sluicing: 'The strongest implication of this analysis is that all languages that appear to violate this generalization [= the PSG - IAS/JN] should be reducible to a pseudosluicing analysis.'

However, we argue in section 7 that there is at least one language – Polish – whose interrogative-clause, Sluicing-like ellipsis would have to be treated as Pseudo-Sluicing if the PSG is assumed, cannot be so treated. Before turning to the Polish data, we must enter into a small digression about the interaction of Sluicing and phrasal complexity.

6 Sluicing and Phrasal Complexity

It is quite likely that the pattern of preposition omission under Sluicing is modulated by both the phrasal complexity of the correlate and that of the remnant *wh*-expression. Phrasal complexity is an alternative to the intuitive sounding but delphic notion of 'D(iscourse)-linking' introduced by Pesetsky (1987). Pesetsky offered D-linking as an explanation of differences in the behavior of interrogative *which*-NP phrases (D-linked) and bare interrogative pronouns (usually non-D-linked) with regard to Superiority effects (*Which book did which student read?* is more acceptable than *What did who read?*)

Which-NP phrases have been shown to improve the acceptability of multiple *wh*-interrogatives. However, Hofmeister and colleagues[7] have argued that the difference between these two types of *wh*-phrase is a special case of a much broader and independently motivated phenomenon. *Which*-NP phrases, since they are more complex than bare interrogative pronouns, facilitate the processing of filler-gap dependencies at the point where a filler must be retrieved from working memory and integrated into the sentence interpretation. This effect produces characteristic reading time differences, correlated with variation in the overall acceptability level of relevant sentences.

We hypothesized that there are two reasons why preposition omission in Sluicing is sensitive to differences in the phrasal complexity of correlates and remnants. First, given that Sluicing is an anaphoric construction, we expect remnants to reflect the degree of accessibility of their correlates, following the predictions of Accessibility Theory (Ariel 1990, 2001). Accessibility Theory highlights the role of (potential) antecedents and anaphors in the process of retrieving linguistic material from memory. As speakers access and re-access utterances in the discourse they have processed, they mark them according to how accessible (prominent or salient) they perceive them to be. Using forms richer in lexical information signals and serves to retrieve low-accessibility antecedents. On the other hand, such forms may themselves become accessible antecedents as discourse evolves.

For Sluicing, the phrasal complexity of both a *wh*-phrase and its correlate increase with the amount of lexical information they encode. A more complex NP becomes a more accessible correlate, which is in turn reflected by the form of a remnant, which is typically a *which*-NP phrase where the head NP is usually absent

[7] See Hofmeister 2007, 2009, Hofmeister et al. 2007, Hofmeister and Sag 2010, and Hofmeister et al. 2011.

due to the repeated name penalty.[8] We make the further prediction that in case the correlate is a PP here, the preposition is not required in the remnant. If, however, a less complex phrase (e.g. an indefinite pronoun) serves as the correlate, it is retrieved using a more explicit form of the remnant. This is done, we propose, by including a preposition in such a remnant in order to compensate for the low degree of accessibility of the phrase's correlate.

The second reason why we explore the effect of complexity under Sluicing is that the complexity of the correlate may play a role similar to the complexity of the filler in filler-gap constructions. The mediating effect of increased complexity in Superiority violations and extractions from islands is evident in English and much cross-linguistic data (Hofmeister et al. 2007, Hofmeister 2009, Hofmeister et al. 2011). This is because complex phrases are understood as providing more specific semantic and syntactic information, and thus receive stronger mental representations that are more accessible for subsequent reference. This provides a means of explaining *which* N/*who* contrasts not by syntactic constraints, but by appeal to memory retrieval.

Building on this research, we may treat both examples with simple correlates and those with complex correlates as grammatical (i.e. allowed by the grammar), accounting for the variable acceptability of such examples in terms of independently motivated aspects of memory and retrieval, rather than grammar. The difference between Sluicing and filler-gap constructions is that when a remnant is encountered in Sluicing, its correlate is retrieved rather than the remnant itself. (By contrast, when a gap is encountered, what is retrieved is the very dislocated *wh*-phrase that was processed earlier). A more complex correlate should be easier to retrieve, because it provides more specific semantic and syntactic information than a less complex correlate. On this view of Sluicing, there is no grammatical connection between preposition stranding in *wh*-extraction and preposition omission in Sluicing remnants. The proposal we are defending here is reminiscent of the remark made in passing by Frazier and Clifton (2011: 43) that 'perhaps activating the antecedent is easier with a D-linked interrogative [...] The D-linked interrogative may simply serve as a better retrieval cue'. This is part of the story, but not the whole story. In addition, when the antecedent is firmly established in memory by a complex correlate, as in (26a), P-omission is facilitated as well. We predict that the same should be true in the case of more complex prepositions, as in (26b):

(26) a. Kim had lunch yesterday with someone she claims was a member of the original Virginia Tea Party organization, but I still don't know *who(m)*. ~~she had lunch with yesterday~~. ($\geq$ I still don't know with whom.)

b. The dog ran right up to someone, but I don't know *who(m)*. ~~the dog ran~~

[8]The repeated name penalty refers to the processing difficulty of accessing prominent antecedents by means of too explicit an anaphor. For more information, see Almor (1999), Garrod et al. (1994), Gordon et al. (1993, 1999, 2004) and Swaab et al. (2004).

~~right up to~~. ($\geq$ I don't know (right) up to whom.)

We are currently exploring predictions such as these in a number of languages (see also the next section).

7 Polish and the P-Stranding Generalization

Sluiced phrases (remnants) without prepositions in Polish cannot be derived from cleft-like structures analogous to those that Rodrigues et al. (2009) posit as the source for prepositionless remnants in Spanish and Brazilian Portuguese. As shown in (27), the case of the Polish Sluicing remnant must correspond to the case of the correlate, which is genitive in (27):

(27) Adam regularnie dostaje prezenty od kogoś/ jakiejś dziewczyny,
Adam regularly gets presents from someone.G/ some girl.G
ale nie wiem kogo/ jakiej.
but not I.know who.G/ which.G

'Adam regularly gets presents from someone/some girl, but I don't know who/which (girl).'

But an NP pivot in the analogue of the structure assumed by Rodrigues et al. must bear instrumental case in Polish, as illustrated in (28). While the undeleted version is fine in (28), the deleted one, producing the instrumental remnant, is not.

(28) Adam regularnie dostaje prezenty od kogoś/jakiejś dziewczyny, ale nie
Adam regularly gets presents from someone.G/some girl.G, but not
wiem kim (*jest osoba/dziewczyna od której Adam dostaje prezenty.)
I.know who.I (*is person.N/girl.N from whom.G Adam gets presents)

'Adam regularly gets presents from someone/some girl, but I don't know who is the person/girl Adam regularly gets presents from.'

Any proposal that posits Pseudo-Sluicing from cleft-like sources must be carefully examined for this kind of obvious misprediction.

An alternative cleft structure is proposed by Szczegielniak (2008) as a way of accounting for an observed difference in acceptability between preposition-less *which*-NP phrases and their non-complex counterparts (bare interrogative pronouns). The underlying cleft structure he assumes for a *which*-NP remnant clause is shown in (29):

(29) Adam regularnie dostaje prezenty od jakiejś dziewczyny, ale nie wiem
Adam regularly gets presents from some girl.G but not I.know
jakiej.G ~~to od dziewczyny Adam regularnie dostaje prezenty.~~
which.G ~~it from girl.G Adam regularly gets presents~~

'Adam regularly gets presents from some girl, but I don't know which (girl) it is that Adam regularly gets presents from.'

Szczegielniak's (2008) argument is that *which*-NP remnants are the only phrases that allow preposition omission in Polish, and that this is due to the fact that in the cleft sources, prepositions are stranded rather than pied-piped with the *which*-NPs. While Szczegielniak offers some support for his analysis, he fails to demonstrate that the proposed underlying cleft structure is fully acceptable in Polish (see Nykiel, under revision, for experimental evidence showing that it is not).

Another reason to doubt Szczegielniak's analysis is that it does not appear to offer any possibility of deriving prepositionless *which*-NP phrases where the NPs are present. This is because of the impossibility of P-stranding in Polish. For example, Szczegielniak's analysis is inconsistent with contrasts like the following, where a well-formed instance of Sluicing would have to be derived from a completely ungrammatical structure, as indicated:

(30) Adam regularnie dostaje prezenty od jakiejś dziewczyny,
Adam regularly gets presents from some girl.G
ale nie wiem jakiej dziewczyny (*to od Adam regularnie dostaje prezenty.)
but not I.know which girl.G (*it from Adam regularly gets presents)

'Adam regularly gets presents from some girl, but I don't know which girl it is that Adam regularly gets presents from.'

While we agree that phrasal complexity is involved in preposition omission in Sluicing, we assume that its involvement follows from the encoding and retrieval of linguistic signs from memory, as discussed in the previous section. We conducted several acceptability judgment experiments testing the interaction of Sluicing and phrasal complexity, whose results we now discuss briefly.[9]

We found that the possibility of preposition omission is a graded phenomenon in Polish. It is sensitive to manipulations of the phrasal complexity of a PP correlate for a given remnant. Either the preposition or the prepositional object can be the target of such manipulations. For correlates containing multisyllabic prepositions, remnants without prepositions are marginally different from their counterparts with prepositions.

(31) Anna poszła zamiast kogoś, ale nie pamiętam (zamiast) kogo.
Anna went instead of someone.G but not I.remember (instead of) who.G
'Anna went instead of somebody, but I don't remember who.'

Similarly, when we have an NP correlate and a *which*-NP phrase remnant (matching in complexity) acceptability is unaffected by P-omission in the remnant clause:

(32) Anna pracowała nad jakimś projektem,
Anna worked on a project.I
ale nie pamiętam (nad) jakim (projektem)
but not I.remember (on) what (project).I

[9] Space limitations prevent us from providing detail here regarding the design of the experiments and statistical analysis of the results.

'Anna worked on a project, but I don't remember what (project).'

If phrasal complexity is decreased such that correlates contain monosyllabic prepositions, omission of such prepositions from the remnants significantly lowers acceptability scores:

(33) Anna poszła do kogoś, ale nie pamiętam (do) kogo.
Anna went to somebody.G but not I remember (to) who.G
'Anna went to somebody, but I don't remember who.'

For non-complex correlates – indefinite pronouns paired with bare interrogative pronouns – preposition omission, too, is degraded:

(34) Anna pracowała nad czymś, ale nie pamiętam (nad) czym
Anna worked on something.I but not I remember (on) what.I
'Anna worked on something, but I don't remember what.'

One might propose that an increase in phrasal complexity has a mitigating effect on an otherwise categorical violation, and that preposition omission is one of these. As a way of verifying whether this is so, we manipulated the phrasal complexity of remnant *wh*-phrases in a related construction, sprouting. Here, there are no overt correlates and preposition omission is categorically unacceptable. We found no difference in acceptability between *which*-NP phrases (35) and bare interrogative pronouns (36):

(35) Ekspedient się zdenerwował, ale nie wiem *(na) którego klienta.
assistant REFL got angry but not I.know *(with) which customer.A
'The assistant got angry, but I don't know with which customer.'

(36) Ekspedient się zdenerwował, ale nie wiem *(na) kogo.
assistant REFL got angry but not I.know *(with) who.A
'The assistant got angry, but I don't know with who.'

This result shows that an increase in the phrasal complexity of the remnant fails to improve the acceptability of a categorical violation. Hence, preposition omission in Sluicing, unlike preposition omission in sprouting, cannot be a categorical violation for its sensitivity to manipulations of phrasal complexity.

Given our assumption, formulated in the previous section, that the effect of phrasal complexity is distributed between the correlate and the remnant, we conducted another experiment. Here, some items instantiated cataphoric Sluicing, e.g. (37), where the order of correlate and remnant was reversed such that the remnant preceded its correlate. Cataphoric Sluicing was compared with the baseline – regular (anaphoric) Sluicing, where correlates preceded remnants, as in (38):

(37) Nie wiem (przeciw) komu, ale większość posłów głosowała
not I know (against) who.D but majority congressmen.G voted
przeciw komuś.
against someone.D

'I don't know who, but the majority of the congressmen voted against someone.'

(38) Większość posłów głosowała przeciw komuś,
majority congressmen.G voted against someone.D
ale nie wiem (przeciw) komu.
but not I.know (against) who.D

'The majority of the congressmen voted against someone, but I don't know who.'

Preposition omission was significantly degraded in cataphoric Sluicing as compared to (1) anaphoric Sluicing and (2) preposition retention in both anaphoric and cataphoric Sluicing. We attribute this result to the fact that a correlate processed prior to a remnant creates a mental representation whose accessibility determines the form of the remnant following that correlate. If a correlate follows a remnant, we expect a degradation in the acceptability of preposition omission due to the difficulty of resolving the remnant before the correlate is encountered. Intuitively, including prepositions in remnants preceding their correlates reduces some of the ambiguity associated with such phrases, which, if prepositionless, could serve as either verbal or prepositional objects in Polish.

In light of these considerations, we conclude that the grammar of Polish should not impose any restriction against the possibility of P-omission in Sluicing – the observed pattern of graded acceptability can be described, even explained, in terms of independently motivated considerations of differential processing complexity. Thus, even if it is possible to find independently motivated, adequate alternative analyses of all the apparent counterexamples to PSG from the other languages cited above (which, as far as we know is not the case), there is at least one language that stands as a true counterexample to the PSG and to the consequences of PSG noted by Rodrigues et al. (2009). Since the PSG is entailed by the 'movement followed by deletion' analysis standardly assumed in current discussions, we believe this provides more than sufficient motivation for considering non-transformational, construction-based alternatives like the one proposed by GS00.

8 The GS00 Analysis

Space limitations prevent us from embarking upon an extensive discussion of the GS00 analysis of Sluicing and the revisions to it that we feel are called for. However, it is worth commenting on how that analysis, as it stands, deals with the various issues we have raised in this paper.

The Basics: GS00's Sluicing Construction is formulated as in (39):

(39)
$$\begin{bmatrix} \textsc{syn} & \textsc{s} \\ \textsc{sem} & \lambda\Sigma\Phi \\ \textsc{cntxt} & \begin{bmatrix} \textsc{sal-utt} & \left\{ \begin{bmatrix} \textsc{syn} & [\textsc{cat}\ X] \\ \textsc{sem} & [\textsc{ind}\ i] \end{bmatrix} \right\} \\ \textsc{max-qud} & \lambda\{\ \}\Phi \end{bmatrix} \end{bmatrix} \rightarrow \begin{bmatrix} \textsc{syn} & [\textsc{cat}\ X] \\ \textsc{sem} & [\textsc{ind}\ i] \\ \textsc{store} & \Sigma \end{bmatrix}$$

where Σ is a nonempty set of parameters.

According to (39), the 'Maximal-Question-Under-Discussion' (MAX-QUD) in the dialogue[10] provides the basis for an interpretation of the remnant clause. In addition, there must be a match re. both syntactic category (CAT) and semantic index (IND) between the remnant and the correlate (identified as the salient utterance (SAL-UTT) associated with the MAX-QUD in the immediate context), as indicated.

The Semantic Identity Condition: Since this analysis defines the interpretation of a Sluiced clause in terms of the MAX-QUD, it provides a fundamentally semantic/pragmatic account of Sluicing. Since there is no syntactic identity condition, we are not surprised to find examples of Sluicing where there is no clear antecedent clause. Though the form of the prior dialogue is a powerful force in shaping the questions under discussion in a dialogue, it is possible for the immediate extralinguistic context to affect these as well, as indicated by some of the examples in (16) above. The immediacy of the relevant context, whether linguistically expressed or not, also follows from the GS00 account of Sluicing, since the value of MAX-QUD, the basis for the interpretation of the Sluiced clause, is constantly being updated as a dialogue progresses. Moreover, since the MAX-QUD is part of the Dialogue Game Board, where the objective facts of the dialogue are recorded (see Ginzburg 2011), it follows that the denotation of any given referring expression is grounded objectively, rather than from the perspective of any single dialogue participant. This provides an immediate account of the constraints on indexical resolution in ellipsis observed by Sag and Hankamer (1984) which we discussed in section 2 above. Our earlier discussion was in terms of VP-Ellipsis, but as examples like (40) make clear, exactly the same constraints apply in Sluicing:

(40) A: Someone is following me.

B: I wonder who __ . [__ = is following A; $\neq$ is following B].

Case Matching Effects: The category of the Sluicing remnant must match that of the correlate (encoded as the SAL-UTT in (39)). Thus all the problems of cleft-based analyses reviewed in section 5 are avoided, as is the problem of restrictions on Sluicing that are observed when a verb's object allows multiple case realizations, as we saw in Hungarian. Since the category identity requirement directly

[10] GS00, building on previous work by Ginzburg, Hull, Keenan and others, argue that questions are propositional abstracts.

relates the Sluicing remnant and its correlate, and since the CASE feature specification is part of the CATEGORY value, this analysis correctly enforces remnant-correlate case identity, which, as we saw, posed difficulties for indirect analyses (like Merchant's) of case matching in Sluicing.

Island Amnesty and the PSG: Ross (1969) noted that in order for a deletion-based analysis of Sluicing to work, *wh*-movement would have to apply in violation of island constraints. This problem also plagues Merchant's deletion analysis, which must transform the theory of syntactic islands to be about PF representations, not the syntactic representations that are directly manipulated by movement operations. The direct theory of GS00, by contrast, solves this problem simply: the remnants are directly generated; no island-sensitive operations are involved. Similarly, the fact that there is no cross-linguistic correlation of P-stranding and the possibility of P-omission in Sluicing is explained by the GS00 account, where the remnant clause involves no filler-gap dependency and hence no expectation that properties of *wh*-movement will be projected into the grammar of Sluicing. On the deletion-based analysis of Sluicing, however, the absence of this correlation, given the impossibility of generalizing the Pseudo-Sluicing analysis to the full range of counterexamples, remains an unexplained problem.

9 Conclusion

In this paper, we have reassessed the data that have been offerred and widely accepted as evidence for a deletion-based analysis of Sluicing. We have reexamined the identity condition involved in deletion in general, arguing against Merchant's *e*-GIVENness condition in favor of the contextualized identity of sense condition proposed by Sag and Hankamer (1984). We have also expanded the range of data relevant to the discussion of case-matching effects in Sluicing, arguing against an indirect account of the sort embraced by deletion-based approaches. In addition, we have called into question Merchant's P-Stranding Generalization and reassessed the importance of the island amnesty effect that has exercised so many researchers since Ross discovered it.

Sluicing is a fundamentally semantic phenomenon whose remnant constituents are directly generated without extraction or deletion. Sluicing lends itself very nicely to a construction-based account of the sort developed by GS00, which, as we have indicated, and intend to show in more detail elsewhere, provides a satisfying account of its syntactic and semantic properties which avoids all the problems raised here for analyses based on movement and deletion.

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Case suffixes and postpositions in Hungarian

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Abstract

This paper examines the morpho-syntactic puzzle of case suffixes and postpositions that Hungarian displays. Although these two categories show distributional similarities, they are distinguishable from a morphological and a syntactic point of view. Moreover, this language has defective postpositions which are in complementary distribution with case suffixes. I argue that there is no real argument for lumping case suffixes together with postpositions into the same syntactic category, as has been suggested in recent linguistics studies (Trommer, 2008; Asbury, 2007). I rather propose to treat case suffixes and postpositions as two different objects: case suffixes are inflectional material on nominal heads and postpositions as well as defective postpositions are independent words subcategorizing an NP. This distinction straightforwardly accounts for morphological and syntactic differences. Finally, the shared distributional properties between case suffixes, postpositions and defective postpositions are captured by means of the use of the MARKING feature.

1 Introduction

Hungarian displays an interesting morpho-syntactic puzzle of case suffixes and postpositions. Although these two categories show distributional similarities, they are distinguishable from a morphological and a syntactic point of view. In this paper, I focus on the similarities and dissimilarities between the two categories and show that an SBCG analysis (Sag, 2010) allows us to provide a descriptively adequate account of the phenomena and to capture their common syntactic behaviour.

2 Definitions

The delimitation of the category of case suffixes is a long-debated issue (Kiefer, 2000; Payne and Chisarik, 2000; Creissels, 2006). I define the class of case suffixes based on 3 criteria that ensure that the noun keeps noun properties after suffixation. Case suffixes may display the possibilities

i. for the noun host to be modified (Kiefer, 2000; Payne and Chisarik, 2000);

ii. for the case suffix to occur with a possessive suffix (Creissels, 2006);

iii. for the case suffix to be combined with the demonstrative (Creissels, 2006).

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This definition leads to a category containing 17 elements[1].

As for the class of postpositions, I adopt the analysis of É.Kiss (2002), who limits the category of postpositions to items

i. taking a caseless NP as argument;

ii. realizing morphologically their pronominal argument;

iii. that get duplicated when used with the demonstrative.

This class is then composed of 34 elements[2].

3 Description of the data

3.1 Differences

3.1.1 Gradient phonological integration

Case suffixes, but not postpositions, are prosodically bound forms and are monosyllabic. More precisely, if we consider six criteria, we observe that the relevant morpho-phonological properties define a scale rather than a binary distinction, as shown in Table 1. Four of these six criteria correspond to the phenomena of internal sandhi occuring with affixation (Creissels, 2006):

- Vowel harmony: the vowel of several suffixes is selected according to the vowels that the nominal base contains.

  (1) a. *h**á**z-b**a**n*
  house-INE

  b. *k**e**rt-b**e**n*
  garden-INE

- Link vowel (LV): the link vowel appears between the nominal base and some suffixes when the base ends with a consonant.

  (2) *börönd-**ö**-t*; *könyv-**e**-t*
  book-LV-ACC suitcase-LV-ACC

[1] Accusative (ACC) *-t*; Dative (DAT) *-nak/-nek*; Instrumental (INS) *-val/-vel*; Causal-final (CAU) *-ért*; Translative (TRA) *-vá/-vé*; Inessive (INE) *-ban/-ben*; Superessive (SUP) *-n*; Adessive (ADE) *-nál/-nél*; Sublative (SUB) *-ra/-re*; Delative (DEL) *-ról/-rõl*; Illative ILL *-ba/-be*; Elative (ELA) *-ból/-bõl*; Allative (ALL) *-hoz/-hez/-höz*; Ablative (ABL) *-tól/-tõl*; Terminative (TER) *-ig*; Essive (ESS) *-ként*; Temporal (TEM) *-kor*.

[2] *alá* 'to under'; *alatt* 'under'; *alól* 'from under'; *mögé* 'to behind'; *mögött* 'behind'; *mögül* 'from behind'; *mellé* 'to next to'; *mellett* 'next to'; *mellõl* 'from next to'; *elé* 'to before'; *elõtt* 'before'; *elõl* 'from before'; *felé* 'towards'; *felõl* 'from'; *fölé* 'to above'; *fölött* 'above'; *fölül* 'from above'; *köré* 'round'; *körül* 'around'; *közé* 'between'; *között* 'in between'; *közül* 'from between'; *által* 'by'; *ellen* 'against'; *helyett* 'instead of'; *szerint* 'according to'; *iránt* 'towards'; *miatt* 'because of'; *nélkül* 'without'; *után* 'after'; *végett* 'because of'; *óta* 'since', *folytán*.

- Lengthening of *a* and *e*: the affixation of a number of suffixes triggers the lengthening of final vowel of the nominal base, if it is an *a* or an *e*.

  (3) *alm**a***; *alm**á**-ban*
  apple apple-INE

- Selection of a suppletive stem

  (4) ***ló***; ***ló**-ban*; ***lov**-on*
  horse horse-INE horse-SUP

The last two criteria concern the number of syllables of these items and their interaction with the demonstrative.

- The monosyllabicity of the item (Trommer, 2008): case suffixes are monosyllabic, whereas postpositions are bisyllabic.
- The interaction with the demonstrative: postpositions beginning witha consonant and case suffixes both interact phonologically with the demonstrative[3].

  (5) **ez**; ***eb**-ben*; ***e*** *mellett*; ***ez*** *allatt*
  DEM DEM-INE DEM next.to DEM under

Given table 1, only one property distinguishes case suffixes from postpositions: the monosyllabicity. However, in section 4, I will show that the essive ***ként***, which is monosyllabic, should be reanalysed as a postposition, leading to the conclusion that it is not possible to draw a clear distinction between case suffixes and postpositions on the basis of phonological properties.

3.1.2 Derivational properties

Postpositions, contrary to case suffixes, can host the derivational suffix *-i* and thus give rise to adjectives.[4]

(6) *a polc mögött-i könyv*
the shelv behind-ADJR book
'the book behind the shelv'

(7) **a János-ról-i könyv*
the János-DEL-ADJR book
'the book about János'

[3]As noted by Creissels (2006), when the demonstrative is followed by a postposition beginning with consonant, the final 'z' of the demonstrative can:

- either be elided, as expressed by the Hungarian spelling (*e mellett*)
- or be assimilated to the initial consonant of the postposition (*em mellett*)

[4]The *-i* suffix is glosed ADJR.

	A	B	C	D	E	F
interaction with demonstrative	+	+	+	+	+	−
monosyllabicity	+	+	+	+	−	−
lengthening of *a* and *e*	+	+	+	−	−	−
vowel harmony	+	+	−	−	−	−
link vowel	+	−	−	−	−	−
selection of a suppletive stem	+	−	−	−	−	−

A. accusative, superessive

B. dative, inessive, elative, illative, adessive, ablative, allative, delative, sublative, instrumental, transformative

C. terminative, causal-final

D. temporal, essive

E. postpositions beginning with consonant

F. postpositions beginning with vowel

Table 1: Gradient phonological integration

These *-i* suffixed words can host inflectional affixes, as adjectives usually do.

(8) (*Melyik virág-o-k a legszebb-e-k?*) *A fá-k*
which flower-LV-PL the most.beautiful-LV-PL the tree-PL
között-i-e-k
between-ADJR-LV-PL
'Which flowers are the most beautiful? The ones between the trees'

(9) (*Melyik bolt-ban lát-t-ad a cipő-t?*) *A pályaudvar*
wich shop-INE see-PST-2SG the shoe-ACC the station
mellett-i-ben.
next.to-ADJR-INE
'(In which shop did you see the shoes?) In the one next to the station'

3.1.3 Coordination

The behaviour of suffixes and postpositions with respect to coordination can be viewed as the consequence of their different morpho-phonological statuses: suffixes, being morphologically bound, do not have wide scope over NP coordination, whereas postpositions, as independent words, do.

(10) *a ház és a garázs előtt*
the house and the garage before
'in front of the house and the garage'

(11) **a ház és a garázs-ban*
the house and the garage-INE
'in the house and the garage' (intended meaning)

Moreover, postpositions, in contrast with case suffixes, can be coordinated (examples (12) and (13)). Note that coordination between a postposition and a case suffix is not possible (example (14)).

(12) *a ház előtt és mögött*
the house before and behind
'in front of and behind the house'

(13) **a ház-tól és -ből*
the house-ABL and -ELA

(14) **a ház-ban és mellett*
the house-INE and next.to

3.2 Common properties

3.2.1 Combinatorial property

Both postpositions and case suffixes appear on the right edge of an NP (examples (15) and (18)); they are strictly adjacent to the head noun (examples (17) and (20)). If the head noun is elided, both are adjacent to the rightmost element of the NP (examples (16) and (19)).

(15) *a kék ház-ban*
the blue house-INE
'in the blue house'

(16) *a kék-ben*
the bleu-INE
'in the blue'

(17) **az utca majdnem-ben*
the street almost-INE
'almost in the street'
(intended meaning)

(18) *a kék ház mellett*
the blue house next.to
'next to the blue house'

(19) *a kék mellett*
the blue next-to
'next to the blue'

(20) **a ház majdnem mellett*
the house almost next.to
'almost next to the house'
(intended meaning)

3.2.2 Demonstrative agreement

Case-marked NPs as well as postpositional phrases (PPs) can combine with a demonstrative (noted DEM in the examples). In this case, they are both obligatorily repeated after the demonstrative.

(21) *eb-**ben** a szép ház-**ban***
DEM-INE the beautiful house-INE
'in this beautiful house'

(22) *e **mellett** a szép ház **mellett***
DEM next.to the beautiful house next.to
'next to this beautiful house'

3.2.3 Grammatical and predicative uses

Both postpositions and case suffixes (except the accusative suffix) can be used as predicative complements of the copula and are thus fully contentful. Additionally, according to Kiefer (2000), all case suffixes, except the temporal suffix, can be subcategorized by a head. Moreover, according to Szende and Kassai (2001), seven postpositions can introduce a subcategorized dependent of a head (*ellen*, *előtt*, *elől*, *után*, *iránt*, *mellett*, *alól*). Thus, their different morphological statuses do not correspond to different uses in the language.

4 Reanalysis of the essive *ként*

Considering the 3 differences between case suffixes and postpositions, the essive *ként* should be reanalysed as a postposition. From a phonological point of view, the essive does not show any affixal properties (cf. table 1). Moreover, using the online Hungarian National Corpus[5], we observe that the essive can host the derivational suffix *-i* (example (23)).

[5]HNC: `http://mnsz.nytud.hu/index_eng.html`

(23) [...] *amely-ek a növény* ***drog-ként-i*** *elhasználás-á-ra*
which-PL the plant drug-ESS-ADJR using-3SG-SUB
utal-nak
make.reference-3PL
'[...] which make reference to the using of the plant as drug'

Finally, using the HNC, we find occurences of the essive suffix with possible wide scope over coordination (example (24)).

(24) Bloch Móricz, aki aztán később Ballagi Mór név-en **neves**
Bloch Móricz who then later Ballagi Mór name-SUP renowned
szótáríró és **tanulmányíró-ként** is ismer-t [...]
lexicographer and essayist-ESS also know-PST.3SG
' Móricz Bloch, who has later been known as Mór Ballagi and a renowned lexicographer and essayist [...]'

Under this new analysis, monosyllabicity cannot be viewed as a criterion to distinguish between case suffixes and postpositions. This reanalysis should be an issue for the analysis of Trommer (2008). According to his paper, case suffixes and postpositions are both functional heads belonging to the same morphosyntactic category (adposition), and monosyllabic adpositions are integrated into the Phonological Word of their nominal lexical head because they are prosodically too small. As an independent monosyllabic adposition, the essive does not fit into Trommer's theory of the Phonological Word.

5 Person-marked postpositions and defective postpositions

Hungarian postpositions realize their complement as a person suffix, whenever the complement has a pronominal form (cf. Table 2). In that case, the nominative pronoun is optional (examples (25) and (26)). These *person-marked postpositions* cannot combine with NPs headed by a noun (example (27)).

(25) *(én) mellett-em*; **(én) mellett*
I next.to-1SG I next.to
'next to me'

(26) *(ő) mellett-e*; **(ő) mellett*
he/she next.to-3SG he/she next.to
'next to him/her'

(27) **A ház mellett-e*; *A ház mellett*
the house next.to-3SG the house next.to
'next to the house'

	Person-marked postpositions		
	'next-to'	'after'	'to before'
1SG	*mellett-em*	*után-am*	*elé-m*
2SG	*mellett-ed*	*után-ad*	*elé-d*
3SG	*mellett-e*	*után-a*	*elé*
1PL	*mellett-ünk*	*után-unk*	*elé-nk*
2PL	*mellett-etek*	*után-atok*	*elé-tek*
3PL	*mellett-ük*	*után-uk*	*elé-jük*

Table 2: Person-marked postpositions paradigms

	Defective postpositions		
	'in'	'on'	'to in'
1SG	*benn-em*	*rajt-am*	*belé-m*
2SG	*benn-ed*	*rajt-ad*	*belé-d*
3SG	*benn-e*	*rajt-a*	*belé*
1PL	*benn-ünk*	*rajt-unk*	*belé-nk*
2PL	*benn-etek*	*rajt-atok*	*belé-tek*
3PL	*benn-ük*	*rajt-uk*	*belé-jük*

Table 3: Defective postpositions paradigms

Furthermore, following Creissels (2006), I consider that Hungarian displays defective postpositions, i.e. postpositions that appear only as hosts of person suffixes and cannot combine with non-pronominal NPs (example (28)). They are postpositions since they behave morphologically along the same pattern as *person-marked postpositions* (cf. Table 3) and have the same distributional properties (examples (29) and (30)) .

(28) **A ház benn(e)*
the house in
'in the house' (intended meaning)

(29) *Ott van a bolt és mellett-e a ház*
there is the shop and next.to-3SG the house
'There is the shop and next to it the house'

(30) *Ott van az erdő és benn-e a ház*
there is the garden and in-3SG the *house*
'There is the garden and inside the house'

Note that postpositions and defective postpositions can be coordinated as shown in (31), whereas postpositions and case suffixes cannot, as we have seen in example (14).

(31) *benn-ünk és mellett-ünk*
in-1PL and next.to-1PL

	1SG	2SG	3SG	1PL	2PL	3PL
nominative	*én*	*te*	*ő*	*mi*	*ti*	*ők*
accusative	*engem(et)*	*téged(et)*	*őt*	*minket*	*titeket*	*őket*

Table 4: Nominative and accusative personal pronouns

'inside us and next to us'

There are only two paradigms of personal pronouns in Hungarian: one for nominative, the other for accusative (Table 4). The other case suffixes are in complementary distribution with the defective postpositions. Indeed, where case suffixes cannot appear (**én-ben*), a defective postposition is used (*benn-em*)[6]. This is true only for 12 case suffixes, since *transformative*, *terminative* and *temporal* have no corresponding defective postposition and cannot be employed with a pronominal NP.

Thus, Hungarian displays

i. 35 postpositions that mostly can be inflected with person suffixes,

ii. 16 case suffixes, among which only the accusative has a pronominal form, and three suffixes have no person form,

iii. 12 defective postpositions that are in complementary distribution with 12 case suffixes.

6 An SBCG account

In the Hungarian grammatical tradition (Kenesei et al., 1998; Szende and Kassai, 2001; Rounds, 2001), postpositions and case suffixes are considered as two different objects, whereas, in recent linguistic studies (Asbury, 2007; Trommer, 2008), they tend to be analysed as realizing the same underlying syntactic category. In this paper, I consider case suffixes as inflectional material appearing on nominal heads, thus accounting for derivational- and combinatorial-specific properties. I use the MARKING feature (Pollard and Sag, 1994; Tseng, 1999, 2002; Van Eynde, 2001) to capture distributional similarities. Finally, I give an explicit analysis for defective postspositions, which accounts for their morphological and syntactic similarities to postpositions, and their distributional likeness to case-marked nouns.

6.1 Case suffixes

Hungarian nouns and adjectives can host a plural suffix, possessive suffixes and a case suffix. The plural suffix and the possessive suffixes belong to the same

[6]Spencer and Stump (ms) provide an analysis, in the Paradigm Function Morphology theory, for defective postpositions that links case suffixes and defective postpositions as realizations of a single lexeme. Such an analysis, though probably preferable, cannot directly be implemented in HPSG/SBCG.

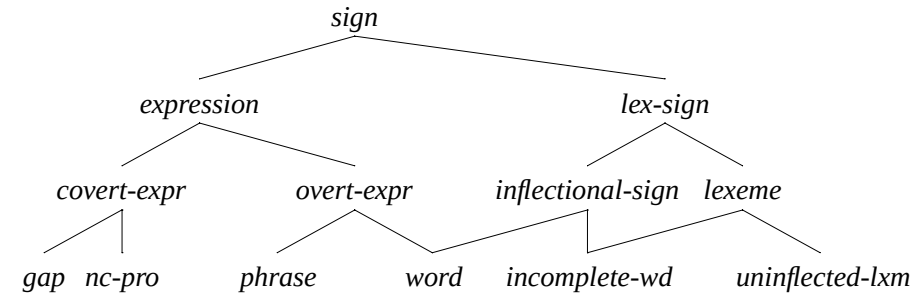


Figure 1: Hierarchy of sign

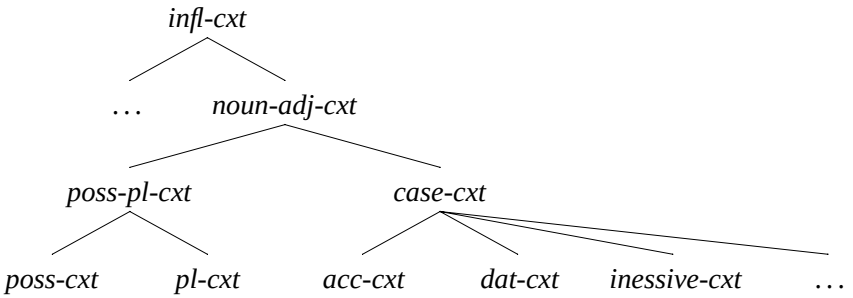


Figure 2: Partial hierarchy of inflectional-cxt

position class. So we can have: *noun*-(PL)-(CASE) (*ház-ok-ban*, house-PL-INE) or *noun*-(POSS)-(CASE) (*ház-am-ban*, house-POSS.1SG-INE). In order to account for this, I postulate the hierarchy of *sign* adapted from Sag (2010) and presented in figure 1, as well as the partial hierarchy of *inflectional-cxt* sketched in figure 2.

On one hand, the inflectional construction for plural and possession, *possessive-plural-cxt*, is satisfied only by *uninflected-lexeme* and produces an *incomplete-word*, as shown in (32). On the other hand, *case-cxt*, presented in (33), can be satisfied by *lexeme*, ensuring that case suffixes appear either directly on the noun or after possessive or plural suffixes.

(32) *poss-pl-cxt*:

$$\begin{bmatrix} \text{MTR} & [\textit{inflectional-sign}] \\ \text{DTRS} & \langle [\textit{uninflected-lexeme}] \rangle \end{bmatrix}$$

(33) *case-cxt*:

$$\begin{bmatrix} \text{MTR} & [\textit{word}] \\ \text{DTRS} & \langle [\textit{lexeme}] \rangle \end{bmatrix}$$

Each subtype of *case-cxt* concatenates the appropriate suffix to the PHON of the noun or adjective base. It specifies an appropriate value for the MARKING feature. Moreover, I postulate the partial hierarchy of *category* sketched in figure 3: *adjective* and *noun* are both subtypes of *noun-adj* because they share inflectional properties, and *noun* and *postposition* are subtypes of *noun-post* since they have common derivational properties (in particular, derivation with *i* suffix). For exam-

ple, *inessive-cxt* is presented in (34)[7].

(34) *inessive-cxt*:

$$\begin{bmatrix} \text{MTR} & \begin{bmatrix} \textit{word} \\ \text{PHON} \ \boxed{1} \oplus \textit{bAn} \\ \text{SYN} \quad [\text{MARKING} \ \textit{inessive}] \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \textit{lexeme} \\ \text{PHON} \ \boxed{1} \\ \text{SYN} \quad [\text{CAT} \ \textit{noun-adj}] \end{bmatrix} \right\rangle \end{bmatrix}$$

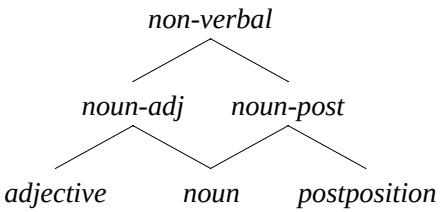


Figure 3: Partial hierarchy for *category* type values

6.2 Postpositions

Postpositions are represented as lexemes[8] having a specific CAT value and an inherent MARKING feature, which takes the form of the postposition as value. Postpositions can be realized as *word* either by means of the *naked-post-cxt* or of the *person-marked-post-cxt*. As shown in (35), the *naked-post-cxt* takes a *uninflected-lexeme* as daughter and produces a mother that is a *word* but otherwise identical to the daughter. This construction is satisfied by a *lexeme* containing an argument with *non-pronominal* content, thus giving a *word* which combines syntactically with an NP that cannot be a pronoun.

(35) *nkd-post-cxt*:

$$\begin{bmatrix} \text{MTR} & \begin{bmatrix} \textit{word} \\ \text{PHON} \ \boxed{1} \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \textit{uninflected-lexeme} \\ \text{PHON} \ \boxed{1} \\ \text{SYN} \begin{bmatrix} \text{CAT} & \textit{postposition} \\ \text{MARKING} & \textit{marked} \end{bmatrix} \\ \text{ARG-ST} \langle [\text{CONT} \ \textit{non-pro}] \rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

[7] In this paper, I simplify the morphological rules and do not account for the internal sandhi phenomena that occur with affixation. The notation *bAn* means that the vowel of the suffix undergoes vowel harmony.

[8] All the postpositions of Hungarian need to be *uninflected-lexeme* in the lexicon, in order to satisfy the derivational construction introducing the *-i* suffix (*i-deriv-cxt*).

As we saw previously, postpositions realize pronominal complements as person suffix with an optional nominative pronoun (cf. examples (25) and (26)). Considering that this is a case of optional pro-drop, I follow the treatment of Bonami and Samvelian (ms) for pro-drop in Persian. I use the *non-canonical-pronoun* type, which is a subtype of *covert-expr* (cf. hierarchy in figure 1). *nc-pro* is defined as having a *pronominal* value for the feature CONT. Then, if an argument is of type *nc-pro*, it is not syntactically realized and it has a *pronominal* content.

The morphological realization of pronominal complement is introduced by means of *person-marked-post-cxt*. An example for first-person singular postpositions is presented in (36).

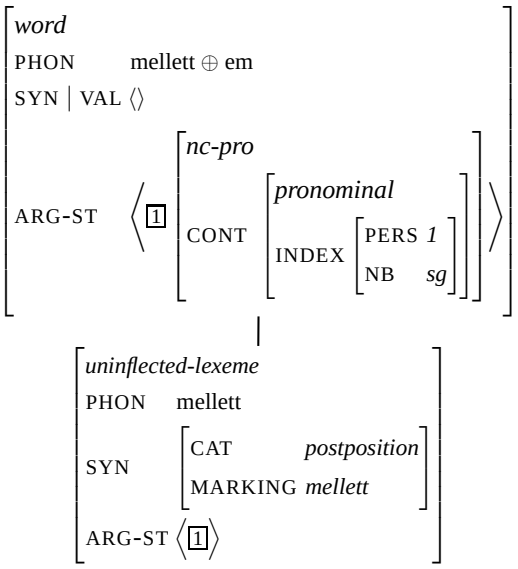
(36) *1sg-mrkd-post-cxt*:

$$\left[\begin{array}{l}\text{MTR}\ \left[\begin{array}{l}\textit{word}\\ \text{PHON}\quad \boxed{1}\oplus \textit{em}\\ \text{ARG-ST}\ \left\langle \boxed{2}\left[\text{CONT}\left[\begin{array}{l}\textit{pronominal}\\ \text{INDEX}\left[\begin{array}{ll}\text{PERS} & \textit{1}\\ \text{NB} & \textit{sg}\end{array}\right]\end{array}\right]\right]\right\rangle\end{array}\right]\\ \text{DTRS}\left\langle\left[\begin{array}{l}\textit{uninflected-lexeme}\\ \text{PHON}\ \boxed{1}\\ \text{SYN}\left[\begin{array}{ll}\text{CAT} & \textit{postposition}\\ \text{MARKING} & \textit{marked}\end{array}\right]\\ \text{ARG-ST}\left\langle\boxed{2}\right\rangle\end{array}\right]\right\rangle\end{array}\right]$$

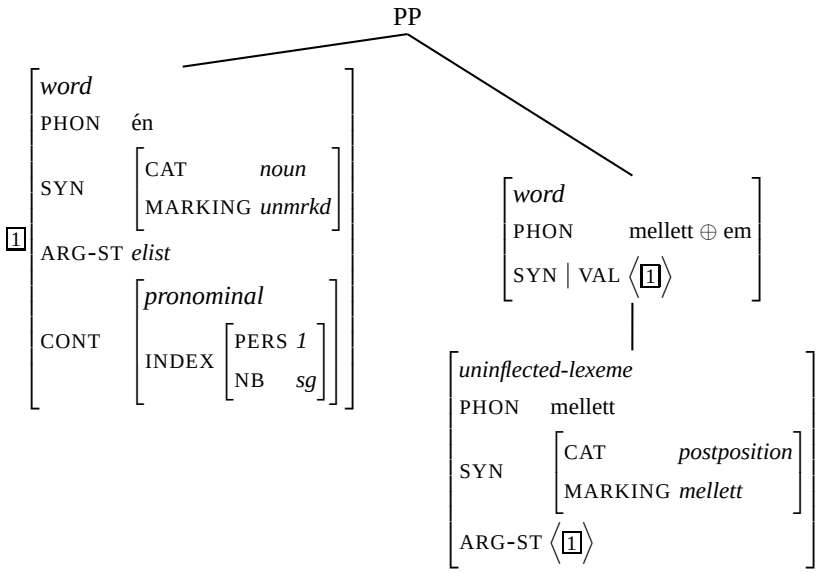
The argument on the ARG-ST has a *pronominal* content and its type of sign is underspecified. Thus, depending on whether the argument has the *nc-pro* type or the *overt-expression* type, this construction accounts for both 'pro-drop' (*mellet-em*) and 'agreement' (*én melletem*) situations. If the argument has the *nc-pro* type, it is realized only in morphology and the person-marked postposition forms a PP on its own, as shown in example (37). In contrast, if the argument has an *overt-expr* type, it is realized both in morphology and in syntax (example (38)).

(37) *mellett-em* 'next to me' (**pro-drop**)

PP



(38) *én mellett-em* 'next to me' (**agreement**)



6.3 Demonstrative agreement

Using the MARKING feature, we can now handle the agreement of postpositions and case suffixes with the demonstrative. I postulate that Hungarian displays a subtype of *head-functor-cxt*, called *demonstrative-head-functor-cxt* (presented in (39)) and specifying that the MOTHER and the DAUGHTERS must share their MARKING

value when one of the DAUGHTERS has a positive value for the DEMONSTRATIVE feature.

(39) *dem-hd-func-cxt*:

$$\begin{bmatrix} \text{MTR} & [\text{SYN} \mid \text{MARKING } \boxed{1}] \\ \text{DTRS} & \left\langle \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{MARKING} & \boxed{1} \\ \text{CAT} \mid \text{DEM} & + \end{bmatrix} \end{bmatrix}, \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{MARKING} & \boxed{1} \\ \text{CAT} \mid \text{DEF} & + \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

6.4 Defective postpositions

Defective postpositions are a subtype of *postpositions* which cannot satisfy the *naked-post-cxt*, because they lexically require an argument with *pronominal* content. The MARKING value of each defective postposition corresponds to that of the case suffix with which this postposition is in complementary distribution.

(40) *defect-post-lxm*:

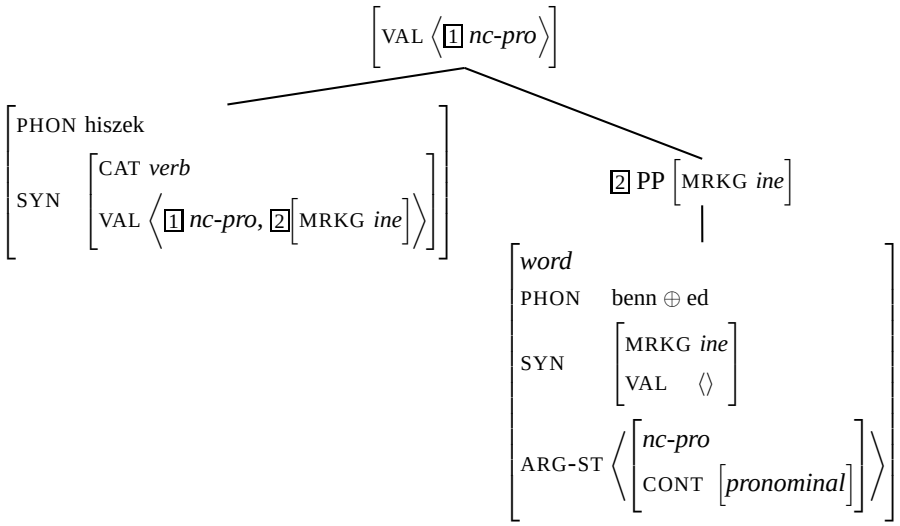
$$\begin{bmatrix} \textit{uninflected-lexeme} \\ \text{ARG-ST} & \left\langle [\text{CONT } \textit{pronominal}] \right\rangle \end{bmatrix}$$

(41) *inessive-defect-post-lxm*:

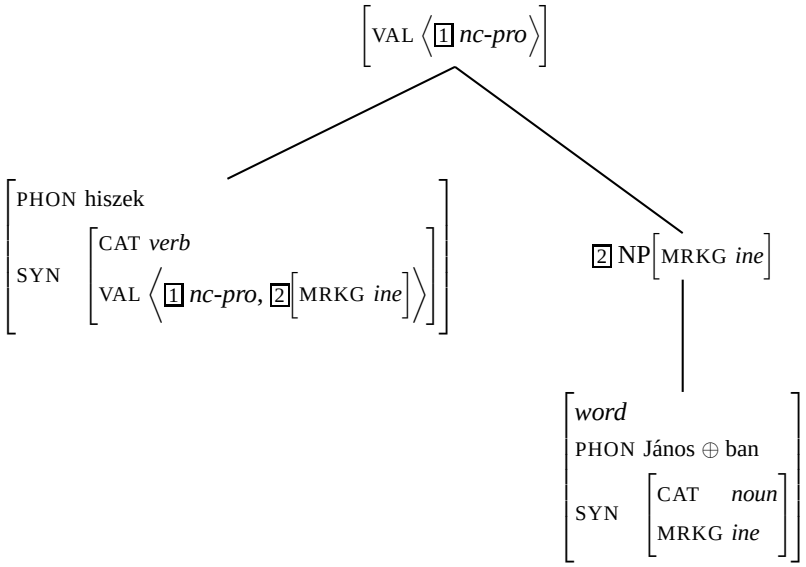
$$\begin{bmatrix} \textit{uninflected-lexeme} \\ \text{ARG-ST} & \left\langle [\text{CONT } \textit{pronominal}] \right\rangle \\ \text{SYN} & [\text{MARKING } \textit{inessive}] \end{bmatrix}$$

As postpositions, defective postpositions head a PP in syntax. Thus, the heads subcategorizing a case suffix select the MARKING feature of their argument, which can be of part of speech noun, as in example (43), or postposition, as in example (42).

(42) Verb selecting an inessive PP: *hiszek* ***benned*** 'I believe in you'



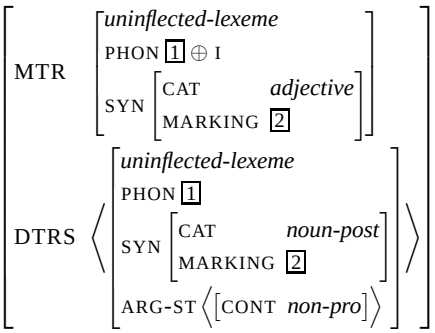
(43) Verb selecting an inessive NP: *hiszek Jánosban* 'I believe in János'



6.5 Derivational suffix *-i*

I also want to provide an account for the fact that *postpositions* can receive the *-i* adjectivizer suffix, unlike case-marked nouns or defective postpositions. The construction introducing this derivational suffix (*i-deriv-cxt* in (44)) is well formed if its argument has a non-pronominal content, ensuring that defective postpositions cannot satisfy this construction. The MTR of this construction is an *uninflected-lexeme*, thus allowing inflectional constructions to apply (cf. examples (8) and (9)). Following the hierarchy of category values in figure 3, I use a *noun-post* type in order to capture the fact that both nouns and postpositions can be *-i* suffixed. The impossibility for case-inflected nouns to host the *-i* suffix is straightfowardly accounted: *i-deriv-cxt* is a lexeme-to-lexeme construction, while case-marked nouns have the *word* type.

(44) *i-deriv-cxt*:



6.6 Nominative and accusative pronouns

Finally, in the case of the accusative suffix, we have an *accusative-cxt*, i.e. a subtype of *case-cxt* introducing an *accusative* value for the noun's feature MARKING. The accusative personal pronouns as well as the nominative ones are lexically specified as having the *word* type, since they cannot satisfy any derivational or inflectional construction.

(45) *én*:

$$\begin{bmatrix} \textit{word} \\ \text{ARG-ST } \textit{elist} \\ \text{SYN} \begin{bmatrix} \text{CAT} & \textit{noun} \\ \text{MARKING} & \textit{unmrkd} \end{bmatrix} \end{bmatrix}$$

(46) *engemet*:

$$\begin{bmatrix} \textit{word} \\ \text{ARG-ST } \textit{elist} \\ \text{SYN} \begin{bmatrix} \text{CAT} & \textit{noun} \\ \text{MARKING} & \textit{accusative} \end{bmatrix} \end{bmatrix}$$

7 Conclusion

In this paper, I have described the properties of case suffixes, postpositions and defective postpositions, showing that the *essive* suffix should be reanalysed as a postposition and that defective postpositions are true postpositions from both a morphological and a syntactic point of view.

In order to deal with these facts, I have proposed to analyse case suffixes and postpositions as two different objects: case suffixes are inflectional material on nominal heads, and postpositions as well as defective postpositions are independent words subcategorizing an NP. This distinction straightforwardly accounts for morphological and syntactic differences. Finally, the shared distributional properties between case suffixes, postpositions and defective postpositions are captured by means of the use of the MARKING feature.

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Adjuncts and the HPSG binding theory

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Abstract

The HPSG binding theory in Pollard and Sag (1994) cannot account for the binding-theoretic interaction between main clause and adjunct-internal elements. Following Hukari and Levine (1995), I claim that structural configurations must be taken into account. In this article, I present a revised version of Hukari and Levine's configurational relation called v(alence-based)-c-command and propose that Principle C must involve this relation in addition to the obliqueness-based relation of o-command. New data are provided that strongly support the proposed revision of the HPSG binding theory. Finally, I argue that Principle C is syntactic rather than pragmatic in nature.

1 Introduction

Binding theory accounts for the distribution of anaphors, personal pronouns, and R-expressions and defines the syntactic conditions under which coreference relations among linguistic expressions are obligatory, permitted, or prohibited. Various syntactic theories in the tradition of the Government and Binding theory, starting with Chomsky (1981) and Reinhart (1976, 1981, 1983), provide an account of coindexation possibilities in terms of the phrase structural relation of c-command. The HPSG binding theory presented by Pollard and Sag (1994) (henceforth P&S-94) rejects these configurational formulations and instead introduces a relation called o-command which is based on the relative obliqueness of arguments of the same head, as reflected in its ARG-ST list.[1] But this analysis faces a number of problems. For example, it fails to address the binding-theoretic interaction between elements in the main clause and elements within adjuncts. In this article, I present a revision of the HPSG binding theory that can account for these binding phenomena. I follow Hukari and Levine (1995), who claim that a configurational relation similar to c-command is needed in order to capture the binding behavior of adjunct-internal elements. To this end, they introduce a relation called v(alence-based)-c-command and propose that Principle C must involve this configurational relation in addition to the obliqueness-based relation of o-command. They show that the (anti)reconstruction effects as well as binding effects in VP topicalization fall out from this revised binding theory. However, as a formal definition in terms of the HPSG formalism, Hukari and Levine's formulation of vc-command is flawed. To remedy this deficiency, I propose a revision of vc-command that is compatible with the foundations of the HPSG framework. I provide new data that strongly support the proposed revision of the HPSG binding theory.

This article is structured as follows: I present a brief review of P&S-94's binding theory in section 2 and some of its problems concerning binding into adjuncts

[†]I would like to thank Bob Levine, Manfred Sailer, Gert Webelhuth, the audience at the HPSG conference, and three anonymous reviewers for helpful comments and discussion.

[1]I employ here the feature ARG-ST as used in more recent work within the HPSG framework to replace the SUBCAT feature as used in P&S-94.

in section 3. In section 4, I give an outline of Hukari and Levine's (1995) valence-based binding theory. After describing its deficiencies, I propose a new formulation of vc-command and explain how it accounts for the problematic data presented earlier. Section 5 shows some further empirical consequences of the revised binding theory, namely that it accounts for the (anti)reconstructions effects and for binding phenomena in extraposition, VP topicalization, and VP complements. Finally, in section 6, I briefly address the question of whether Principle C is pragmatic in nature, a claim that has often been made in the literature. I argue that the evidence provided in favor of these claims is not convincing enough to refute the syntactic nature of Principle C, which is also supported by psycholinguistic evidence.

2 Binding theory in P&S-94

The binding theory proposed by Pollard and Sag (1994) replaces the tree-configurational notion of c-command by a relation called o(bliqueness)-command, which is based on the relative obliqueness that obtains between arguments of the same head. Relative obliqueness is modeled by position on the ARG-ST list of some lexical head. The ordering corresponds to the traditional obliqueness hierarchy, with the subject (the least oblique element) appearing first (leftmost), followed by the primary object, the secondary object, and other, more oblique complements (in that order, if such exist). In the revised binding theory presented in chapter 6.8.3 of P&S-94, two relations, a general ("weak") relation called o-command and a "strong" relation called local o-command, are defined as follows:

(1) Let Y and Z be *synsem* objects with distinct LOCAL values, Y referential. Then Y *locally o-commands* Z just in case either:

   i. Y is less oblique than Z; or

   ii. Y locally o-commands some X that subcategorizes for Z.

(2) Let Y and Z be *synsem* objects, with distinct LOCAL values, Y referential. Then Y *o-commands* Z just in case either:

   i. Y is less oblique than Z; or

   ii. Y o-commands some X that subcategorizes for Z; or

   iii. Y o-commands some X that is a projection of Z (i.e. the HEAD values of X and Z are token-identical).

It follows from these definitions that local o-command is a special case of o-command; the cases of local o-command are just those cases covered by clauses (i) and (ii) of o-command. O-command serves as the basis of the o-binding relation:

(3) Y *(locally) o-binds* Z just in case Y and Z are coindexed and Y (locally) o-commands Z. If Z is not (locally) o-bound, then it is said to be *(locally) o-free*.

The Binding Principles are formulated as follows:

(4) i. Principle A. A locally o-commanded anaphor must be locally o-bound.
ii. Principle B. A personal pronoun must be locally o-free.
iii. Principle C. A nonpronoun must be o-free.

To illustrate this binding theory, consider the following ill-formed example:

(5) * She$_i$ believes that John likes Mary$_i$.

The ARG-ST list of the matrix verb *believes* consists of the pronoun *she* and the CP *that John likes Mary*, hence *she* (locally) o-commands the CP by definition (2i) (or (1i), respectively). By repeated application of (2ii) and (2iii), *she* o-commands the head daughter *that* of the CP, the head verb *likes* of the subclause, and finally the arguments of *likes*. Hence, *she* o-commands *Mary*. Since the two are coindexed, *Mary* is o-bound and Principle C is violated.

3 Problems with P&S-94's binding theory

P&S-94's nonconfigurational binding theory cannot account for the coindexation between main clause and adjunct-internal elements. Adjuncts are not selected by heads and thus do not appear on ARG-ST lists. Hence, they do not stand in obliqueness relations to arguments.[2] It follows that an adjunct is never (locally) o-commanded, and no element within it can ever be o-bound by an element outside of the adjunct. Consequently, P&S-94's theory cannot predict any Principle C effects involving nonpronominal NPs within adjuncts bound by arguments of the main clause.

But there is considerable evidence that adjuncts are transparent for binding purposes. First of all, a nonpronominal NP contained within a relative clause cannot be coreferential with an argument preceding the NP containing the relative clause, as illustrated in (6).[3] Since a relative clause functions as a modifier, a name within

[2] As will become clear in the following discussion based on Hukari and Levine (1995), approaches in which adjuncts are added to the ARG-ST list, as for example van Noord and Bouma (1994) and Sag (2005), fail on empirical grounds since they cannot predict the complex cataphora asymmetries demonstrated below, for example the contrast between subject-based and object-based cataphora into *without*-adjuncts as shown in (7) and (8).

[3] During the discussion after the talk, Ivan Sag claimed that the acceptability of the ungrammatical examples provided in this article would improve in certain contexts or, for example, when the name is more deeply embedded, as in (i):

(i) She$_i$ was grateful to ALL the people who contributed to the campaign that had guaranteed Lola$_i$'s election to public office.

Sag proposes no non-structural analysis of the effect. Bob Levine replied that the reason for this effect could be processing and memory effects. Be that as it may, sentences such as in (i) contain a number of structural properties simultaneously, like constrative focus on *all* and the doubly embedded relative clauses, that might be structurally responsible for the weaker effect of Principle C as well. Moreover,

it is not o-commanded by a preceding argument of the matrix clause, and P&S-94's binding theory incorrectly does not predict a Principle C violation for these sentences.[4]

(6) a. * She$_i$ admires the people [who work with Lola$_i$].
(Reinhart, 1983, p. 102)

b. * I sent her$_i$ many gifts [that Mary$_i$ didn't like] last year.
(Culicover and Rochemont, 1990, p. 29)

c. * I told him$_i$ about your new argument [that supports John$_i$'s theory].
(Fox and Nissenbaum, 2000, p. 5)

Other types of adjunct clauses also constitute a problem for the binding theory. As observed by Hukari and Levine (1995, 1996), an R-expression within a *without*-clause may not be coreferential with the subject pronoun of the matrix clause:

(7) a. * They$_i$ went into the city [without anyone noticing the twins$_i$].

b. * They$_i$ went into the city [without the twins$_i$ being noticed].

c. * They$_i$ could never do anything [without the twins$_i$ feeling insecure about it].

However, there is an asymmetry between subject and object antecedents. While cataphora into the *without*-adjunct is impossible when the pronoun is in subject position (as in (7)), it is possible when the pronoun is an object of the main clause, as shown in (8).

(8) a. You can't say anything to them$_i$ [without the twins$_i$ being offended].

b. You can't say anything about them$_i$ [without Terry criticizing the twins$_i$ mercilessly].

c. I lectured her$_i$ for an hour [without a single one of my points getting through to Terry$_i$].

d. I was able to criticize him$_i$ [without anyone realizing that Robin$_i$ was the object of my scorn].

e. I was able to criticize her$_i$ [without anyone realizing that I was talking about Robin$_i$].

---

as Bob Levine has pointed out to me, the necessary strong destressing of *Lola* to get the coreference might turn the name into a kind of epithet, which must be treated differently than regular names and descriptions with respect to the binding principles.

[4]Note that the original formulation of Pollard and Sag's binding theory (1992; 1994) can account for these data because o-command is defined in terms of a domination relation. Thus, the pronoun locally o-commands the phrase which dominates the nonpronominal NP within the relative clause so that the latter is o-commanded and hence o-bound by the coindexed pronoun in violation of Principle C. However, these definitions of the binding theory fail to predict binding relations in certain unbounded dependency constructions. In addition, Pollard and Sag (1994, p. 277) suggest to "minimally extend local o-command in such a way that unexpressed reflexive subjects of VP and predicative complements become subject to Principle A". That is why they revise the definitions and provide a totally nonconfigurational binding theory in chapter 6.8.3.

This subject/object-asymmetry can also be found in sentences with other types of adjunct clauses:

(9) a. * She$_i$ always gets angry [if/when Kim$_i$ is criticized].
b. * He$_i$ always stops [before Freddy$_i$ says something stupid].
c. * He$_i$ came into the room [as quickly as John$_i$ could].
((9c) from Culicover and Rochemont (1990, p. 33))

(10) a. Sara always stops him$_i$ [before/when Freddy$_i$ acts stupid].
b. We always console her$_i$ [when Kim$_i$ is criticized].

The binding theory in P&S-94 does not predict these cataphora asymmetries. According to its definitions, all of the sentences in (7)-(10) should be equally grammatical.

Hukari and Levine (1995) argue that the *without*-clause has the status of a VP-adjunct by applying conventional tests for VP-adjuncthood (coordination, proform replacement, and displacement) that clearly suggest a structural difference between *without*-clauses and complements on the one hand, and between *without*-clauses and sentential adjuncts on the other. These structural differences are reflected and thus supported by contrasts in coreference possibilities. Compare the sentences in (8) to those in (11).

(11) a. * You can't tell them$_i$ [that the twins$_i$ are being offensive].
b. * You can't tell them$_i$ [that people are irritated at the twins$_i$].

Cataphora is possible from an object pronoun into a *without*-adjunct, as in (8), but not into a *that*-clause complement, as in (11). Assuming a configurational binding theory that is based on a c-command relation, Principle C prohibits the coreference in (11) since the nonpronominal is in an object clause which is clearly c-commanded by the coindexed pronoun *them*.[5] The fact that the sentences in (8)

[5] An anonymous reviewer claimed that there are variants of (11), such as in (i), which are (more) acceptable. Similarly, Ivan Sag (p.c.) provided the example in (ii), among others, as a counterexample to a structural version of Principle C.

(i) ? You can't require/expect of them$_i$ that the twins$_i$ should win every single match they$_i$ play.

(ii) I've never been able to explain to her$_i$ that Betsy$_i$'s gophers destroyed my lawn each spring.

If the PP containing the pronoun was less oblique than the complement clause containing the coindexed name, these examples would be problematic for both, the binding theory proposed here as well as for P&S-94's theory based on o-command. However, I argue that the PP is indeed more oblique than the *that*-clause. The following paradigm shows that only the direct object can be passivized:

(iii) a. You required that of them.
b. That was required of them.
c. * They were required that of.

The argument structure of *require* seems to be: ARG-ST <NP, NP, PP$_{of}$>. When the direct object is a *that*-clause, as in the sentences above, it is probably linearized last because of its heaviness. But

are grammatical indicates a lack of a c-command relation in those examples and hence a structural difference between the complement clause on the one hand and the adjunct clause on the other.

Moreover, the difference in coreference possibilities between (12) and (13) is an indication of the structural difference between *without*-adjuncts and adjuncts that are clearly sentential.

(12) * They$_i$ could never do anything [without the twins$_i$ feeling insecure about it].

(13) They$_i$ hadn't been on the road for half an hour [when the twins$_i$ noticed that they had forgotten their money, passports and ID].

In both sentences, the relevant NP *the twins* appears within an adjunct clause and is coindexed with a pronoun in the subject position of the main clause. But only when the NP is within the sentential adjunct is coreference possible (see (13)). When it is inside the VP-adjunct, as in (12), coreference is not allowed. This contrast cannot be predicted by an obliqueness-based binding theory. Since neither sentential nor VP-adjuncts appear on ARG-ST lists, the nonpronominal NP *the twins* is not o-commanded and thus not o-bound by the subject pronoun in either case. The sentences should be equally grammatical. In terms of c-command, however, (12) is ruled out by Principle C since the subject pronoun c-commands the coindexed nonpronominal inside the VP-adjunct. The sentential adjunct in (13) is not c-commanded by the subject and thus the sentence is correctly predicted to be grammatical.

Finally, the subject/object-asymmetry between the sentences in (7) and those in (8) also indicates a c-command relation between the subject of the matrix clause and the adjunct in (7), but a lack of a c-command relation between the complement of the matrix verb and the adjunct in (8). It thus supports the assumption that the *without*-clause is a VP-adjunct.

All these data provide evidence that there are some binding-theoretic interactions between main clause elements and elements within adjuncts. Specifically, there is a subject/object-asymmetry in cataphora possibilities. But, as shown in detail, the HPSG binding theory in P&S-94 does not capture these effects. It has to be modified in order to rule out cataphora into certain adjuncts. One possible solution, which was specifically addressed by Hukari and Levine (1995), would be to add adjuncts to the ARG-ST list in the style of van Noord and Bouma (1994) or Sag (2005), in order to preserve P&S-94's purely obliqueness-based approach. The VP-adjuncts would have to be placed between the subject and the complements. In this position, elements within the adjunct would be o-commanded by the subject but not by any objects, and the cataphora asymmetries would be correctly predicted. Sentential adjuncts, however, would have to be treated differently. Since

with the underlying argument structure, these sentences do not constitute a problem for a binding theory based on o-command or vc-command.

they do not show any Principle C effects with main clause elements, they should not be placed on the ARG-ST list.

Hukari and Levine (1995) argue that this approach is problematic since this position on the ARG-ST list is implausible for adjuncts. There is ample cross-linguistic evidence, for example Keenan and Comrie's (1977) tests for relativizability which have led to the formulation of the accessibility hierarchy, that adjuncts are placed at the lower end of the obliqueness hierarchy, being more oblique than subjects, direct objects, and other objects. This is also supported by linearization facts, as the examples from Hukari and Levine (1995) in (14) show.

(14) a. Harry talked [to Margaret] [about the problem] [without paying attention to the time].
b. * Harry talked [to Margaret] [without paying attention to the time] [about the problem].
c. * Harry talked [without paying attention to the time] [to Margaret] [about the problem].
d. Harry talked [about the problem] [to Margaret] [without paying attention to the time].
e. * Harry talked [about the problem] [without paying attention to the time] [to Margaret].
f. * Harry talked [without paying attention to the time] [about the problem] [to Margaret].

The unmarked linear order seems to be that adjuncts come last. Even Pollard and Sag (1987, p. 181) concluded their discussion about the position for adjuncts and complement PPs and APs with the remark that "[...] adjuncts are more oblique than complements".

However, there is an alternative solution, which was proposed by Hukari and Levine (1995) and which I adopt. This approach is presented in the next section.

4 A valence-based binding theory

In order to account for the cataphora effects with elements inside of adjuncts, Hukari and Levine (1995) suggest to supplement the definitions of the HPSG binding theory with the new structural relation of vc-command and reformulate Principle C so that it is based on both, o-command and vc-command. In the following, I will first introduce Hukari and Levine's valence-based binding theory. I will then propose a revision of the relation of vc-command and demonstrate that it captures all the binding effects depicted above.

Hukari and Levine (1995) propose the following command relationship in terms of configuration. Since it is similar to c-command but based on the valence of an element, they call it v(alence-based) c-command.

(15) **v(alence-based) c-command**:
Let α be an element on a valence list γ and α' the DTRS element whose SYNSEM value is structure-shared with α. Then if the constituent that would be formed by α' and one or more elements β has a null list as its value for γ, α vc-commands β and all its descendants.

This relation is added to the definitions of P&S-94's binding theory; that is, it exists in addition to o-command, and Principle C is replaced by the following formulation, which I slightly adapted here:

(16) **Principle C**: A nonpronominal must neither be bound under o-command nor under a vc-command relation.

In essence, a subject vc-commands the VP and all its descendants, and a complement vc-commands all its sister constituents and their descendants. So, crucially, vc-command is a relation that exists between a subject and VP-adjuncts (including all descendants) but not between complements and VP-adjuncts. Moreover, it exists between a subject or complement and any adjuncts within more oblique complements. The revised Principle C prohibits the binding of nonpronominals under vc-command as well as o-command, thus causing the desired effects.

While I agree with the gist of Hukari and Levine's definition of vc-command, its formulation is conceptually flawed, especially as concerns the modality in the formulation, which renders it extremely suspect. In order to determine whether or not a given feature structure is legal, one has to compare it to other possible feature structures and identify whether a certain relationship holds between them. That is somewhat strange for a formalism that employs the kind of foundations that HPSG adopts. The modality in the definition might not be formally compatible with and, moreover, it might not even be formulable in a constraint-based framework like HPSG.[6] I therefore propose the following refinement:

(17) **vc-command (revised)**[7] :
Let α, β, γ be *synsem* objects, and β' and γ' signs such that β': [SYNSEM β] and γ': [SYNSEM γ]. Then α vc-commands β iff

i. γ': [SS|LOC|CAT|VAL|SUBJ $\langle\alpha\rangle$] and γ' dominates β', or

ii. α locally o-commands γ and γ' dominates β'.

[6]This was also endorsed by one of the anonymous reviewers, whom I would like to thank for his or her additional comments.

[7]Stefan Müller has suggested to change the requirement that α be on the SUBJ-list of γ' into the requirement that it be the first element on the ARG-ST list so that the definition would also apply to other languages like pro-drop languages. Along these lines, Olivier Bonami has proposed the following formulation as an alternative to (17i):

(i') γ': [SS|LOC|CAT|ARG-ST $\langle\alpha, ...\rangle$] and γ' is the HEAD-DTR of a phrase that dominates β'.

On closer inspection, however, it becomes evident that this definition fails to account for the sentences in (7). I leave it to future work to carefully scrutinize the proposal and investigate its empirical relevance. I am grateful to Stefan Müller and Olivier Bonami for their comments.

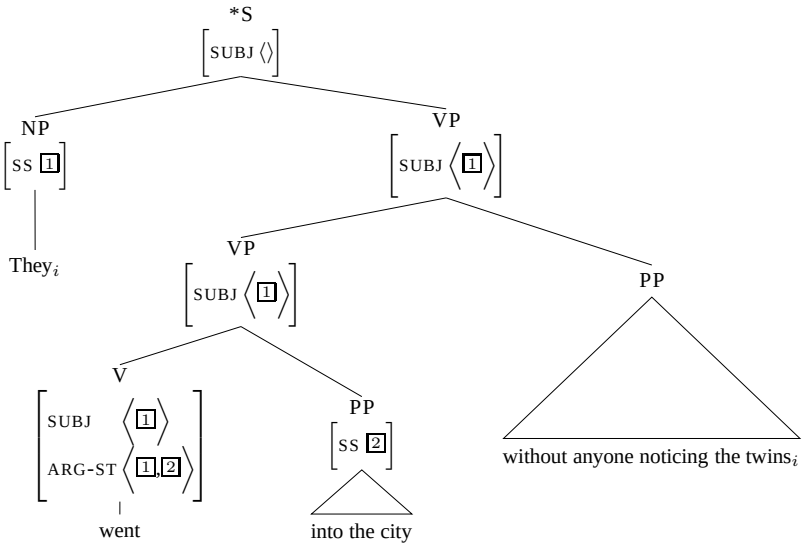
This revised formulation of vc-command is formally and technically clean. Moreover, it emphasizes the primacy of the subject. The subject is the least oblique and (in English) the sole obligatory argument of the verb and is in a superior structural position. This special status is reflected in its binding behavior. Subjects are strong binders; some languages possess anaphors that can only be bound by subjects.

The revised binding theory predicts all of the data provided above. The ungrammatical sentences are now correctly ruled out by Principle C. First of all, in the sentences in (6), the pronoun locally o-commands the NP containing the relative clause because they both appear on the ARG-ST list of the main verb. The NP in turn dominates the nonpronominal NP inside the relative clause so that the latter is vc-commanded by the coindexed pronoun in violation of Principle C.

Next, consider again the sentences in (7). The structure of (7a), repeated here in (18a), is given in (18b). The SYNSEM value of the subject pronoun *they* is structure-shared with the element on the SUBJ list of the VP. Under the assumption that the *without*-clause is adjoined to VP, the adjunct is dominated by the higher VP node. But then the nonpronominal NP *the twins* is also dominated by that VP. It follows from clause (i) of the definition in (17) that the NP *the twins* is vc-commanded by the subject pronoun. Since the two are coindexed, Principle C is violated.

(18) a. * They$_i$ went into the city [without anyone noticing the twins$_i$].

b.



There is no Principle C effect in the sentences in (8) since the relevant nonpronominal is not vc-commanded by the coindexed pronoun. (17i) does not apply since the pronoun is an object and not a subject, and (17ii) does not apply since the *without*-clause does not appear on the ARG-ST list of the main verb and therefore is not locally o-commanded by the pronoun.

The relevant nonpronominal in (13) is not bound by the subject pronoun, either, under the assumption that the adjunct containing the nonpronominal is a sentential adjunct. It adjoins to the S node, which already has an empty SUBJ list.

5 Further consequences of the revised binding theory

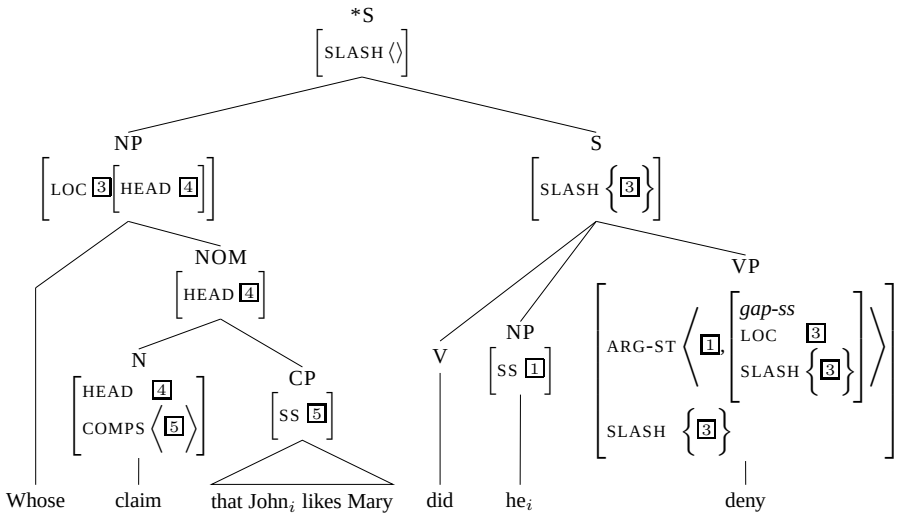
The binding theory that incorporates both obliqueness and configuration into the formulation of Principle C has additional desirable consequences. First of all, as Hukari and Levine (1995) noticed, it can account for phenomena known as (anti)reconstruction effects, first observed by van Riemsdijk and Williams (1981) and taken up by Lebeaux (1988), in which adjuncts and complements within extracted arguments show different behavior with respect to Principle C. When a coindexed name appears inside a complement, a Principle C violation is maintained when the NP including the complement is extracted, as shown in (19). When the name is in an adjunct, as in (20), a Principle C violation is circumvented when the NP including the adjunct is fronted.

(19) a. * He$_i$ denied the claim [that John$_i$ likes Mary].
b. * Whose claim [that John$_i$ likes Mary] did he$_i$ deny t?

(20) a. * He$_i$ denied the claim [that John$_i$ made].
b. Which claim [that John$_i$ made] did he$_i$ later deny t?

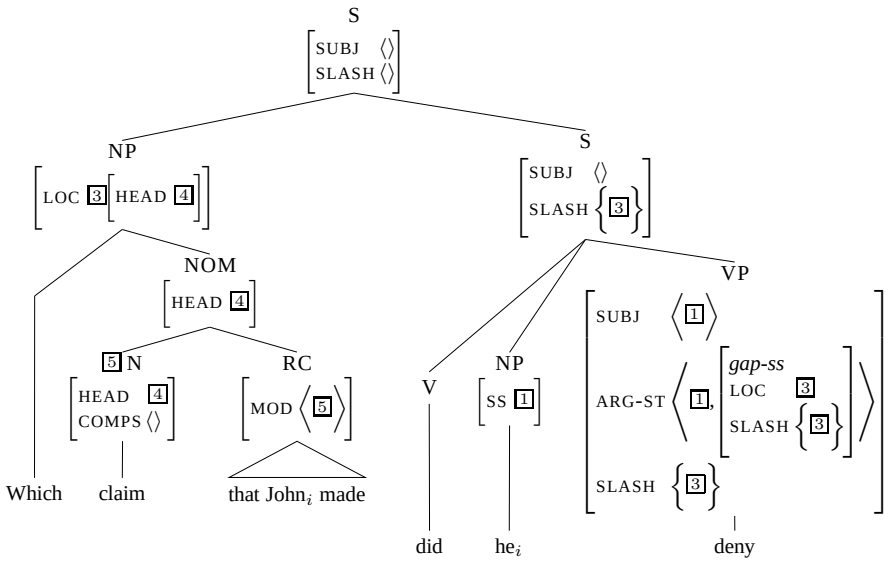
With the new Principle C being based on both relations, o-command and vc-command, these effects can be straightforwardly explained. (19a) is ruled out because the pronoun (locally) o-commands the NP *the claim that John likes Mary* on the ARG-ST list of *denied*. Since the coindexed name *John* is within the clausal complement of *claim*, it is also o-commanded by the pronoun *he* by repeated application of clauses (ii) and (iii) of P&S-94's definition of o-command (see (2)). (20a) is correctly predicted to be ungrammatical because the name is vc-commanded by the coindexed pronoun (by (17i) or (17ii)). It is the o-command relation that is responsible for the ungrammaticality of (19b). Recall that o-command is defined in terms of "projection of", or shared HEAD features. As shown in the tree structure in (21), *he* locally o-commands the gap on the ARG-ST list of *deny*.

(21)



Since the gap structure-shares its LOCAL value with the filler (the NP *whose claim that John likes Mary*), its HEAD value is identical with the HEAD value of the filler as well as its head daughter (*claim*). Thus, by repeated application of (2ii) and (2iii), *he* o-commands *claim*, the clausal complement of *claim*, and finally the coindexed name *John* in violation of Principle C. The tree structure for (20b) is shown in (22). Although the head of the filler, *claim*, is o-commanded by the pronoun *he* in the same way as in (19b/21), the o-command relation does not extend to the relative clause because relative clauses are not selected by the head that they modify. So, *John* inside the relative clause is not o-commanded by the matrix clause subject *he*. It is also not bound under a vc-command relation. In order for *John* to be vc-commanded by *he*, it would have to be dominated by a constituent that is locally o-commanded by *he* (according to (17ii)) or by a constituent on whose SUBJ list the pronoun appears (i.e., the VP with the head *deny*) (according to (17i)). But there is no way in which such domination relations can exist, independent of which analysis is assumed for unbounded dependency constructions.

(22)



I would like to emphasize the crucial difference between o-command and vc-command at this point. The relation of vc-command, being defined in terms of domination, breaks off at the gap site. It is not passed on from a gap to its filler. The o-command relationship, on the other hand, is passed on since it is defined in terms of the relation "projection of", or shared HEAD features.

Observations similar to the (anti)reconstruction effects can be found in extraposition constructions. Adjunct extraposition circumvents a Principle C violation, but complement extraposition does not, as the examples from Fox and Nissenbaum (1999, p. 139) demonstrate:

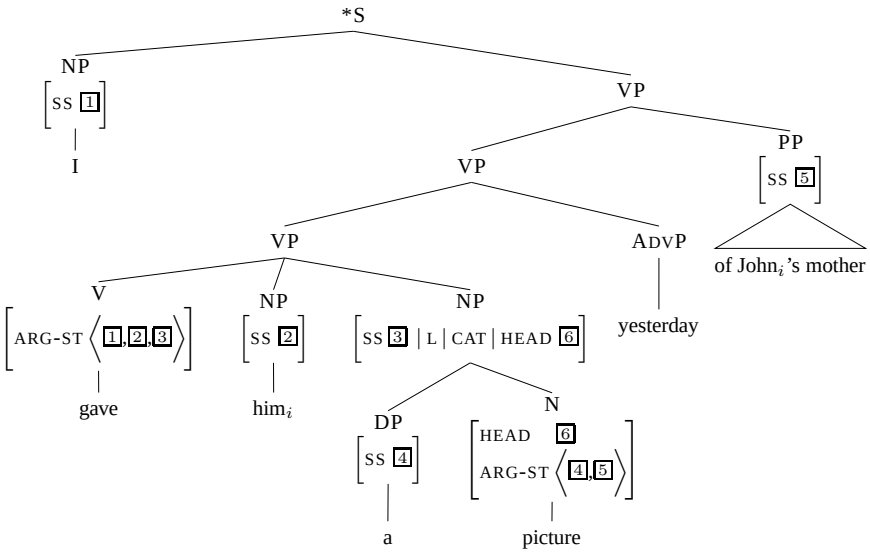
(23) a. ??/* I gave him$_i$ a picture [from John$_i$'s collection] yesterday.

b. I gave him$_i$ a picture yesterday [from John$_i$'s collection].

(24) a. * I gave him$_i$ a picture [of John$_i$'s mother] yesterday.
b. ??/* I gave him$_i$ a picture yesterday [of John$_i$'s mother].

It should be clear by now how the revised Principle C rules out the nonextraposed sentences. The nonpronominal is vc-commanded by the coindexed pronoun when it appears within an adjunct, as in (23a), and o-commanded when it is inside a complement, as in (24a). The extraposed variants are shown in the (b)-sentences. There are different approaches to extraposition in HPSG. Several movement-based analyses treat extraposition as a nonlocal dependency using the same kind of mechanism that accounts for extraction to the left (e.g., Keller, 1994; Müller, 1999). For relative clause extraposition, an anaphoric approach assuming simple adjunction of the extraposed adjunct is proposed by Kiss (2005). Crysmann (To appear) suggests a combination of the two approaches for complement clause and relative clause extraposition in German. No matter which analysis is applied, the binding theory proposed here interacts with any of them in the desired way. For this reason, the extraposition mechnism is not further specified in the tree structure in (25), which shows the syntactic structure of the sentence in (24b) with the extraposed complement. Since a complement, whether extraposed or not, is selected by a head, it appears on the ARG-ST list of that head, where the binding principles can be applied in the familiar way. So, *him* (locally) o-commands the NP *a picture* on the ARG-ST list of *gave*, and through a chain of HEAD identities and selection (see (2ii) and (2iii)) it finally o-commands the coindexed name *John* within the extraposed PP, and Principle C is violated.

(25)



Elements within adjuncts, on the other hand, are never o-commanded by arguments outside of the adjunct, as I have explained in detail above. The nonextraposed version in (23a) is ruled out by Principle C under vc-command. The extraposed adjunct in (23b), however, escapes a vc-command relation. Even though the pronoun

him locally o-commands the NP *a picture,* it does not vc-command the coindexed name *John* because, under the assumption that constituents extraposed from within VP may adjoin to the VP, the NP *a picture* does not dominate the extraposed PP containing *John*. Note that when the pronoun is in the subject position, as in (26), adjunct extraposition does not circumvent a Principle C violation. This fact supports the suggestion by Culicover and Rochemont (1990), among others, that a constituent extraposed from an object must be adjoined to VP rather than S. Under this assumption, the sentences in (26) are correctly ruled out by the binding theory proposed here since the subject pronoun vc-commands the coindexed name within the extraposed adjunct.

(26) a. * She$_i$ invited many people to the party [that Mary$_i$ didn't know].
(Culicover and Rochemont, 1990, p. 28)

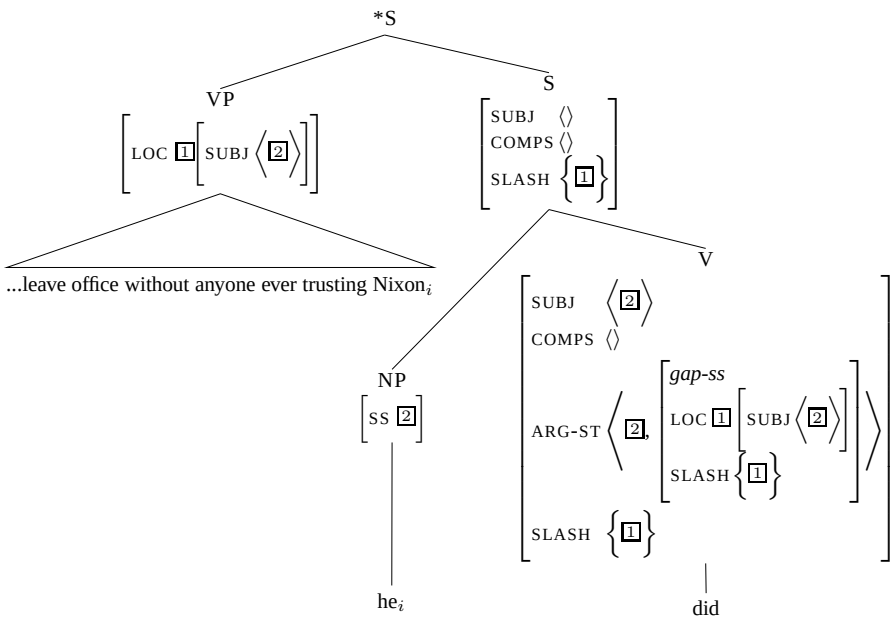
b. * She$_i$ told many people about the concert [who Mary$_i$ made nervous].
(Guéron and May, 1984, p. 10)

As the examples from Hukari and Levine (1995) in (27) demonstrate, (anti)reconstruction effects are not found in VP topicalization, an observation cited by Huang (1993) which goes back to Chomsky. In contrast to argument extraction (cf. (20b)), a Principle C violation is not circumvented when a VP is fronted that includes an adjunct that contains a name coindexed with the matrix subject pronoun.

(27) a. * . . . and leave office without anyone ever trusting Nixon$_i$ he$_i$ did.

b. * . . . and gather injunctions until Richardson$_i$ had every crook behind bars he$_i$ knew he$_i$ would.

(28)



On Huang's account, these contrasts follow from the VP-internal Subject Hypothesis. But the same effects also fall out from the proposed revision of the HPSG binding theory, as noticed by Hukari and Levine (1995). As shown in (28), the SUBJ specification of the fronted VP is structure-shared with the SUBJ specification of the VP gap, which in turn is structure-shared with the SYNSEM value of the subject pronoun *he*. Therefore, all these elements share their indices. Since the SUBJ specification of the fronted VP vc-commands any constituent dominated by that VP (according to (17i)), no element within it may bear the same index, as required by Principle C.

Finally, another outcome of the revised Principle C is that it correctly predicts the ungrammaticality of sentences as in (29). The offending name is in a relative clause that is contained within a VP complement. It is bound by the pronoun complement of the matrix verb under vc-command (see (17ii)), but not under o-command.

(29) * John seems to her$_i$ to have made a claim which Mary$_i$ resented.

To sum up, I have shown that the binding theory proposed here accounts for all of the problematic data given above concerning the behavior of adjunct-internal elements with respect to Principle C. In addition, it has some further benefits. It offers an account of the (anti)reconstruction effects and of the binding behavior in sentences with extraposition, VP topicalization, and VP complements. In the following section, I will address the question of whether Principle C is pragmatic in nature and provide evidence that refutes this claim.

6 Is Principle C pragmatic in nature?

It has been repeatedly suggested in the literature that Principle C should be explained in semantic/pragmatic rather than in syntactic terms (cf. Bolinger (1979); Bresnan (2001); Bouma et al. (2001); Kuno (1975); Bickerton (1975); McCray (1980); among others). Bresnan (2001) and Bouma et al. (2001), for example, provide contrasting pairs such as (30) and (31) to demonstrate that Principle C cannot be based on grammatical structure, or more specifically c-command, because in that case the (b)-sentences, which they assume to be structurally identical to the sentences in (a), would be incorrectly ruled out. They therefore suggest that pragmatic effects, theme/rheme conditions, and information structure must be taken into account, but they do not provide a specific analysis. Moreover, I am not aware of a pragmatic theory which covers all Principle C effects that has been integrated into HPSG.

(30) a. * She$_i$ was last seen when Lola$_i$ graduated from high school.
(cited from Reinhart (1983, p. 104) in Bresnan (2001, p. 227))

b. He$_i$'s imPOSSible, when Ben$_i$ gets one of his tantrums.
(cited from Bolinger (1979, p. 302) in Bresnan (2001, p. 227))

(31) a. * He$_i$ always gets angry when Sandy$_i$ is criticized.
(cited from Hukari and Levine (1996, p. 490) in Bouma et al. (2001, p. 44))

b. He$_i$ gets angry whenEVER the people Sandy$_i$ loves criticize him.
(Bouma et al., 2001, p. 44)

The proposals that have been provided in functionalist terms, for example, Kuno (1975), Bickerton (1975), Bolinger (1979), and McCray (1980), cannot adequately account for the coreference options of nonpronominals, as already noticed by Reinhart (1983). She carefully scrutinizes these approaches, notes that they either fail, are vague, or "not fully formalisable" (p. 98), and concludes that "[...] the fact that when there is a discrepancy between domain relations and functional relations coreference options follow the synactic requirements, indicates that coreference restrictions are determined by syntactic properties" (p. 100).[8]

In addition, as far as I am aware, the proponents of the pragmatic approach have not provided any careful syntactic analyses of the examples they discuss. Thus, they do not show that these data actually fall within the scope of Principle C and accordingly falsify a configurational binding theory. In the following, I will show that under a correct syntactic analysis of the sentences such as in (30) and (31), a configurational binding theory can indeed account for the contrast in coreference possibilities.

Consider Bolinger's example in (30b). In addition to it, Bolinger (1979, p. 302) provides the example shown in (32a), in which the temporal adjunct appears in the first position of the sentence. An adequate structural description is given in (32b), in which the *when*-clause is adjoined to S. Since such adjunct structures exist, and since, in principle, adjunct configurations are symmetrical, it follows that (33) is a plausible analysis for the sentence in (30b); that is, the sentence-final *when*-clause is also analyzed as a sentential adjunct.[9] This is additionally supported by phonological considerations. The sentence must be pronounced with an intonational break between the main clause and the subclause, which is typically indicated in written form by a comma. Under this analysis, sentences like (30b) and (31b) are not problematic for a configurational version of the binding theory. Since the names are within sentential adjuncts, they are not vc-commanded (or c-commanded) by the coindexed pronouns in the main clause, and Principle C is not violated.

(32) a. When he gets one of his tantrums, Ben is impossible.

b. [$_S$ [When he$_i$ gets one of his tantrums] [$_S$ Ben$_i$ is impossible]].

(33) [$_S$ [$_S$ He$_i$'s impossible] [when Ben$_i$ gets one of his tantrums]].

(34) * [$_S$ He$_i$ [$_{VP}$ always [$_{VP}$ gets angry [when Sandy$_i$ is criticized]]]]

[8]The reader is referred to Reinhart (1983), especially chapter 4, for her survey of functional approaches, which I cannot reproduce here for reasons of space.

[9]I thank an anonymous reviewer for pointing out to me this symmetry of adjunct configurations.

The *when*-clauses in (30a) and (31a), on the other hand, are analyzed as VP-adjuncts, as shown in (34). Hence, the name is vc-commanded by the coindexed subject pronoun of the main clause in violation of Principle C.

Further evidence that *when*-clauses can appear in different structural positions and thus behave differently with respect to Principle C is provided by Kazanina (2005, pp. 13-21). She argues that in the sentences in (35), the name in the *when*-clause and the pronoun in the matrix clause can be coreferential since the *when*-clause is a sentential rather than a VP-modifier. To justify her claim, Kazanina presents several arguments. First, she observes that the *when*-clauses in (35) contain a non-agentive event which is not controlled by the agent of the main clause and often causes surprise or even shock for that agent. Changing the content of the *when*-clause so that it expresses an agentive event results in decreasing acceptability of coreference between the two subjects, as shown in (36).

(35) a. He$_i$ had been staring at the control panel for over an hour when Jack$_i$ received a message from his commander.

b. He$_i$ was threatening to leave when Jack$_i$ noticed that the computer had died.

c. He$_i$ was about to place a few bets when Mike$_i$ was advised that the cops were in the bar.

(36) a. ?? He$_i$ had been staring at the control panel for over an hour when Jack$_i$ gave an order to his soldier.

b. * He$_i$ was threatening to leave when Jack$_i$ turned on his computer.

c. * He$_i$ was about to place a few bets when Mike$_i$ started singing a song.

Secondly, Kazanina claims that *when*-clauses have different statuses depending on the various interpretations of the word *when*.[10] These include an interpretation corresponding to the subordinator *while* and thus serving to provide the background for the main event (see (37a)), and an interpretation similar to *after*, which links the subclausal event expressing a cause to the main clause event that expresses the result of that cause (see (38a)). In both cases, *when* locates the event of the main clause inside the event of the embedded clause, and a *when*-question about the main event (see (37b)/(38b)) is felicitously answered by the sentence. As the (c)-sentences in (37) and (38) show, coreference between the pronoun in the main clause and the name within the *when*-clause is impossible in these cases.

(37) a. Mary was talking on the phone when John was cooking dinner.

b. When was Mary talking on the phone?

c. He$_{*i/*k}$ was talking on the phone when John$_i$ was cooking dinner for Mark$_k$.

[10] Kazanina (2005) refers to Moens and Steedman (1988) and Harris and Bates (2002), who noted that *when* is ambiguous and that its different interpretations depend on the different kinds of events that it links.

(38) a. Kate broke the glass when John kicked the door.
b. When did Kate break the glass?
c. * He$_i$ broke the glass when John$_i$ kicked the door.

In the sentences in (35), in which coreference is available, *when* functions as a coordinator with an interpretation like "and/but suddenly at that moment". The event in the main clause serves as a setting for the event expressed by the subordinate clause. According to Kazanina, these sentences are infelicitous as an answer to a corresponding *when*-question about the main event, even when coreference is not at issue, as the following question-answer pairs show:

(39) a. When had he been staring at the control panel?
b. Larry had been staring at the control panel for over an hour when Jack received a message from his commander.

(40) a. When was he threatening to leave?
b. Mark was threatening to leave when Jack noticed that the computer had died.

(41) a. When was he about to place a few bets?
b. Samuel was about to place a few bets when Mike was advised that the cops were in the bar.

The contrast in behavior between the sentences in (35) and (37)-(38) is unnatural if *when* has the same status in all of these sentences. However, Kazanina (2005) claims that it can be straightforwardly explained under the assumption that there are two different kinds of *when*. One functions as a sentential modifier that adjoins to IP (or S), and the other is a VP-modifier that adjoins to VP. So, when a question is asked about temporal properties of the VP that expects a VP-modifier as an answer, it follows naturally that the sentences in (35) and (39)-(41) are infelicitous as answers since the *when*-clauses here are sentential adjuncts. In addition, the differences in binding behavior are correctly predicted. In (37) and (38), *when* functions as a subordinator and adjoins to VP. Hence, coreference between the main clause subject and the name within the adjunct is ruled out by Principle C. In (35), *when* is similar to a coordinator and therefore reasonably adjoined to S, where it escapes a Principle C violation.

Kazanina (2005) and Kazanina et al. (2007) also provide psycholinguistic evidence that Principle C is syntactic in nature by investigating backwards anaphora in language development and in sentence processing. Based on a comprehension task with 3-6-year-old Russian speaking children, Kazanina (2005) shows that structural constraints on coreference, in particular Principle C, are respected by children already at the age of three. The Russian-specific discourse constraint on backwards anaphora, on the other hand, becomes operative in the child's grammar only at the age of 5-6. In real-time processing, the findings from several online self-paced reading studies on English and Russian reveal that backwards anaphora dependencies are processed with a grammatically constrained active search mechanism. This

means that when the parser encounters a cataphoric pronoun, it actively searches for an antecedent in the following material. Importantly, during this search, it does not consider positions that are excluded by Principle C. Additionally, results from offline acceptability rating experiments show that judgments of coreference are degraded when a pronoun c-commands its antecedent (Kazanina, 2005; Kazanina et al., 2007).

Summarizing the discussion, the data that have been claimed to undermine the structural account of Principle C stop being problematic once they are carefully analyzed and a proper syntactic structure is provided. Results from psycholinguistic investigations show that structural constraints on coreference exert an influence at the earliest stage of language development and real-time processing. I therefore conclude that there is no strong evidence against the syntactic nature of Principle C.

7 Conclusion

In this paper, I have argued, following Hukari and Levine (1995), that structural configurations must be taken into account in order to capture the intricate binding-theoretic interactions between adjunct-internal and main clause elements, which are not predicted by P&S-94's binding theory. To this end, Hukari and Levine introduced the configurational relation of vc-command and reformulated Principle C so that it prohibits coindexation under both relations, o-command and vc-command. Phenomena such as the (anti)reconstruction and VP topicalization effects fall out from this revision. I have developed Hukari and Levine's approach further and proposed a refinement of the definition of vc-command. My proposal has four benefits: First, my revised definition of vc-command does not involve a modality, and secondly, it motivates the superior role of the subject in binding. Thirdly, I have proposed crucially different interactions of the relations of o-command and vc-command with fillers (including extraposed constituents). Fourthly, I have provided new data that strongly support the proposed revision of the HPSG binding theory. Finally, I have shown that, once they are correctly analyzed, the data that have been provided against a syntactic account of Principle C can be explained straightforwardly by the configurational binding theory proposed here.

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A construction-based cross-linguistic analysis of V2 word order

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Abstract

Verb second (V2) word order is determined by considering the absolute position of clausal constituents. Previous accounts of such word order in HPSG have been developed for individual V2 languages (predominantly German) but are often not cross-linguistically applicable. I propose a set of generalized mechanisms in linearization-based SBCG which accounts for cross-linguistic V2 data by use of: (1) a simple two-valued feature rather than many-typed topological domains, (2) domain compaction, and (3) constructionally-determined domain positions. Not only does this analysis account for V2 placement, but it can also model verb third (V3) placement and other positionally-stipulated word orders.

1 Introduction

Verb second (V2) word ordering is defined by the appearance of the finite verb in the second position, determined by considering the absolute position of all clausal constituents. Such clauses exhibit a degree of flexible constituent order allowing a variety of elements, such as the subject or objects, to appear in the single position before the finite verb. Thus, it often becomes difficult to characterize such languages as SVO or OVS, as there are many possible permutations of syntactic elements, that is, there may be no dominant word order (cf. Dryer, 2011). This interplay between relatively free word order and a positionally-strict verbal position provides a challenge for syntactic analyses, particularly those based on phrase structure grammars.

The V2 phenomenon is most thoroughly examined and associated with German. However, there are other languages, including non-Indo-European ones, which also attest this type of word ordering. In order to provide a complete account of the phenomenon, these additional languages require equal examination so that a full characterization of V2 as a cross-linguistic phenomenon may be developed. As such, the syntactic structures of a genealogically broad sampling of V2 languages are considered, including Breton, German, Ingush, Karitiâna, Kashmiri, and Yiddish.

Using the insight from this language sampling, which is briefly summarized in this paper, it is possible to determine the syntactic structures which account for the occurrence of V2 word order and the degree to which these structures are shared among the languages, consequently enabling cross-linguistic generalizations of the phenomenon as a whole to emerge. These generalizations will be formalized in a linearization-based (Reape, 1994, 1996; Kathol and Pollard, 1995; Müller, 1996; Kathol, 2000) version of Sign-Based Construction Grammar (SBCG) (Sag, 2010;

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Boas and Sag, to appear). This combination is particularly well suited to describe V2 languages because it both allows flexible constituent order via domains and linear precedence rules as well as the definition of constructions to restrict the positioning of clausal elements.

The analysis presented in this paper advocates the use of minimally-defined constructions which capture the constraints of this cross-linguistic word order phenomenon while remaining compatible with other language-dependent constructions and rules. This approach is in contrast to other analyses which utilize more restrictive mechanisms, such as topological fields, or extraction schemata and instead directly generalizes the structures attested in cross-linguistic data.

To begin, I will present a brief summary of the clause structures in the sampling of V2 languages and provide pertinent data in §2. In §3 previous analyses for V2 word order will be examined, and then in §4 I will describe a generalized construction-based analysis highlighting the mutually shared linearization mechanisms of the languages.

2 Verb Second Clause Structure

The constituent order of V2 languages is often relatively flexible, which allows many options for the linearization of elements. Naturally there are often pragmatic factors which control the order, but syntactically many variants are permissible. However, in all permutations, the finite verb is restricted to a particular position, such as the second position immediately after a single constituent, and may not be displaced like the other clausal elements. The example in (1) illustrates this interaction between flexible constituent order and the restriction of the finite verb to the second position, where the finite verb is shown in boldface.

(1) a. Peter **wollte** dem Jungen das Buch schenken.
Peter want.3SG.PST the.DAT boy.DAT the.ACC book give.INF

b. Dem Jungen **wollte** Peter das Buch schenken.

c. Das Buch **wollte** Peter dem Jungen schenken.

d. Schenken **wollte** Peter dem Jungen das Buch.

'Peter wanted to give the book to the boy.' *German* (Uszkoreit, 1987, 156)

In this particular German sentence, which characterizes V2 clause structure, the finite verb is consistently after exactly one constituent while all other elements may be flexibly placed with respect to syntactic constraints. Formally, following the definition by Anderson (2005, 179), a V2 clause is characterized by the verb with tense, mood, and agreement properties, if available, (i. e. the finite verb) appearing in the second position immediately after one constituent.

Although this V2 phenomenon is most cited with Germanic languages, most notably German but including Danish, Dutch, Icelandic, and Yiddish, among others, it also occurs in other non-Germanic languages such as Breton (Celtic), Ingush

(Nakh-Daghestanian), Karitiâna (Tupian), Kashmiri (Indic), and Romansch (Romance) as illustrated by examples (2)–(4). Additionally, the sentence in (4) shows how the first element may be an entire clause.

(2) akhbaar **por** laRkan raath
newspaper read boy yesterday
'It was the newspaper that the boy read yesterday' *Kashmiri* (Bhatt, 1999, 137)

(3) he boued **e** **tebr** Mona er gegin
her food PRT eat.3SG Mona in.the kitchen
'Mona eats her food in the kitchen' *Breton* (Press, 1986, 197)

(4) [boroja taso oky tykiri] **Ø-naka-hyryp-Ø** õwã
snake man kill PFV 3-PRT-cry-NFUT child
'When the man killed the snake, the child cried.' *Karitiâna* (Storto, 2003, 414)

2.1 Clause type asymmetries

Even though a language may employ V2 word order, it may not be applied to all clause types. That is, subordinate and question clauses, among others, may exhibit different finite verb placements than verb second positioning. For example, the Kashmiri sentence in (5) contains a subordinate clause which maintains V2 word order, not including the subordinator, however the Breton sentence in (6) attests a verb initial subordinate clause word order. The difference between verb placement in main and subordinate clauses is often called *root-subordinate asymmetry*, because each clause type exhibits different finite verb placements, but differences also extend beyond just these two clause types. Thus, the position of the finite verb is patterned by the clause type and is a necessary component of sentence structure for a V2 language.

(5) tem-is chu afsoos [ki yi kitaab **cha-yi**
he-DAT be.3SG.M regret.PRS.PTCP that this book be.F-2SG
tse par-mets]
you.F.SG.ERG read-PST.PTCP
'He regrets the fact that it is this book that you have read.' *Kashmiri* (Bhatt, 1999, 100)

(6) gwelout a reas Lenaig [**e** **save** an dour]
see.INF PRT do.PST.3SG Lenaig PRT rise.PST.3SG the water
'Lenaig saw the water was rising.' *Breton* (Stephens, 2002, 399)

2.2 Verbal elements

Although the finite verb must appear in the second position of a V2 clause, the non-finite verbs are realized in many different locations. For instance, Ingush,

like German, places non-finite verbs at the end of a clause as in (7), but Breton commonly places the non-finite verbs either in the first position or immediately after the finite verb as in (8).

(7) Muusaa **vy** hwuona telefon *jettaxh*
Musa V.PROG you.SG.DAT telephone strike.CVB
'It's Musa on the phone for you.' *Ingush* (Nichols, 2009)

(8) E voued **en** **deus** *debret* Yann er wetur
his food 3SG.M have.PRS.3 eat.PST.PTCP Yann in.the car
'Yann has eaten his food in the car.' *Breton* (Press, 1986, 200)

Non-finite verbs have more flexibility in Yiddish and may appear in any position, that is, immediately after the finite verb, between arguments and adjuncts as in (9), or at the end of the clause. Additionally some V2 languages have constructions which allow non-finite verbs to be placed in the first position either alone or in groups such as a partial verb phrase like in example (10).

(9) m'**hot** durx ale fentster *arojssgehangn* weʃ
one=have.3SG through all windows out.hung.PST.PTCP laundry
'Out of all the windows one hung the laundry.' *Yiddish* (Weissberg, 1988, 153)

(10) [Das Buch *schenken*] **wollte** Peter dem Jungen.
the.ACC book give.INF want.PST.3SG Peter the.DAT boy
'Peter wanted to give the book to the boy.' *German* (Uszkoreit, 1987, 156)

2.3 Multiple first elements

In other instances, clause types may display a similar verb third (V3) order as with the sentences in (11) and (12) where the finite verb appears in the third position after two initial constituents. The German example presents an alternative word order from the usual V2 for main clauses. However, the Kashmiri content question clause must be V3 where a single constituent as well as the question word appear before the finite verb.

(11) [Zum zweiten Mal] [die Weltmeisterschaft] **errang** Clark 1995
the.DAT second time the world.championship win.1SG.PST Clark 1995
'Clark won the world championship for the second time in 1995.' *German* (Beneš, 1971) quoted from (Müller, 2005b)

(12) raath kyaa **dyut-na-y** rameshan
yesterday what.NOM give.PST.M.SG-3SG.ERG-2SG.DAT Ramesh.ERG
tse
you.DAT
'As for yesterday, what is it that Ramesh gave you?' *Kashmiri* (Bhatt, 1999, 107)

Additionally, even more elements could appear before the finite verb in certain contexts to form clause orders of V4, V5, and so forth (cf. Müller, 2003).

2.4 Summary

The data presented in the previous sections show the typical form of a V2 clause, that finite verb placement is dependent upon the clause type, and that the positioning of non-finite verbs varies in each language. Table 1 summarizes the possible finite verb placements by clause type for six V2 languages examined in an extensive typological survey[1] which I undertook. The new analysis of V2 word order presented in §4 generalizes the syntactic structures from this survey.

	Main:		Subordinate:		Question:	
	Affirmative	Negative	Content	Relative	Content	Polar
Breton	V2	V_I(V2)	V_I	V_I(V2)	V2	V2(V3/V_I)
German	V2(V3)	V2(V3)	V_F(V_I)	V_F	V2	V_I
Ingush	V2(V3)	V2	V_F	V_F	V2	V2
Karitiâna	V2/V_I(V3)	V2/V_I	V_F	V_F	V2	V2/V_I
Kashmiri	V2	V2	V2	V_F	V3	V2(V_I/V3)
Yiddish	V2(V3)	V2	V2	V2(V_I)	V2	V_I(V2)

Table 1: Verb placement in various clause types. Non-basic alternative word orders appear in parentheses. (V_I = verb initial and V_F = verb final)

3 Previous Analyses

Previous analyses of V2 word order in HPSG (Pollard, 1996; Kathol, 2000; Borsley and Kathol, 2000; Richter and Sailer, 2001; Müller, 2002) generally fall somewhere on the spectrum between a purely linearization and extraction-based approach. The extraction-based approach accounts for flexible constituent order by motivating the movement or displacement of constituents to other locations in a clause by the application of additional phrase structure schemata. This most notably occurs with the movement of a single constituent to the first position immediately before the finite verb of a V2 clause. The linearization-based account posits the separation of syntactic structure and surface word order via *word order domains* (Reape, 1994, 1996). This separation allows the stipulation of a constituent's location without needing to motivate a parallel process in the syntactic structure. Thus, a single constituent's domain may be relegated to the first position without modifying the clause's phrase structure. This approach reflects the intuition that the same syntactic processes occur despite linear order.

[1]The sources for the typological survey include: Bhatt (1999), Borsley and Kathol (2000), Dudenredaktion (2005), Jacobs et al. (1994), Landin (1982), Landin (1984), Müller (2003), Nichols (2009), Press (1986), Stephens (2002), Storto (2003), Uszkoreit (1987), Wali and Koul (1997), Weissberg (1988)

Collectively these analyses all draw upon a common set of mechanisms to account for V2 clause structure: word order domains, linear precedence rules, an INVERTED feature, SLASH, topological fields, and constructions. Yet some of these mechanisms are redundant and perform similar functions. For example, the INVERTED feature and SLASH as well as domains and linear precedence (LP) rules both allow variety in the linear realization of elements. Similarly, topological fields and constructions both provide the means to constrain clausal elements in particular configurations.

The analysis I propose here follows a more strict linearization-based approach than previous analyses and requires no local extraction to the first position to account for V2 word order or a HEAD-FILLER SCHEMA to mark the topological field of the first element. Furthermore, in order to avoid the redundancies among many of the syntactic mechanisms and to provide an appropriately flexible yet succinct description which generalizes the linearization behavior of all V2 languages, I utilize only word order domains, LP rules, and constructions to stipulate clause-internal word order. This means I do not employ a topological field model or, in the case of a V2 clause, extraction via the HEAD-FILLER SCHEMA to the first position. I examine this selection of mechanisms in the next two sections.

3.1 Problems for topological fields

The topological field model, drawn from traditional grammar, provides a precise and accurate way in which to describe the word order of German. But this model becomes problematic when it is applied to other languages (cf. Kathol, 2000, 285) and increases the difficulty for cross-linguistic generalization. Consider the traditional order of topological fields for German cast into LP rules in (13) by Kathol (2000, 79), which describes the word order placement fields of a sentence.

(13) TOPOLOGICAL LP STATEMENT
Vorfeld $\prec$ *complementizer field* $\prec$ *Mittelfeld* $\prec$ *verb cluster* $\prec$ *Nachfeld*

This typological field schema presents the following problems when accounting for word order in the V2 languages reviewed in §2:

Competition between finite verb and complementizer In order to account for *root-subordinate asymmetries* (cf. §2.1), the finite verb and complementizer compete for the *complementizer field* (i. e. the second position): Only one of these elements may occupy the field and the complementizer takes precedence. If a complementizer is present, then the finite verb must appear in the only other verbal field, the *verb cluster* (i. e. clause final position). But in the case of a main clause, which has no complementizer, the finite verb is realized in the *complementizer field*. This competition describes clausal word order in asymmetric V2 languages, like German, but is inaccurate for symmetric languages like Yiddish and Kashmiri. In these languages the finite verb always appears in the *complementizer field* and the complementizer appears before the *Vorfeld* (i. e. the first position).

Non-finite verbs This model places all non-finite verbal elements in the *verb cluster*. But, Karitiâna and Breton often maintain a linearly contiguous verb phrase, in which case all the verbs, including non-finite ones, remain in the second position.

Post-verbal objects In some V2 languages, such as Yiddish, non-finite verbs may appear as a group among the non-verbal elements and not clause final. That is, non-verbal elements may appear both before and after the *verb cluster* thus effectively splitting the *Mittelfeld*. Because the *Nachfeld* in the topological field schema is for extraposed elements, there is no place to put objects after the non-finite verbs.

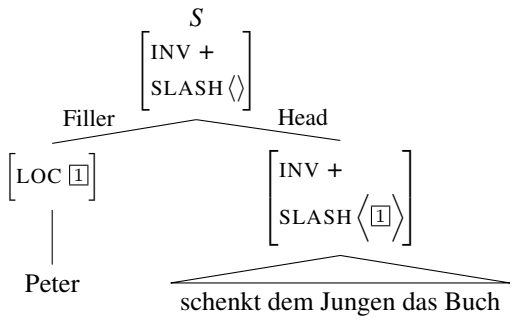
Thus, it is hard to extend this topological model, which was originally intended for German, to other V2 languages. Various modifications have been proposed to adapt the topological field model to other languages (Kathol, 2000; Borsley and Kathol, 2000), but no uniform and generalized model exists for all V2 languages. So, it is unclear if such a model may be used when describing a generalized V2 word order placement. Instead, I use constructions in my analysis to determine the clausal positions of constituents.

3.2 Problems for extraction

Many analyses utilize the HEAD-FILLER SCHEMA to front a constituent before a clause-initial finite verb to effectively produce V2 word order as a result of extraction,[2] which is illustrated in Figure 1. The INVERTED feature is also used in this example to displace the finite verb *schenkt* 'gives' from clause final position to clause initial. The HEAD-FILLER SCHEMA is typically associated with a class of constructions that link a filler to an arbitrarily embedded gap such as topicalization, relative clauses, and wh-interrogatives, all of which license otherwise impossible word orders, particularly in English. However, given the flexible constituent order of V2 languages and the ability of constituents to shuffle under normal circumstances as *word order domain* elements, it is possible to realize V2 word order without this schema.

The HEAD-FILLER SCHEMA subsumes a set of constructions which allow unbounded extraction, that is, the realization of arbitrarily embedded elements in an alternative location, usually clause initial. For example, non-subject wh-interrogatives in English are realized as a filler in the first position. However, subject wh-interrogatives are a type of SUBJECT-HEAD CONSTRUCTION (cf. Sag, 2010, 533) and do not require extraction to alter word order. Similarly, because word order domains allow any clausal element to appear in the first position via shuffling in V2 clauses, the HEAD-FILLER SCHEMA need not be employed to alter word order and realize the initial element.

[2] Although the analysis proposed by Kathol (2000) uses domains and LP rules to realize an element in the *Vorfeld*, this element is assigned to the *Vorfeld* by virtue of being the filler of the HEAD-FILLER SCHEMA (p. 85)



"Peter gives the boy the book."

Figure 1: Accounting for V2 with extraction.

There is cross-linguistic evidence which indicates that all wh-interrogatives, even subject ones, are reflected in the morphosyntax as extraction phenomena (Hukari and Levine, 1995; Bouma et al., 2001), which could indicate that first elements should be extracted. For instance, Yiddish verb inversion in embedded relative clauses (Diesing, 1990) is cited as part of this evidence, where the expletive *es* appears in the first position (after the wh-interrogative) before the finite verb in the absence of any other element. For instance, in (14a) an expletive is inserted to maintain the V2 word order of the subordinate clause, that is, the extracted wh-interrogative is unable to fill the first position as only local elements may satisfy the V2 word order requirements.

(14) a. Ikh veys nit [ver es **iz** gekumen].
I know.1SG not who.NOM EXPL be.3SG come.PST.PTCP
b. *Ikh veys nit ver iz gekumen.
'I don't know who came.' *Yiddish* (Diesing, 1990, 68)

(15) Ver **hot** gegesn dos broyt?
who.NOM have.3SG eat.PST.PTCP the bread
'Who ate the bread?' *Yiddish* (Diesing, 1990, 52)

However, this expletive is not used in content question clauses, which also utilize wh-interrogatives as in (15). Here the wh-interrogative is indeed able to fill the first position, reserved for local elements, thus suggesting that extraction is not used to license this clause. Thus, is seems that the obligatory extraction of a particular element is clause specific and should not be reflected in the basic mechanisms for the realization of V2 word order.

Finally, if the HEAD-FILLER SCHEMA were utilized to realize the first element of a V2 clause, it is unclear where this construction would appear in a FILLER-HEAD CONSTRUCTION hierarchy as illustrated in Figure 2. None of these constructions appropriately predict V2 in all of its instances. A TOPICALIZATION CONSTRUCTION would indeed allow V2 word order but also includes the corresponding prosodic and pragmatic information associated with topicalization, which

are not appropriate for pragmatically focused constituents or elements with no emphasis, in particular, expletives. For instance, the expletive 'es' in German may appear locally in the first position as in (16a), however, it may not be topicalized to a matrix clause as shown in (16c).

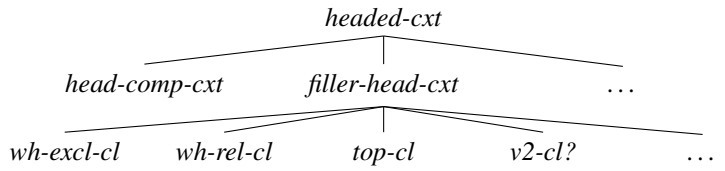


Figure 2: Placement of a V2-FILLER-HEAD-CONSTRUCTION.

(16) a. Es regnet in der Stadt.
EXPL rain.3SG.PRS in the city
'It is raining in the city.' *German*

b. [In der Stadt]$_i$ sagt er, dass es $_{-i}$ regnet.
in the city say.3SG.PRS he COMP EXPL rain.3SG.PRS
'In the city, he said, that it's raining.' *German*

c. *Es$_i$ sagt er, dass $_{-i}$ in der Stadt regnet.

So, some V2-FILLER-HEAD CONSTRUCTION would need to be posited to allow V2 word order without any additional prosodic or pragmatic information. Additionally, because the first element must be realized clause internally (i.e. it may not appear in a higher matrix clause), this V2-FILLER-HEAD CONSTRUCTION would need to be constrained so that the filler could not cross clausal boundaries so that it would in fact be a bounded dependency. Such constraints are clearly very different than those of the TOPICALIZATION CONSTRUCTION. Thus, a HEAD-FILLER SCHEMA approach would require the definition of at least two nearly identical constructions.

The analysis I propose here avoids the over-generalization of extraction as well as the redundancies between HEAD-FILLER SCHEMAS and word order domains to realize V2, and instead captures the V2 word order by using only word order domains. Unbounded dependencies still exist under my analysis and are compatible with a V2 clause (cf. §4.2.1), but extraction is not necessary to realize V2.

4 Constructionally-Determined Word Order

Conceptually, the generalized analysis I propose here places all constituents of a clause into a *word order domain*. These domain elements are by default *flexible*, that is, able to shuffle, via Reape's shuffle operator '◯', and produce a variety of word orderings from a single set of domains. However, constructions may place positional restrictions on particular domain elements by specifying that they are *fixed* and stipulating their linear position within a clause. Linear precedence rules

may only affect *flexible* domain elements and do not interact with *fixed* elements. In this way, free word order and strict positional stipulations may simultaneously exist within a single clause. Thus, a V2 construction would specify that the finite verb is *fixed* and must appear in the second position. All other *flexible* elements may then shuffle around this *fixed* verb, which is exempted from linear precedence constraints.

Formally, I describe this generalized analysis within the Sign-Based Construction Grammar (SBCG) framework (Sag et al., 2003; Sag, 2010; Boas and Sag, to appear). As such, I incorporate *domains* into the structure of a *sign*, like Reape (1994, 1996), via a DOM attribute which itself is a list of *signs*. Re-formulating the *Constituent Ordering Principle*, as shown in (17), a *sign's* FORM is then the concatenation of the FORM values of its domain elements.

(17)
$$\textit{sign} \Rightarrow \begin{bmatrix} \textsc{form}\ \mathrm{L}_1 \oplus \mathrm{L}_2 \oplus \ldots \oplus \mathrm{L}_n \\ \textsc{dom}\left\langle \left[\textsc{form}\ \mathrm{L}_1\right], \left[\textsc{form}\ \mathrm{L}_2\right], \ldots, \left[\textsc{form}\ \mathrm{L}_n\right] \right\rangle \end{bmatrix}$$

In §4.1 I will first describe the generalized mechanisms necessary for a construction-based analysis of V2 word order: (1) a simple two-valued feature rather than many-typed topological domain elements, (2) domain compaction, and (3) constructionally-determined domain positions. Then, in §4.2 I will outline grammar fragments to illustrate how these mechanisms license clause structure in V2 languages.

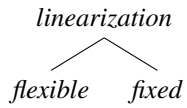
4.1 Generalized Mechanisms

4.1.1 Two-typed domain elements

In order to facilitate the division between *flexible* and *fixed* domain elements, I introduce a new attribute LIN with *linearization* values: *flexible* and *fixed*, as depicted in (18). This LIN attribute is part of a domain *sign* and has a default value of *flexible* defined by the constraint in (19). *Persistent Default Unification*, as described by Lascarides and Copestake (1999), is employed to ensure that the default value remains a part of the feature structure during unification and may be realized in a fully licensed construct when no other value overrides it, namely *fixed*. That is, unless otherwise specified, the *linearization* value of a domain element in a construct is *flexible*. The *fixed* value is only assigned by constructions to override the default *flexible* value. [3]

[3] It may be desirable to avoid using defaults, which could be done in two ways: (1) Some elements could be lexically marked *fixed* leaving all others underspecified. However, the same element may be *fixed* in one construction but *flexible* in another. Also, there should be no underspecified LIN attributes in a fully licensed clause so that the LP rules, which only affect *flexible* elements, behave properly. (2) Constructions could explicitly specify all potential elements as *fixed* or *flexible*, which means many clause constructions would stipulate lists of *flexible* elements to account for any other possible items. This ensures that all domain elements do not remain underspecified. But in order for the word order constructions defined here to appropriately interact with each other and correctly

(18)



(19) $\textit{sign} \Rightarrow \left[\text{DOM } \textit{list}\left(\left[\text{LIN } /\textit{flexible}\right]\right)\right]$

In this way, linear precedence rules may only affect domain elements with a LIN value of *flexible*, as illustrated by the sample LP rule in (20). This allows *fixed* domain elements to remain in a constructionally-determined position without affecting the placement of the other *flexible* elements.

(20) $\begin{bmatrix}\text{LIN} & \textit{flexible} \\ \text{FOCUS} & - \end{bmatrix} \prec \begin{bmatrix}\text{LIN} & \textit{flexible} \\ \text{FOCUS} & + \end{bmatrix}$

4.1.2 Domain compaction

Following Reape, there are two kinds of DOMAIN CONSTRUCTIONS: LIBERATING, which keeps the daughter domain elements of a construction independent in the mother, and COMPACTING, which, like Kathol and Pollard (1995) and Donohue and Sag (1999), creates a *single* new domain element in which all the daughter domain elements may still shuffle. Compaction allows LP rules to still affect the order of the domain elements in the mother's domain, but forces them to act as a single unit in any further construction. Thus, the compacting mechanism enables multiple elements, when appropriate and specified by language-specific constructions, to form a single domain element which may appear in a single constructionally-determined domain position.

(21) a. $\textit{liberating-domain-cxt} \Rightarrow \begin{bmatrix}\text{MTR} & \left[\text{DOM } \text{L}_1 \bigcirc \ldots \bigcirc \text{L}_n\right] \\ \text{DTRS} & \left\langle\left[\text{DOM } \text{L}_1\right], \ldots, \left[\text{DOM } \text{L}_n\right]\right\rangle\end{bmatrix}$

b. $\textit{compacting-domain-cxt} \Rightarrow \begin{bmatrix}\text{MTR} & \left[\text{DOM } \left\langle\left[\text{DOM } \text{L}_1 \bigcirc \ldots \bigcirc \text{L}_n\right]\right\rangle\right] \\ \text{DTRS} & \left\langle\left[\text{DOM } \text{L}_1\right], \ldots, \left[\text{DOM } \text{L}_n\right]\right\rangle\end{bmatrix}$

Compaction is vital for an analysis of flexible word order because it allows the definition of linear constituents which may not correspond to the phrase structure. This distinction is particularly salient with partial compaction (Kathol and Pollard, 1995; Yatabe, 1996), a mixture of the liberating and compacting domain constructions where only some of the daughter domains are compacted. This type of compaction is further explored in §4.2.1.

license clauses, they must remain silent about these other items. So, defaults seem to be necessary. Yet, it may still be possible to avoid defaults with method (2), which is compatible with the theory presented here. This is something which warrants further investigation.

4.1.3 Cross-linguistic constructions

Drawing from the constructional approach taken by Kathol (2000, Ch.7), my analysis similarly constrains clauses by a combination of *linear* and *sentence mode* constructions. Using the attested linearization patterns in V2 languages, I propose a general set of common clausal constructions for word order determination, provided in Figure 3, which describe the mutually occurring syntactic constraints in all V2 languages. The *sentence mode* constructions license various clause types such as declarative, relative, and interrogative. And as illustrated in §2.1, the clause type patterns the position of the finite verb in a clause, thus making the *sentence mode* a necessary component when specifying linear order. Each language independently stipulates the combination of *linear* and *sentence mode* constructions which license a complete clause.

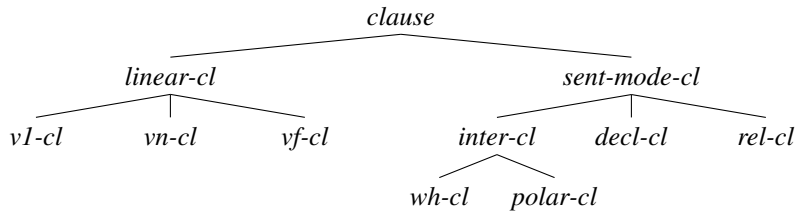


Figure 3: Hierarchy of clausal constraints common to all V2 languages.

The linear clause constraints are formally defined by the rules in (22)–(24). Each of these constructions explicitly states the location of the domain for the finite verb. The V1 and VF-CLAUSE CONSTRUCTIONS straight-forwardly stipulate that the domain element with the finite verb form must appear either clause initially or finally, respectively. Notice that the finite verb domain element is constructionally stipulated to be *fixed* and may be a phrase, that is, a complex predicate.

(22) a. In a verb initial clause, the domain element with the finite verb appears *before* all other domain elements.

b. $$\textit{v1-cl} \Rightarrow \left[\text{MTR}\left[\text{DOM}\left\langle\left[\begin{array}{ll}\text{LIN} & \textit{fixed}\\ \text{SYN} & \left[\text{CAT}\left[\text{VFORM}\ \textit{finite}\right]\right]\end{array}\right]\right\rangle \oplus \ldots\right]\right]$$

(23) a. In a verb final clause, the domain element with the finite verb appears *after* all other domain elements.

b. $$\textit{vf-cl} \Rightarrow \left[\text{MTR}\left[\text{DOM}\ \ldots \oplus \left\langle\left[\begin{array}{ll}\text{LIN} & \textit{fixed}\\ \text{SYN} & \left[\text{CAT}\left[\text{VFORM}\ \textit{finite}\right]\right]\end{array}\right]\right\rangle\right]\right]$$

The VN-CLAUSE CONSTRUCTION in (24) must not only specify the position of the finite verb domain element, but must also limit the number and types of elements that precede it so that V2 or V3 may be realized. In the absence of any

other constructions to specify *fixed* domain elements before the finite verb, only one element appears before the verb, namely a *flexible* element, thus creating V2 word order. If there is an additional construction specifying *fixed* elements before the finite verb, it then becomes possible to define V3 word order or, for that matter, V4, V5, and so on. The VN-CLAUSE CONSTRUCTION is remarkable in that it licenses all placements of the finite verb in some nth position from the beginning of a clause in exactly the same way.

(24) a. In a clause which positions the finite verb domain element in the nth position from the beginning, the finite verb is preceded by exactly one *flexible* domain element and any number of *fixed* domain elements, in any order, and followed by all other domain elements.

b. $$\textit{vn-cl} \Rightarrow \left[\textsc{mtr}\left[\textsc{dom}\left(\textit{list}\left(\left[\textsc{lin}\ \textit{fixed}\right]\right) \bigcirc \left\langle\left[\textsc{lin}\ \textit{flexible}\right]\right\rangle\right) \oplus \left\langle\left[\begin{array}{ll}\textsc{lin} & \textit{fixed}\\ \textsc{syn} & \left[\textsc{cat}\left[\textsc{vform}\ \textit{finite}\right]\right]\end{array}\right]\right\rangle \oplus \ldots\right]\right]$$

Finally, for all V2 languages which attest complementizers, these elements are not shuffled with a clause's word order domains and must instead be positionally stipulated by the COMPLEMENTIZER CONSTRUCTION as shown in (25), which is like the HEAD-FUNCTOR CONSTRUCTION. This construction concatenates a *fixed* complementizer domain to the beginning of a saturated clause's domain list. Here, SELECT indicates which expression the complementizer modifies, following Sag (to appear). Thus, the correct position of the complementizer is specified without interfering with a clause's word order. This separate COMPLEMENTIZER CONSTRUCTION is posited in order to avoid overgeneralizing the values of the LINEARIZATION features in other HEAD-FUNCTOR CONSTRUCTIONS.

(25) $$\textit{complementizer-cxt} \Rightarrow \left[\begin{array}{l}\textsc{mtr}\left[\begin{array}{l}\textsc{syn}\ \mathrm{X}\\ \textsc{dom}\ \mathrm{L}_1 \oplus \mathrm{L}_2\end{array}\right]\\ \textsc{dtrs}\left\langle\left[\begin{array}{l}\textsc{syn}\left[\textsc{cat}\left[\begin{array}{l}\textit{comp}\\ \textsc{select}\ \mathrm{H}\end{array}\right]\right]\\ \textsc{dom}\ \mathrm{L}_1\!:\!\left\langle\left[\textsc{lin}\ \textit{fixed}\right]\right\rangle\end{array}\right], \mathrm{H}\!:\!\left[\begin{array}{l}\textsc{syn}\ \mathrm{X}\!:\!\left[\begin{array}{l}\textsc{cat}\left[\textsc{vform}\ \textit{finite}\right]\\ \textsc{val}\ \langle\rangle\end{array}\right]\\ \textsc{dom}\ \mathrm{L}_2\end{array}\right]\right\rangle\\ \textsc{hd-dtr}\ \mathrm{H}\end{array}\right]$$

4.2 Language-specific clause licensing

The use of the generalized mechanisms to describe the clause structure in a particular language may be illustrated by a fuller hierarchy of PHRASAL CONSTRUCTIONS in Figure 4. The HEADED CONSTRUCTIONS, adopted from SBCG (Sag, 2010, to appear), are not necessarily shared among V2 languages, but illustrate where they

may exist in the phrasal hierarchy. Two variants of the HEAD-COMPLEMENT CONSTRUCTION are used: The PREDICATIONAL CONSTRUCTION combines a head with one or more of the items on its VALENCE list, but not all. Whereas the SATURATIONAL CONSTRUCTION combines a head with all of the remaining elements on its VALENCE list and licenses a complete clause. Thus, constructs may now be fully licensed by a combination of HEADED, DOMAIN, LINEAR-CLAUSE, and SENTENCE-MODE-CLAUSE CONSTRUCTIONS.

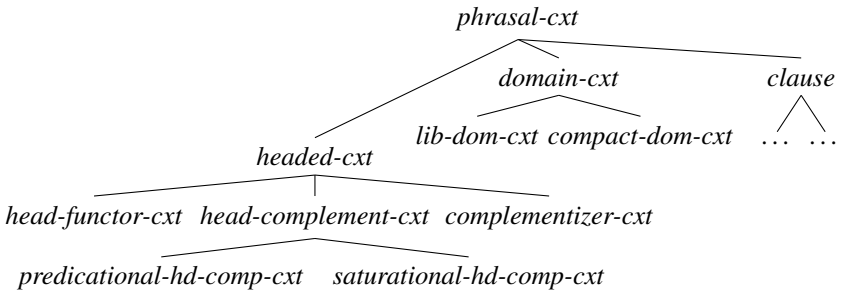


Figure 4: Partial hierarchy of phrasal constructs for V2 languages.

I will first briefly illustrate the use of the generalized mechanisms to license various word order phenomenon in German in §4.2.1, as this will enable an easy comparison to previous analyses. Then in §4.2.2 I will sketch out analyses in Kashmiri and Breton.

4.2.1 German

Consider the clausal hierarchy for German in Figure 5, which utilizes the common clausal constraints from Figure 3.[4] The bottom row in this hierarchy represents a sampling of complete clause constructs, which are a combination of the *linear* and *sentence-mode* types.

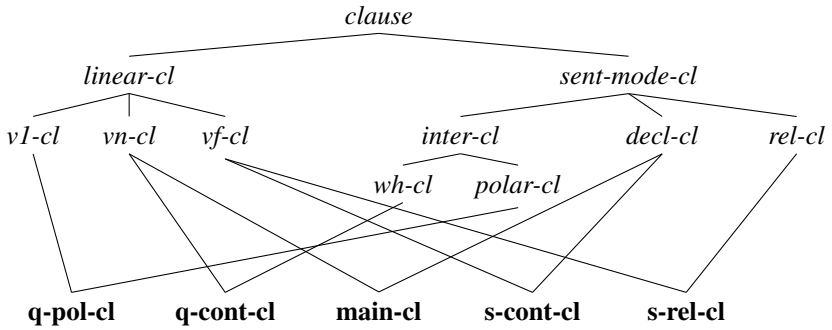


Figure 5: Partial hierarchy of clausal constructs for German.

[4]In all clausal hierarchies the following abbreviations are used to conserve space: s(ubordinate), cont(ent), rel(ative), q(uestion), pol(ar).

Given the language-specific phrasal constructions in (26), which also contain generalized constructions discussed in §4.1, it is possible to license a V2 main clause such as in example sentence (1b).

(26) Some PHRASAL CONSTRUCTIONS for German

a. *lib-pred-hd-comp-cxt* ⇒ *predicational-head-complement-cxt* ∧ *liberating-domain-cxt*

b. *main-lib-sat-hd-comp-cl* ⇒ *saturational-head-comp-cxt* ∧ *declarative-cl* ∧ *liberating-domain-cxt* ∧ *vn-cl*

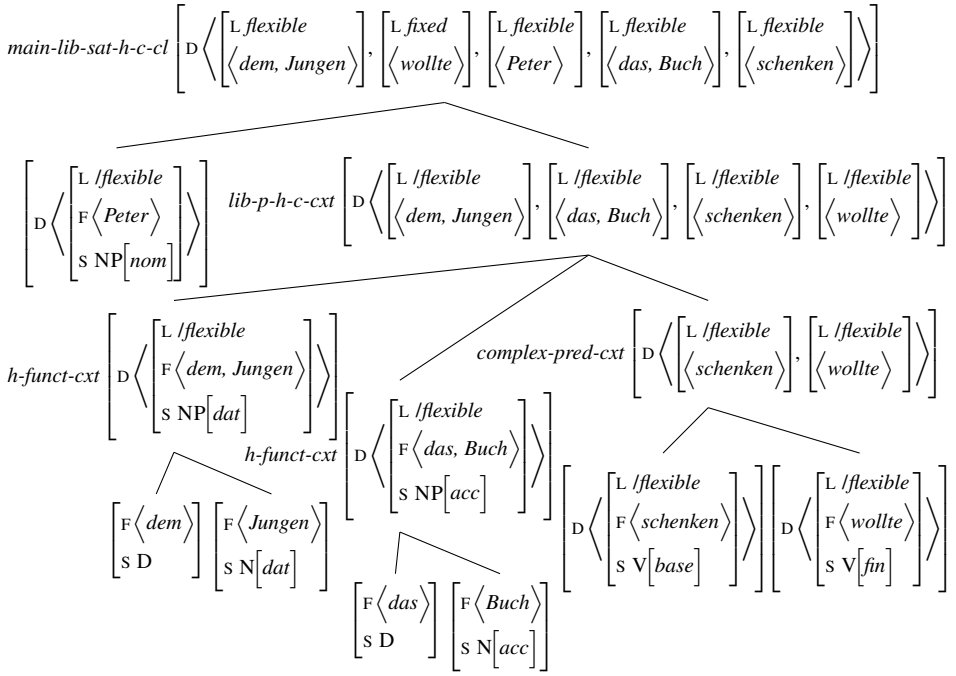


Figure 6: Clause structure for German V2 sentence.

The structure of this V2 sentence is illustrated in Figure 6.[5] Here, the MAIN-LIB-SAT-HD-COMP-CLAUSE CONSTRUCTION licenses the saturation of the finite verb's complement list while keeping all of the domain elements liberated and free to shuffle except for the finite verb itself, which is constructionally specified as *fixed* and relegated to the position after a single *flexible* domain, as according to the VN-CLAUSE CONSTRUCTION. A COMPLEX-PREDICATE CONSTRUCTION is used to create a verbal complex which combines all of the arguments from both verbs (cf. Hinrichs and Nakazawa, 1998, *inter alia*). Language-dependent LP rules determine the positions of the *flexible* elements, such as constraining the non-finite verb domain element to the end of the clause. Naturally, other constructions could

[5] Abbreviations will also be used in AVMs to conserve space: D(OM), L(IN), F(ORM), S(YN), C(AT), VF(ORM).

be defined to stipulate the non-finite verb domain element as *fixed* in a different position.

Similarly, the V3 sentence in (11) can be licensed by the same VN-CLAUSE CONSTRUCTION with further language-specific constraints, such as the DISCOURSE-PROMINENCE CONSTRUCTIONS in (27). These constructions utilize partial compaction, as mentioned in §4.1.2, which allow the first two elements before the finite verb to form a single domain element despite not forming a phrase structure constituent.

(27) DISCOURSE PROMINENCE CONSTRUCTIONS for German

a. $doms_{\bigcirc}\left(\left\langle\left[\text{DOM } \mathrm{X}_1\right], \ldots, \left[\text{DOM } \mathrm{X}_n\right]\right\rangle\right) \equiv \mathrm{X}_1 \bigcirc \ldots \bigcirc \mathrm{X}_n$

b. *prom-part-compact-dom-cxt* $\Rightarrow$

$$\left[\begin{array}{ll} \text{MTR} & \left[\text{DOM}\left\langle\left[\begin{array}{l}\text{PROM } +\\ doms_{\bigcirc}\left(\mathrm{L}_1\right)\end{array}\right]\right\rangle \bigcirc doms_{\bigcirc}\left(\mathrm{L}_2\right)\right] \\ \text{DTRS} & \mathrm{L}_1{:}list\left(\left[\text{PROM } +\right]\right) \bigcirc \mathrm{L}_2{:}list \end{array}\right]$$

c. *prom-main-cl* $\Rightarrow$ *main-lib-sat-hd-comp-cl* $\wedge$ *prom-part-compact-dom-cxt*

The PROMINENCE-PARTIAL-COMPACTION-DOMAIN CONSTRUCTION shown in (27b) appeals to a common discourse-oriented feature which compacts the prominent elements into a single domain. Here this discourse feature is represented by a binary PROM(INENCE) attribute. However, this construction and new feature are only used for illustrative purposes and do not necessarily reflect a pragmatic analysis, instead they only show how such an analysis is compatible with the other word order constraints proposed in this paper. So, using the new $doms_{\bigcirc}$ function

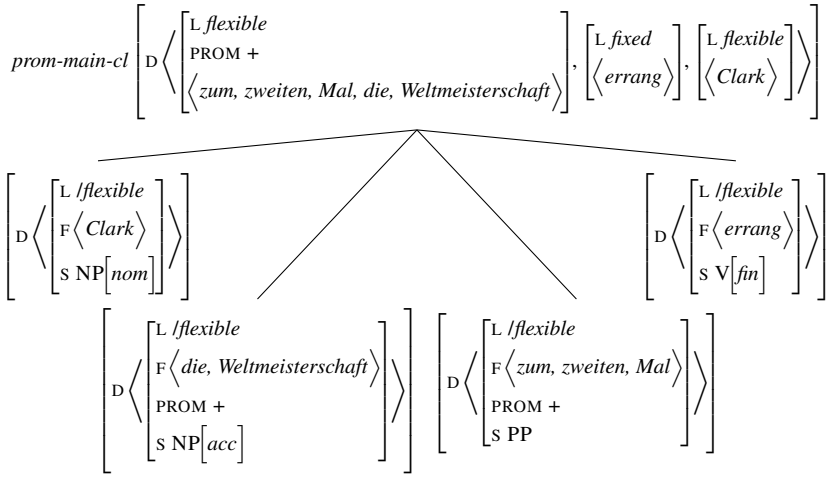


Figure 7: Clause structure for German V3 sentence.

defined in (27a), this construction stipulates that discourse prominent elements are compacted while all other elements remain liberated. Linear precedence rules subsequently cause the single prominent domain element to appear in the clause initial position. Figure 7 illustrates this clause structure for the V3 sentence in (11).

Finally, although the HEAD-FILLER SCHEMA is not used to realize the first element of a basic V2 clause, it still allows the non-local extraction of an embedded element and appropriately interacts with the VN-CLAUSE CONSTRUCTION to license a complete sentence. For instance, consider the sentence in (28) with an element extracted out of the subordinate clause into the first position of the matrix clause. Using the TOPICALIZATION CONSTRUCTION in (29) the clause structure for this complex sentence is illustrated in Figure 8.

(28) [Um zwei Millionen Mark]$_i$ versucht er [eine Versicherung $_{-i}$ zu betrügen]
of two million Mark try.1SG.PRS he a insurance to defraud.INF
'Of two million Marks, he is trying to defraud an insurance company.'
German (adapted from Müller, 2005a)

(29) TOPICALIZATION CONSTRUCTION for German
top-main-cl $\Rightarrow$ *main-lib-sat-hd-comp-cl* $\wedge$ *filler-head-cxt*

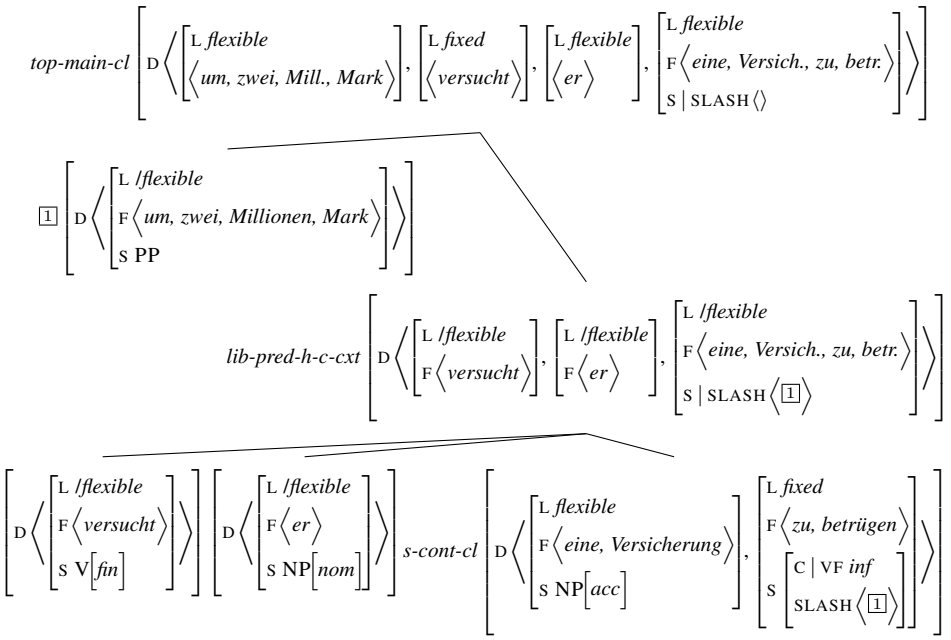


Figure 8: Clause structure for German sentence with topicalized element.

4.2.2 Other V2 Languages

The same generalized mechanisms extend to other V2 languages. For instance, the common clausal constraints are also used by Kashmiri in Figure 9 to define its clausal constructs. Notice that the linking of LINEAR and SENTENCE-MODE CLAUSAL CONSTRUCTS here are different than for German. Thus, a Kashmiri question clause, which is obligatorily V3 such as in example (12), may be licensed by the language-specific construction in (30) which also utilizes the common VN-CLAUSE CONSTRUCTION and has the resulting domain structure in (31). This construction uniquely specifies a *fixed* question word domain element which appears before the finite verb, thus allowing verb third word order.

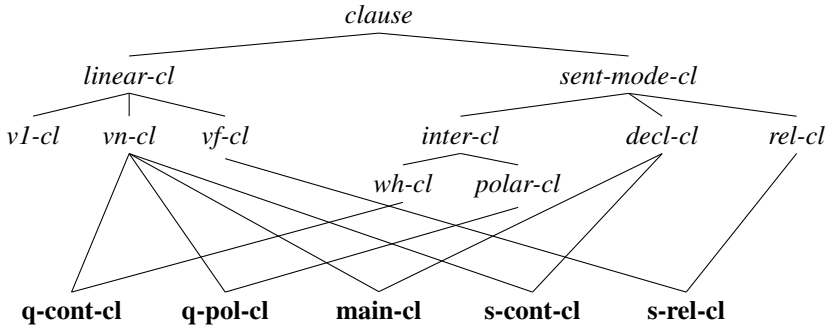


Figure 9: Partial hierarchy of clausal constructs for Kashmiri

(30) CONTENT QUESTION CONSTRUCTION for Kashmiri

$$\textit{cont-question-cl} \Rightarrow \textit{vn-cl} \wedge \textit{wh-cl} \wedge \left[\text{DOM} \left\langle \left[\text{LIN } \textit{flexible} \right], \begin{bmatrix} \text{LIN } \textit{fixed} \\ \text{SYN WH} \end{bmatrix}, \ldots \right\rangle \right]$$

(31)
$$\left[\text{D} \left\langle \begin{bmatrix} \text{L } \textit{flexible} \\ \text{F} \left\langle \textit{raath} \right\rangle \\ \text{S ADV} \end{bmatrix}, \begin{bmatrix} \text{L } \textit{fixed} \\ \text{F} \left\langle \textit{kyaa} \right\rangle \\ \text{S WH} \end{bmatrix}, \begin{bmatrix} \text{L } \textit{fixed} \\ \text{F} \left\langle \textit{dyutnay} \right\rangle \\ \text{S V} \left[\textit{fin} \right] \end{bmatrix}, \begin{bmatrix} \text{L } \textit{flexible} \\ \text{F} \left\langle \textit{rameshan} \right\rangle \\ \text{S NP} \end{bmatrix}, \begin{bmatrix} \text{L } \textit{flexible} \\ \text{F} \left\langle \textit{tse} \right\rangle \\ \text{S NP} \end{bmatrix} \right\rangle \right]$$

Additionally, domain compaction becomes important for the analysis of the Breton V2 clause in example sentence (8). When both of the finite and non-finite verbs are analyzed as a complex predicate, they may be compacted together to form a single domain element which is then correctly positioned by the VN-CLAUSE CONSTRUCTION as shown in (32).

(32)
$$\left[\text{D} \left\langle \begin{bmatrix} \text{L } \textit{flexible} \\ \text{F} \left\langle \textit{e, voued} \right\rangle \\ \text{S NP} \left[\textit{acc} \right] \end{bmatrix}, \begin{bmatrix} \text{L } \textit{fixed} \\ \text{F} \left\langle \textit{en, deus, debret} \right\rangle \\ \text{S VP} \left[\textit{fin} \right] \end{bmatrix}, \begin{bmatrix} \text{L } \textit{flexible} \\ \text{F} \left\langle \textit{Yann} \right\rangle \\ \text{S NP} \left[\textit{nom} \right] \end{bmatrix}, \begin{bmatrix} \text{L } \textit{flexible} \\ \text{F} \left\langle \textit{er, wetur} \right\rangle \\ \text{S PP} \end{bmatrix} \right\rangle \right]$$

5 Conclusion

By examining the mutually-shared characteristics of V2 languages it is possible to define the common mechanisms which accurately describe their word orders, namely: a shared set of LINEAR, SENTENCE-MODE, and DOMAIN CONSTRUCTIONS; *flexible* and *fixed* domain elements; language-specific constructions which specify *fixed* domain elements; domain compaction; and linear precedence rules which only affect *flexible* domain elements. In this paper I have shown that a linearization-based analysis can account for a variety of word ordering phenomena in V2 languages. Where traditional phrase structure rules are ill suited, using two-valued domain elements in combination with constructional stipulations, the interaction of flexible word order and strict positional constraints may be appropriately defined while remaining compatible with other phenomena such as non-local extraction.

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Part II
Contributions to the Workshop

Topic and focus in local subject extractions in Danish

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Abstract

The present paper proposes an analysis of the asymmetrical distribution of *der*, 'there', in embedded interrogative and relative clauses, respectively, in standard Danish. The analysis sets itself apart from previous analyses in integrating information structural constraints. We will show that the discourse function of the extracted subject in the clauses in question determines whether *der* insertion takes place in standard Danish. The analysis will further be shown to support the position that *der* in interrogative and relative clauses is an expletive subject filler, and that from an information structural point of view, the *der* in existential, presentational, passives and relative clauses is indeed the same *der*.

1 Introduction

In standard Danish the word *der*, 'there', is used in embedded subject interrogative clauses, but not in subject relative clauses. The different distribution in interrogatives and relatives is shown in (1).

(1) a. Jeg ved hvem der vandt.
I know who there won
'I know who won.'

b. Da jeg var i tvivl ringede jeg til dem, og spurgte hvilken der
as I was in doubt called I to them and asked which there
passede til min bil.
suited to my car
'As I was in doubt I called them and asked which one suited my car.'

c. Jeg kender manden hvis bror __ vandt.
I know man.DEF whose brother won
'I know the man whose brother won.'

d. Vi skulle dykke ud for Mactan Island, hvilken __ ligger lige over
we should dive out for Mactan Island which lies right over
for Cebu City.
for Cebu City
'We were going to dive off Mactan Island which lies right opposite Cebu City.'

If no relative pronoun is present, we also find *der* in relative clauses, as the examples in (2) show.

(2) a. Manden der vidste for meget
man.DEF there knew too much
'The man who knew too much'

†We want to thank the participants of the HPSG2011 conference for valuable discussion. Special thanks go to Stefan Müller for his detailed comments.

b. Bogen der ligger til grund for filmen er en klassiker.
book.DEF there lies to ground.DEF for movie.DEF is a classic
'The book which the movie is based on is a classic.'

Traditionally, cf. Wiwel (1901), Diderichsen (1957) and Hansen (1974), the *der* in (1) and (2) is assumed to be the same *der* that occurs in e.g. existential, presentational and impersonal passive clauses, as in (3), where it functions as an expletive subject filler when a subject does not appear in subject position or is missing altogether.

(3) a. Han siger, at der er elefanter i alle størrelser.
he says that there are elephants in all sizes
'He says that elephants exist in all sizes.'

b. Han siger, at der løber en blå smølf efter mig.
he says that there runs a blue smurf after me
'He says that a blue murf is running after me.'

c. Han siger, at der synges i parallelle kvinter.
he says that there sing.PRS.PASS in parallel fifths
'He says that people are singing in parallel fifths.'

In more recent Danish generative literature on *der*, this assumption has been challenged, and it has been discussed whether *der* in embedded interrogative and relative clauses is indeed an expletive occuring in subject position, cf. the analyses in Erteschik-Shir (1984), Vikner (1991) and Mikkelsen (2002). Arguments have been put forward suggesting that *der* in embedded subject interrogatives and relatives differs wrt. a number of syntactic phenomena from the expletive *der*, so much so that it cannot be maintained to be categorized as the expletive *der*. The inconsistent distribution of *der* in standard Danish embedded clauses has, however, not been a focus of attention. Outside the Danish literature, e.g. Engdahl (1984) has proposed that the asymmetrical distribution of *der* is a consequence of interrogative and relative clauses having different clause structural properties.

The present paper addresses the inconsistent distribution of *der* shown in (1) and (2). The proposed analysis is based on different information structural properties of the clauses. Apart from explaining the distribution in (1) and (2), incorporating information structure in the analysis provides a uniform account of *der* in Danish, and hence simultaneously lends support to the argument that *der* in embedded interogatives and relatives is indeed an expletive subject filler in subject position.

2 The data

In this section we will be more specific about what types of relative clauses are discussed in this paper. The relative clauses dealt with here are bound subject

relative clauses. Some of them involve extractions. There are potentially three such cases in Danish, as shown in (4).

(4) a. Husker I historien om drengen hvis mor __ ville
remember you story.DEF about boy.DEF whose mother wanted
stave hans navn Christophpher?
spell his name Christophpher
'Do you remember the story about the boy whose mother wanted to spell his name Christophpher?'

b. Aspasim ligger i en by kaldet Vallvidrera, hvilken __ ligger oppe
Aspasim lies in a town called Vallvidrera which lies up
i bjergene lidt udenfor Barcelona.
in mountains.DEF little outside Barcelona
'Aspasim lies in a town called Vallvidrera which is situated in the mountains a little outside Barcelona.'

c. * Jeg har en ven, hvem __ bor i Barcelona.
I have a friend who lives in Barcelona
'I have a friend who lives in Barcelona.'

In (4a) we have a bound subject relative clause involving pied piping, the relative pronoun *hvis* is the specifier of a larger noun phrase with which it is extracted from subject position. In (4b) the relative pronoun *hvilken*, used to refer to a non-human, is extracted from subject position. Finally, in (4c) the relative pronoun *hvem*, used to refer to a human, is extracted from subject position. (4c), however, is not well-formed in Danish, cf. e.g. Hansen (1974).

In addition, we have subject relative clauses without relative pronouns, as in (2). More example are provided in (5).

(5) a. Pigen der legede med ilden
girl.DEF there played with fire.DEF
'The girl who played with fire'

b. Hønsine og himlen der faldt ned
Hønsine and sky.DEF there fell down
'Hønsine and the sky that fell down'

We follow Erteschik-Shir (1984) and Mikkelsen (2002) in treating *der* as an expletive. This means that they are not treated as relative pronouns, as in textbook grammars like e.g. Allan et al. (1996). We therefore do not analyze these as involving extraction.

It should be noted that the examples in (6) are not subject relative clauses, and they do consequently not constitute contradictions to our observations about *der* in relative clauses.

(6) a. Stephen King er en forfatter, hvis bøger der kan koges
Stephen King is a writer whose books there can boil.PRS.PASS
meget suppe på.
much soup on
'Stephen King is a writer whose books cannot be flogged to death.'

b. Herefter følger I vejen, langs hvilken der vokser cypresser.
hereafter follow you road.DEF along which there grow cypresses
'From then on you follow the road along which cypresses grow.'

In (6a) *der* is inserted in an embedded passive missing a subject, and in (6b) *der* is inserted in an embedded presentational there clause where the "subject" appears in direct object position.

The data we have presented so far are standard Danish. Hansen (1974) gives an account of *der* insertion in non-standard Danish. He observes that here we also find *der* in examples like (7).

(7) a. ? Bogen handler om en dreng der hedder Mikkel, hvis
book.DEF is about a boy there calls Mikkel whose
mor der døde da han var 13 år gammel.
mother there died when he was 13 years old
'The book is about a boy called Mikkel whose mother died when he was 13 years old.'

b. ? Jeg slap for flere konfrontationer, hvilke der måtte ende
I escaped for more confrontations which there must.PST end
voldeligt ligegyldigt hvordan de blev vendt og drejet.
violently no matter how they were tossed and turned
'I avoided more confrontations which were bound to end violently whichever way you looked at them.'

We cannot do justice to the data in Hansen (1974) in this paper, but can conclude that in standard Danish *der* is inserted in embedded subject interrogatives, but not in bound subject relative clauses. In non-standard Danish dialects *der* is inserted as a subject filler with varying degrees of acceptability in different clause types, including subject relative clauses. In this paper we are concerned with the distribution of *der* in standard Danish. The non-standard distributions, however, will be shown to follow from exempting non-standard Danish from constraints to be presented in Section 5 governing the standard distribution.

3 Theoretical background

As stated in Section 1, the present paper proposes an analysis based on information structural properties of the clauses, allowing for a uniform analysis of *der* as an expletive subject filler in subject position. This is in answer to the following

theoretical questions arising when dealing with the data at hand. Do we explain the "inconsistent" distribution of *der* in Danish embedded interrogative and relative clauses as a result of asymmetrical syntactic structures or something else? And can we provide a uniform analysis of *der* as a subject expletive in both interrogatives, relatives and other *der*-constructions?

Engdahl (1984) explains the ill-formedness of subject extractions out of relative clauses in constrast to interrogative clauses in Norwegian as being a result of the empty category in subject position not being properly governed within its governing category $\overline{\text{S}}$. This is shown in (8).

(8) a. Ola$_i$ skjønner jeg ikke [$_{\overline{\text{S}}}$ [$_{XP}$ hva$_j$] [$_{\overline{\text{S}}}$ [$_{Comp}$ e_i] [$_S$ e_i sier e_j]]]]
Ola understand I not what says

b. * Ola$_i$ kjenner jeg [$_{NP}$ mange [$_{\overline{\text{S}}}$ [$_{Comp}$ som$_j$] [$_S$ e_i liker e_j]]]
Ola know I many that like

The analysis is based on assigning interrogative and relative clauses different syntactic structures. Interrogative clauses have an extra XP position, as can be seen in (8a). (8a) is well-formed because the empty category e_i in S is properly governed by e_i in $\overline{\text{S}}$. In (8b), on the other hand, the empty category e_i in S is not properly governed within $\overline{\text{S}}$.

Engdahl (1984) refers to the non-occurrence of Norwegian *som* in relative clauses as independent support for the asymmetrical clause structures. She further proposes that Danish *der* can be a proper governor in Danish like the Norwegian *som*. This means that we get the structures in (9a) for Danish.

(9) a. Jeg husker ikke [$_{\overline{\text{S}}}$ [$_{XP}$ hvis hest$_i$][$_{\overline{\text{S}}}$ [$_{Comp}$ der$_i$] [$_S$ e_i vandt
I remember not whose horse there won
løbet]]]
the race

b. Jeg kender [$_{NP}$ manden [$_{\overline{\text{S}}}$ [$_{Comp}$ hvis hest]$_i$ [$_S$ e_i vandt løbet]]]
I know the man whose horse won the race

In (9b) *hvis hest* appears in Comp. There can only be one element in Comp in this analysis. As there is no XP position in the relative clause, there is no room for *der*, as Comp is already occupied. In this way the asymmetry between interrogative and relative clauses is explained.

Apart from the fact that we must accept phrases in Comp, the analysis is problematic for Danish. In non-standard Danish, cf. also Bjerre (2010), we find the complementizer *som* in front of pied piping phrases as in (10), both contending for the Comp position.

(10) a. ? Har nemlig en veninde som hvis hund løb væk i november
have you see a friend Comp whose dog ran away in November
'I have, you see, a friend whose dog ran away in November.'

b. ? 3 dejlige sorte hanner som hvis far og mor begge
3 lovely black male dogs Comp whose father and mother both
er en blanding af en border collie og labrador
are a mix of a border collie and labrador
'3 lovely black male dogs whose father and mother both are a cross between a border collie and labrador.'

Similarly, in the example in (7) repeated here as (11), we find the extracted phrases and *der* contending for the Comp position.

(11) a. ? Bogen handler om en dreng der hedder Mikkel, hvis
book.DEF is about a boy there calls Mikkel whose
mor der døde da han var 13 år gammel.
mother there died when he was 13 years old
'The book is about a boy called Mikkel whose mother died when he was 13 years old.'

b. ? Jeg slap for flere konfrontationer, hvilke der måtte ende
I escaped for more confrontations which there must.PST end
voldeligt ligegyldigt hvordan de blev vendt og drejet.
violently no matter how they were tossed and turned
'I avoided more confrontations which were bound to end violently whichever way you looked at them.'

And finally, in (12) we find *som* and *der* contending for the Comp position.

(12) a. ? Jeg vil godt vide hvem som der lægger stemmer til
I will good know who Comp there lays voices to
Mumitroldene i tegnefilmserien.
Mumins.DEF in cartoon series.DEF
'I would like to know who provides voices for the Mumins in the cartoon series.'

b. ? Min smukke dejlige pony som der er solgt til Sofia
my beautiful lovely pony Comp there is sold to Sofia
'My beautiful lovely pony which is sold to Sofia.'

As mentioned earlier, previous Danish analyses of *der* in interrogative and relative clauses have focused on the categorial status of *der*. Erteschik-Shir (1984) assumes that *der* is an expletive subject, and restricts the insertion of *der* to contexts where "co-superscripting", or agreement, can occur with an adjacent operator. This is shown in (13).

(13) a. Jeg ved ikke hvem^{i} der^{i} kan lide ham.
I know not who there can like him
'I do not know who likes him.'

b. ? Manden hvis hest^i der^i vandt løbet
man.DEF whose horse there won race.DEF
'The man whose horse won the race.'

In (13) *hvem* and *hvis hest* are adjacent operators licensing *der* insertion.[1]

In the analysis of Vikner (1991) *der* is assumed to occur in C^0 position, rather than being an expletive. On this analysis *der* may only occur if the specifier of its complement is coindexed with its own specifier in which case it may properly govern the specifier of its complement. The examples in (14) illustrate.

(14) a. Jeg ved [$_{CP}$ hvis hund$_i$ der$_i$ [$_{IP}$ t$_i$ spiser æbler]]
I know whose dog there eats apples

b. ? Jeg kender en pige [$_{CP}$ hvis hund$_i$ der$_i$ [$_{IP}$ t$_i$ spiser æbler]]
I know a girl whose dog there eats apples

In these examples the operator moves from IP-spec to CP-spec, and leaves a trace in IP-spec and *der* is inserted in C^0. *Der*'s complement is the IP, and *der*'s specifier is the operator in CP-spec. The examples are well-formed, as the specifier of *der*'s complement is coindexed with *der*'s own specifier.

Mikkelsen (2002) argues that the distribution of *der* is a result of its expletive status. *Der* is inserted in the position targeted by the Extended Projection Principle, cf. Chomsky (1981). According to Mikkelsen (2002), the Extended Projection Principle can be satisfied in two ways. If the subject moves to CP-spec via IP-spec, it leaves a trace in IP-spec, and no expletive *der* is inserted. Only if the moved element is overt may its trace in IP-spec satisfy the Extended Projection Principle. If the subject moves directly from its thematic position to CP-spec, *der* is inserted in IP-spec to satisfy the Extended Projection Principle. The examples in (15) illustrate.

(15) a. Jeg kender en pige$_i$, [$_{CP}$ [hvis$_i$ hund]$_j$ [$_{IP}$ t$_j$ [$_{VP}$ t$_j$ har spist
I know a girl whose dog has eaten
æblet]]]
the apple

b. Jeg kender en pige$_i$, [$_{CP}$ [hvis$_i$ hund]$_j$ [$_{IP}$ der [$_{VP}$ t$_j$ har spist
I know a girl whose dog there has eaten
æblet]]]
the apple

In (15a) the operator moves via IP-spec and leaves a trace that satisfies the EPP. In (15b) the operator moves directly from its position in VP and the expletive *der* is inserted to satisfy the EPP.

Even though there is disagreement as to the category of *der*, there is agreement that the main obstacles to a syntactically uniform analysis are the definiteness and

[1] Erteschik-Shir (1984, p. 134) mentions that topics do not license *der* insertion, however this aside observation is not incorporated into her proposed analysis.

transitivity restrictions that are observed for *der*.[2] Mikkelsen (2002) gives the examples in (16) and (17) which show that the definiteness restrictions applying to expletive *der* do not apply to *der* in relative clauses.

(16) Vi ved at ...
We know that

a. der vil komme mange lingvister.
there will come many linguists

b. * der vil komme de lingvister.
there will come the linguists

(17) Vi kender ...
We know

a. mange lingvister der vil komme *t*.
many linguists there will come

b. de lingvister der vil komme *t*.
the linguists there will come

And Vikner (1991) gives the examples in (18) which show that the transitivity restrictions applying to expletive *der* do not apply to *der* in relative and interrogative clauses.

(18) a. * Vi ved at der vil mange lingvister læse denne bog.
We know that there will many linguists read this book

b. Vi kender de lingvister der vil læse denne bog.
We know the linguists there will read this book

c. Vi ved ikke hvilke lingvister der vil læse denne bog.
We know not which linguists there will read this book

In spite of their differences concerning the categorial status of *der*, the analyses have in common that they do not explain why *der* does not occur in standard Danish subject relative clauses. In contrast to e.g. Engdahl (1984) they assume that relative clauses have the same clausal structure as embedded interrogative clauses. In Section 4 we will show that the asymmetry may be explained in terms of information structural rather than clause structural differences.

4 Analysis

Bresnan and Mchombo (1987) argue that to provide a natural analysis of the agreement system of Chichewa, both syntactic and discourse functions have to be taken into account. In their paper they establish three principles about the role of the topic

[2] The present analysis explains these differences in terms of different constructional constraints.

and focus functions in the grammars of natural language, based also on evidense from Kuno (1976) and Dik (1978). We will use these principles as the basis of our analysis and refer to the functions of topic and focus to explain the inconsistent distribution of *der* in standard Danish embedded clauses. At the same time we will argue that when integrating an account of discourse functions, a uniform account of *der* in Danish as an expletive subject filler in subject position can be maintained.

According to Bresnan and Mchombo (1987), in relative clauses the relative pronoun universally bears the topic function. In interrogative clauses the interrogative pronoun universally bears the focus function. And, finally, the same constituent cannot be both focus and topic of the same level of clause structure.

The examples in (19) show these principles exemplified in Danish, clefting being a test for focus.

(19) a. Som komponist er det naturligvis vigtigt, at lytterne
as composer is it of course important that listeners.DEF
ved, hvem det er der har skrevet den musik, de lytter til.
know who it is there has written that music they listen to
'As a composer it is of course important that the listeners know who it is that has written the music they are listening to.'

b. ??? Som komponist er det naturligvis vigtigt, at lytterne
as composer is it of course important that listeners.DEF
kender den musik hvilken det er der lyttes til.
know that music which it is there listen.PRS.PAS to
'As a composer it is of course important that the listeners know that music which it is that is listened to.'

The example in (19a) where the interrogative pronoun is clefted is fine whereas the example in (19b) where the relative pronoun is clefted is questionable. The discourse functions of the extracted pronouns in the embedded clauses from (1) are shown in (20).

(20) a. Jeg ved hvem$_{focus}$ der vandt.
I know who there won
'I know who won.'

b. Da jeg var i tvivl ringede jeg til dem, og spurgte hvilken$_{focus}$
as I was in doubt called I to them and asked which
der passede til min bil.
there suited to my car
'As I was in doubt I called them and asked which one suited my car.'

c. Jeg kender manden hvis$_{topic}$ bror __ vandt.
I know man.DEF whose brother won
'I know the man whose brother won.'

d. Vi skulle dykke ud for Mactan Island, hvilken$_{topic}$ -- ligger lige
we should dive out for Mactan Island which lies right
over for Cebu City.
over for Cebu City
'We were going to dive off Mactan Island which lies right opposite Cebu City.'

We propose that the discourse function of the extracted pronoun determines whether expletive *der* is inserted in subject position. If the subject has "moved" to receive focus, expletive *der* is inserted in subject position.

This also accounts for the occurrence of *der* in hypothetical sentences like (21).

(21) a. Hvem der var barn i dag!
who there was child today
'If only I were a child today!'

b. Hvem der bare var studerende i dag!
who there only was student today
'if only I were a student today!'

The hypothetical sentences are formally interrogatives and have embedded clause structure, consequently the pronoun "moves" to a focus position and *der* is inserted.

The account of *der* insertion in embedded interrogative and relative clauses extend to include *der* insertion in impersonal passives, existential and presentational clauses. So, in general, if a clause which requires a subject is missing one, or if the subject has moved to receive focus, then expletive *der* is inserted. These rules explain *der* insertion in all the examples in (22).

(22) a. Han siger, at der synges i parallelle kvinter.
he says that there sing.PRS.PASS in parallel fifths
'he says that people are singing in parallel fifths.'

b. Manden der vidste for meget
man.DEF there knew too much
'The man who knew too much'

c. Han siger, at der er elefanter$_{focus}$ i alle størrelser.
he says that there are elephants in all sizes
'He says that elephants exist in all sizes.'

d. Han siger, at der løber (en blå smølf)$_{focus}$ efter mig.
he says that there runs a blue smurf after me
'He says that a blue murf is running after me.'

e. Jeg ved hvem$_{focus}$ der vandt.
I know who there won
'I know who won.'

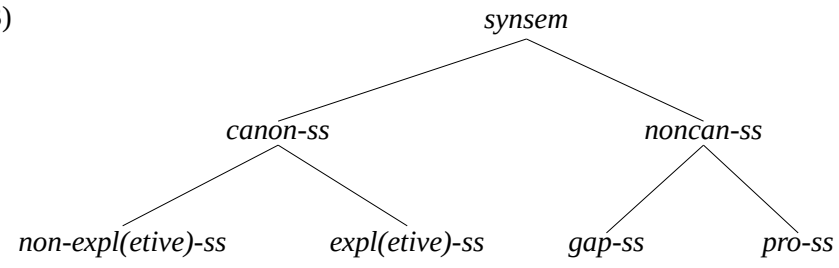
In (22a) the subject is missing in an impersonal passive and *der* is inserted. In (22b) the subject is again missing because there is no relative pronoun in the relative clause and *der* is inserted. In the embedded existential clause in (22c), the subject appears post-verbally to receive focus, and in the embedded presentational clause in (22d), the subject has likewise "moved" to receive focus, to the direct object position[3], and *der* is inserted. Finally, in (22e) the subject has "moved" to receive focus in the embedded interogative clause. Our analysis, then, lends support to the argument that *der* in embedded interogatives and relatives is indeed an expletive subject filler in subject position.

5 Formalization

The formalization of our analysis is based on the account of extraction in Ginzburg and Sag (2000). In this account a non-empty SLASH feature is introduced by the Argument Realization Principle (Ginzburg and Sag, 2000, p. 171) and the SLASH-Amalgamation Constraint (Ginzburg and Sag, 2000, p. 169). The Argument Realization Principle may introduce a "gap" on the ARG-ST list of a word, at the same time not mapping *synsem*s that have been resolved to *gap-ss* to the COMPS list of a word. The SLASH-Amalgamation Constraint ensures that the SLASH values of the arguments of a word are passed up to the word itself. The inheritance of the SLASH value in constructions is effected by the Generalized Head Feature Principle (Ginzburg and Sag, 2000, p. 33), which specifies inter alia the inheritance of the SLASH feature from the head-daughter to the mother in a construction. Finally, various contructions are responsible for binding off the SLASH value, either constructions involving a filler daughter or unary constructions where a construction type is responsible for binding off the "gap". Our formalization of information structural properties is an addition to and modification of the analysis of extraction in Danish presented in Bjerre (2010) and Bjerre (2011). We will repeat the main ideas here.

To account for the Danish *der* insertion phenomenon in subject extraction contexts, we introduce an additional *synsem* type. The extended *synsem* hierarchy[4] is shown in (23).

(23)



[3]Cf. Platzack (1983), Askedal (1986), Lødrup (2000) and Bjerre and Bjerre (2008)

[4]The hierarchy presented here is a modification of the hierarchy in Bjerre (2010) and Bjerre (2011).

The Expletive *der* has an *expl-ss* which is introduced as a subtype of *canon-ss*, and it is consequently governed by the Principle of Canonicality (Ginzburg and Sag, 2000) which ensures that *sign*s are canonical, i.e. have overt expression.

In (24) the constraint for *expl-ss* is shown.

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

An expletive structure-shares its CONTENT value with the constituent it replaces.

In Danish, the Argument Realization Principle additionally does not map *synsem*s that have been resolved to *gap-ss* to the SUBJ list of the word. However, the subject is visible as the value of the SUBJECT feature.[5] The Danish Argument Realization Principle is shown in (25).

(25) Argument Realization Principle (Danish):

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

The Argument Realization Principle results in different representations for the verb *synger*, 'sings', in (26).

(26) a. Jeg kender kvinden hvis søn __ synger.
I know woman.DEF whose son sings
'I know the woman whose son is singing.'

b. Jeg ved hvem der synger.
I know who there sings
'I know who is singing.'

The verb *synger* in (26a) corresponds to (27).

(27) $$\begin{bmatrix} \textit{word} \\ \text{SS} \mid \text{LOC} \mid \text{CAT}\begin{bmatrix}\text{HEAD} \mid \text{SUBJECT } \boxed{A} \\ \text{SUBJ } \langle\rangle \\ \text{COMPS } \boxed{B}\end{bmatrix} \\ \text{ARG-ST } \boxed{A}\left\langle \textit{gap-ss} \right\rangle \oplus \boxed{B} \end{bmatrix}$$

[5] Cf. Meurers (1999) for further arguments that we need a SUBJECT feature as part of the HEAD feature.

However, the *synger* in (26b) with an expletive subject corresponds to (28).

(28)
$$\left[\begin{array}{l} \textit{word} \\ \text{SS} \mid \text{LOC} \mid \text{CAT} \left[\begin{array}{l} \text{HEAD} \mid \text{SUBJECT} \boxed{A} \\ \text{SUBJ} \boxed{A} \\ \text{COMPS} \boxed{B} \end{array}\right] \\ \text{ARG-ST} \boxed{A} \left\langle \textit{expl-ss} \right\rangle \oplus \boxed{B} \end{array}\right]$$

As can be seen, subject gapped words have an empty SUBJ list. This is in contrast to Ginzburg and Sag (2000), where a *gap-ss* remains on the SUBJ list. In this way we can account for the potential realization of an expletive in subject position in Danish. If the subject is resolved to an *expl-ss*, it remains on the SUBJ list to be cancelled off in the *hd-subj-ph*.

As argued in Bjerre (2010) and Müller and Ørsnes (2011), *der* insertion in standard Danish clauses involving extractions is constrained to local extractions. We therefore, in addition to the default SLASH-Amalgamation Constraint, propose the *Expletive* SLASH Constraint in (29), cf. also (Bjerre, 2010) and (Bjerre, 2011).

(29) *Expletive* SLASH Constraint:

$$\neg \left[\begin{array}{l} \textit{word} \\ \text{ARG-ST} \left\langle \left[\begin{array}{l} \text{L} \mid \text{C} \mid \text{H} \mid \text{S} \left\langle \textit{expl-ss}_i \right\rangle \\ \text{SLASH} \left\{ \left[\text{CONT} \mid \text{INDEX } i \right] \right\} \uplus \boxed{\Sigma} \end{array}\right], \ldots \right\rangle \end{array}\right]$$

The constraint in (29) makes sure that *der* insertion only takes place if we have a local subject extraction. The constraint excludes words which contain an element on the ARG-ST list with an expletive subject corresponding to an element in the SLASH set, i.e. an element which has not already been bound off. This means that a SLASH value originating from an expletive can only be bound off locally. The *Expletive* SLASH Constraint applies in standard Danish.

The information structure part of our formalization is based on Paggio (2009), but cf. Engdahl and Vallduví (1996), Vallduví and Engdahl (1996), Kuthy (2002) and Kuthy and Meurers (2003) for analyses of information structure in e.g. English and German. We adopt the feature INFOSTR from Paggio (2009) to encode the grammaticalized discourse functions of interrogative and relative pronouns. The feature INFOSTR is part of the CONTEXT and it has the features TOPIC and FOCUS, each taking as its value a list of semantic indices. As stated in Section 4, *der* insertion indicates that the subject appears in extracted position to receive focus. In our analysis the occurrence of an expletive subject in the subject "gap" position is licensed by the occurrence of a subject filler marked for focus. In (30) we show the constraint licensing *der* in finite-*wh*-subject-interrogative clauses.

(30) *fin-wh-su-int-cl*:

$$\begin{bmatrix} \quad \end{bmatrix} \longrightarrow \begin{bmatrix} \text{SS} \mid \text{WH} \left\{ \begin{bmatrix} \textit{param} \\ \text{IND } \boxed{1} \end{bmatrix} \right\} \\ \text{CTXT} \mid \text{IS} \begin{bmatrix} \text{FOC} \left\langle \boxed{1} \right\rangle \end{bmatrix} \end{bmatrix}, \mathbf{H} \begin{bmatrix} \text{SS} \mid \text{L} \mid \text{C} \mid \text{H} \mid \text{SUBJECT} \left\langle \textit{expl-ss} \right\rangle \end{bmatrix}$$

Interrogative pronouns lexically have a non-empty FOCUS list. The constraint ensures that the subject of the head daughter is an expletive, not a gap.

Topic subject fillers do not license *der*, as shown in the constraint on finite-*wh*-subject-relative clauses in (31).

(31) *fin-wh-su-rel-cl*:

$$\begin{bmatrix} \quad \end{bmatrix} \longrightarrow \begin{bmatrix} \text{SS} \mid \text{REL} \left\{ \begin{bmatrix} \textit{param} \\ \text{IND } \boxed{1} \end{bmatrix} \right\} \\ \text{CTXT} \mid \text{IS} \begin{bmatrix} \text{TOP} \left\langle \boxed{1} \right\rangle \end{bmatrix} \end{bmatrix}, \mathbf{H} \begin{bmatrix} \text{SS} \mid \text{L} \mid \text{C} \mid \text{H} \mid \text{SUBJECT} \left\langle \textit{gap-ss} \right\rangle \end{bmatrix}$$

Relative pronouns lexically have a non-empty TOPIC list. The constraint ensures that the subject of the head daughter is a gap, not an expletive.

To account for the distribution of *der* in non-standard Danish relative clauses, we simply propose that the constraints on *fin-wh-su-rel-cl* in (31) do not apply. This means that either an *expl-ss* subject or a *gap-ss* subject may occur.

6 *Der* as a resumptive pronoun

In the present paper it has been shown that standard and non-standard Danish differ wrt. *der* insertion in embedded clauses involving local extractions. This difference is also evident in non-local extractions. In non-local extractions, called "sætningsknuder", 'sentence knots', in Danish, *der* is not inserted, as shown in (32).

(32) a. Jeg ville gerne vide hvem han troede __ vandt touren.
I would good know whom he thought won tour.DEF
'I would like to know whom he thought won the tour.'

b. Hold uden et indre sammenhold og "social ro" tror
teams without an internal solidarity and social stability believe
jeg ikke __ vinder særlig ofte.
I not win very often
'Teams without an internal solidarity and social stability I don't think will win very often.'

c. Tid til at ruste os til det næste opsving, som ingen ved
time to to prepare us for the next upturn Comp no one knows
hvornår __ kommer.
when comes
'It's time to prepare ourselves for the next upturn which no one knows when will come.'

The insertion of *der* in relative clauses involving local extractions in non-standard Danish is parallelled in non-local extractions, with varying degrees of acceptability, as shown in (33).[6]

(33) a. ? Et par af mine elever spurgte mig for et par dage siden,
a couple of my pupils asked me for a couple days ago
hvem jeg troede der ville vinde valget.
whom I believed there would win election.DEF
'Some of my pupils asked me a couple of days ago whom I believed would win the election.'

b. ? Lyngby tror jeg ikke, der vinder over OB.
Lyngby believe I not there beats over OB
'Lyngby I don't believe will beat OB.'

c. ? Jeg traf en fyr som jeg bare ikke kan huske hvor der
I met a guy Comp I just not can remember where there
boede.
lived
'I met a guy whom I just can't remember where lived.'

The use of resumptive pronouns in Danish is limited, and in contexts where resumptive pronouns are accepted by some Danes, we generally do not accept *der*, cf. Vikner (1991). This said, Hansen (1974) concludes that "*Der*-indsætning er en meget sen transformation, som koldblodigt udfylder enhver tom subjektsplads i sætningsknuder (...) Tendensen minder slående om *der*-indsætning i relativkonstruktion."[7] The development seems to be towards *der* functioning as a resumptive subject pronoun in Danish non-local extractions, and it seems that the development in subject relative clauses resembles this development and does not constitute an argument against the analysis of *der* as a "focus marker" presented in this paper.

7 Conclusion

In this paper an analysis of the distribution of *der* in embedded interrogative and relative clauses in standard Danish was proposed. The analysis sets itself apart

[6](33c) is from Hansen (1974).

[7]*Der* insertion is a very late transformation which cold-bloodedly fills every empty subject position in sentence knots (...). The tendency strikingly resembles *der* insertion in the relative construction.

from previous analyses in integrating information structural constraints. We have shown that the grammaticalized discourse function of the extracted subject in the clauses in question determines whether *der* insertion takes place in standard Danish. When the subject is extracted to receive focus, *der* is inserted. We have shown that in non-standard Danish *der* may be inserted in pied piping subject relative clauses as well, and that the constraints on *fin-wh-su-rel-cl* in (31) do not apply, suggesting that in Danish the development seems to be towards *der* functioning as a resumptive subject pronoun. We further believe that the proposed analysis lends support to the position that *der* in interrogatives and relatives is an expletive subject filler. In passives missing a subject and in subject relative clauses missing a relative pronoun, *der* is inserted. In embedded interrogtive, passive, existential and presentational clauses where the subject is "moved" to receive focus, either to the front position or to the direct object position, *der* is inserted. This means that from an information structural point of view, the *der* in existential, presentational, embedded interrogatives and relative clauses is indeed the same *der*.

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Integrating GIVENness into a structured meaning approach in HPSG

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Abstract

In this article we show how the HPSG approach to information structure of De Kuthy (2002) and De Kuthy and Meurers (2003) can be extended to capture givenness (Schwarzschild, 1999) and make the right predictions for so-called *deaccenting* of given information, a widespread phenomenon (Büring, 2006) not previously dealt with in HPSG.

1 Introduction

The information structure of a sentence captures how the meaning expressed by the sentence is integrated into the discourse. The structured meaning approach (von Stechow, 1981; Jacobs, 1983; Krifka, 1992) provides a compositional semantic mechanism based on separate representations of the semantic contribution of the focus and that of the background – and De Kuthy (2002) and Webelhuth (2007) worked out how a structured meaning approach can be integrated into the HPSG architecture. This opened up the possibility of providing explanations for constraints previously stipulated in syntax by deriving the constraints from the nature of the integration of a sentence into the discourse. For example, De Kuthy (2002) relates the occurrence of discontinuous NPs in German to specific information-structural contexts, and De Kuthy and Meurers (2003) show that the realization of subjects as part of fronted non-finite constituent and its constraints can be accounted for based on independent information-structure conditions. In the same spirit, Bildhauer and Cook (2010) show that sentences in which multiple elements have been fronted are directly linked to specific types of information structure.

While the HPSG approaches successfully capture some aspects of the relation between intonation, syntax, semantics, and information structure, none of the HPSG approaches so far capture the important empirical generalizations established by Schwarzschild (1999) around the notion of *givenness*. In this abstract, we show how the HPSG approach to information structure of De Kuthy (2002) and colleagues can be extended to capture givenness and to make the right predictions for so-called *deaccenting*, which has been shown to be widespread (Büring, 2006). In contrast to Schwarzschild (1999), who spells out his approach in the framework of alternative semantics (Rooth, 1992), we show how the notion of givenness can be couched in a standard structured meaning approach – thereby preserving the explicit, compositional representations of focus and background which have been so fruitful in the work mentioned above.

2 Focus, Focus Projection, and Givenness

Languages differ with respect to how the information structure of an utterance is marked. Linguistic means of marking information structure include word order, morphology, and prosody. English and German are so-called intonation languages

where information structuring is signaled by the intonation of an utterance, including different types of pitch accents. The presence and nature of an accent is an indicator of the discourse function of a particular part of a sentence (cf., e.g., Beckman and Pierrehumbert, 1986; Grice et al., 2002).

The most widely discussed discourse function is the focus, which has been characterized in a variety of ways as the "most important" or "new" information of an utterance (cf. Krifka, 2007). The focus can be defined to be the part of an answer that corresponds to the *wh*-part of a question.[1] The question-answer congruence is not always explicitly expressed in discourse. Instead, a coherent discourse can be structured by implicit *Questions Under Discussion (QUD)* (cf., e.g., Roberts, 1996; Büring, 2003). As a simple example with an explicit question, consider (1a) asking for the object that John is renting.

(1) a. What did John rent?
b. He rented ⟦a BICYCLE⟧$_F$. (narrow NP focus)

The answer in (1b) provides the element asked for, the focus of the utterance marked by ⟦ ⟧$_F$: Out of the various alternative things John could have rented, he picked a bicycle. The word *bicycle* is shown in small caps to indicate that it contains a syllable bearing a nuclear pitch accent. In this most basic case, the focused material thus is marked by a pitch accent and consists of information that is new in the discourse. However, the relation between pitch accent, focus, and new information often is much less direct.

The identical prosodic realization of sentence (1b), with a single pitch accent on the object *bicycle*, is traditionally also assumed to be appropriate in contexts requiring a wider focus (2).

(2) a. What did John do?
John ⟦rented a BICYCLE⟧$_F$. (wide VP focus)
b. What happened yesterday?
⟦John rented a BICYCLE⟧$_F$. (wide S focus)

The question in (2a) requires an answer in which the VP *rented a bicycle* is the focus: Out of the alternative actions John could have performed, it is renting a bicycle that he did. And the question in (2b) puts the entire sentence *John rented a bicycle* into focus: Out of everything that could have happened yesterday, it asserts that John renting a bicycle is what happened. Crucially, the exact same realization of the answer is traditionally assumed to be appropriate for either of the three focus interpretations. This flexible relation between pitch accent placement and focus interpretation is generally referred to as as **focus projection**. A number of lexical and syntactic conditions have been formulated in the literature to define when focus can project in this way (e.g., Gussenhoven, 1983; von Stechow and

[1] We only use the term focus in this formal pragmatic sense to avoid confusion with the prosodic notion (pitch accent, focus exponent).

Uhmann, 1986; Uhmann, 1991; Selkirk, 1995) and De Kuthy (2002) showed how they can be integrated into the HPSG architecture.

However, Schwarzschild (1999) observed an important **dissociation of focus and new information** in sentences where some information is ***given* in the discourse**, which so far are not captured by any of the HPSG approaches. To exemplify the phenomenon, we add the context in (3) introducing some conference participants, Bill, the rental of vehicles, and red and blue convertibles into the discourse. Based on this context, we then again consider the question (3a) asking for the object that John is renting as the focus.

(3) The conference participants are renting all kind of vehicles. Yesterday, Bill came to the conference driving a red convertible and today he's arrived with a blue one.
   a. What did John rent?
   b. He (only) rented $[\![$a GREEN convertible$]\!]_F$.

One can now answer this question with sentence (3b), where *a green convertible* is the focus: Out of all the things John could have rented, he picked a green convertible. In this focus, only *green* is new to the discourse, whereas convertibles were already given in the context. That the focus is indeed the full expression *a* GREEN *convertible* can be confirmed by adding the focus-sensitive expression *only* in front of the verb in (3b). Considering the relation between the pitch accent and the focused meaning, example (3b) shows that when focused material is already given in the discourse, the focus includes unaccented substantive material – so-called **deaccenting of given material**. In general, every focused expression must contain a pitch accent. Where given material occurs in the focus, the pitch accent is realized on another, new word in the focus.

Pushing the dissociation of focus and new information to the extreme, it is possible for the focus to consist entirely of material already given in the context, as illustrated by (4b). In this example, the focus contains no new information so that the pitch accent is exceptionally realized on a given element.

(4) In the rental lot, there were two bicycles and a motorcycle.
   a. What did John rent?
   b. He rented $[\![$a BICYCLE$]\!]_F$.

Büring (2006) further explores the perspective of Schwarzschild (1999) and shows that deaccenting of given material is a widespread phenomenon. Yet, currently it is not captured by any HPSG approach. In the remainder of this article, we develop an approach integrating the notion of givenness in a structured meaning approach to information structure which makes the proper predictions for the cases of deaccenting.

3 An HPSG Analysis Incorporating Givenness

We couch our analysis in the HPSG approach to information structure developed in De Kuthy (2002). Her approach builds on the proposal of Engdahl and Vallduví (1996), in which a focus-background structure for every sentence is build up compositionally from the focus-background structures of its subparts. The information structure is encoded in the attribute INFO-STRUC that is appropriate for signs. As discussed in De Kuthy (2002), it leads to unintended consequences to encode the attribute INFO-STRUC as part of local objects (as in Engdahl and Vallduví (1996), where it is included under CONTEXT) since in unbounded dependency constructions the INFO-STRUC values should not be structure shared between a filler and its gap.

The appropriate features for INFO-STRUC are FOCUS and TOPIC, with lists of so-called meaningful expressions (semantic terms, cf. Sailer 2000) as values. The background of a sentence is defined to be that part of the logical form (LF) of the sentence which is neither in focus nor in topic. This characterization of background closely resembles the definition of background employed by the so-called *structured meaning* approaches to focus of von Stechow (1981), Jacobs (1983), or Krifka (1992). As an example, Figure 1 shows the INFO-STRUC representation resulting for the example (2a), where the VP is focused.

$$\begin{bmatrix} \text{S|LOC|CONT|LF } \exists x[bicycle'(x) \wedge rent'(j,x)] \\ \text{INFO-STRUC} \left[\text{FOCUS } \langle \lambda y \exists x[bicycle'(x) \wedge rent'(y,x)] \rangle\right] \end{bmatrix}$$

Figure 1: Sign-based representation of information structure for example (2a)

We start our extension of the approach of De Kuthy (2002) by distinguishing the compositional built-up of structured meanings from the information structure as such, which we only want to encode for unembedded signs, i.e., the signs for which it makes sense to encode how they are integrated into the discourse. We therefore introduce the feature STRUCTURED-MEANING and make it appropriate for all *signs*, whereas the feature INFO-STRUC is changed to only be appropriate for *unembedded-signs*. A constraint ensures that the value of INFO-STRUC for unembedded signs is that composed in STRUCTURED-MEANING.

To capture the relation between focus and givenness as introduced in section 2, we add the feature GIVEN to the types *structured-meaning* and *info-struc*. Parallel to the attribute FOCUS, the attribute GIVEN has (lists of) semantic terms as value. Figure 2 sums up the relevant parts of the signature and theory.

To model phenomena such as focus projection and deaccentuation of given material, one also needs to make explicit the relation between pitch accent placement and the interpreted focus. Following De Kuthy (2002), we include an ACCENT attribute to encode whether a word receives an accent or not (and what type of accent it is, an issue ignored here since it is orthogonal to the topic of this article). The relation between pitch accents and the information structure of words is defined by the principle shown in Figure 3 depending on the type of accent the word receives.

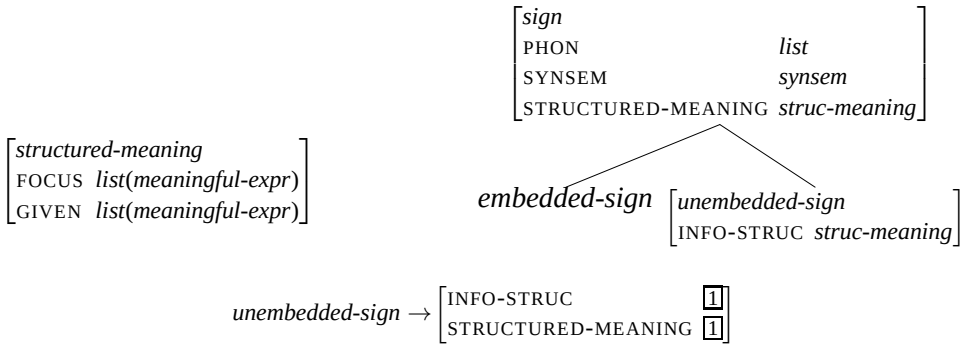

Figure 2: Basic information structure signature and constraint

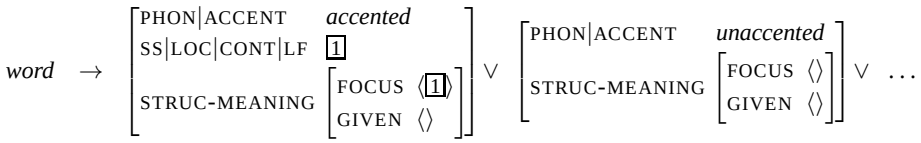

Figure 3: Relating intonation and information structure for words

Now we are ready for the core of the approach, the build-up of the structured meaning representation in phrases. This is the part of the theory which needs to capture focus projection and the impact of given information. We extend the Focus Projection Principle of De Kuthy and Meurers (2003) with a disjunct capturing focus projection in the presence of givenness. Figure 4 shows the resulting principle.[2] The first three disjuncts are adapted from De Kuthy and Meurers (2003). The first disjunct in the consequent of the principle covers the base case in which the focus does not project further; the mother of the phrase just collects the focus values of all her daughters. The second disjunct covers focus projection in the nominal domain, where focus always projects from the rightmost daughter of a phrase. Note how focus is encoded: If a constituent is part of the focus then its logical form is token identical to an element of its FOCUS value.[3] The third disjunct specifies under which circumstances focus can project in the verbal domain: a phrase headed by a verb can only be in the focus (i.e., its entire logical form is token identical to an element of its focus value) if a non-head daughter with focus projection potential (FPP *plus*) is entirely focused itself.

[2]The auxiliary relations are defined as:

$$\textit{any-dtr}\left(\boxed{1}\right) := \left[\text{HEAD-DTR } \boxed{1}\right].$$
$$\textit{any-dtr}\left(\boxed{1}\right) := \left[\text{NON-HEAD-DTRS } \textit{element}\left(\boxed{1}\right)\right].$$
$$\textit{collect-focus}\left(\langle\rangle\right) := \langle\rangle.$$
$$\textit{collect-focus}\left(\left\langle\left[\text{STRUC-MEANING|FOCUS } \langle\boxed{1}\rangle\right] \mid \boxed{2}\right\rangle\right) := \left\langle\boxed{1} \mid \textit{collect-focus}\left(\boxed{2}\right)\right\rangle.$$

[3]FOCUS is list valued to account for sentences with multiple foci, cf. De Kuthy (2002, p. 164).

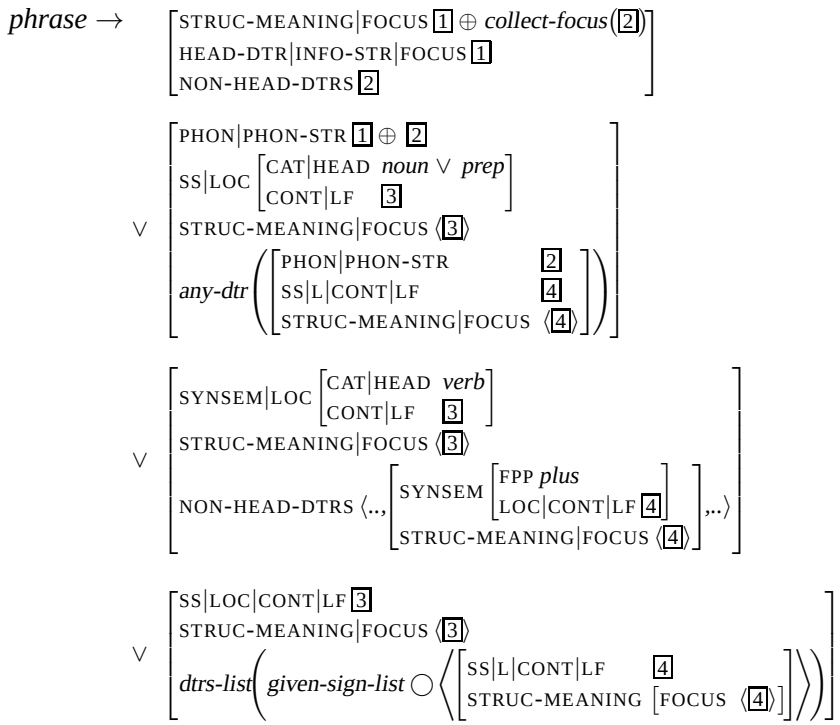

Figure 4: Focus Projection Principle

The FPP lexically encodes from which elements focus can project for a given verb, encoding the lexical subregularities discussed in the literature (cf., e.g., von Stechow and Uhmann, 1986). For example, a transitive verb such as *rent* specifies in the lexical entry or as the result of a lexical principle that its subject argument is FPP *minus* whereas its object is FPP *plus* to encode that this verb supports focus projection only from the object.

Figure 5 illustrates how the principles interact in licensing a regular VP focus example, such as the one we saw in (2a). The pitch accent in example (2a) is on the noun *bicycle* so that according to the information-structure principle for words of Figure 3 it contributes its LOGICAL FORM (LF) value to its FOCUS value. The Focus Projection Principle of Figure 4 ensures that the focus can project over the entire NP *a bicycle*, i.e., its FOCUS element is identical to its LF value. Since *a bicycle* as the object of *rented* in the tree in figure 5 is lexically marked as FPP *plus*, the principle governing focus projection in the verbal domain in figure 4 licenses the focus to project over the entire verb phrase *rented a bicycle*. The VP thus contributes its LF value to its FOCUS value. In this example, the focus does not project further. In the head-subject phrase the focus values of the two daughters thus is simply collected as specified by the first disjunct of the principle of Figure 4. As a result, the FOCUS value of the overall sentence is the FOCUS value of the VP, which here is the LF of the VP.

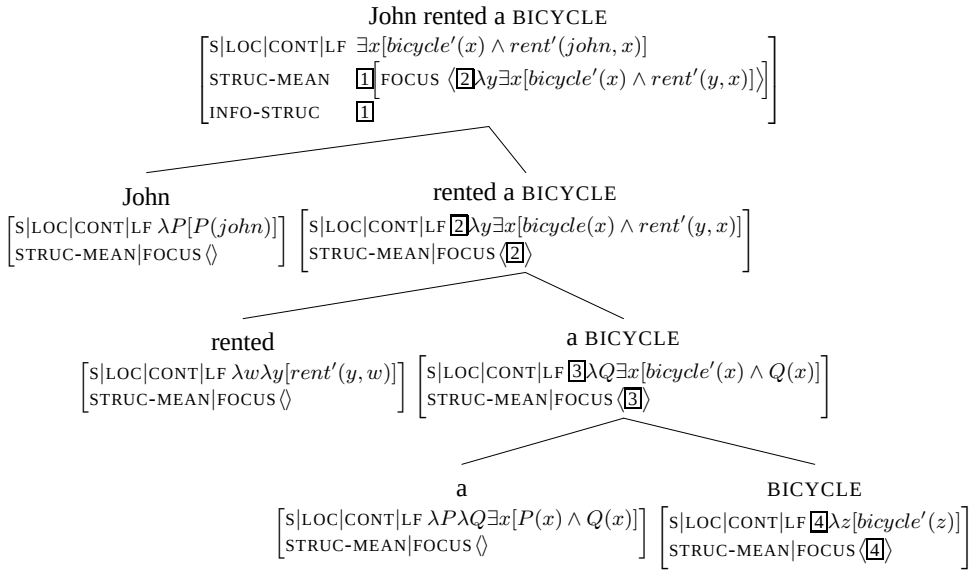

Figure 5: Structured meaning and information structure in VP focus example (2a)

We now turn to the fourth disjunct of the Focus Projection Principle.[4] It captures the previously unaccounted cases where given material in a focused phrase is deaccented, as discussed in section 2. Focus in those examples can project from a focused daughter in a position which normally does not allow focus projection. This only is an option if all other daughters in that focused phrase are *given*. Spelling this out, the fourth disjunct of the principle in Figure 4 specifies that the mother of a phrase can be in the focus (i.e., the entire LF value of the mother's CONTENT is token identical to an element on the mother's FOCUS list) if it is the case that the list of all daughters (provided by *dtrs-list*) consists of *given* signs into which a single *focused* sign is shuffled ($\bigcirc$).[5] As before, a sign is focused if its LF value is token identical to an element of its FOCUS value; and a sign is given if its LF value is token identical to an element of its GIVEN value.

Figure 6 provides an example showing the INFO-STRUC and STRUCTURED-MEANING values of the example (3b), a case involving deaccentuation of given material in the focus domain.

[4]The auxiliary relations are defined as:

$$\textit{dtrs-list}\left(\left\langle \boxed{1} \middle| \boxed{2} \right\rangle\right) := \begin{bmatrix} \text{HEAD-DTR} & \boxed{1} \\ \text{NON-HD-DTRS} & \boxed{2} \end{bmatrix}$$

$$\textit{given-sign-list} := \langle\rangle.$$

$$\textit{given-sign-list} := \left\langle \begin{bmatrix} \text{SS|L|CONT|LF} & \boxed{1} \\ \text{STRUC-MEANING} & \begin{bmatrix} \text{GIVEN} & \langle \boxed{1} \rangle \end{bmatrix} \end{bmatrix} \middle| \textit{given-sign-list} \right\rangle.$$

[5]If only binary structures are assumed, as in the examples in this paper, the principle can be simplified. We here kept the general version with recursive relations following De Kuthy and Meurers (2003), which also support flatter structures.

Figure 6: Example involving givenness deaccenting and focus projection

The pitch accent in this example is on the adjective *green* so that the principle in Figure 3 licenses structure sharing of the adjective's content with its FOCUS value. In the context of the question (3a), the entire NP *a green convertible* of example (3b) is in the focus. In the phrase *green convertible*, the clause licensing focus projection in NPs does not apply since the adjective *green*, from which the focus has to project in this case, is not the rightmost element of the phrase. What does apply is the fourth disjunct of the principle licensing focus projection in connection with givenness. Since the noun *convertible* is given, the adjective *green* is the only daughter in the phrase that is not given and focus is allowed to project to the mother of the phrase. In the phrase *a green convertible*, focus projection is again licensed via the clause for focus projection in noun phrases, since the focused phrase *green convertible* is the rightmost daughter in that noun phrase.

We note in closing that the first three disjuncts of the Focus Projection Principle also apply when elements are given. This is intentional since pitch accent placement in complex focused phrases only containing given material follows the same regularities as pitch accent placement in focused constituents only containing new material. For example, the pitch accent in a focused given NP occurs on the rightmost element in that NP as the example (5b) illustrates.

(5) Mary rented a blue motorcycle.
   a. What did John rent?
   b. He also rented $[\![$ a blue MOTORCYCLE$]\!]_F$.

Related work Despite its importance for the syntax-pragmatic-intonation interface, focus projection and the issue of deaccenting has received only little attention in the HPSG architecture. Engdahl and Vallduví (1996) discussed aspects of information packaging in HPSG and included an INFO-STRUC instantiation principle for English licensing focus projection from the most oblique object in a VP. Our approach is inspired by their work, but it provides a more explicit formalization in the HPSG architecture and it significantly extends the empirical coverage to include the verbal and nominal domain, cases where focus does not project, and the deaccenting phenomenon tackled in this article.

4 Summary and Outlook

We showed in this article how the HPSG approach to information structure of De Kuthy (2002) and De Kuthy and Meurers (2003) can be extended to capture givenness (Schwarzschild, 1999) and make the right predictions for so-called *deaccenting* of given information, a widespread phenomenon (Büring, 2006) not previously dealt with in HPSG.

Our approach captures the relation of pitch accentuation, syntax, and information structure on the sentence level. To be able to interpret notions such as focus and givenness as part of a theory of discourse, the approach naturally needs to be

integrated into a formal pragmatic theory of how explicit and implicit questions under discussion arise and are addressed (cf., e.g., Roberts, 1996; Büring, 2003).

Complementing the issue of givenness in the context of focus projection discussed in this paper, there seems to be a related issue warranting attention, namely the nature of the material projected over in the cases of focus projection. Consider, for example, the following examples in (6a) and (6b) in the out of the blue context given.

(6) Hi John, good to see you here in the department! But why are you so pale?
   a. ⟦I just saw a man with an AXE!⟧$_F$
   b. ⟦I just saw a chicken with an AXE!⟧$_F$

In such a wide focus context, the sentence (6a) is unremarkable, whereas the almost identical one in (6b) appears problematic with the given intonation. The intuitive explanation is that seeing *chicken* in a department is so unexpected that it needs to be introduced as new information by its own accent. This is not the case for men, which roam around departments all the time. Relatedly, axes are typically carried by men as in (6a). It remains to be explored whether the kind of non-accenting of material projected over in focus projection cases (such as (6a)) is related to the deaccenting of given material discussed in this paper.

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Floating numeral classifiers in Korean: A thematic-structure perspective

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Abstract

The syntactic and semantic complexity of the so-called numeral classifier (NUM-CL) constructions in languages like Korean (Japanese and Chinese as well) has much challenged theoretical as well as computational approaches. Among several types of the NUM-CL constructions, the most complicated type includes the so-called FQ (floated numeral classifier/quantifier) construction where the NUM-CL 'floats' away from its antecedent. This paper, couched upon the non-derivational VP-modifier view, shows that in addition to the grammatical function of the host NP and types of the main predicate, properties of the intervening expression between the FQ and its host NP also play an important role in licensing the FQ's distribution. In particular, we show that the FQ introduces new information in discourse and as default sets off rheme in the thematic structure. This functional analysis can provide an answer to several puzzling contrasts we observe in the distribution of the FQ.

1 The Issues

There exist at least three different environments where numeral classifiers (NUM-CL) in Korean can appear:

(1) a. Genitive-Case (GC) Type:

sey myeng-uy pemin-i iss-ta
three CL-GEN criminal-NOM exist-DECL
'There are three criminals.'

b. Noun Initial (NI) Type:

pemin sey myeng-i iss-ta
criminals three CL-NOM exist-DECL

c. Floated Numeral Classifier (FNC) Type:

pemin-i sey myeng iss-ta
criminals-NOM three CL exist-DECL

Though these three types of NUM-CL constructions behave similarly with respect to the propositional meaning, they are different in many syntactic and semantic respects. In the GC type, the NUM-CL appears with the genitive case marking, preceding the head noun *pemin* 'criminal' whereas in the NI, the NUM-CL sequence

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follows the head noun. Meanwhile, in the FNC type, the head noun is case-marked, followed by the NUM-CL. In this case, the NUM-CL can further 'float' away from the associated NP:

(2) **pemin-i** cengmal **sey** **myeng** te iss-ta
criminal-NOM really three CL more exist-DECL
'There are really three more criminals.'

In this example, the NUM-CL *sey myeng* and its antecedent NP *pemin-i* are not adjacent, but are separated by an intervening adverb, *cengmal* 'really'.

In the FNC type there are several constraints where the NUM-CL can be floated and with which argument the floated NUM-CL can be associated. For example, the NUM-CL just like adverbial elements, canonically has a free distribution, but cannot precede its host NP (cf. Kim 1984, Choi 1988, Lee 1989, Shi 2000, Kang 2002):

(3) *__sey myeng__ cengmal **pemin-i** te iss-ta
three CL really criminal-NOM more exist-DECL

Matters become complicated when an argument intervenes between the two. Literature has often noted that there is an asymmetry between subject and object (see Park and Sohn 1993, Kang 2002, Ko 2007 for Korean and Saito 1985 and Miyagawa 1989 for the same paradigm in Japanese):

(4) a. ??/*__haksayng-tul-i__ chayk-ul **sey** **myeng** ilkessta
student-PL-NOM book-ACC three CL read
'(int) Three students read books.'

b. **chayk-ul** haksayng-tul-i **sey** **kwen** ilkessta
book-ACC student-PL-NOM three CL read
'Students read three books.'

As seen from (4a), the object cannot intervene between the subject and its NUM-CL whereas as illustrated in (4b) such an effect disappears when the subject intervenes between the scrambled object and its NUM-CL.

Numerous attempts have been made to understand the grammatical properties of numeral classifier constructions, mainly focusing on how to generate the three types of NUM-CL and figure out the syntactic relations among these three if there are any. The generation of the GC and NI construction has been rather simple, but that of the FNC has been controversial. In the traditional 'stranding' view, the FNC construction is derived from the NI by moving the NP antecedent out of the VP, leaving the FNC and its trace behind (e.g., Sportiche 1988, Koopman and Sportiche 1991, Bošković 2004, Miyagawa 1989, Miyagawa and Arikawa 2007, for Japanese, Park and Sohn 1993, Ko 2005, 2007 for Korean). However, there are many facts arguing against this kind of movement assumption, but support for

the base-generated VP-modifier view (e.g., Bobaljik 2003 for English, Fukushima 1991, Gunji and Hasida 1998, Kuno and Takami 2003 for Japanese, Kang 2002, Shi 2000, Kim and Yang 2007 for Korean). In the VP-modifier view we support here too, the floated-away NUM-CL is simply taken to modify a verbal predicate in situ and quantifies over the event that the VP denotes.

In addition to supporting this VP-modifier view, this paper also suggests that the main function of the floated NUM-CL is to start off rheme in the thematic structure. This functional approach, accompanied by the VP-modifier view, can provide the subtle contrasts previous literature have tried to capture. In so doing, in what follows, we will first review some formal properties of the three types and then discuss the pros and cons of the stranding and VP-modifier view. We then discuss how the functionally-motivated thematic structure can account for the phenomena in question.

2 Some Main Properties of the Three Types

As indicated by the name of the three NUM-CL constructions, the possible case value on the NUM-CL in each is different. In particular, even though the NI type can host almost any semantic case marker, the FNC type allows only nominative or accusative on the NUM-CL (cf. Choi 2001). In terms of syntactic structures, the three types also display clear differences. For example, coordination shows us a main difference with respect to constituenthood: the GC and the NI type can participate in coordinate constructions, but the FNC type cannot:

(5) a. Kim-un [[sey kwen-uy kongchayk]-kwa [twu calwu-uy
Kim-TOP three CL-GEN notebook-CONJ two CL-GEN
yenphil]]-ul sassta.
pencil-ACC bought
'Kim bought three notes and two pencils.'

b. Kim-un [[kongchayk sey kwen]-kwa [yenphil twu calwu]]-lul
Kim-TOP notebook three CL-CONJ pencil two CL-ACC
sassta
bought

c. ??*Kim-un [[kongchayk-ul sey kwen]-kwa [yenpil-ul twu
Kim-TOP notebook-ACC three CL-CONJ pencil-ACC two
calwu]] sassta.
CL-ACC bought

The syntactic differences among the three types also lead to subtle semantic and pragmatic differences. Unlike the GC and NI type, the FNC construction licenses a partitive reading. Consider the following set of data:

(6) a. Seoul-lo tomangka-n tases myeng-uy haksayng-i tolawassta
Seoul-to run-away-PNE five CL-GEN student-NOM returned
'The five students who ran away for Seoul returned.'

b. Seoul-lo tomangka-n haksayng tases myeng-i tolawassta.
Seoul-to run-away-PNE student five CL-NOM returned
'The five students who ran away for Seoul returned.'

c. Seoul-lo tomangka-n haksayng-i tases myeng-(i) tolawassta.
Seoul-to run-away-PNE student-NOM five CL-NOM returned
'Of those who ran away for Seoul, just five returned.'

The examples (6a) and (6b) are true in the situation where there are five students who left for Seoul, and they all came back. Meanwhile, the preferred reading of (6c) is such that there are more than five students who left for Seoul and of them just five returned, thus licensing a partitive reading here.

We can also observe a difference in the specific and nonspecific reading. The NI allows either a specific or nonspecific reading whereas the FNC allows only a nonspecific reading (cf. Lee 1989, Kim 2005):

(7) a. pemin twu myeng-i ecey tomangkassta
criminal two CL-NOM yesterday ran.away
'Two (specific or nonspecific) criminals ran away yesterday.'

b. pemin-i ecey twu myeng-i tomangkassta
criminal-NOM yesterday two CL-NOM ran.away
'Of the criminals, two (nonspecific) ran away.'

As given in the English glosses here, in the NI type, the two criminals can be either specific or nonspecific whereas in the FNC, they can be only nonspecific. With respect to this reading, (7b) can be interpreted as having a partitive and nonspecific reading such that there are a set of criminals and of the members in this set, two unspecific criminals ran away. No such reading is available in the NI type (or the GC) type.

3 Two Different Approaches for the FNC Construction

Stranding Approaches: The traditional wisdom of dealing with a FNC example has been the stranding approach, trying to link the NI or GC type to the FNC type. For instance, the FNC type is derived from the following source with movement processes (cf. Miyagawa 1989, Miyagawa and Arikawa 2007, Lee 1989, etc).

(8) Mia-nun [$_{VP}$chayk$_i$-ul [$_{VP}$ ceketo [$_{VP}$t$_i$ sey kwen-(ul) ilkessta]]]

The NP *chayk* 'book', being in the same local domain (e.g., mutual c-commanded) with the NUM-CL is moved out of the VP, stranding behind the NUM-CL in the original position. The claimed argument for this stranding view follows from the strict locality condition between a NUM-CL and its associated NP. That is, if they two are not adjacent to each other, the NUM-CL has been 'stranded' by the NP. This locality requirement has been motivated from the contrast between subject and object, which we have seen earlier. However, as even the proponents of the stranding approach acknowledge (cf. Miyagawa and Arikawa 2007), there is a question if such an example is really unacceptable. There are many examples where a similar ordering is acceptable. In particular, a case marking or a delimiter marker on the NUM-CL, makes the following acceptable:

(9) **haksayng-tul-i** [maykcwu-lul [**sey myeng-i/ina/man**] masiessta]
students-NOM beer-ACC three CL-NOM/even/only drank
'Even/Only three of the students drank beer.'

VP-modifier Analyses: Unlike the standing analysis, the VP modifier analysis assumes that there is no transformation relation between the NI or GC and FNC version (Fukushima 1991, Gunji and Hasida 1998 for Japanese, Kang 2002 and Kim and Yang 2007 for Korean). Contrary to the stranding view, the VP-modifier view assumes the NUM-CL directly combines with a verbal predicate in syntax and semantically modifies an event structure the predicate denotes:

(10) pemin-i cengmal [$_{VP}$ sey myeng [$_{VP}$ te iss-ta]]
criminal-NOM really three CL more exist-DECL
'There are really at least three more criminals.'

As given in the structure, there is no movement: the NUM-CL just modifies the VP.

Several welcome predictions follow from this view. First of all, the VP-modifier view will predict the distributional possibilities of the NUM-CL as an adverbial element. As we have seen, the NUM-CL can appear where an adverbial element can occur otherwise constraint such as it cannot precede its associate NP. In addition, since there are no direct links between the FNC type with the other two types, we expect each will behave differently in many syntactic and semantic aspects. This has been true as we have observed so far. Additional support can also find from semantic aspects: the NI or GC type induces either specific or non-specific whereas the FNC has only nonspecific. This also has to do with the fact that the FNC allows only a narrow scope reading when interacting with another scope operator such as negation:

(11) a. NI Type: $\exists 3 >$ NOT or NOT $> \exists 3$

haksayng sey myeng-i acik ttenaci anh-ass-ta
students three CL-NOM still leave-COMP not-PAST-DECL
'Three students haven't left yet or
these three students still didn't left yet.'

b. FNC Type: *∃3 > NOT or NOT > ∃3

haksayng-i acik **sey** **myeng-i** ttenaci anh-ass-ta
student-NOM still three CL-NOM leave-COMP not-PAST-DECL
'Three students haven't left yet,
(even though more had already left)'

The VP modifier approach allows us to specify that the floated NUM-CL has a narrower scope reading than the VP it modifies, which may not be an easy task within a stranding approach.

4 A Functional Account

Even if we adopt the VP-modifier approach, puzzles still remain: why certain FNC examples are bad or at least unnatural. As we have seen so far, when the FNC is marked with a case marker or a delimiter, the intervening effects or contrasts (subject and object asymmetry, unaccusative/unergative contrast) disappear. In this paper, we suggest that the floated NUM-CL and the modified verbal predicate serve as rheme in the thematic structure. In particular, we claim that the floated NUM-CL starts off the rheme in a given clause.

Based on the interactions between information and intonation structure in partitioning theme and rheme, we assume that the FNC is subject to the functional constraint that the number of referents it denotes conveys new information, part of the rheme in the thematic structure. Together with this notion of thematic structure, we suggest that the floated NUM-CL sets apart theme and rheme whose constraint can be paraphrased as in (12):

(12) Thematic Constraint in Korean:
A floated NUM-CL in Korean sets off rheme in the thematic structure.

The constraint states that the floated NUM-CL marks the beginning of rheme which may contain both old and new information, but tells about the information about the theme.

According to this, the subject-object asymmetry follows immediately. What sets off the rheme in a given clause determines the degree of acceptability: In (4a), it is not the NUM-CL but the intervening object that marks the beginning of rheme, which violates the constraint in (12). Note that unlike (4a), we have seen that in (4b) the subject can intervene between the object and its NUM-CL, whose example we repeat here:

(13) chayk-ul haksayngtul-i ‖ sey kwen ilkessta
book-ACC student-NOM three CL read
'Students read three books.'

In this example, both the fronted object and the subject are theme elements, and thus the NUM-CL starts the rheme of the sentence (marked with the symbol ||), observing the thematic constraint.

Further welcoming effects of this constraint can be observed from the following set of examples:

(14) a. haksayngtul-i || **sey myeng(-i)** tosekwan-eyese chayk-ul
students-NOM three CL-NOM libary-at book-ACC
ilkessta
read
'As for the students, there were three who read the book at the library.'

b. haksayngtul-i tosekwan-eyese || **sey myeng(-i)** chayk-ul ilkessta
'As for the students at the libary, there were three who read the book.'

c. haksayngtul-i tosekwan-eyese chayk-ul || **sey myeng(-i)** ilkessta
'As for the students at the libary and as for the book, there were three who read it.'

As pointed out earlier and illustrated here, the adverbial NUM-CL can appear in various places, but induces subtle differences in the thematic structure. Given our thematic constraint, the expressions preceding the NUM-CL are themes in the clause whereas those following it are the members of rheme. This results in the subtle meaning differences here as indicated in the English glosses (see Kim 2005 for similar meaning differences among these), which would be hard to capture otherwise.

Note that the thematic constraint can also account for the difference between high and low adverb with respect to the distribution of a floated NUM-CL:

(15) a. ai-tul-i ecey sey myeng kyosil-eyse wusessta
child-PL-NOM yesterday three CL classroom-at laughed
'Three children laughed at the classroom yesterday.'

b. *ai-tul-i khu-key sey myeng wusessta
child-PL-NOM loudly three CL laughed
'Three children laughed loudly at the classroom.'

Within the traditional stranding view, the contrast follows from the following derivations:

(16) a. $[_{TP}$ ai-tul-i $[_{VP}$ ecey $[_{VP}[t_i$ sey myeng] kyosil-eyse wusessta]]]

b. *$[_{TP}$ ai-tul-i $[_{VP}$ t_i $[_{VP}$[khu-key sey myeng wuessta]]]]

In (16a) with the high adverb 'yesterday', the NUM-CL is in the same local domain with its associated subject here, observing the strict locality requirement. However, in (16b) with the low adverb 'loudly', the subject and its NUM-CL are not in the same local domain. Once again, note that when the NUM-CL has a focus marker, indicating the starting point of the rheme, the grammaticality improves a lot:

(17) a. ai-tul-i || sey myeng-i khu-key wusessta
child-PL-NOM three CL-NOM loudly laughed
'Three children laughed loudly.'

b. ai-tul-i khu-key || sey myeng-ina wusessta

c. ai-tul-i ecey khu-key || twu myeng-i/ina wuessta

In our thematic constraint, given the assumption that either a manner adverb or a floated NUM-CL can set off the rheme, the accceptablity of all these examples then follows straightforwardly.

Our account, resorting to the thematic structure, can also get support from the claimed contrast between unergative and unaccusative (cf. Ko 2007):

(18) a. koyangi-ka pyeng-ulo sey mali cwukessta
cat-NOM illness-of three CL died
'Three cats died of illness.'

b. ?*haksayng-tul-i caki-uy ton-ulo twu myeng
student-PL-NOM self-GEN money-with two CL
cenhwahayessta
phoned
'Two students made a phone call with their own money.'

In the stranding view, (18b) with the unergative verb 'phoned' violates the strict locality condiiton betwen the subject and its NUM-CL. However, note that the grammaticality of (18b) improves greatly with supporting elements:

(19) haksayng-tul-i caki ton-ulo cikcep Seoul-ey || twu
student-PL-NOM self money-with without.help Seoul-at || two
myeng cenhwahayessta
CL phoned
'Two students made a phone call to Seoul with their own money without any help.'

In the context where it is important to see how many students made a phone call to Seoul by themselves, such a sentence is more than acceptable, supporting our analysis. It is also not difficult to construct acceptable unergative examples with the same configuration:

(20) a. haksayng-tul-i himtulkey caki ton-ulo || twu myeng
student-PL-NOM hard self money-with two CL
mikwuk-ey kassta
America-to went
'Two students went to America with difficulties with their own money.'

b. haksayng-tul-i pwumonim towum epsi caki ton-ulo ||
student-PL-NOM parents help without self money-with
twu myeng mikwuk-ey kassta
two CL America-to went
'Two students went to America for themselves
with their own money and without their parents' help.'

What this means is that being the subject of an unergative verb does not block its NUM-CL from being floated or being in a nonlocal position. Our conjecture is that the unacceptability of (18b) is rather related to the thematic constriant: the phrase, *caki ton-ulo*, is rheme, so that the NUM-CL cannot starts the rheme component, violating our thematic constraint.

5 Conclusion

The syntactic and semantic complexity of the so-called numeral classifier (NUM-CL) constructions in languages like Korean (Japanese and Chinese as well) has much challenged theoretical as well as computational approaches. Among several types of the NUM-CL constructions, the most complicated type includes the one where the NUM-CL 'floats' away from its antecedent.

This paper supports a non-movement approach for the NUM-CL constructions, in particular, a VP-modifier approach for the floated NUM-CL (FNC) construction. In the paper, we claim that the main function of the FNC is to set off rheme in the thematic structure, cued by both information and intonation tunes. Further supported by a pilot prosodic test, this functional-based approach can provide us with a streamlined analysis for various distributional possibilities of the FNC without resorting to movement operations.

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The information structure of subject extraposition in Early New High German

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Abstract

This paper investigates the information-structural characteristics of extraposed subjects in Early New High German (ENHG). Based on new quantitative data from a parsed corpus of ENHG, I will argue that unlike objects, subjects in ENHG have two motivations for extraposing. First, subjects may extrapose in order to receive narrow focus, which is the pattern Bies (1996) has shown for object extraposition in ENHG. Secondly, however, subjects may extrapose in order to receive a default sentence accent, which is most visible in the case of presentational constructions. This motivation does not affect objects, which may achieve the same prosodic goal without having to extrapose. The study has two major consequences: (1) subject extraposition in ENHG demonstrates that there is not necessarily a one-to-one correspondence between syntactic structure and information structural effect (cf. Féry, 2007); and (2) the overall phenomenon of DP extraposition in ENHG fits into a broader set of crosslinguistic focus phenomena which demonstrate a subject-object asymmetry (cf. Hartmann and Zimmermann, 2007; Skopeteas and Fanselow, 2010), raising important questions about the relationship between argument structure and information structural notions.

1 Introduction

This paper investigates the information-structural characteristics of extraposed subjects in Early New High German (ENHG). Based on new quantitative data from a parsed corpus of ENHG, I will argue that unlike objects, subjects in ENHG have two motivations for extraposing. First, subjects may extrapose in order to receive narrow focus, which is the pattern Bies (1996) has shown for object extraposition in ENHG. Secondly, however, subjects may extrapose in order to receive a default sentence accent, which is most visible in the case of presentational constructions. This motivation does not affect objects, which may achieve the same prosodic goal without having to extrapose.

I will begin from the following information-structural assumptions. This paper is roughly based on a theory of information structure as in Vallduví (1992), in which every sentence is divided into a Focus-Ground partition, and every sentence has only one information-structural focus. I assume that any constituent (and possibly some non-constituents) may be the focus of a sentence. I use the term *narrow focus* to describe a DP which is, in itself, the sole focus of a clause (that is, neither part of the Ground, nor part of a larger focused constituent). The term *narrow focus* in this sense covers a number of more specific focus types.

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I will also use the term *presentational focus,* which describes the type of focus which introduces a new entity into the discourse (it has in other works been described by the term *new information focus*). As I will discuss later, a newly introduced DP in a presentational construction may be narrowly focused, or it may not. In other contexts, narrowly focused DPs may also be interpreted as other types of focus, for example contrastive focus, which will not be discussed in detail in the current paper.

The remainder of this paper will be organized as follows. In the next section, Section 2, I will discuss some previous studies on related phenomena, which will help to structure the current investigation. Then, in Section 3, I will outline the methodology and quantitative results of the current study. I propose an analysis of these results in Section 4; finally, in Section 5, I offer some concluding remarks.

2 Related Studies

Although I know of no previous studies of subject extraposition in ENHG (particularly from a quantitative perspective), some related phenomena in Germanic have been explored by previous works. For my purposes, the most notable are two studies based on quantitative data: Bies (1996) on object extraposition in ENHG, and Prince (1989) on subject extraposition in Yiddish. A brief review of these two works is necessary before proceeding to the current study.

2.1 Object Extraposition in ENHG

Bies (1996) provides a detailed analysis of the information structure of DP extraposition, based on a corpus of examples collected from various ENHG texts. She considers two possible motivations for extraposition, discourse newness and narrow focus on the DP. Before considering discourse factors, however, Bies identifies external influences on DP extraposition; first, quantified and indefinite objects are much less likely to extrapose (Table 1). Second, DP length (or 'weight') also strongly influences extraposition (Table 2).

	Postposed	**Non-post.**	**Rate of post.**
Negation	0	86	0%
Indefinite	8	301	2.3%
Other QP	2	83	2.4%
Non-quant.	64	408	13.6%

Table 1: DP type of extraposed objects in ENHG (Bies, 1996).

Based on these observations, Bies restricts her data set to non-quantified DPs of 'regular length' (that is, without PP modifiers, relative clauses or conjunction). She also excludes topicalized and scrambled objects from the set of non-extraposed

	Postposed	Non-post.	Rate of post.
Conjoined	13	17	43.3%
Relative clause	5	2	71.1%
PP postmodifier	25	34	42.4%
Regular length	82	722	10.2%
Total	125	775	13.9%

Table 2: Modifiers as a measure of DP weight for extraposed objects in ENHG (Bies, 1996).

DPs, assuming that they represent unrelated information structural phenomena. Bies then separates her (restricted) data set into three informational categories: discourse-new, evoked/inferred, and given information, adapted from a broader hierarchy of information types in Prince (1981). She observes a gradient relationship between newness and extraposition (Table 3).

	Postposed	Non-postposed	Rate of postposing
Given	11	100	10%
Evoked/Inf.	37	81	31.4%
Disc.-new	16	21	43.2%
Total	64	202	24.1%

Table 3: Discourse status of extraposed objects in ENHG (Bies, 1996).

Bies then asks: is this the main discourse motivation for DP extraposition, or a symptom of it? She suggests that discourse-newness of a DP may contribute to its likelihood of being narrowly focused: discourse-new elements often are the focus of a sentence. Perhaps the relationship between discourse-newness and extraposition is simply a consequence of the fact that these elements are more likely to be narrowly focused. To explore this alternate hypothesis, she further classifies her sentences into (narrow) DP focus and (wide) VP focus, wherever context allows an unambiguous classification (Table 4). The effect of narrow focus, as the data show, is stronger than that of information status. Bies therefore concludes that narrow focus alone motivates object extraposition in ENHG.

	DP focus	VP focus	Percent DP focus
Non-postposed DP	19	123	13.4%
Postposed DP	46	4	92%

Table 4: Focus structure of clauses with an extraposed object in ENHG (Bies, 1996).

2.2 Subject Extraposition in Yiddish

One could simply assume that Bies's conclusions may naturally extend as the general pattern for DP extraposition in ENHG, covering both subjects and objects. However, a second study suggests that another analysis may be possible. There is some reason to believe that subject extraposition may occur for independent purposes within a related Germanic language. Prince (1989) considers the pragmatic properties of subject extraposition in Yiddish, a language closely related to ENHG, and argues that in this case, the extraposition is motivated by the discourse-new status of the DP.

Prince begins by considering a set of examples collected from a Yiddish text. She finds that in certain subordinate clause types, brand-new subjects are highly motivated to postpose (Table 5). This leads her to suggest that discourse status is strongly related to the motivation for subject extraposition in Yiddish.

	Non-postposed	**Postposed**	**Total**
Adverbial	16 (57%)	12 (43%)	28
Complement	14 (30%)	32 (70%)	46
Total A/C	30 (41%)	44 (59%)	74
Free Relative	0 (0%)	7 (100%)	7
Indirect Q.	0 (0%)	3 (100%)	3
Relative	0 (0%)	2 (100%)	2
Total WH	0 (0%)	12 (100%)	12

Table 5: Extraposition of brand-new subjects in Yiddish by clause type (Prince, 1989).

Prince also proposes a syntactic motivation for her analysis. Although the data are small, she notes that extraposition of discourse-new subjects appears to be categorical in relative clauses, free relatives, and indirect questions. She links this to another phenomenon seen in Yiddish: the expletive *es* ('it') is licensed to fill Spec,TP when the subject is extracted from a free relative or indirect question (Prince, 1989; Diesing, 1990). Crucially, this does not occur in subject relative clauses.

(1) a. Ikh veys nit ver **es** iz gekumen
I know not who ES is come
'I don't know who came.'

b. * Ikh veys nit ver iz gekumen

(2) a. Der melamed vos iz besser far ir iz beser far mir.
the teacher that is better for her is better for me
'The teacher that is better for her, is better for me.'

b. * Der melamed vos **es** iz beser far ir iz beser far mir.

Prince hypothesizes that this expletive appears when the subject is extracted from a postposed position, leaving Spec,TP empty. This would provide a pragmatic explanation for the fact that the expletive appears only in indirect questions and free relatives, which (unlike relative clauses) typically have an extracted element that is discourse-new.

Prince therefore provides both quantitative and syntactic arguments for the claim that subject extraposition in Yiddish is motivated by the discourse status of the subject. This raises a question: should ENHG have a unified analysis for DP extraposition as a whole, or do subject and object extraposition behave differently? Phrased differently, do subjects in ENHG pattern like subjects in a related language, or like non-subject DPs in ENHG? My goal in this study is to propose an answer to this question, based on new data on subject extraposition in ENHG.

3 The Current Study

In this section, I will outline the methodology for the current study, and present the quantitative results. This will set the stage for Section 4, in which I present an analysis of subject extraposition in ENHG. I will argue that, although narrow focus proves to be a factor in both subject and object extraposition in ENHG, there is an additional motivation for subject extrapositio. This is in fact related to the discourse status of the subject, as Prince (1989) argued for Yiddish.

3.1 Methodology

The data for my study were drawn from a parsed corpus of Martin Luther's first New Testament translation, the *Septembertestament*, published 1522. The *Septembertestament* corpus consists of rougly 102,000 words, including the full text of Matthew, Mark, John and the Acts of the Apostles. It was initially parsed by automatic methods (including Bikel, 2004), but ultimately I hand-corrected the full text. The parsing format is modeled on the guidelines for the Penn Historical Corpora of English and the York-Toronto-Helsinki Parsed Corpus of Old English Prose (cf. Kroch and Taylor, 2000; Kroch et al., 2004; Taylor et al., 2003), adapted for use for a German corpus.

From the *Septembertestament* corpus, I extracted all unambiguous examples of extraposed subjects, using clause-final verbs and verbal particles as diagnostics. I found 115 examples which fit these requirements. All were hand-coded for definiteness, syllable length, and discourse status of the subject (based on Bies's classifications). I also coded the examples for focus structure using a binary measure: either (1) they had narrow focus on the extraposed subject or (2) they had a focus structure of another type (I did not code in more detail in this case). These were compared to 1261 examples of subjects that could have been extraposed but were not. This excludes pronominal subjects (including impersonal *man*, 'one') and demonstrative determiners, which are too light to extrapose. Each of these

tokens was coded for syllable length and the definiteness of the subject. Different sub-samples of this set were isolated for the consideration of the pragmatic and information-structural characteristics of subject extraposition, which will be discussed shortly.

3.2 Quantitative Results

In the sample collected, subject extraposition occurs at an overall rate of 8.4%. This is lower than the rate of object extraposition described in Bies (1996), 13.2%.

As Bies showed for object extraposition, weight proved to be a strong influence on subject extraposition (I deviate from Bies in measuring DP weight by syllables, rather than by modifier presence and type). The minimum weight of an extraposed subject was 2 syllables, while the maximum was 64 (due to a sequence of embedded clauses within the DP). The average weight of extraposed subjects was 13.07 syllables. In comparison, the minimum weight of a non-extraposed subject was 1 syllable, and he maximum was 29. The average weight of non-extraposed subjects was only 3.29 syllables.

To minimize the effect of DP weight on the sample, I chose to limit my sample to subjects of 15 syllables or less. This ensures that the DPs are of a weight safely below the limit found on non-extraposed subjects, without too greatly restricting the data set. The remainder of the paper deals only with this subset of the data, unless otherwise noted. The adjusted sample includes 86 extraposed subjects and 1257 non-extraposed subjects, or extraposition at a rate of about 6.4%.

The consideration of definiteness exposes a striking difference between subject and object extraposition: quantified/numeric subjects are extraposed more frequently than definites. This is true of the entire sample regardless of weight; Table 6 shows the distribution of subject types for the full sample of clauses.

	Non-extraposed	**Extraposed**	**% Extraposed**
Negative	47	0	0.0%
QP/Numeric	76	17	18.28%
Indefinite	98	9	8.41%
Bare	12	13	52.00%
Free rel.	13	28	68.29%
Definite	1015	48	4.52%
Total	1261	115	8.36%

Table 6: DP types of extraposed subjects in ENHG.

Note, however, that the sample contains no extraposed negated subjects. This is an interesting fact, but a detailed discussion is beyond the scope of the current paper. Furthermore, bare subjects extrapose more often than not. It is unclear how this relates to Bies's data on object extraposition, because her examples suggest

that she may have included bare DPs in her 'non-quantified' category (but this fact is never explicitly noted). Regardless, the overall distribution of DP types demonstrates a contrast between subject and object extraposition in ENHG.

I then compared the discourse status of all extraposed subjects to all non-extraposed subjects in a subset of 443 matrix and 173 subordinate clauses (for purposes of examining a smaller subset of the data); clauses with subjects of more than 15 syllables are excluded. As Table 7 demonstrates, the majority of extraposed subjects are discourse-new, but the majority of non-extraposed subjects are given. This is as expected, based on Bies's results for object extraposition in ENHG.

	Discourse-new	**Evoked/Inf.**	**Given**
Extraposed	**33 (38.82%)**	26 (30.59%)	26 (30.59%)
Non-extraposed	75 (12.17%)	165 (26.79%)	**376 (61.04%)**

Table 7: Discourse status of extraposed subjects in ENHG.

The 86 clauses with extraposed subjects were then compared to a randomly selected sample of 60 clauses with non-extraposed subjects, for a detailed consideration of the focus structures of these groups. Contextually and structurally ambiguous examples were set aside. An example of an extraposed subject coded for narrow focus is given in (3). Note that the extraposed subject contains the focus particle *auch*, making the focus structure particularly clear.

(3) denn es werden falsche Christi, vnd falsche propheten auff stehen, vnd
for it will false Christs and false prophets up stand and
grosse tzeychen vnd wunder thun **das verfuret werden, yhn denn**
great signs and wonders do that misled will.be in the
yrthum wo es muglich were auch die auserweleten.
confusion where it possible would.be also the chosen
'For false Christs and false prophets will come forward and perform great signs and wonders, so that in the confusion, where possible, even the chosen will be misled.'
(*Septembertestament*, Matthew 24:24)

As discussed above, this study creates a binary distinction between narrow focus on the extraposed subject and any other focus structure, all of which are included in the "Other foc." category. I find that extraposed subjects are narrowly focused more often than non-extraposed subjects (Table 8). However, whereas Bies found that 92% of extraposed objects were narrowly focused, only 62% of subjects in my data are narrowly focused. This leads me to reject the hypothesis that subject extraposition is driven solely by narrow focus as a broad category.

The data discussed in this section suggest that the relationship between subject and object extraposition is not simple. In many cases, there is a distinct similarity between the two: both show an effect of both discourse status and focus structure,

	Narrow S-foc.	Other foc.	% Narrow foc.
Extraposed	31	19	62.0%
Non-extraposed	4	41	8.9%
Total	35	60	36.8%

Table 8: Focus structure of clauses with extraposed subjects in ENHG.

although to different degrees. However, there are also some distinct differences, most notably in the DP types associated with each: while object extraposition occurs more frequently with definite DPs, subject extraposition shows the opposite tendency.

In the following section, I will present a proposal that may capture both the similarities and differences outlined above. I will suggest that the general motivation of subject extraposition is prosodic; while narrow focus is certainly the central motivation for some cases of subject extraposition, I will suggest that a different, more specific information structural phenomenon underlies the cases that define the difference between subject and object behavior.

4 Analysis of Subject Extraposition

As the data in the preceding section suggest, there are some ways in which subject and object focus pattern similarly. For example, many examples can be found which involve narrow focus on an extraposed definite subject, as (4) demonstrates (note that two contrastive subjects have been extraposed in two separate clauses). This is exactly the sort of example we expect if subject and object extraposition share the same information structural properties in ENHG. I argue that in cases such as these, subject and object extraposition do in fact have the same motivation: narrow focus on the DP.

(4) vnnd eynem gab er funff centner, dem andern zween, dem dritten eyn,
and one gave he five talents the other two the third one
eynem ydern noch seynem vermugen vnd zoch hynweg . . . **vnd da tratt**
one each after his ability and went away . . . and then tread
ertzu, der da funff centner empfangen hatte . . . **Do trat auch**
forward who PART five talents received had . . . Then tread also
ertzu, der do zween centner empfangen hatte . . .
forward who PART two talents received had . . .
'And he gave five talents to one, two to another, one to the third, each according to his ability, and went away . . . and then the man who had received five talents came forward . . . Then also, the one who received two talents came forward . . . '
(*Septembertestament*, Matthew 25:15–22)

However, the frequencies at which quantified subjects extrapose suggests a similarity between subject extraposition in ENHG and subject extraposition in Yiddish, where the discourse status of the subject plays a more important role. I assume that indefinite and quantified DPs are more likely to be discourse-new. The higher rate of extraposition of indefinite/quantified subjects suggests a stronger effect of discourse status on subject than on object extraposition in ENHG. Based on this fact, I will argue that subject extraposition in ENHG can also be motivated by a more specific type of focus.

In German, the sentence accent generally falls on the rightmost argument of the VP by default, even if followed by a clause-final non-finite verb or verbal particle (see Ladd, 1996; Truckenbrodt, 2007, for a summary of the literature on this). As a result, object DPs *in situ* are frequently in the appropriate position to receive default sentence accent. Scrambling of other elements can further help to situate a non-topicalized DP at the right edge of the 'middle field,' so that it may be in the rightmost position and receive the default accent when necessary. Because this is permitted, extraposition of object DPs may be expected to have more specific motivations than simply to obtain default accent. This seems to be compatible with Bies's analysis. However, more elaborate means are often required to maneuver the subject into the location of default accent. For example, expletive *es* may be inserted in topic position, while the subject appears in a low position.

I propose that subject extraposition may be used as a general means to obtain a default accent on a subject, without resulting in a contrastive interpretation. There is a specific clause type that may demonstrate this: clauses with presentational focus. In fact, a large subset of the extraposed subjects are presentational, and best translated into English with the use of existential *there*, as in (5).

(5) Aber die kinder des reychs werden außgestossen ynn die
but the children of-the kingdom will-be cast-out in the
außersten finsternisß, **da wirt seyn weynen vnd tzeen klappen**.
outermost darkness there will be weeping and teeth gnashing
'But the children of the kingdom will be cast out into the outermost darkness. In that place there will be wailing and gnashing of teeth.'
(*Septembertestament*, Matthew 8:12)

Other clauses may be found which have the same effect of introducing a new entity into the discourse, but do not appear to involve narrow focus on the extraposed DP (but rather a broader focus structure). I present (6) as a clear example of this phenomenon; note that the modifiers on the subject are intended to introduce the entity it denotates, emphasizing the fact that the entity has not been previously discussed.[1] However, the focus structure of the clause is broad, as the remainder of the information (namely, the actions taken by the newly introduced Gamaliel) is also newly introduced and focal.

[1]However, the length of this subject would make it a non-ideal example otherwise; I will simply mention that, while this is a particularly useful example for demonstrating the phenomenon under consideration, other examples exist which do not have its shortcomings.

(6) Da stund aber auff ym radt **eyn Phariseer mit namen**
then stood however up in-the council a Pharisee with name
Gamaliel, eyn schrifftgelerter, wolgehallten fur allem volck
Gamaliel a scholar well-held before all people
'But then a Parisee named Gamaliel stood up in the council, a scholar, well regarded by all the people.'
(*Septembertestament*, Acts 5:35)

The nature of these subjects implies that they will generally be quantified, indefinite or bare DPs. Additionally, they will generally be new entities in the discourse. This embodies the difference between subject and object extraposition in ENHG. We can also observe this effect by considering the occurrence of copular clauses in each data set: while 16 (18.6%) of extraposed subjects occur in copular clauses, only 92 (7.3%) of non-extraposed subjects do. This means that copular clauses extrapose at a rate of 14.8%, while non-copular clauses extrapose at a rate of 5.67%. My argument is that the link between subject extraposition is due to the fact that many copular clauses are presentational, and thus favor extraposition of the subject above other clause types.

4.1 Extraposition and Sentence Accent

Before concluding, I will offer some brief remarks on the relation between extraposition and sentence accent. Ladd (1996) presents a metrical account of sentence accent. He observes that the accent patterns of the two sentences in (7) may differ, even when both are interpreted with broad (sentential) focus. He proposes that this can be explained by the fact that the shorter utterance may consist of only one intermediate intonational phrase, and within this intermediate phrase the primary accent falls on the subject. However, once the utterance is as long as it is in (7b), the subject and predicate may not form a single intonational phrase, and must be split into two intermediate phrases. These two phrases have a weak-strong relation, so that the primary sentence accent falls on the strongest accent in the second intonational phrase. Ladd notes, "The heavier a constituent is, the more likely it is to constitute its own intermediate phrase."

(7) a. JOHNSON died.
b. Former president Johnson unexpectedly DIED today.

Wallenberg (p.c.) proposes that in English Heavy NP-Shift (HNPS), a "Heavy NP" moves rightward past any material on its right in order to consitute its own (rightmost) intermediate phrase, and thus bear the primary sentence accent. I tentatively propose the same analysis for subject extraposition in ENHG: in order to receive the primary sentence accent while allowing a presentational (and non-contrastive) focus interpretation, the subject may move to the right edge. By extraposing, the subject forms its own intermediate intonational phrase, which enters a

weak-strong metrical relation with other intermediate phrases in the sentence, and ultimately receives the primary sentence accent.

This proposal requires further testing, but it may help explain why subjects might extrapose in presentational contexts. Under this analysis, a central motivation of subject extraposition is prosodic. It may also help to explain why extraposition targets particularly heavy DPs: these are the DPs, in Ladd's own observation, which are most likely to constitute their own intermediate phrase. Extraposition may be a way to syntactically facilitate this.

5 Conclusion

I have argued, based on quantitative data from a parsed corpus of ENHG, that there are both similarities and differences between subject and object extraposition in ENHG. Both subjects and objects may be extraposed to express narrow focus on the extraposed DP. However, subjects may also be extraposed for a more specific motivation: as a means to achieve default accent on the subject, particularly in presentational contexts. As a result, subject extraposition occurs more frequently with quantified subjects, as well as with entities are new to the discourse.

The result of this conclusion is twofold. First, I have argued that subjects may have multiple motivations to extrapose: either to express narrow focus or to obtain a default sentence accent in a non-contrastive context. Second, I have shown that the phenomenon of DP extraposition in ENHG demonstrates a subject-object asymmetry.

This has certain consequences for the broader study of information structure. On one hand, subject extraposition in ENHG provides new evidence that there is not necessarily a one-to-one correspondence between syntactic construction and information structural interpretation; rather, in this case, the syntax may be manipulated to accomplish multiple information structural and prosodic goals (cf. Féry, 2007). On the other hand, DP extraposition in ENHG fits into a broader set of crosslinguistic focus phenomena which demonstrate a subject-object asymmetry (cf. Hartmann and Zimmermann, 2007; Skopeteas and Fanselow, 2010), raising important questions about the relationship between argument structure and information structural notions.

On an unrelated note, I offer this study as a demonstration that parsed corpora may be used as resources in information structural research, and of the importance of quantitative data when exploring such subtle and complex issues. As the study of information structure progresses, and judgments become more elaborate and less reliable, large corpora of attested examples embedded within concrete contexts may become an important and valuable resource, offering a type of data that judgments alone cannot achieve.

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Subject inversion in French: The limits of information structure

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Abstract

My objective here is to assess the relevance of information structural notions for analyzing subject inversion in French. Subject inversion is not a unified phenomenon. In fact, there are three distinct constructions featuring an inverted subject. I show that the sentences do not have the same informational potential (the type of focus-ground articulation they are compatible with) depending on the construction they abide by. I propose a contextual factor – the informational solidarity between the verb and its first argument – to account for those differences. Then, I show that the three constructions share a common feature that pertains to a completely different dimension: the perspective chosen to describe the situation. I adopt Langacker's notion of absolute construal to characterize it. Finally, I present another common feature: the blocking of the referential anchoring of the referent of indefinite and partitive NPs.

1 Introduction

Information structure is often invoked to analyze word order variations, in particular subject inversion in French. My point here is not to dismiss the relevance of information structure, but to put it in its right place. The various proposals linking subject inversion and information structure – the focus-ground and/or the topic-comment articulations of sentences – can be summarized in three proposals (1).

(1) a. Inverted subjects are narrow foci;
b. Inverted subjects occur in broad or all focus sentences;
c. Inverted subject are detopicalized.

Until recently, the syntactic/constructional diversity of subject inversion has not been recognized. In fact, there are three different constructions featuring subject inversion, i. e. occurrence of subject NPs to the right of verbs.

(2) a. Inversion in extraction-context [EXTR-INV]: le livre qu'a écrit Marie
Lit. the book that has written Marie
b. Presentative inversion [pres-inv]: Alors entra un soldat.
Lit. Then entered a soldier.

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c. Inversion via permutation [PERM-INV] : Sont reçus Pierre et Marie.
Lit. passed Pierre and Marie

A close scrutiny shows that these constructions do not behave informationally in the same way, which calls into question the relevance of the claims in (1). Hence, the link between subject inversion and information structure must be investigated afresh. My objective is twofold. First, I characterize the difference between the three constructions as regard information structure. I propose that the informational solidarity between the verb and its first argument affords – "contribute to the possibility of"– the use of EXTR-INV and PRES-INV. Then, I bring to light what the three constructions have in common. It does not pertain to the packaging of content, but to the content itself: the perspective chosen to describe the situation. I propose the notion of absolute construal (Langacker 2000) to characterize it. Finally, I relate the blocking of the referential anchoring of specific indefinites and partitive NPs to the demotion of postverbal subjects from their primary status in the description. Before proceeding further, I sketch some backstage assumptions about subject inversion in French.

2 Background

2.1 Three constructions

There are three constructions featuring an inverted subject in French. The first one – *inversion in extraction context* (henceforth EXTR-INV) – is licensed by extraction. Its main criterial property is that it allows scrambling among the dependents of the verb (3) – a rather rare phenomenon in French – (Bonami & Godard 2000).

(3) a. Je ne retrouve pas le livre que pensait [recommander [le professeur de philosophie]$_{\text{Subject}}$ à ses élèves pour l'examen]$_{\text{VP}}$
Lit. I do not find the book that intended [to recommend [the philosophy professor]$_{\text{Subject}}$ to his students for the exam]$_{\text{VP}}$
b. Je ne retrouve pas le livre que pensait [recommander pour l'examen [le professeur de philosophie]$_{\text{Subject}}$ à ses élèves]$_{\text{VP}}$
Lit. I do not find the book that intended [to recommend for the exam [the philosophy professor]$_{\text{SUBJECT}}$ to his students]$_{\text{VP}}$

The other properties characterizing EXTR-INV are the unconstrained choice of verbs and the ban against referential NPs as direct object. In (4a), the bare noun *cours* is grammatical while the fully referential *des cours de logique* is not.

(4) a. la salle où fait cours Marie
Lit. the room where makes class Marie
b. ?? la salle où fait des cours de logique le tout nouveau prof de philo
Lit. the room where makes classes of logic the newly appointed philosophy teacher

The second construction – *inversion via permutation* (PERM-INV) – resembles a permutation of VP and the subject NP (5).

(5) a. [Les cartes de crédit et le permis de conduire]$_{\text{NP-SUBJ}}$ [ne sont pas des pièces d'identité]$_{\text{VP}}$ NP < VP
Lit. credit cards and the driving license are not IDs
b. [Ne sont pas des pièces d'identité]$_{\text{VP}}$ [les cartes de crédit et le permis de conduire]$_{\text{NP-SUBJ}}$ VP < NP
'The credit cards and the driving license are not IDs'

There is no constraint on the verb but, unlike EXTR-INV, no licensing context is required, referential objects are grammatical (6a) and scrambling is not possible (6b).

(6) a. Fait [un cours de logique aux linguists]$_{\text{NP-OBJECT}}$ [tout nouveau prof de philosophie]$_{\text{NP-SUBJECT}}$
Lit. gives a class of logic to linguists each newly appointed philosophy teacher
b. * Fait un cours de logique [tout nouveau prof de philosophie]$_{\text{NP-SUBJECT}}$ aux linguistes.
Lit. gives a class of logic each newly appointed philosophy teacher to linguists

The third one – *presentative inversion* (PRES-INV) – is not always analyzed as a separate construction (see Lahousse 2006, 2011). However, it does have specific features that set it apart from STYL-INV and PRES-INV. Firstly, the verb should be presentative (7a) or in the passive (7b) (Marandin 2001).[1] Secondly, the postverbal subject has object properties; in particular, it requires the encliticization of quantitative *en* when it is an indefinite nounless NP, which is a received criterion for objecthood (7).[2]

[1] The most frequent presentative verbs in the corpus Frantext (http://www.frantext.fr/) are: *apparaître, arriver, commencer, cesser, éclater, mourir, naître, passer, retentir, surgir, …*

[2] In order to help the reader in the terminological maze: (i) *Inversion in extraction context* corresponds to the stylistic inversion of the generative tradition (i.a. Kayne 1973, Milner 1978); (ii) *Presentative inversion* corresponds to the unaccusative inversion proposed in Marandin 2001; (iii) *Inversion via permutation* corresponds to the elaborative inversion in Marandin (1997, 2010) or the focus inversion in Lahousse (1997, 2011). Many illustrations of PRES-INV and PERM-INV may be found in Atkinson 1973, Le Bidois 1950, Lahousse 2011.

(7) a. Alors en entrèrent deux autres [de soldats].
a'. * Alors entrèrent deux autres [de soldats]
Lit. Then entered two others [soldiers]
b. Je voudrais qu'en soient votés deux autres [de décrets].
b'. * Je voudrais que soient votés deux autres [de décrets]
Lit. I would like that be voted two others [decrees]

Accordingly, the study of subject inversion must investigate each construction. This means that one should verify whether each proposal (for example (1) above) holds for all three constructions or merely for a subset of them.

2.2 Information structure and subject inversion

Due to space limitations, I do no give a detailed account of the many different proposals assigning inverted subjects a role in information structure (either focus-ground or topic-comment articulation).[3] Here, I give the more telling observations that motivate a change of tack.

– Proposal (1a): Inverted subjects are narrow foci (i.a. Drijkoningen & Kampers-Manhe 2001, Zubizarreta 1998). The claim can only be put to the test naturally with PRES-INV sentences.[4] I ran an informal survey and a pilot questionnaire (allowing statistical measures). Informants were given the description of a scenario (8a) and a question, either a partial question on the subject (8b) or a broad question (8c).

(8) a. Une assistante sociale discute avec une patiente qui se plaint de ses problèmes avec ses enfants.
'A social worker talks to a patient who complains about her problems with her children.'
b. Parmi tous vos problèmes, lequel devrait s'arrêter pour que soyez plus tranquille?
'Among your problems, which one should stop so you could live more quietly?'

[3] In particular, I leave aside Lahousse's (2006, 2011) claim that the inverted subject is an informational focus in EXTR-INV and PRES-INV (her « inversion ordinaire ») and an identificational focus in PERM-INV (her « inversion focus exhaustif »).

[4] Unfortunately, EXTR-INV cannot be tested. One could have thought of sentences featuring a locative inversion (extraction of locative PPs), but for some reason, their use is limited to narratives (contra Bonami & Godard 2000). For example, *sur la place principale se trouve la grande mosquée* ('on the main square stands the great mosque') cannot be used naturally to answer either *où se trouve la grande mosquée ?* ('where is the great mosque') or *qu'est-ce qui se trouve sur la place principale ?* ('what is on the main square').

c. Quel changement dans votre environnement personnel vous ferait le plus plaisir?
'What change in your life would please you most ?'

They were asked to judge the appropriateness of the answer, either an answer with a preverbal or a postverbal subject (9).[5]

(9) a. Je voudrais que s'arrête [la brouille entre mes deux fils]$_{Subject}$
b. Je voudrais que [la brouille entre mes deux fils]$_{Subject}$ s'arrête.
'I would like that the quarrel between my two sons stops.'

The results are clear: informants or participants in the questionnaire clearly prefer the answers with preverbal subjects (9b) to answer partial questions (8b), while they accept answers with postverbal subjects (9a) to answer broad questions (8c).

Crucially, PERM-INV answers behave differently: they are judged appropriate to answer partial questions (10).

(10) Q: Quels papiers sont valides?
'Which papers are valid ?'
A: Sont valides [le passeport et la carte d'identité]$_{Subject}$
Lit. are valid the passport and the identity card

– Proposal (1b): Inverted subjects occur in broad or all focus sentences. The results above seem to support the proposal. But, this is not the end of the story. Consider what happens in codas of clefts. Inversion is appropriate whether it contributes focal (11a) or ground content (11b).

(11) a. Q. Qu'est-ce que c'est, ce bruit?
'What is this noise ?'

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[5] Subject inversion is sensitive to metric constraints that should be respected in forged examples or questionnaire items. Unfortunately, those constraints have not yet been studied in detail. Nevertheless, it is commonly assumed that monosyllabic verbs are banned from the rightmost position of the utterance (corresponding to the rightmost position in the Intonation Phrase (IP)) especially when the subject NP is heavy. More exactly, the weaker in content the monosyllabic verb is (copula, light verb), the more the constraint applies.

(i)	a. * la voiture que le fils de Paul a]$_{IP}$	Lit. the car that the son of Paul has
	a'. la voiture que le fils de Paul possède]$_{IP}$	Lit. the car that the son of Paul owns
	b. ?? l'avare que Depardieu fait]$_{IP}$	Lit. the miser that Depardieu makes (= shows himself to be)
	b'. l'avare que Depardieu joue]$_{IP}$	Lit. the miser that Depardieu plays

A. C'est les poubelles que sort le concierge.
Lit. it is the bins that puts out the janitor
b. Q. Qui sera reçu par le directeur?
'Who will be received by the boss ?'
A. C'est Bernard que recevra le directeur.
Lit. it is Bernard whom will-receive the boss

There is something true in proposal (1b): both inverted subject and verb have the same informational status in the coda: either focus or ground. We will see shortly that this is a characteristic of EXTR-INV and PRES-INV clauses.

– Proposal (1c): Inverted subject are detopicalized (i. a. Comorowski 1995). The notion of topic is complex; it subsumes several dimensions (Jacobs 2001). Here, we limit ourselves to predication. In that dimension, the topic is a categorical subject: the entity of which the property denoted by the VP is affirmed or denied of. Claims (1c) amounts to saying that inverted subjects cannot be categorical subjects. In fact, this is true of subjects in PERM-INV where they are specificational (Marandin, *in prep*). As regards PRES-INV clauses, they often have a thetic flavor (see (22) below), but they are not inherently thetic since they accept fully referential subjects (see for example (9a) above; (28a) below). Finally, subjects in EXTR-INV clauses may be thetic or categorical. For sure, they are categorical when used with I-level predicates (McNally 1998): *J'ai été surpris par le nombre de langues que connaissaient mes étudiants* ('I was surprised by the number of languages that my students knew'). Hence, it is not true of inverted subjects in general that they cannot be categorical. Again, PERM-INV clauses behave differently from EXTR-INV or PRES-INV clauses as regards the type of proposition conveyed by the clause.

Now, I turn to the factor explaining such a difference and thereby, to the proper characterization of the informational potential of the sentences depending on each construction. In essence, information structure is an interface between context and sentence content. In the following, I focus on the relations between context and information structure. The notion of licensing is not appropriate for capturing such relations. X licenses Y if both X and Y belong to the same dimension. For example, extraction licenses EXTR-INV. Secondly, licensing is a necessary condition of grammaticality: inversion is only grammatical in extraction contexts. Thirdly, it is categorical: either X licenses Y or it does not. The picture is different as regards the relation context/information structure. I borrow the notion of affordance – term and global insight – from Gibson 1979.[6] X affords Y (resp. X hinders Y)

[6] "In any interaction involving an agent with some other system, conditions that enable that interaction include some properties of the agent along with some

if X and Y belong to different dimensions (typically, X is a contextual feature and Y a grammatical one). X makes the use or occurrence of Y possible and the relation may be gradient.

3 Informational solidarity

3.1 Definition

I introduce the notion of informational solidarity that is based on Saeboe's (2004) condition for the prosodic marking of the answer in (12) – one prosodic focus anchored on the subject– compared to that of (13) – double focus anchored on both subject and verb.

(12) Q. What happened to make you leave home ?
A. [my MOther died]$_F$

(13) Q. What became of your parents ?
A. [my MOther]$_F$ [DIED]$_F$ (..)

Saeboe claims that it corresponds to a difference in the semantic construal of the question that the answer resolves. The question in (12) is made up of a single set of alternatives – a plausible illustration is given in (14) –, while the question in (13) is based on pairwise alternatives to « mother » and « die » as illustrated in (15).

(14) {mother died, mother emigrated, father died, there was a fire, we lost our money, ..}

(15) {{mother emigrated, mother died, …}, {father died, father emigrated, ..}}

When two components of the proposition do not give rise to separate relevant alternatives (in the local context), we say that they are informationally interdependent ("they stick together"). Hence, we derive the general definition (16).[7]

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properties of the system. […] The term affordance refers to whatever it is about the environment that contributes to the kind of interaction that occurs. [..]"(Greeno 1994: 338).

[7] The definition (16) is reminiscent of that of informational nonautonomy (Jacobs 1999). It is meant to overcome the difficulties of the procedural definition given by Jacobs. According to Jacobs, X and Y are informationally nonautonomous when « they are processed in one step ». Jacobs's definition tends to confuse the referential nonautonomy of a constituent (the identification of its referent depends on the clause

(16) Informational solidarity : X and Y are informationally interdependent ('solidaires informationnellement') iff there are no salient alternatives to X and Y separately in the local context.

3.2 Hypothesis

I propose that EXTR-INV and PRES-INV are sensitive to the informational solidarity of the verb and its first argument realized as the subject, while PERM-INV is not. More precisely:

(17) Contexts where subject and verb are informationally interdependent afford EXTR-INV and PRES-INV.

Intuitively, when speakers use (1a) *le livre qu'a écrit Marie*, there are no relevant alternatives to *Marie* and/or *écrire* ('write') that are under discussion or merely relevant (say for contrast) in the current context. On the contrary, *le livre que Marie a écrit* is compatible with a context where *Marie* or *écrire* are singled out among other entities or relations in the current context. More technically, hypothesis (17) makes a prediction: EXTR-INV and PRES-INV clauses should be hindered – hence judged less appropriate by informants – when the discourse role of the subject requires alternatives. There are two such roles: (i) narrow focus resolving a partial question, (ii) contrastive topic à la Büring (1997; S-topic). Accordingly, EXTR-INV and PRES-INV clauses should be dispreferred when subjects – or verbs – are narrow foci or contrastive topics. Both predictions are borne out; the results come from informal surveys I ran following traditional linguistic methodology (Sprousse 2005).[8]

3.3 Data

We already saw that PRES-INV clauses are dispreferred as answers to partial questions (see (8)-(9) above). The use of post-verbal subjects as contrastive topics can be easily tested in relative clauses (RC) used to split the answer to a question. For example, the speaker may choose to answer question (18) by distinguishing different groups of students as in (19). In such a case, informants clearly prefer the answers with preverbal subjects (19a).

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it is a constituent of) and the informational nonautonomy (it does not give rise to it own set of alternatives, rather it belongs to a set where it co-varies with other constituents).

[8] I am currently launching a series of questionnaires to assess the results quantitatively.

(18) Que sont devenus les étudiants de Bernard?
‘ What became of Bernard’s students ?’

(19) a. Les étudiants que [Bernard]$_{Subject}$ a entraînés sont devenus des sportifs professionnels, ceux de Marie sont devenus des profs de gym.
b. Les étudiants qu’a entraînés [Bernard]$_{Subject}$ sont devenus des sportifs professionnels, ceux de Jean-Marie sont devenus des profs de gym.
‘The students Bernard trained became professional sportspersons, Jean-Marie’s became PE teachers.’

Even more, a direct answer to (18) with preverbal subject like *Les étudiants que Bernard a entraînés sont devenus sportifs professionnels* is implicational, unless it is used with a marked parenthetical intonation:[9] the subject (*Bernard*) or the verb (*entraîner*) invoke alternatives (other teachers, other relations between teachers and students, ..) worth being elaborated to fully address the issue conveyed by (18).

We already saw that subjects in PERM-INV clauses may be narrow foci ((10) above). PERM-INV clauses may also feature a constrastive predicate or a contrastive subject (20), which means that subject and VP give rise to two distinct sets of alternatives. Moreover, they may simply be all focus sentences (21). Thus, it is confirmed that PERM-INV clauses are informationally different from EXTR-INV or PRES-INV clauses.

(20) Q. Dans cette société, qui est responsable d’un nouveau-né?
‘In this society, who is responsible for a newborn baby?’
a. A. Est symboliquement responsable la lignée maternelle, alors que sont financièrement responsables les parents biologiques.
Lit. is symbolically responsible the mother’s line, while are financially responsible the biological parents
b. A. Est responsable la lignée maternelle. Sont aussi responsables les oncles maternels du père.
Lit. is responsible the mother’s line. Are also responsible the uncles on the mother’s side of the father

(21) Q. Quel est le nouveau règlement? ‘What’s in the new regulation ?’
A. Ne sont plus acceptés les permis delivrés avant 1960.
Lit. are no longer accepted the permits issued before 1960

[9] It implicates a residual topic (Büring 1997). Intuitively, it amounts to bringing about the effect that there is more to say about the question .

3.4 Discussion

The fact that the informational solidarity between subject and verb affords EXTR-INV and PRES-INV has a direct impact on clauses: it limits their informational potential. They are either all focus or all ground. In other words, their informational structure is all in one piece: subject and verb together feed the focal or the ground part of the content of the whole sentence. Indeed, this is what is observed in actual discourses.[10]

PERM-INV clauses behave differently: they may convey an informationally partitioned content. Subjects in PERM-INV may be narrow foci or contrastive topics (but not categorical subjects!). In fact, PERM-INV clauses are just indifferent to the relation of informational solidarity between subjects and verbs.

Hence, we must conclude that the three constructions behave differently as regards information structure: EXTR-INV and PRES-INV on one side, PERM-INV on the other. Accordingly, the occurrence of the subject NP to the right of the verb cannot be associated with a single informational value. In fact, its value depends on the whole construction.

4 Non-dynamic construal

4.1 Informational lightness

Descriptive grammarians repeatedly mention the intuition that (in substance) some sort of weakening affects the verb's meaning when the subject is postverbal (i.a. Fuchs 1997, Korzen 1985). They adduce two observations to support their intuition. The first one pertains to the use of root EXTR-INV or PRES-INV clauses in discourse. They are mainly used in narratives with a presentative function, i.e. they are ancillary sentences introducing a circumstance or a discourse referent into the discourse universe.[11] This is illustrated in (22) with a sentence featuring a locative inversion (an instance of EXTR-INV): in (22a) a circumstance is described; in (22b), a new discourse referent is introduced into the narrative. The common analysis is that the contribution of the verb is merely to provide a predicate of existence, of coming to existence or of disappearing.

(22) Pierre entra dans la ville. 'Pierre walked in the city'
a. Sur la place se pressaient des badauds. Il se dirigea vers le palais.
Lit. on the square were thronging onlookers. He went to the palace

[10] The question of how informational solidarity is brought about in context exceeds the limits of the present study.

[11] These are the sentences with a thetic favor; they show the well-known "event-centered vs entity-centered reading" contrast. See also Wehr 1984.

b. Sur la place se pressaient des badauds. Immédiatement, ils le prirent à partie.
Lit. on the square were thronging onlookers. Immediately, they took him to task.

The other observation seems to point in the same direction. If one tries to paraphrase a *de*-PP complement, say *de Paul* in (23a), with a RC, most often a RC with an inverted subject turns out to be felicitous. This is verified when the underspecified relation denoted by *de* is predictable given the modified noun –write a novel in (23b)– or is given/well-known in the context: suppose (23c) is uttered in the context of a binding workshop.

(23) a. le roman de Paul — Lit. the novel of Paul
b. le roman qu'a écrit Paul — Lit. the novel that has written Paul
c. le roman qu'a relié Paul — Lit. the novel that has bound Paul

Taking advantage of studies on similar usages in English (i. a. Bolinger 1989, Zubizarreta 1998), one could reformulate the observation as in (24) from an informational perspective.

(24) The content of the verb is informationally light in EXTR-INV and PRES-INV.

In fact, generalization (24) is not satisfactory. Indeed, it is far from clear how to weight bits of information. Moreover, it is not even true of presentative sentences in general: the descriptive content of the verbs is not bleached. It is not the same to use *se presser* ('throng') to describe the onlookers in (22) above, rather than *flâner* ('stroll') or *manifester* ('demonstrate'), etc. As for (23), the observation is certainly to the point, but its import should be discussed. It is expected that the more the relation between subject and verb is given, the less it gives room for independent alternatives for subject and verb (Marandin 2010). Hence, the solidarity constraint alone explains the preference for a paraphrase with a RC featuring a postverbal subject. It says nothing regarding the weakening of verb meaning.

From now on, I radically change tack to account for the intuition that subject inversion is correlated with a modification of the sentence meaning.

4.2 Hypothesis

Based on two facts to be presented shortly, I propose that inversion is correlated with an attenuation of the dynamic dimension of the meaning of the clause. In particular, inversion is correlated with the attenuation of the causal efficacy of the agent (when the verb assigns such a role).

The first observation pertains to the use of agentive adverbs (Geuder 2002, henceforth Ag-ADV), such as *intelligemment* ('cleverly'), *courageusement* ('bravely'). Ag-ADVs indicate that the event described in the clause is a realization of the disposition of the agent: it "depends on the decisions of the agent" (Geuder, *ibid*.: 172). Informants' rating of Ag-ADVs occurring in RCs featuring EXTR-INV (25a) is telling: some consider them as ill-formed, others as weird, all would prefer the subject to be preverbal (25b).

(25) a. ?? Ma voiture, qu'a gentiment révisée mon copain Pierre, devrait passer le test pollution sans problème.
b. Ma voiture, que mon copain Pierre a gentiment révisée, devrait passer le test pollution sans problème.
'My car my pal Pierre has kindly overhauled should pass the pollution test easily'

Informants have no such reactions with VP-internal manner adverbs, – such as *soigneusement* ('carefully') in (26) – even if those adverbs refer to the action or behavior of the agent.

(26) Ma voiture, qu'a soigneusement révisée mon copain Pierre, devrait passer le test pollution sans problème.

They make the same judgment when Ag-ADVs occur in clauses featuring PRES-INV and verbs in the passive as in (27a): they clearly prefer preverbal subjects (27b).[12]

(27) a. ?? Quand sont bêtement multipliées les niches fiscales, les recettes diminuent.
b. Quand les niches fiscales sont bêtement multipliées par dix, les recettes diminuent.
'When tax breaks are stupidly increased ten times, tax collections are reduced.'

In (25a) or in (27a), there is an entity playing the role of agent (by virtue of the verb meaning), but the whole event cannot be presented as the result of the causal efficacy of this entity as is required by the semantics of Ag-ADVs.

The second observation pertains to the use of discourse connectors and has the same flavor: using an explicit causal connector – which brings the causal relation to the fore – renders inversion dispreferred. The observation is based on the use of causal connectors *du coup* and *de ce fait* ('as a result') whose arguments are situations and whose interpretation involves factual causality

[12] PERM-INV clauses cannot be put to the test because there is no Agent role assigned in such clauses.

(Rossari & Jayez 1997). Informants readily accept (28a). One can infer a cause-consequence relation (based on world knowledge) between the two temporal clauses. If one makes it explicit (28b), informants bulk: they repute (28b) weird and clearly judge (28c) more appropriate.

(28) a. Quand la température augmente et que s'écroulent les ponts de neige, il est trop tard pour partir en rando sur les glaciers.
b. ?? Quand la température augmente et que, de ce fait, s'écroulent les ponts de neige, il est trop tard pour partir en rando sur les glaciers.
c. Quand la température augmente et que, de ce fait, les ponts de neige s'écroulent, il est trop tard pour partir en rando sur les glaciers.
'When temperature rises and , as a result, the snow bridges collapse, it's too late for a treck on the glaciers.'

The same judgment obtains with EXTR-INV ((28b) *vs* (28c)) and PERM-INV ((30b) *vs* (30c)).[13]

(29) a. On a examiné les éléments de preuve qu'avaient livrés à la presse les avocats de la partie adverse et qu'avait dû accepter le juge d'instruction.
b. ?? On a examiné les éléments de preuve qu'avaient livrés à la presse les avocats de la partie adverse et que, de ce fait, avait dû accepter le juge d'instruction.
b. On a examiné les éléments de preuve qu'avaient livrés à la presse les avocats de la partie adverse et que, de ce fait, le juge d'instruction avait dû accepter.
'One examined the proofs that the lawyers of the opposing party had disclosed to the press and that, as a result, the judge had to accept.'

(30) a. Mes étudiants ont très bien réussi. Ont pu s'inscrire en master dix d'entre eux.
b. ?? Mes étudiants ont très bien réussi. Du coup, ont pu s'inscrire en master dix d'entre eux.
b. Mes étudiants ont bien réussi. Du coup, dix d'entre eux ont pu s'inscrire en master.
'My students did well. As a result, ten of them could enrol in graduate school.'

Clauses featuring any type of inversion resist entering an explicit action chain, i.e. a discourse making explicit a causal link between two events, even if such a causal link is factually inferable.

[13] In the absence of any explicit link, the discourse relations between the two temporal clauses are additive rather than causal. Thus, the predominant relation to intuition is one of contiguity in (28a), addition in (29a) and elaboration in (30a) (following Keller's (2002) taxonomy).

4.3 Absolute construal

Several authors have proposed a notion of perspective to capture differences in prominence holding among the entities making up the situation described in clauses (i.a. Kuno 1987, Borshev & Partee 2002). Langacker (2000) in the framework of Cognitive Grammar (CG) proposes to account for those differences with the general notion of construal. Construal refers to how the participants or aspects of situations are profiled in clauses. Differences in prominence may arise lexically (by virtue of the ranking of the arguments of lexical heads) and/or constructionally. Passive is a textbook case: the first argument of verbs (prototypically associated with the agentive role) is demoted to the advantage of the second. The agentive interpretation is still accessible, but the agent is no longer the center of the description (see (27) above).
Two types of construal have been distinguished in CG (i. a. Langacker 2000, Maldonado 1993):
– The force dynamic perspective: profiling the force interactions between participants/aspects of the situation (causation or energy transfer);
– The absolute perspective: profiling the participants/aspects of the situation independently of the force interactions between them.

The behavior of clauses featuring a postverbal subject is readily explained by hypothesis (31): the referent of the subject is no longer the center of the description because the perspective taken to describe the situation results in attenuating its dynamic participation in it.

(31) Subject inversion contributes to the absolute construal of the described situation.

Hypothesis (31) captures what the informants' judgments convey: the process is not profiled as dynamic « even though [it] may be clearly energetic in objective terms » (Langacker, 2000: 381). In (25a), (27a), there is an agent (explicit or implicit), but the situation cannot be presented as what comes about by virtue of her agency. In (28b, 29b, 30b), a cause-consequence is inferable on an encyclopedic or situational basis, but it cannot be profiled at the discourse level with an explicit causal connector.

Under hypothesis (31), the subject is no longer the center of the description (the "trajector" in Langacker's parlance). Thus, inversion breaks the default alignment (in construal) between "the most active participant" and "the primary figure of attention". This should impact the role the entity it refers to may play in discourse. For example, one may expect that postverbal subjects

are less prone to be the source of anaphoric chains than preverbal ones.[14] Obviously, this could be the basis for the common claim that postverbal subjects are less "topical" than preverbal ones.

5 Referential anchoring of the subject

Another feature is common to the three constructions featuring an inverted subject: the referential anchoring of the referent of indefinite NPs is blocked.[15]

5.1 Data

Two types of interpretation are blocked for postverbal subject NPs. In (32)-(33) below, the fact is illustrated with RCs featuring EXTR-INV.

– specific nonpartitive reading for indefinite NPs. In (32), the only reading available for *un étudiant chilien* is specific given the negation (blocking the existential reading): (32b) is interpretable, while (32a) is not.

(32) a. ?? L'examen que n'a pas pu passer un étudiant chilien la semaine dernière faute d'être prévenu à temps sera annulé.
b. L'examen qu'un étudiant chilien n'a pas pu passer la semaine dernière faute d'être prévenu à temps sera annulé.
'The exam that a Chilian student couldn't take last week because he didn't receive the notice in time will be cancelled.'

– partitive reading for quantificational NPs without explicit partitive complement. In (33a), *beaucoup d'étudiants* ('many students') cannot give rise to a partitive reading 'many students of the university', while such a reading is the preferred one in (33b): in (33a), it only has a cardinal reading 'a great number of students'.

(33) a. Le stade de l'université, où s'entraînent beaucoup d'étudiants le soir, est un lieu sympa.
b. Le stade de l'université, où beaucoup d'étudiants s'entraînent le soir, est un lieu sympa.
'The stadium of the university, where many students are training at night, is a nice place.'

[14] I owe this prediction to Barbara Hemforth (pc).
[15] To my knowledge, this feature has remained unnoticed until now, to the exception of Tasmowski & Willems 1987 and Marandin 2000 where it is wrongly analyzed as the reflex of some sort of anaphoric opacity.

The same ban is observed with bare strong partitive NPs (34).[16]

(34) D'après une enquête auprès de mes étudiants,
a. * les romans qu'apprécient la plupart sont du genre sentimental.
b. les romans que la plupart apprécient sont du genre sentimental.
'According to a survey among my students, the novels that most like belong to the romantic genre.'

The ban holds across the three constructions. Examples (35) illustrate the ban against specific indefinites in both PRES-INV and PERM-INV. Similarly, the non-availability of the partitive reading of the postverbal NPs results in semantic weirdness in (36).[17]

(35) a. [PRES-INV] ?? Je m'attends à ce que soit adopté un amendement demain en séance. Celui qui concerne le bisphénol A.
Lit. I expect that will be adopted an amendment during tomorrow session. That against bisphenol A
b. [PERM-INV] * Je suis surpris; n'ont pas reçu la convocation des voisins et la concierge.
Lit. I am surprised; did not received the invitation some neighbors and the caretaker

(36)a. [PRES-INV] ?? Dans ce service, il faudrait que soient renvoyés beaucoup d'employés pour améliorer la rentabilité.
Lit. in this service, it is necessary that are fired many employees to improve the profitability
b. [PERM-INV] ?? Les dernières élections ont été annulées dans le collège étudiants: se sont abstenus trop d'étudiants.
Lit. the last ballot has been declared void in the student college. Has abstained too many students

In sum, postverbal indefinite subject NPs cannot be specific and postverbal NPs with weak or partitive determiners cannot give rise to a partitive reading in the absence of an explicit partitive complement. Notice that indefinite NPs

[16] The ill-formedness of (34a) cannot be ascribed to the fact that *la plupart* occurs to the right of verb, as it makes a good object: *j'ai vu la plupart lire des romans policiers* (Lit. I saw most read detective novels).

[17] Scopal specific indefinites also must be preverbal. In (i) below, the indefinite *un voisin* cannot be specific: (i) cannot be continued with *Tu sais, son ami qui est charpentier* ('You know, his friend who is a carpenter'), while a continuation like *Il ne sait pas encore à qui s'adresser* ('He does not know yet whom to ask') is perfect. The preverbal version of the RC (*qu'un voisin peut lui recommander*) allows both the specific and nonspecific reading.
(i) Il veut uniquement une maison que peut lui recommander un voisin.
Lit. He only wants a house that can recommend a neighbor

with an explicit indication of specificity (37a) and NPs with an explicit partitive complement (37b) are *bona fide* postverbal subjects, along with presuppositional NPs (i. e. definite NPs) or anaphoric NPs (37c).

(37) a. L'examen que n'a pas pu passer un étudiant chilien que nous connaissons tous sera annulé.
Lit. the exam that could not take a Chilian student we all know will be cancelled
b. Les romans qu'apprécient la plupart des garçons sont du genre sentimental.
Lit. the novels that like most of the boys belong to the romantic genre
c. les romans qu'apprécient {Marie et ses soeurs | de tels étudiants} ..
Lit. novels that like {Marie and her sisters | such students} ..

Furthermore, bare quantificational NPs (*personne, rien, tout, chacun* ('nobody, nothing, all, each')) – whose interpretation is not partitive and which require a loose contextual restriction – are well-formed postverbal subjects even if they are not very frequent in actual use (38).

(38)a. Paul aimait cette Lina que ne plaignait personne.
Lit. Paul loved this Lina for whom felt-sorry nobody
b. une vie où ne se produit jamais rien
Lit. a life where happens never nothing

5.2 Analysis

I adopt Heusinger's (2002, 2011) analysis of specificity. Specific indefinites introduce novel discourse referents that are anchored to an already established discourse entity. The identification of the newly introduced referent depends both on the anchor – that is either intended by the speaker or present in the universe of discourse – and on the anchoring function that enables the discourse participants to single out an entity that is the value for the variable introduced by the indefinite determiner. Heusinger analyzes the partitive interpretation of NPs with weak determiners along the same lines: they introduce a novel referent that is part of another. The whole – or the superset – must be referentially anchored to an already established entity (in the speaker's or discourse universe).[18]
Remember that postverbal indefinite subjects may be specific (37a) and that NPs featuring a weak determiner may be partitive (37b) as long as the anchor or the partitive complement are explicit in the NP. Hence, the readings per se are not blocked for postverbal subjects; what is specifically blocked is the referential anchoring itself. It is hard to see why the anchors would be

[18] I assume here that bare strong partitives (i.e. *la plupart*) involve the same mechanism.

inaccessible from the postverbal position or to deem the context responsible:[19] the contexts are the same whether the subject is pre- or postverbal or the anchors implicit or explicit ((32a) vs (37a)).

What appears to go wrong is the identification function itself. It does not have enough content to single out the referent (in the case of indefinites) or the whole (in the case of partitives). More precisely, it goes through when the subject is preverbal; it does not when it is postverbal. One may conjecture that the prominence of the subject is the decisive factor. Thus, when the subject is preverbal, the selection/identification process can use the prominent status of the referent in the description and its full involvement in the described process. When it is postverbal, the referent is just another participant in the described situation. Another observation brings support to the conjecture that the identification of the referent does not go through because of the lack of identifying means. It suffices to enrich the description of the referent within the NP to make the specific reading of the indefinite NP felicitous. The identification means contributed by the NP compensate so to speak the lack thereof in the sentence: (39) is much better than (32a).

(39) L'examen que n'a pas pu passer un étudiant qui a séché tous les cours ce semestre sera annulé.
Lit. the exam that could not pass a student who cut all classes this term will be cancelled

In sum, referential anchoring is the only mechanism of accessing referents that is barred for postverbal subjects: anaphora and presupposition readily operate. If the conjecture presented here is on the right track, then the blocking of the referential anchoring would be another effect of the lack of prominence of inverted subjects with respect to the other participants in the described situation.

5. Conclusion

I have made three proposals to capture the fine-grained properties of the three constructions that feature the subject to the right of the verb.
– The informational solidarity holding in the context between the verb and its first argument affords EXTR-INV and PRES-INV, i. e. makes it possible without imposing it. This condition limits the information structure of EXTR-INV and PRES-INV clauses to be all in one piece: all focus or all ground. There is no constraint whatsoever on the information structure of PERM-INV.

[19] Likewise, one cannot invoke a weak crossover effect since the blocking is observed in the three constructions, i. e. there are no operators playing around.

– Subject inversion conveys an absolute construal of the situation described in the clause, which results in the attenuation of the dynamic aspects of the description: causal efficacy of the agent, clausal relations between clauses.
– The referential anchoring of the referent is not available for postverbal indefinite or quantificational NPs, which, I conjecture, is due to the lack of prominence of the subject.

Two general points can be made in the light of the analysis I have just proposed for subject inversion in French.
– Construal, in particular the relative salience of entities in the described situation, should be considered a relevant factor to explain word order variations. The analysis given here reinforces a similar claim made by Abeillé & Godard 2008 to capture the difference between two constructions showing object preposing in French.
– Word order potential to convey informational values depends on the construction. The striking fact presented here is that its potential to convey an absolute construal is the same across the three constructions featuring an inverted subject. One should not conclude too hastily that word order variations per se are primarily exponents of construal values. This again should be investigated construction by construction.

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Using information structure to improve transfer-based MT

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Abstract

This paper hypothesizes that transfer-based machine translation systems can be improved by encoding information structure in both the source and target grammars, and preserving information structure in the transfer stage. We explore how information structure can be represented within the HPSG/MRS formalism (Pollard and Sag, 1994; Copestake et al., 2005) and how it can help refine multilingual MT. Building upon that framework, we provide a sample translation between English and Japanese and check the feasibility of the proposals in small-scale translation systems built with the HPSG/MRS-based LOGON MT infrastructure (Oepen et al., 2007). Our experiment shows the information structure-based MT system that we propose in this paper reduces the number of translations 75.71% for Japanese and 80.23% for Korean. The dramatic reductions in the number of translations is expected to make a contribution to our HPSG/MRS-based MT in terms of latency as well as accuracy.

1 Introduction

In the context of MT, we find that allosentences – close paraphrases which share truth conditions (Lambrecht, 1996) – are not always felicitous as translations of the same inputs. For example, a simple English sentence (1a) can be translated into at least two Japanese allosentences such as (1b) (i.e. with the nominative marker *ga* or with the topic marker *wa*).

(1) a. I am Kim. (English)

b. watashi-ga/wa Kim desu.
I-NOM/TOP Kim COP [jpn]

However, the choice between the alternatives shown in (1) is conditioned by the given context; the NP marking hinges on whether or not *watashi* 'I' functions as the topic. If the sentence is an answer to a question like 'Who are you?', the topic marker *wa* is strongly preferred. In contrast, if the sentence is used in reply to a question like 'Who is Kim?', the answer with the topic marker *wa* sounds unnatural to Japanese native speakers.[1]

The difference in felicity conditions between allosentences is the subject of study of information structure. Thus, we hypothesize that information structure

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[1]Japanese judgments reported in this paper were provided by Naoko Komoto.

can be used to improve machine translation. Information structure is hypothesized to be universal: All languages have some way to mark topics and foci, such as with pitch accent, word order, morphological marking or some combination of these (Gundel, 1999), though the marking is not necessarily unambiguous. The universality of information structure suggests that it should transfer well and that it in turn can help facilitate transfer when the syntactic structures in the source and target languages diverge.

The underlying hypothesis of this study is that translation is, in essence, the process of reshaping the means of conveying information, instead of simply changing the words or reordering phrases. Building upon this fundamental premise, this study sets up a working hypothesis: Transfer-based MT systems can be strongly supported by (i) encoding information structure in both the source and target grammars, and by (ii) preserving information structure in the transfer stage. That implies that information structure needs to be marked within the MRS representation in each step of the translation process: parsing, transfer, and generation.

In this paper, we explore (i) how information structure can be represented within the HPSG (Pollard and Sag, 1994) and Minimal Recursion Semantics (MRS; Copestake et al., 2005) formalisms and also (ii) how information structure can be used to improve our multilingual MT system. We also offer (iii) an experimental result to show the computational feasibility with a pair of small-scale MT systems built with the LOGON MT infrastructure (Oepen et al., 2007). This paper looks at the particular case of translating English passive sentences into Japanese and Korean. This case is of interest because active/passive pairs can yield relatively larger numbers of allosentences.

This paper is structured as follows: Section 2 provides a more concrete example which shows why it is necessary to look into information structure in the study of MT. Section 3 proposes a way to capture information structure in HPSG/MRS for the purpose of transfer-based MT. Section 4 covers how information structure is modeled in our source and target languages (English and Japanese/Korean, respectively) with the formalism given in Section 3. Section 5, next, shows how information structure can be used to refine translations with a sample translation, and measures the improvement that our system provides over a baseline system which does not refer to information structure in MT. Section 6 summarizes the paper and outlines plans for future work.

2 Basic Data

One type of example exhibiting structural divergence across languages in translation is active/passive pairs. In English, passives are used productively and constraints on passivization are relatively weak. In contrast, Japanese and Korean, which tend to downplay the role of passives, have stronger constraints on pas-

sivization.[2] Consider the Japanese sentences in (3), which are translations of the English sentences in (2). The active sentence (3a) is just fine, but the passive sentence (3b) sounds like a clumsy translation, as inanimate nouns tend not to appear in subject position of passive clauses in Japanese. That is, passives in one language cannot always be translated into passives in another. Though the syntactic encoding is different, the active sentence (3a) is one potentially legitimate translation of the English passive one (2b), while the passive one (3b) is not.

(2) a. Kim tore the book.
b. The book was torn by Kim. (English)

(3) a. Kim-ga sono hon-o yabut-ta.
Kim-NOM DET book-ACC tear-PST
'Kim tore the book.'
b. ?sono hon-ga Kim-ni yabu-rare-ta.
DET book-NOM Kim-DAT tear-PASS-PST
'The book was torn by Kim.' [jpn]

Moreover, even though transfer-based MT with semantic representations as the transfer level can translate the passive sentence (2b) into an active sentence in Japanese, there still remain two additional issues in translating English passives into Japanese. As presented in (1), case makers (e.g. *ga* for nominatives and *o* for accusatives) in Japanese are in complementary distribution with the topic marker *wa*. In addition, so-called scrambling (OSV order) is highly productive in Japanese (Ishihara, 2001); (4a) exhibits 'normal' major constituent order while (4b) illustrates scrambling, as the object *sono hon* 'the book' is followed by the subject 'Kim'. Hence, (3a) has at least eight allosentences ($2\times2\times2$) as given in (4).[3]

(4) a. Kim-ga/wa sono hon-o/wa yabut-ta.
Kim-NOM/TOP DET book-ACC/TOP tear-PST
b. sono hon-o/wa Kim-ga/wa yabut-ta.
DET book-ACC/TOP Kim-NOM/TOP tear-PST

[2]In fact, passive is not such a widespread phenomenon; Siewierska (2011) reports in WALS Online that languages without passives outnumber those with passives, showing a ratio of 211 to 162. This is consistent with the observation that the productivity of passivization differs in different languages, and underscores the need to be able to translate passives into actives and vice versa.

[3]An anonymous reviewer noted two facts regarding these allosentences. First, the so-called double *wa* construction, in which the topic marker *wa* attaches to both the subject and the object, occurs only rarely in Japanese. On the other hand, it is also true the double *wa* construction is not illegitimate in Japanese, though its productivity is rather low. We assume that the first *wa*-marked NP in a sentence is the topic of the sentence, and the second *wa*-marked NP conveys the meaning of contrastive-focus. Second, since Japanese allows so-called 'pro-drop', we can consider one more option. That is, *Kim* and *sono hon* 'the book' can be freely dropped, in appropriate discourse contexts. Moreover, since NP markers (e.g. *ga* and *wa*) are optional in Japanese, we have at least 32 allosentences in total. However, in this paper, as our aim is to verify whether or not information structure can improve performance of transfer-based MT with a small-scale experiment, we provisionally ignore these last two options.

What needs to be taken into consideration here is that these eight sentences are not felicitous in the same contexts, though they presumably share the same truth conditions. We propose to take sets of translation candidates like these (for more details, see §5) and refine them on the basis of information structure. In order to do so, we first explore how to represent information structure in MRS and then how to build those representations compositionally in HPSG grammars.

3 Information Structure in HPSG/MRS

Because assignment of information structure categories to referents can be constrained by both lexical marking and phrase-structural configurations, we analyze information structure in terms of three levels of structure: a semantic feature INFO-STR in the MRS (§3.1), a syntactic feature MKG encoding the lexical marking (§3.2), and a set of constraints on phrase structure rules relating the two (§3.3).

Our analysis builds on the following assumptions: First, while sentences always have at least one focus, they do not always have a topic (Gundel, 1999); further, constituents may be 'background' (i.e. neither topic nor focus) (Büring, 1999). Second, we treat 'contrast' as a cross-cutting information structure category, which contributes the entailment of an alternative set (Molnár, 2002). Lambrecht (1996) regards 'contrastiveness' as a merely cognitive concept, yet there are several cross-linguistic counterexamples to his claim; some languages employ specific markers or syntactic means to express contrastiveness. For example, Vietnamese uses a contrastive-topic marker *thì*, exemplified in (5) (Nguyen, 2006, p. 1). This marker is distinct from the regular topic marker (i.e. our *aboutness-topic*). The contrast function is shown by the alternative set evoked in (5), while the distinctiveness from focus is shown by the fact that *thì*-marked NPs cannot be used to answer *wh*-questions (*Ibid.*).

(5) Nam thì di Hanoi
Nam CT go Hanoi
'Nam goes to Hanoi(, but nobody else).' [vie]

We can also find syntactic marking of contrast in several languages. In Standard Arabic, for instance, contrastively focused items are normally preposed to the initial position of the sentence, while non-contrastively focused items which convey 'new information' (i.e. *semantic-focus* in this paper) are in-situ with a specific pitch accent, as exemplified in (6a-b) respectively (Ouhalla, 1999, p. 337).

(6) a. RIWAAYAT-AN ʔallat-at Zaynab-u
novel-ACC wrote-she Zaynab-NOM
It was a NOVEL that Zaynab wrote.

b. ʔallat-at Zaynab-u RIWAAYAT-an
wrote-she Zaynab-NOM novel-ACC
Zaynab wrote a NOVEL. [arb]

Similarly, in Portuguese, contrastive focus precedes the verb, while non-contrastive focus follows the verb (Ambar, 1999). In Russian, contrastive focus is preposed, while non-contrastive focus shows up clause-finally (Neeleman and Titov, 2009). In addition to these distributional facts, there is also evidence that contrast behaves differently from non-contrastive focus (or topic) in the semantics. On the one hand, regarding the difference between contrastive focus and non-contrastive focus, Gundel (1999) argues the former cannot have an effect on the truth conditions, whereas the latter is truth-conditionally relevant. On the other hand, Nakanishi (2007), who compares contrastive topic with non-contrastive topic (i.e. *aboutness-topic* in this paper) in Japanese, claims they can have a different scopal interpretation when they co-occur with negation.

Our third assumption is that semantically empty categories (e.g. complementizers, expletives) and syncategorematic items (e.g. relative pronouns) are informatively empty as well (i.e. assigned no information structure category, though they may be required by constructions which serve to mark information structure, such as the cleft construction in English). For example, in (7a), the expletive *it* and the copula *is* are semantically empty and the relative pronoun *that* is syncategorematic; thus, they are informatively vacuous. Likewise, since the preposition *by* in English passive sentences is assumed to be semantically void, it cannot take part in information structure, as shown in (7b).

(7) a. ~~It~~ ~~is~~ the book ~~that~~ was torn by Kim.

b. The book ~~was~~ torn ~~by~~ Kim.

Finally, we assume the canonical position of topics is sentence-initial in our sample of languages (English, Japanese, and Korean), though this generalization does not hold for all languages (Erteschik-Shir, 2007).

3.1 MRS: *info-str*

Although information structure is strictly speaking pragmatic rather than semantic, we represent it in our MRS semantic representations. Our motivation for doing so is primarily practical: The MT infrastructure we are using (Oepen et al., 2007) does MRS-based transfer. Thus, (contra Engdahl and Vallduví (1996), Bildhauer (2007), and Paggio (2009)), we encode information structure in the semantics (MRS) rather than in a CONTEXT attribute. Like Paggio, we associate information structure with semantic indices; however, while Paggio has information structure-related lists in the CONTEXT structure taking indices as their elements, we represent information structure with a feature on indices directly in the MRS. This feature (INFO-STR) draws its values from the hierarchy in Figure 1.[4]

[4]In associating information structure with indices alone, rather than as a relationship between an index and a particular clause, we are not fully accounting for how information structure works in multi-clausal sentences. We leave a more complete representation of information structure which encodes such relationships to future work.

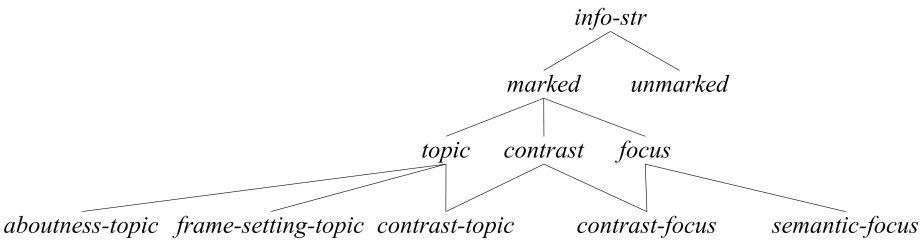

Figure 1: Type Hierarchy of *info-str*

Aboutness-topic refers to regular topics lacking a contrastive interpretation. *Frame-setting-topic* refers to adverbial expressions which present dimension of evaluation, such as 'as for' constructions in English or temporal/spatial adverbials which appear sentence-initially (Krifka, 2008). *Contrast-topic* and *contrast-focus* convey a contrastive interpretation, while *semantic-focus*, which does not introduce an alternative set, does not.

3.2 Markedness: *mkg*

The lexical marking itself is recorded via a syntactic feature MKG, inside of CAT. MKG has two subfeatures, TP and FC, which can be constrained independently.[5] The value of MKG is always a subtype of *mkg*, drawn from the hierarchy in Figure 2 (*Tp* is constrained to be [TP +], *non-tp* [TP −], *fc* [FC +], and *non-fc* [FC −]).

(8)
$$\begin{bmatrix} \text{MKG} & \begin{bmatrix} \text{TP} & \textit{bool} \\ \text{FC} & \textit{bool} \end{bmatrix} \end{bmatrix}$$

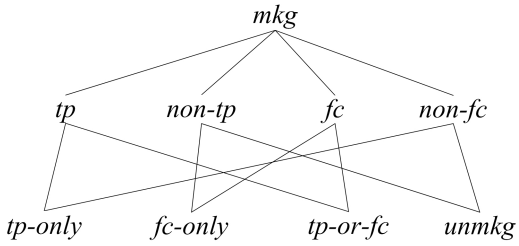

Figure 2: Type Hierarchy of *mkg*

The MKG value reflects the morphological marking but not necessarily the actual INFO-STR value because in some languages syntactic constructions assign the

[5]We believe that *mkg* could in principle be used in modeling focus projection, in the sense that foci can be classified into narrow focus and wide focus. Pursuing these ideas is left for future work.

INFO-STR, taking into account both the MKG value of the daughters and construction-specific constraints on their order. For instance, the topic markers *wa* in Japanese and *(n)un* in Korean can involve a focus reading if the topic-marked NP is scrambled as shown in (4b), which will be explained in detail in §4.2.

3.3 Sentential Forms: *sform*

Building on previous literature (Lambrecht, 1996; Engdahl and Vallduví, 1996; Paggio, 2009), we propose the classification of phrase types in Figure 3. *Topicality* is mainly concerned with how the topic is realized in a sentence. In *topic-comment* constructions (e.g. 'as for' constructions such as (9)), topics are followed by other constituents.[6]

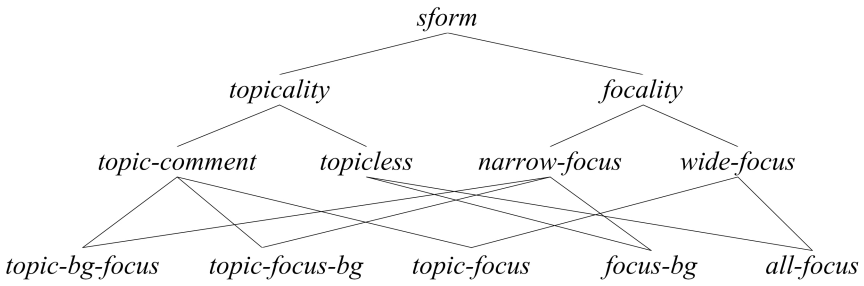

Figure 3: Type Hierarchy of *sform*

(9) As for **the book**, KIM tore it.

As noted, not all sentences have topics. We provide for this with the type *topicless* (e.g. cleft sentences in English such as (7a)). *Focality* is divided into *narrow-focus* and *wide-focus*. The distinction between them, however, is not necessarily equivalent to argument focus *vs*. predicate focus (Lambrecht, 1996; Erteschik-Shir, 2007), because verbs can bear *narrow-focus*.

Several of these sentence types are illustrated in English allosentences in (10)–(11), where we have added annotations disambiguating the information structure: SMALL CAPS for an A-accented phrase (H*), **boldface** for a B-accented one (L+H*), and $[_f\ ]$ for focus projection (Bolinger, 1961; Jackendoff, 1972).

(10) a. **The book** was torn by $[_f$ KIM].
b. **The book** $[_f$ was torn] by Kim.
c. **The book** $[_f$ was torn by Kim].
d. $[_f$ THE BOOK] was torn by Kim.
e. $[_f$ The book was torn by Kim].

[6]The conventions used in (9) are described above (10).

(11) a. **The book** [$_f$ was torn].
b. [$_f$ THE BOOK] was torn.
c. [$_f$ The book was torn].

In (10a), the subject 'the book' has a B-accent and the agent 'Kim' that follows the verb bears an A-accent (i.e. argument focus), which correspond to *topic* and *focus* of the sentence, respectively. As the remaining part 'was torn by', which is neither of them, corresponds to *bg*, we find (10a) is encoded as *topic-bg-focus* in the order named, which is the most unmarked *sform* in English (Lambrecht, 1996).[7] (10b-c), with predicate foci, are *topic-focus-bg* and *topic-focus*, respectively. The focus 'was torn' (i.e. narrow focus on the verb) is followed by the background 'by Kim' in (10b), unlike (10a). (10c) with *wide-focus* does not include any background. (10d-e) are *topicless*; *focus-bg* and *all-focus*, respectively. The cleft sentence (7a) is virtually the same as (10d) in terms of *sform*, because the expletive 'it', the copula, and the relative pronouns in clefts are informatively empty. That is, all cleft constructions in English are instances of *focus-bg*. *All-focus* (a.k.a. sentence focus in which the entire sentence is asserted) is typically an answer to the question like 'What happened?' (Lambrecht, 1996). On the other hand, the agent often disappears in passive sentences, as shown in (11). Since *topic-bg-focus* and *topic-focus-bg* that require three components are ruled out from (11) consisting of only the subject and the verb, there are three readings; *topic-focus* for (11a), *focus-bg* for (11b), and *all-focus* for (11c).

If INFO-STR is lexically or prosodically determined as in (10a), SFORM can be easily detected as well. For example, the 'as for' construction in English, such as (9), belongs to *topic-comment* because the (near) lexical expression 'as for' which has the *tp-only* (i.e. [TP +, FC –]) marks (*contrastive*)-*topic*, and the NP precedes the comment; (9) is encoded as *topic-focus-bg*. However, since the Japanese marker *wa* itself is informatively ambiguous, the syntactic configuration is required to determine SFORM as well as INFO-STR of each sentence in (4), as discussed in the next section.

4 Information Structure in English and Japanese/Korean

4.1 English

In English, information structure is normally constrained by pitch accents (Bolinger, 1961; Jackendoff, 1972)[8]; thus, English uses the A-accent (H*) to prosodically

[7] In contrast, in head-final languages (e.g. Japanese and Korean) in which the most unmarked focus position is immediately preverbal *topic-focus-bg* is the most unmarked *sform* (Ishihara, 2001). This implies that the most unmarked sentential forms differ in different languages, being largely dependent upon the default word order (Lambrecht, 1996; Erteschik-Shir, 2007): First, subjects normally are the most unmarked topics in most languages. That means subjects mostly function as the topic of the sentence unless there is a special cue to identify topic. Second, it is cross-linguistically common that an object is a case of unmarked argument focus.

[8] We are not considering the pitch accents directly in this study.

mark foci and the B-accent (L+H*) to prosodically mark topics, as presented in (12). As for contrast in English, its prosodic marking is partially similar to both A/B-accent (Hedberg and Sosa, 2007). As a result, both accents can be interpreted as contrast, in an appropriate context. Therefore, we assign the INFO-STR values *topic* and *focus*, which are compatible with the more specific *contrast-topic* and *contrast-focus* as well as *aboutness-topic* and *semantic-focus*.

(12)
$$\textit{fp-lex-rule} \rightarrow \begin{bmatrix} \text{PROSODY A-}\textit{accent} \\ \text{INFO-STR } \textit{focus} \end{bmatrix} \qquad \textit{tp-lex-rule} \rightarrow \begin{bmatrix} \text{PROSODY B-}\textit{accent} \\ \text{INFO-STR } \textit{topic} \end{bmatrix}$$

In the context of our text-based MT, this property might be problematic, because written English does not explicitly mark prosody, removing this cue to information structure. However, information structure categories presumably could be added to an English input sentence as a preprocessing step, either on the basis of prosodic analysis in a speech-based system or on the basis of a classifier which takes extra- as well as intra-sentential context into account. For present purposes, we represent these patterns with typeface variations in this paper. In the evaluation process of this study, we tentatively made use of hypothetical suffixes '-TP', '-FP', which represent B-accent for topics, and A-accent for foci respectively. For instance, (10a) is entered into our system as 'The book-TP was torn by Kim-FP'.[9]

4.2 Japanese/Korean

Japanese and Korean employ topic markers (*wa* and (*n*)*un*, respectively) which actively participate in encoding information structure. The topic markers in Japanese and Korean can also be used to denote contrastiveness. For example, as exemplified in (13), the sentence with the topic marker *wa* can sometimes be a felicitous answer to a given question.

(13) Q: Who came?

A: Kim-ga/wa ki-ta.
Kim-NOM/TOP come-PAST
'Kim came.' [jpn]

Kim-ga/wa in (13) directly correspond to the wh-word in the given question,[10] which means 'Kim' has to be interpreted as the focus of the sentence though the topic marker *wa* is attached to it. This implies the lexical marking in Japanese

[9]English also uses lexico-syntactic patterns to mark information structure, notably clefts, English focus movement, and *as for*. As these are much less pervasive than prosodic marking of information structure in English (and morphosyntactic marking in Japanese and Korean), we leave the integration of these into our English grammar fragment for future work.

[10]Many previous studies employ wh-questions as diagnostics to identify focus (e.g. Partee, 1991; Lambrecht, 1996; Gundel, 1999).

does not necessarily directly constrain the information structure in the way that prosodic marking in English does. *Kim-ga/wa* in (13), however, do not have the same meaning as each other (i.e. *semantic-focus vs. contrast-focus*). In an actual sense, if the topic marker *wa* is made use of, the answer conveys the meaning like 'Kim surely came, but whether anybody else came or not lacks confirmation.' (14) shows the difference between them more clearly.

(14) Kim-ga/#wa ki-ta-si, Lee-mo ki-ta.
Kim-NOM/TOP come-PAST-and, Lee-also come-PAST.
'Kim came and Lee also came.' [jpn]

Contrast never shows up out of the blue, because it has to involve an exclusive selection from alternatives (i.e. an available contrast set in the given context). Thus, if 'Kim' is exclusively chosen with the topic marker *wa*, (14) in which the alternative 'Lee' co-occurs sounds awkward. In sum, *wa*-marked NPs can be interpreted as *contrast-focus*.

The lexical markers alone do not fully identify the information structure in Japanese and Korean. Further information comes from word order, and in particular the phenomenon of scrambling (e.g. (4b)) (Choi, 1999; Ishihara, 2001). Whereas scrambling in Japanese/Korean has often been considered as a syntactically optional, semantically void operation, Ishihara argues it is an operation that offers potential focus sets which are not available with different word orders. Assuming Reinhart (1995)'s Focus Rule[11], Ishihara claims that there is a set of constituents that can serve as a focus domain as exemplified in (15) taken from Ishihara (2001, p. 157). (15a) in which the object *hon-o* 'book-ACC' bears the main stress of the given sentence has the focus set as (15c), which means any syntactic constituent containing the stressed word (i.e. OBJ as an argument focus, VP as a predicate focus, and IP as a sentence focus) can be the focus of the sentence.

(15) a. Taro-ga hón-o kat-ta.
Kim-NOM book-ACC buy-PST
'Taro bought a book.'

b. $[_{IP}$ SUBJ $[_{VP}$ $[_{DP}$ OBJ] V]]

c. Focus Set = {OBJ, VP, IP}

However, if the sentence is scrambled as (16b) taken from Ishihara (2001, p. 159), the focus set is also computed differently; VP1 in (16b) cannot function as the focus of the sentence, because it does not include the stressed element.[12]

[11] The focus of IP is a(ny) constituent containing the main stress of IP, as determined by the stress-rule.

[12] According to Cinque (1993), the main stress in head-final languages (e.g. Japanese, Korean) has a strong tendency to fall on the preverbal phrase. For instance, the object *hon* 'book' is most likely to have the main stress in (16a), while *kyoo* 'today' bears it in (16b).

(16) a. [$_{IP}$ Taro-ga [$_{VP2}$ kyoo [$_{VP1}$ [$_{DP}$ hón-o] kat-ta]]]
Taro-NOM today book-ACC buy-PST
Focus Set = {OBJ, VP1, VP2, IP}

b. [$_{IP2}$ hon-o [$_{IP1}$ Taro-ga [$_{VP2}$ [$_{ADV}$ kyóo] [$_{VP1}$ kat-ta]]]]
book-ACC Taro-NOM today buy-PST
Focus Set = {ADV, VP2, IP1, IP2}

In a similar vein, Choi differentiates contrasts from non-contrastive foci and topics in Korean. First, contrasts can freely scramble, while non-contrastive foci (a.k.a. *semantic-focus* (Gundel, 1999)) cannot. Second, when (*n*)*un* attaches to the in situ (i.e. non-scrambled) subject, the subject can be either *aboutness-topic* or *contrast-topic*. On the other hand, when (*n*)*un* attaches in situ non-subjects (e.g. objects), such constituents have only the contrastive reading.

We note the following generalizations which appear to hold for both Japanese and Korean: First, as discussed above, the markers *wa* and (*n*)*un* do not directly constrain information structure, but rather interact with word order phenomena to do so. Second, constituents marked with *wa* or (*n*)*un* are however marked as not 'background' (i.e. topic or focus, contrastive or otherwise). Third, *wa* or (*n*)*un* cannot appear in *all-focus* constructions that allow only *semantic-focus* lacking contrastive meanings, as exemplified in (17).

(17) Q: What happened?
A: Kim-ga/#wa sono hon-o/#wa yabut-ta.
Kim-NOM/TOP DET book-ACC/TOP tear-PST

Finally, we note the three possible interpretations of a *wa*- or *(n)un*-marked NP, depending on its syntactic function and position, shown in Table 1 adapted from Choi (1999). Although (4) illustrates the range of possible translations in Japanese corresponding to the English passive sentence (2b), they have different information structure in accordance with Table 1, as given in (18).

Table 1: Information Structure of Topic-marked NP

	in-situ	**scrambling**
subject	*topic*	*contrast-focus*
non-subject	*contrast-focus*	*contrast-topic*

(18) a. Kim-wa sono hon-o yabut-ta.
Kim-TOP DET book-ACC tear-PST
(*topic*)

b. sono hon-o Kim-wa yabut-ta.
DET book-ACC Kim-TOP tear-PST
(*contrast-focus*)

c. Kim-ga sono hon-wa yabut-ta.
Kim-NOM DET book-TOP tear-PST
(*contrast-focus*)

d. sono hon-wa Kim-ga yabut-ta.
DET book-TOP Kim-NOM tear-PST
(*contrast-topic*)

In short, the challenge in Japanese and Korean is to map from the morphological marking in combination with phrase structure patterns to the specific INFO-STR, including *contrast-topic* and *contrast-focus* which are the only possible interpretations of topic-marked NPs in certain positions. To handle this, we first use MKG to associate partial information with the nominative and topic markers:

(19)

$$\begin{array}{ll} \textit{nom-marker} \rightarrow & \textit{topic-marker} \rightarrow \\ \begin{bmatrix} \text{ORTH} \left\langle \textit{ga} \right\rangle \\ \text{MKG } \textit{unmkg} \\ \text{CASE } \textit{nom} \end{bmatrix} & \begin{bmatrix} \text{ORTH} \left\langle \textit{wa} \right\rangle \\ \text{MKG } \textit{tp} \\ \text{CASE } \textit{case} \end{bmatrix} \end{array}$$

The value of MKG is mapped to values of INFO-STR via the constraints on the various *sform* types. *Topic-comment* requires *tp* of non-head-daughter such that only NPs with topic markers can participate in *topic-comment*. The construction itself is [MKG *tp*] so that constituents which have picked up a topic cannot serve as the head daughter of another *topic-comment* phrase.

(20)

$$\begin{bmatrix} \textit{topic-comment} & \\ \text{MKG} & \textit{tp} \\ \text{HD} \mid \text{MKG} & \textit{fc} \\ \text{NON-HD} \mid \text{MKG} & \textit{tp} \end{bmatrix}$$

In this way, INFO-STR in Japanese and Korean, unlike in English, is specified at the phrasal level (by grammatical rules, such as specialized subtypes of *subj-head* and *comp-head*). The phrasal rules are now classified into eight subrules, which inherit from two types of head-phrases (i.e. *subj-head-phrase* and *comp-head-phrase*) and optionally *topic-comment*. The type hierarchy is sketched in Figure 4, in which there are two factors that have an influence on branching nodes; topic-marking and scrambling.

On the one hand, four rules which the prefix *top* is attached to multiply inherit from *topic-comment* as well as either *subj-head-phrase* or *comp-head-phrase*. On the other hand, four rules that contains *scr* that stands for 'scrambled' deal with constructions in which the non-head-daughter is not in-situ. As presented in (21), INFO-STR in Japanese and Korean is specified in each rule. *Top-scr-subj-head* in

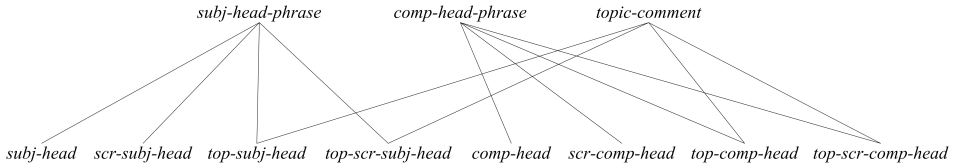

Figure 4: Type Hierarchy of Phrasal Rules

(21) specifies INFO-STR of the non-head-daughter (i.e. a subject) as *contrast-focus* in accordance with Table 1. The non-head-daughter in *top-scr-comp-head* (i.e. a non-subject), likewise, is specified as *contrast-topic*.

(21) $\begin{bmatrix} \textit{top-scr-subj-head} \\ \text{HD} \mid \text{VAL} \mid \text{COMPS} \left\langle [] \right\rangle \\ \text{NON-HD} \mid \text{INFO-STR} \ \textit{contrast-focus} \end{bmatrix} \begin{bmatrix} \textit{top-scr-comp-head} \\ \text{HD} \mid \text{VAL} \mid \text{COMPS} \langle\rangle \\ \text{NON-HD} \mid \text{INFO-STR} \ \textit{contrast-topic} \end{bmatrix}$

For example, Figure 5 shows the derivation tree of (22). The phrase structure rule building the node combining the subject and the verb for (22) (attaching *Kim-ga* 'Kim-NOM' to the rest of the sentence) is an instance of *scr-subj-head*, which combines via the *top-scr-comp-head* rule with the topic-marked object *sono hon-wa*.

(22) sono hon-wa Kim-ga yabut-ta.
DET book-TOP Kim-NOM tear-PST

NPs with nominative markers (e.g., *Kim-ga* in (22)) can't be interpreted as either topic or contrast (i.e., must be non-constrastive focus or background), because the non-head-daughter of *topic-comment* is incompatible with [TP –] as given in (20). On the other hand, *sono hon-wa* 'DET book-TOP' in (22) is a scrambled complement; it is licensed by *top-scr-comp-head* which inherits from both *comp-head-phrase* and *topic-comment*. Its INFO-STR is *contrast-topic* because of the constraint on the rule shown in (21). This models the fact that it is interpreted as both contrast and topic.

5 Translation

For our experiment, we made use of 24 input sentences in English; eight types of allosentences as shown in (10)–(11) for each of the three verbal types: 'tear', 'chase', and 'hit' as exemplified in Table 2 (i.e. 8×3). The first verbal type takes inanimate nouns as complements, and thus resists passivization in Japanese and Korean. The second one tends to be freely passivized. The third one does not have passive forms in Korean, whereas it can be passivized in Japanese. Table 2 compares the linguistic properties of source/target languages discussed so far, and gives three types of verbs in each language.

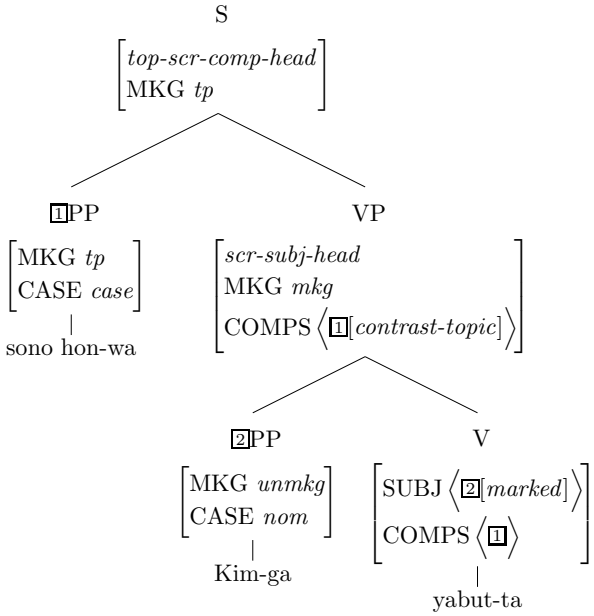

Figure 5: A Sample Derivation in Japanese

5.1 A Sample Translation

The most remarkable advantage of the model that we propose is that information structure-based system can significantly reduce the number of translations. Information structure in MT can function as a filter to reduce the number of candidate translations. To illustrate the process, we will step through the translation of (10a), which has at least eight potential translations in Japanese as given in (4), if we ignore information structure.

Parsing (English): The corresponding tree derivation is sketched out in Figure 6, in which 'the book' with the B-accent is straightforwardly specified as *topic*, and 'Kim' with the A-accent is specified as *focus*.

Transfer and Input/Output MRS: The transfer stage takes as its input the MRS in Figure 7, from the English parse tree, which specifies [INFO-STR *topic*] on the ARG0 of *_book_n_rel* (shared with the ARG0 of *exist_q_rel*), and [INFO-STR *focus*] on that of *named_rel* for 'Kim'. This information is preserved in the mapping to the target language MRS in Figure 8.[13]

Generation (Japanese): The Japanese grammar used in generation only generates structures which are compatible with the input MRS (Figure 8), including the constraints it places on INFO-STR. Because only *wa*-marked NPs can be topics in Japanese, *sono hon* 'the book' must be marked by *wa* in any realization of this

[13] In this study, we avoid the need for transfer rules by using pseudo-interlingual predicate names. This approach works at the very small scale we are experimenting at, but does not scale up. The LOGON system provides extensive support for developing transfer grammars.

Table 2: Source/Target Languages

	English	**Japanese**	**Korean**
focus	A-accent	case markers	
topic	B-accent	topic markers (*wa*, (*n*)*un*)	
contrast	A/B-accent		
passives	productive	less productive	
animacy	insensitive	sensitive	
verb1	'tear'	*yaburu-*	*ccic-*
verb2	'chase'	*ou-*	*ccoch-*
verb3	'hit'	*naguru-*	*ttayli-*

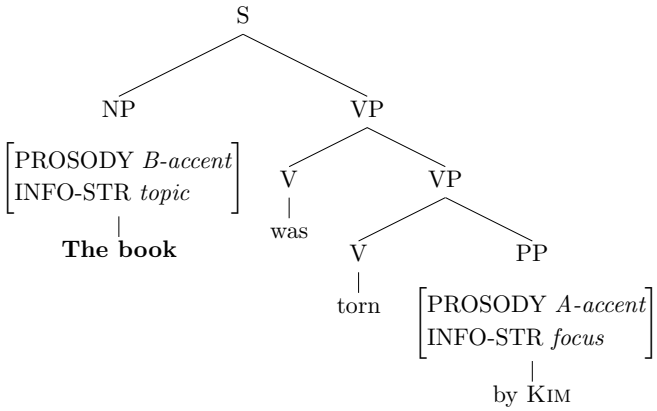

Figure 6: A Sample Derivation in English

MRS. Furthermore, since topics must be sentence-initial, only scrambled versions of the sentence are generated.

Using this constraint, now we can rule out infelicitous sentences. There are, as stated before, eight potential translations as given in (23): ~~strike~~ in (23) indicates the sentence is regarded as an inappropriate translation in the given context, and thus not generated by the grammar that takes information structure into account.

(23) a. ~~Kim-ga sono hon-o yabut-ta.~~
b. ~~Kim-ga sono hon-wa yabut-ta.~~
c. ~~Kim-wa sono hon-o yabut-ta.~~
d. ~~Kim-wa sono hon-wa yabut-ta.~~
e. ~~sono hon-o Kim-ga yabut-ta.~~
f. ~~sono hon-o Kim-wa yabut-ta.~~
g. sono hon-wa Kim-ga yabut-ta.
h. sono hon-wa Kim-wa yabut-ta.

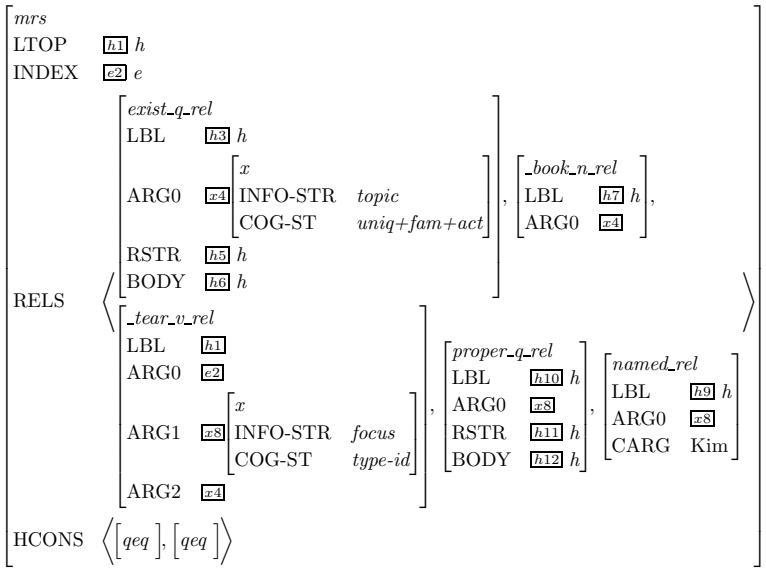

Figure 7: Input MRS (English)

First, since 'the book' is the topic and topics in Japanese must occur sentence-initially, (23a-d) are not generated. Second, (23e-f) in which *sono hon* is not topic-marked are not generated, because the *o*-marked NPs with [MKG *unmkg*] cannot be used as the non-head-daughter of *topic-comment*. Finally, when the underspecified value *focus* of 'Kim' in the MRS is passed to the Japanese grammar, the Japanese grammar provides two different outputs that are consistent with *semantic-focus* and *contrast-focus*, respectively. On the one hand, *ga*-marked *Kim* in (23g) is consistent with a context that calls for semantic focus but no contrast. On the other hand, *wa*-marked Kim in (23h) is interpreted as *contrast-focus* in accordance with Table 1. As a result, only the scrambled variants (23g-h) are generated as the felicitous translations directly corresponding to (10a). That is, we filter out 6 infelicitous translations out of 8 potential translations. For an example derivation, see Figure 5, which corresponds to (23g).

5.2 Evaluation: Translating Passives

To evaluate these proposals, we have implemented them in tdl (type description language), the high-level language interpreted by the LKB (Copestake, 2002). The first step is to construct small starter grammars for English, Japanese, and Korean, using the Grammar Matrix customization system (Bender et al., 2010). As a second step, other rules to produce allosentences (e.g. actives/passives) are added to each starter grammar. The third step is to implement information structure into each grammar, as given earlier. Finally, we create the mapping between internal and external features of indices (*semi.vpm*), in accordance with the LOGON MT

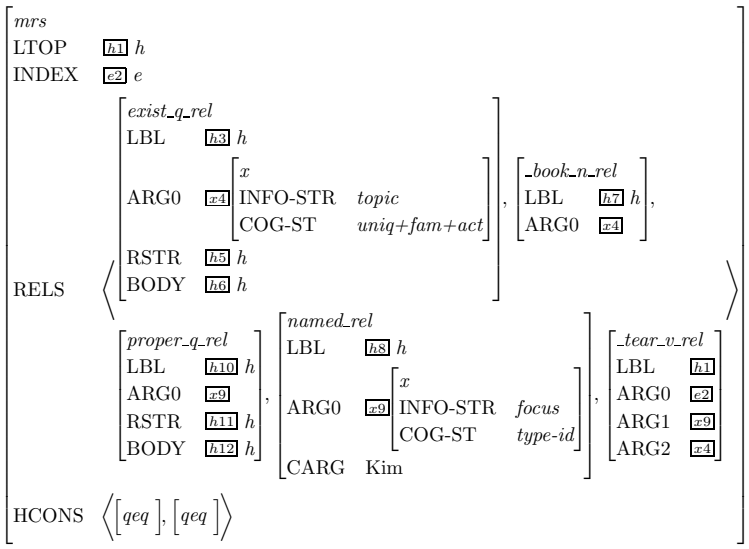

Figure 8: Output MRS (Japanese)

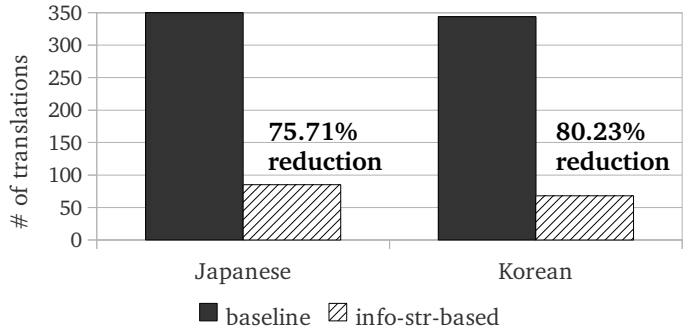

Figure 9: Evaluation

infrastructure (Oepen et al., 2007).

Our experiment shows our information structure-based system, compared to the baseline that lets all of potential translations through (without filtering for information structure), filters out 265 outputs in Japanese and 276 in Korean.[14] Consequently, as shown in Figure 9, we can reduce the number of outputs by 75.71% (from 350 to 85) for Japanese, and by 80.23% for Korean (from 344 to 68).

Thus, our information structure-based MT system has reduced the number of translations dramatically, which has two obvious effects on the performance of transfer-based MT: First, the processing burden of MT component which ranks the translations and select only suitable results can be greatly lightened, which

[14]We hand-verified the filtered Korean outputs and found that they were indeed less suitable.

should improve translation speed. Second, though it is still necessary to harness a re-ranking model for choosing translations, we can start from once-refined sets of translations, which should improve translation accuracy.

6 Conclusion

In this paper, we have made a proposal for how to represent information structure within the HPSG/MRS framework and have shown how it can be used to refine translations, especially focusing on translating English passives. The implications of this study are as follows: One the one hand, since the type hierarchies for information structure that this paper proposes are constructed almost language-independently, we are optimistic that they will apply to other language pairs as well. On the other hand, by enriching our semantic representations with information structure, we effectively move further up the MT pyramid (Vauquois, 1968), reducing the burden on the transfer component. Semantic-transfer based MT allows a system to handle a broad range of structural divergences. However, this also means that the search space of possible translations get larger. We expect information structure to be useful in navigating the array of possibilities provided by many different syntactic constructions and (thus types of syntactic divergence).

Our future work includes the following: First, we plan to evaluate our information structure-based system with various types of sentences, such as clefting, topicalized sentences, and topic-drop sentences. Second, other language pairs also need to be covered in order to check out the feasibility of this proposal. In particular, MT from Japanese/Korean to English has to be examined in the sense that Japanese/Korean employ more specific information structure than English in our proposal. Third, we plan to extend our analyses to handle information structure in multi-clausal sentences. Finally, we plan to build up an library of information structure analyses for the Grammar Matrix customization system (Bender et al., 2010), which contains and extends the main proposals of this paper.

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Information structure as parallel tree building

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Abstract

This paper presents a Synchronous Tree Adjoining Grammar (STAG) account of Information Structure, whereby Givenness-marking requires a link between nodes on a syntactic tree and LF nodes whose interpretation is supplied by a contextually determined set of Given semantic objects. By hypothesis, the interpretation of linked nodes bypasses a default interpretation principle that requires pragmatic reasoning to disambiguate elements and enrich semantic material. Thus, interpreting Given elements requires less cognitive effort than Focused elements. This, combined with some established insights from Game-theoretic pragmatics, yields empirical advantages over more traditional semantic/pragmatic analyses of equal simplicity.

1 Introduction

1.1 The problem

The default right-edge stress pattern of the English sentence is necessarily violated when certain pragmatic considerations license de-accenting in the sense of Ladd (1996), as illustrated by the following question-answer pairs (primary sentential stress in small caps).

(1) Q: Did anything interesting happen at the party?
A: Yes. Mary DANCED.

(2) Q: Did anybody dance at the party?
A: Yes. MARY danced. / #Mary DANCED.

The expectation that somebody was dancing at the party prohibits primary stress on *danced*. Although de-accenting in this sense is not found in every language, different effects of this pragmatic dimension are found in a variety of languages. For example, in Czech and other Slavic languages, syntactic configuration is affected.

(1') Q: 'Did anything interesting happen at the party?'
A: Ano. Marija tancovala.
yes Mary danced

(2') Q: 'Did anybody dance at the party?'
A: Ano. Tancovala Marija.
yes danced Mary
(from Kucerova 2007, p.6)

Canonical SV word order is violated in (2'); the verb *tancovala* 'danced', which is also de-accented, moves across the subject.

Much ink has been spilled pinning down the semantic and pragmatic distinctions that determine such prosodic and syntactic behaviors. Under the umbrella of

[†]I'd like to thank Robin Clark, Anthony Kroch, and the audience of the Information Structure and Formal Grammar workshop for their helpful input. Of course, any follies are my own.

'Information Structure' (IS), these and related phenomena are most often analyzed using some combination of three distinct notions: Focus, Givenness, and Contrast.

The position taken here is that current conceptions of IS require all three of these notions, despite attempts to collapse them. I argue that a true simplification of the theory comes only when we view IS as a set of instructions to an online interpretive system rather than a part of grammar; I model the interaction between these two systems using a simple Tree Adjoining Grammar (TAG). This approach is similar in spirit to Vallduví's (1990) Informational Component, but unlike that work it does not rely on any particular semantic theory, and it makes no specific claims about the architecture of Universal Grammar. The main advantage of this approach is that it is easily folded into a Game-theoretic pragmatic framework of the type suggested by Clark (2011) and Parikh (2010), which simplifies UG by explaining linguistic phenomena in terms of general reasoning behaviors. The result accounts for a wide range of facts without sacrificing explanatory power.

The rest of this introduction reviews the relevant phenomena. Section 2 reviews relevant ways in which Game Theory and Decision Theory have been applied to language. Section 3 is a brief overview of TAG. Section 4 contains the current proposal. Section 5 discusses some empirical and conceptual advantages of this proposal, and Section 6 concludes.

1.2 Focus, Givenness, and Contrast

The primitive distinctions of IS are not agreed upon, but three notions are commonly invoked: Focus (and its complement Ground), Givenness (and Newness), and Contrast. The question is whether all of these notions are necessary to account for the problem outlined above. For the sake of convenience let's refer to the de-accenting in (2) and the syntactic movement in (2') with a theory-independent term, *G-marking*; the G might stand for Given or Ground, and is meant merely as a descriptor. G-marking is often seen as a way of marking constituents outside of the Focus of a sentence, where the Focus has the role of filling in some salient open proposition (e.g. 'somebody danced' in (2), see Prince 1986). Formally, this has been analyzed in a few different ways. One may reduce the distinction to a Focus feature in narrow syntax, whereby Ground is nothing more than lack of an F-feature (Rooth 1992). Alternatively, one may view Focus and Ground as primitives of a separate component of grammar which gives instructions on how to organize the storage of propositional content (Vallduví 1990). Under this view, knowledge is stored in file cards in the sense of Heim (1988) which contain salient open propositions introduced by discourse. Finally, Roberts (1996) adopts the view that discourse is structured into Questions Under Discussion (QUDs), and relevant declarative sentences address or answer QUDs. Under this conception of discourse, the Ground of a sentence can be seen as the QUD selector, while the Focus of a sentence can be seen as the QUD addresser.

These different formalizations describe three different levels of the language faculty: for Rooth, information structure is a component of grammar as it is nar-

rowly defined within the Chomskyan paradigm; for Vallduví, it is part of a larger linguistic system that interacts with structured knowledge of the world; for Roberts, it is the product of communicative goals held by interlocutors situated within a discourse context. But these accounts all get at the same generalization. Linguistic objects that are de-accented in languages like English and fronted in languages like Czech all correspond to an open proposition that is salient to the hearer. This generalization can account for a wide variety of examples, including the question-answer pairs in (1) and (2), but it is not without its problems.

After Schwarzschild (1999), G-marking can alternatively be analyzed as marking Givenness rather than Ground. To illustrate, consider the following example.

(3) PAT: I just got tickets to the BeeGees concert!
CHRIS: I used to ROADIE for the BeeGees.

The prosodic contour of Chris's utterance is similar to that of example (2) above, where the default right-edge stress pattern is altered via de-accenting of some constituent, in this case the PP *for the BeeGees*. The broad Focus counterpart of this sentence (e.g. the response to "tell me something interesting about yourself") would maintain prominence on *BeeGees*. The sentence in (3), on the other hand, behaves like the answer to the question, "what is your relationship to the BeeGees?" But no such question has been posed or implied. Certainly there need not be an antecedent set of relevant propositions of the form $PAST(P(me, BGs))$ or an open proposition of the same form to be filled in by $P = roadie$. De-accenting here seems to be motivated by a different notion, Givenness.

Under the analysis given by Schwarzschild (1999), a constituent is Given when the discourse context saliently entails it under existential closure or existential type-shifting. If the Given element denotes a predicate (e.g. 'danced'), then the context entails its existential closure ('there exists an x such that x danced'). If the Given element denotes an entity (e.g. 'Mary'), then the context entails its existential closure after type-shifting ('there exists an x such that x is Mary'). Under this analysis, the G-marking of the BeeGees in (3) is licensed by the fact that the preceding context entails the existence of an entity called "the BeeGees" (and that this entailment is salient to the hearer).

In many contexts, Givenness subsumes the Focus-Ground account, and therefore it has been suggested (beginning with Schwarzschild himself) that Givenness is the only relevant pragmatic dimension affecting de-accenting. This runs into problems, however, in that there are numerous cases in which Given information must bear sentential stress, as in the following example.

(4) A waiter walks up to a table with two customers holding a plate of chicken and a plate of tofu. The waiter has forgotten who ordered which meal and asks, "who ordered what?"
A: HE ordered the TOFU. / #HE ordered the tofu.

In this case it is necessary to accent both the subject and the object, as both consti-

tute the answer to the multiple wh-question under discussion. Under Schwarzschild, one should be able to de-accent the entire VP *ordered the tofu*, as the context entails that somebody ordered a plate of tofu. In this case, the Focus-Ground distinction more straightforwardly accounts for the observed prosodic contour. Also, consider the following contrast.

(5) a. Q: Why are you limping?
A: I fell down the STAIRS this afternoon.
b. Q: Where did you fall and when?
A: I fell down the STAIRS this AFTERNOON.

Broad Focus on the answer in (5a) does not prevent the de-accenting of "this afternoon" when the relevant time variable is easily inferable from context (notice that replacing "this afternoon" with "at lunch" no longer allows de-accenting). However, similarly to (4), the context in (5b) forces accent on "afternoon". From this it appears that accent is required on question-answering constituents. This is straightforward under the Focus-Ground approach to G-marking, but not under the Given-New approach.

The seemingly disjunctive nature of de-accenting in English is not an isolated phenomenon. Consider again the case of Czech.

(6) Q: 'Who gave Pavel the book and when?'
A: Pavlovi knížku dala včera Marie.
Pavolv.dat book.acc gave yesterday Marie.nom
(from Kucerova 2007, p.11)

(7) 'A little girl on her way to school lost a lollipop. And then...'
lízátko našel chlapec.
lollipop.acc found boy.nom
(from Kucerova 2007, p.3)

Here we see pragmatic similarities between Czech and English G-marking. In (6) both 'Pavel' and 'the book' are part of the multiple wh-question, mirroring example (5) above. In this case, the backgrounded elements must precede the rest of the elements in the sentence. As in example (5), the word meaning 'yesterday' cannot be G-marked, suggesting a Focus-Ground analysis. Example (7), on the other hand, defies a straightforward Focus-Ground analysis in that the G-marked element *lízátko* 'lollipop' is straightforwardly Given but not necessarily part of a salient open proposition or QUD (indeed the story could have continued about the girl rather than the lollipop). Given these facts, distinct notions of Givenness and Ground form a natural class within the linguistic system. The problem is to explain why this should be so.

Büring (2007) combines the two notions into a single constraint that prohibits the de-accenting of a Given element when it is maximally Focused, i.e. not dominated by any other Focus. This accounts for the accent patterns in question-answer

pairs like in (4). Although it unsatisfyingly relies on a disjunction, the constraint covers the range of facts once we grant a distinction between Focus as it has been presented thus far (often called "information focus" after Kiss 2007) and Selkirk's (2007) Focus of Contrast (FOC). Selkirk notes that, contra the predictions of previous analyses (Rooth 1992, Schwarzschild 1999), there are distinct prosodic correlates of Focused constituents that receive a contrastive interpretation. As shown below, contrastive focus licenses the de-accenting of what follows, perhaps to avoid stress clash (see e.g. Speyer 2008), violating the normal question-answer congruence.

(8) PAT: I heard your uncle bought you a blue convertible.
CHRIS: No, he bought me a RED convertible. / #No, he bought me a CHEAP convertible.

In this case 'red' is a contrasting alternative to 'blue' (the two are mutually exclusive in this context), but 'cheap' is not. This leads Wagner (2006) to propose that the true license for de-accenting is local contrast, e.g. a contrastive interpretation relative to the sister of the G-marked node (*convertible* here). Büring (2008) points out a hole in the empirical coverage of the analysis, showing that FOC is more likely the feature that is marked here, rather than Givenness. This is consistent with Selkirk's (2007) argument that both Givenness and Focus of Contrast are marked in natural language.

I should note that Wagner (2010) has proposed a unified analysis of Givenness, Ground, and Contrast that addresses the issues brought forth in Büring (2008); however, though Wagner's insights about local contrast are important, there are some conceptual and empirical problems with the unification. First, an unsatisfying disjunctive characterization of local contrast is required to account for all cases. Also, Wagner's analysis relies on Given elements moving to a propositional node at LF when no alternatives are introduced by the discourse context. This claim is suspicious, as some of its predictions are not borne out. For instance, Wagner predicts (9) not to be possible in the absence of an explicit contrast set for *friend*, since DPs do not have a propositional node to move to.

(9) Q: Who did Jones's father vote for?
A: He voted for a FRIEND of Jones.
(from Büring 2007, p.8)

On these grounds, I am going to maintain that most elegant analysis of the facts thus far relies on distinct notions of Focus, Givenness, and Contrast. What we are left with is something like the following generalization: (1) a Given element is de-accented unless it is in Focus, and (2) accent can shift within a Focused phrase to yield a Contrastive interpretation.

Although there are some subtleties beyond what has been said here, I take this descriptive generalization to be basically correct. The problem is that even under a concise formal statement of the pragmatic conditions on de-accenting, we are

left with a disjunction. We want to know why Givenness and Ground (or lack of Focus) form a natural class. A disjunctive generalization does not solve the problem. By getting rid of the disjunction, we will be able to explain the facts rather than merely describing them. The key to accomplishing this, I argue, is to model IS as a set of instructions to an interpretive system. The model set forth here conceives of G-marking as an instruction to retrieve a contextually entailed Logical Form (LF), overriding a default Game-theoretic interpretation mechanism. This analysis echoes Schwarzschild (1999), but by moving G-marking from grammar to online interpretation, broader behavioral principles can be called upon to explain cases which previously required a complication of the theory.

2 Game-theoretic Pragmatics

Linguistic communication is a cooperative process whereby interlocutors agree on intended propositional content. At the heart of pragmatics, beginning with Grice, is the observation that it is not enough to decode words and phrases from conventional semantic representations; interlocutors must be reasonable. Game-theoretic pragmatics is a simple mathematicization of this idea, founded on the premise that there is nothing specifically linguistic about the reasoning behaviors involved in choosing from among possible interpretations of an utterance.

We begin with the premise that language can be modeled as a game in which players use grammar strategically to accomplish shared goals. Because players' interests converge, it is a coordination game of a type first observed by Schelling (1960). Players receive a positive Utility (payoff) only when all players take the same action. The players in a linguistic game are a Speaker and a Hearer, who must both converge on the same meaning for an utterance to ensure a positive outcome. Utility in a linguistic game is the benefit of successfully communicating. A simple example of metaphor illustrates.

(10) I need a new phone; this one's a <u>dinosaur</u>!

		HEARER	
		'very old thing'	'extinct reptile'
SPEAKER	'very old thing'	b,b	0,0
	'extinct reptile'	0,0	a,a

The diagram above states that some non-negative Utility a is awarded to both the Speaker and the Hearer for coordinating around the literal meaning of *dinosaur*, and some higher Utility b for coordinating around the metaphorical meaning. There is no reward for miscommunication. Utilities in a communication game are, generally speaking, degrees to which a common communicative goal is accomplished. If the purpose of an utterance is to convey information, we may use Relevance to model Utility. The metaphorical meaning in (10) is more Relevant than the literal

meaning iff it contributes information that is more useful given the discourse context. (The literal meaning is probably of no use at all as the resulting proposition is obviously false, so we may want to say that a is 0.) Given that the Speaker and Hearer both want a higher payoff, they will coordinate around the action with a higher payoff; the Speaker will intend to say something Relevant, and the Hearer will interpret it as such. Thus, the interpretation of (10) can be reduced to a simple Decision problem: choose the meaning with the highest degree of Relevance.

As pointed out by Clark (2011) and Parikh (2010), a game like the one in (10), while illustrative, needs an additional component to adequately model interpretation: probability. The game in (10) assumes that it is equally probable within the context for the Speaker to want to convey either the literal or the metaphorical meaning. Of course, this is not true. In reality, certain interpretations are far more frequent within certain contexts. This does not affect the outcome of (10), but in other cases it is very important. Consider the sentence, *My friend lives by the bank.* In a town with both a river and a financial institution, either meaning for *bank* would be equally Relevant (either resulting proposition could be true as far as the Hearer knows). However, if there are many densely populated neighborhoods by the nearest financial institution, and very few residential areas by the riverbank, the former meaning becomes much more probable *a priori*. Because of this, coordination is possible. The Hearer simply chooses the more probable meaning. The Speaker, knowing the Hearer will do this, will explicitly disambiguate if she intends the less probable meaning. From this we can posit that semantic Decision problems are solved by maximizing the product of Utility (Relevance) and contextual probability. Economists call this quantity Expected Utility, and it is a notion that factors into multiple aspects of human behavior. By applying the concept to linguistic interpretation, we are supporting the idea that pragmatics is the result of domain-general reasoning mechanisms. However, for clarity and ease of description it may be useful to give a formulation that is specific to language. Let's call it the Strategic Interpretation Principle (SIP).

Given an uttered word or phrase u, a set of possible meanings $\{M_1, \cdots, M_i\}$, and a discourse context C, the Hearer chooses a single interpretation M that maximizes the following quantity:

$prob(M|u, C) * Relevance(M)$

BOX 1: THE STRATEGIC INTERPRETATION PRINCIPLE

The way in which contextual probability and Relevance are quantified will of course vary from context to context, from speech act to speech act, and will often be difficult to achieve in practice. But in theory, all types of utterances are subject to this sort of reasoning, and in certain closed contexts (giving instructions for a task with a finite number of possible actions, for example), Game-theoretic pragmatics makes concrete and quantitative predictions. The nature of these predictions is a topic for another time; see Clark (2011), Parikh (2001, 2010), and Sally (2002) for

foundations. The rest of this paper is devoted to showing that the SIP does not apply to G-marked constituents, and that this may be the defining characteristic of IS. To formalize this, I model semantic interpretation with a Partially Synchronous Tree Adjoining Grammar, the components of which are reviewed in the next section.

3 Tree Adjoining Grammar

Tree Adjoining Grammar (TAG) is a mildly context-sensitive (Joshi 1985) grammar formalism in which complex tree structures are built up from atomic units called Elementary Trees, via two operations: Substitution and Adjoining. We see in Fig. 1 the elementary tree for the present tense verb *wants* being supplied with two DP arguments by substituting the DPs *Mary* and *pizza* in for the empty DP argument nodes.

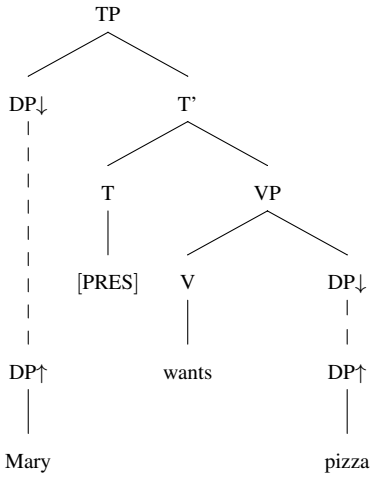

FIG. 1: SUBSTITUTION

Simple sentences are built up this way, inserting argument constituents into lexically determined verbal structures. The Adjoining operation (Fig. 2) inserts structure into a tree by splitting a node and performing two substitutions. In the following example, the DP node dominating *pizza* is pulled apart from the main tree, at which point the structure $[_{DP}$ DP $[_{PP}$ from Gino's $]$ $]$ is substituted for the direct object DP node of *wants*. Then, the separated DP *pizza* is substituted in for the sister DP of *from Gino's*, creating the structure $[_{DP}$ pizza $[_{PP}$ from Gino's $]$ $]$. This transforms the sentence *Mary wants pizza* into *Mary wants pizza from Gino's*.

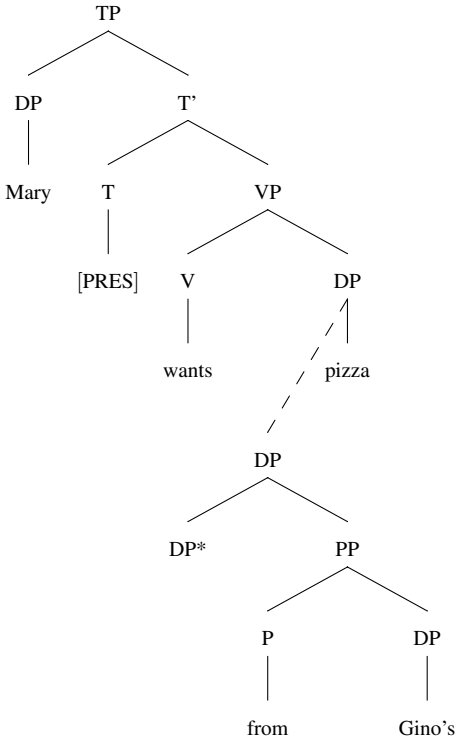

FIG. 2: ADJOINING

The mildly context-sensitive status of TAG gives it enough power to derive crossed dependencies (via Adjoining), but is more constrained than other context-sensitive systems (Joshi 1985). Also, the formalism has proven to have advantages in deriving certain locality phenomena that are found in natural language (Kroch and Joshi 1985, Frank 2002). As we see from the examples given above, the Elementary Trees of TAG are highly lexicalized. Proposed derivational operations such as movement are accounted for within a TAG framework by constraints on the inventory of Elementary Trees in a language. These meta-constraints may themselves be modeled with a grammar formalism, such as a Minimalist Grammar (Frank 2002).

Schabes and Schieber (1990) propose Synchronous TAG (STAG) to formalize the isomorphism between syntax and semantics. Simply put, a STAG formalism builds a logical form (LF) for a sentence as a separate tree with nodes that are "linked" to nodes in the syntactic tree. Every Substitution or Adjoining operation that affects a particular node on the syntactic tree must analogously affect its linked node on the LF tree. So, substituting *Mary* and *pizza* in for the DP arguments of *wants* is necessarily accompanied by the substitution of those constituents' denotations into the LF tree corresponding to *wants*, which is shown in Fig. 3.

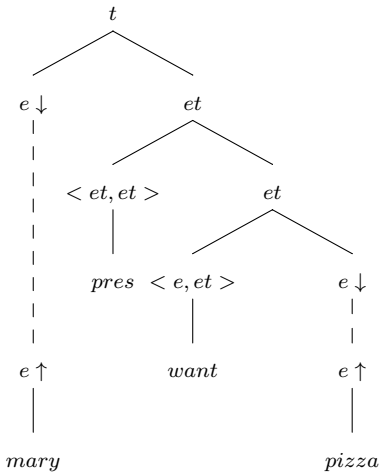

FIG. 3: SUBSTITUTION AT LF

I offer a simple extension, a Partially Synchronous TAG structure (PSTAG), to model how utterances are interpreted. Utterances are parsed online and placed into TAG structures that are interpreted as they are built. At any given time, there is some set of Given semantic objects available to the Hearer. For now, we adopt Schwarzschild's definition: all meanings that are entailed by the salient preceding context (possibly under existential closure and/or type-shifting) are in the Given set. If a constituent is G-marked, its interpretation is linked to a node on the corresponding LF tree, and linked LF nodes are filled in with meanings from the Given set. Focused constituents are not linked (thus the structure is Partially Synchronous), and thus do not receive an interpretation in this way. Focused constituents are interpreted via the SIP.

4 Parallel Tree Building

Recall the Strategic Interpretation Principle, and consider how it applies to (a) and (b) below.

(11) PAT: I need a new place to live. I looked into those new condos on the riverfront, but they're too expensive. Do you have any suggestions?

CHRIS:

a. My friend lives by the BANK, and she loves it.

b. My FRIEND $[_G$ lives by the bank $]$, and she loves it.

In this context, it is much more helpful for Chris to be talking about a financial institution rather than a riverbank, since Chris has already been informed that the riverbank neighborhood is too expensive for Pat. Also, let's pretend (as we did in Section 2) that there are well-populated neighborhoods near the Savings & Loan in our fictional town, and that the riverbank is by comparison sparsely populated.

In this case, both contextual probability and Relevance are on the side of one particular interpretation for the ambiguous word *bank*: by the SIP, Pat should gather from Chris's utterance that Chris's friend lives near the Savings & Loan, not the riverbank. This is borne out in (a), but not in (b). In (b) the riverbank interpretation is favored, resulting in an unhelpful utterance. The intonation pattern affects how *bank* is disambiguated.

As outlined in Section 1, response (b) is only allowed when one of the possible meanings for *bank* is Given; manipulating the context to exclude mention of the riverfront results in infelicity. The G-marked constituent *lives by the bank* is licensed by the mention of a riverfront neighborhood (the existence of which entails that people live near the bank of a river), and the corresponding meaning must be chosen, rendering the SIP completely irrelevant to interpreting the predicate. The subject *my friend*, being in Focus, still requires the SIP to arrive at the specific indefinite meaning for *my friend*.

This is easily modeled with a PSTAG. As the syntactic structure of the sentence is built up in real time, only the G-marked nodes are linked to an LF tree. The terminal nodes of the LF tree are supplied by the Given set, containing all and only those semantic objects that are entailed by the salient preceding discourse context. In (b), the predicate is G-marked, and thus Logical Forms for each terminal node dominated by T' are determined by intersecting the corresponding sets of possible conventional meanings with the Given set. These are composed to yield the intended meaning for the predicate. The subject, being in Focus, does not receive an LF, and therefore must be assigned one through different means: the Hearer must use pragmatic reasoning to solve for the most likely and Relevant interpretation for the subject.

So far, this shows only that the kind of pragmatic reasoning entailed by the SIP is unnecessary to derive meaning from G-marked linguistic material. It has not yet been shown whether the SIP is vacuously at work, with G-marking merely whittling the set of possible meanings down to a singleton. Also, no predictions have been discussed beyond those shared by Schwarzschild (1999). The next section shows that circumventing Strategic Interpretation in the presence of G-marking leads to better predictions, and that the resulting analysis accounts for the problematic examples discussed in Section 1. Most importantly, this analysis relies only on the simple model sketched above and established general principles of human behavior. Separate linguistic notions of Focus and Givenness are not needed.

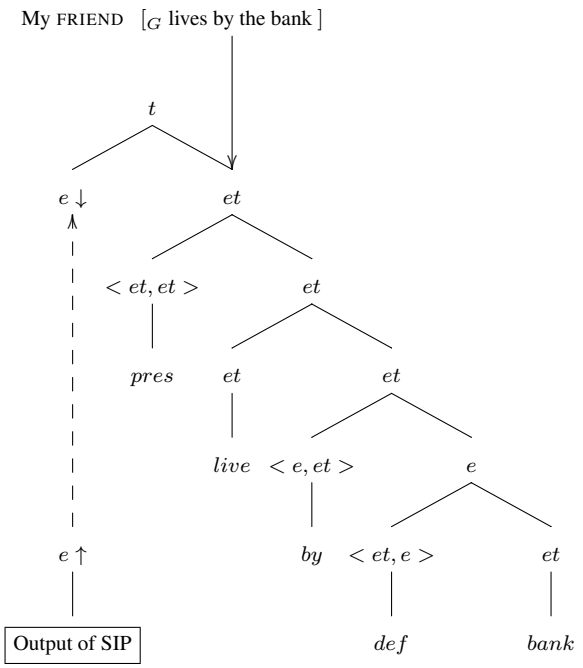

FIG. 4: LINKING G-MARKED NODES

5 Unifying Givenness and Focus

5.1 Effort minimization and forward induction

The chief difference between the current analysis and Schwarzschild (1999) is that the current analysis does not place IS inside the conventional semantics. Rather than determining the meaning of an utterance directly, IS determines *how* an utterance's meaning is to be derived. This places the PSTAG account somewhere between Schwarzschild (1999) and Vallduví (1990). A further point of differentiation is the congruence of the current analysis with Game-theoretic pragmatics. This allows well-established behavioral principles to be brought to bear on why IS looks the way it does. The interaction of two such principles explains why answers to QUDs are not G-marked, even when Given: effort minimization and forward induction.

Effort minimization is somewhat obvious: given the choice of two ways of accomplishing the same goal, people will generally choose the one that is less effortful. This applies to pragmatics in ways originally recognized by Grice, e.g. the Maxim of Manner (containing the humorously redundant decree, "be brief; avoid unnecessary prolixity"). For our purposes it is enough to say that the Speaker is expected to minimize production effort as well as cognitive effort for the Hearer, all things being equal. This is at odds with the idea that cases like (4), reproduced below, involve forgoing a possible G-marking. After all, G-marking causes de-

accenting in English and other languages, which reduces phonetic effort. And if it bypasses the SIP entirely, then G-marking requires less cognitive effort for the Hearer, with the resulting interpretation relying only on the retrieval of conventional meanings and the Given set (assumed to be quite accessible cognitively, as the phenomenon of priming suggests). Interpreting Focus requires an implicit calculation (or estimation) of contextual probability and a consideration of Relevance, as well as the retrieval of conventional meanings. In a cooperative discourse, the Speaker should G-mark whenever possible.

(12) A waiter walks up to a table with two customers holding a plate of chicken and a plate of tofu. The waiter has forgotten who ordered which meal and asks, "who ordered what?"
A: HE ordered the TOFU. / #HE ordered the tofu.

A second principle can be brought in to account for examples like this: the principle of forward induction. Applied to language by Sally (2002), forward induction simply states that agents assume others' past actions to be rational (Utility-maximizing). This is crucial to deriving Gricean implicatures. Implicature calculations always rely on reasoning of the form, 'The Speaker could easily have said X, but instead said Y, and thus must have intended to convey something by choosing Y...'. This is forward induction at work. When a Maxim is violated, there must have been a reason for it. More generally, when Utility is sacrificed, it must signal a gain down the road. In this way language involves *signaling*. Assuming the Speaker to be rational, unnecessary effort is a signal of higher Utility, just as a large bet in a poker game signals (perhaps dishonestly) a good hand. If certain elements in an utterance contribute more Utility than surrounding material, then forward induction predicts an effortful formulation of these elements. Such a formulation is intended to convey to the Hearer that these elements constitute the important contributors to the shared communicative goal.

The combination of forward induction, effort minimization, G-marking, and Strategic Interpretation yields a unified account of IS based purely on general pragmatic behaviors, which is explicated below.

5.2 When not to G-mark

There are many possible communicative goals, and thus many ways for linguistic material to contribute Utility, but consider the special case of Questions under Discussion (QUDs). In (4)/(12) above, there is a clear QUD: 'which person ordered which dish?' The communicative goal is the answer to the QUD, a set of pairs of the form $\{< A, tofu >, < B, chicken >\}$ pairing the right patron with the right food. The QUD-answering elements (A, B, $tofu$, $chicken$) are particularly important to the Hearer in that those contribute to the identity of the set which the Hearer is trying to discover. Thus, any of these elements is a more useful/Relevant contribution than the surrounding elements which only serve to identify the QUD. If the QUD is obvious from the context (as it is here, where it's made explicit), then

the QUD-answering elements are solely responsible for the Utility of the utterance. The rest of the utterance is redundant. This is obvious from the fact that when syntax allows it, everything but the Utility contributors is elided (Q: Who ordered the fish? A: Bob.) Syntactic requirements notwithstanding, answers to a QUD in a context where the QUD is explicit constitute the minimal set of linguistic material that accomplishes the communicative goal. This privileged status is signaled by the increased effort associated with failing to G-mark. The result is the following principle of linguistic behavior.

G-marking bypasses the SIP to reduce interpretive effort for elements in the Given set, and is omitted to signal QUD-answering status.

BOX 2: THE EFFICIENCY PRINCIPLE

Applied to (4)/(12) above, we can derive the intonation pattern with the following steps: (1) for each word in the utterance, if its meaning is in the Given set, G-mark it (in this case, G-mark all of the words), (2) identify the QUD (x ordered y), (3) remove any G-marking from the elements that correspond to the open variables in the QUD (*he* and *tofu*), and (4) ignore G-marked words when assigning prosodic prominence. The Hearer will vacuously apply the SIP to *he* and *tofu* and take the ordered set of those elements to be the answer to the question, 'who ordered what?'

So far, we have not said anything about Focus of Contrast. I will leave an in-depth discussion of FOC for another time, but it should be clear that effort minimization and forward induction are general enough to apply to cases that do not fall under the QUD umbrella. Failure to G-mark has to do with QUDs in the illustrative case of 'who ordered what?', but this type of signaling should be possible in other contexts as well, as long as it is possible to derive higher Utility from the signals. Tentatively, this same principle could be responsible for cases of Contrastive Focus. FOC serves to exhaustively identify an element in a contextually given set (see Kiss 2007), and if Utility is proportional to the amount of information conveyed (and it is, up to a point, by Grice's Maxim of Quantity), then forward induction could be used to derive an exhaustivity presupposition from an unnecessarily effortful instantiation of a word or phrase. Future work will determine the degree to which the generalization is useful. For now, we can say that Givenness and Focus are one in the same, that the pragmatics of utterance choice and interpretation is responsible for the data we see, and that it should be tested whether the same pragmatic mechanisms can explain Contrast.

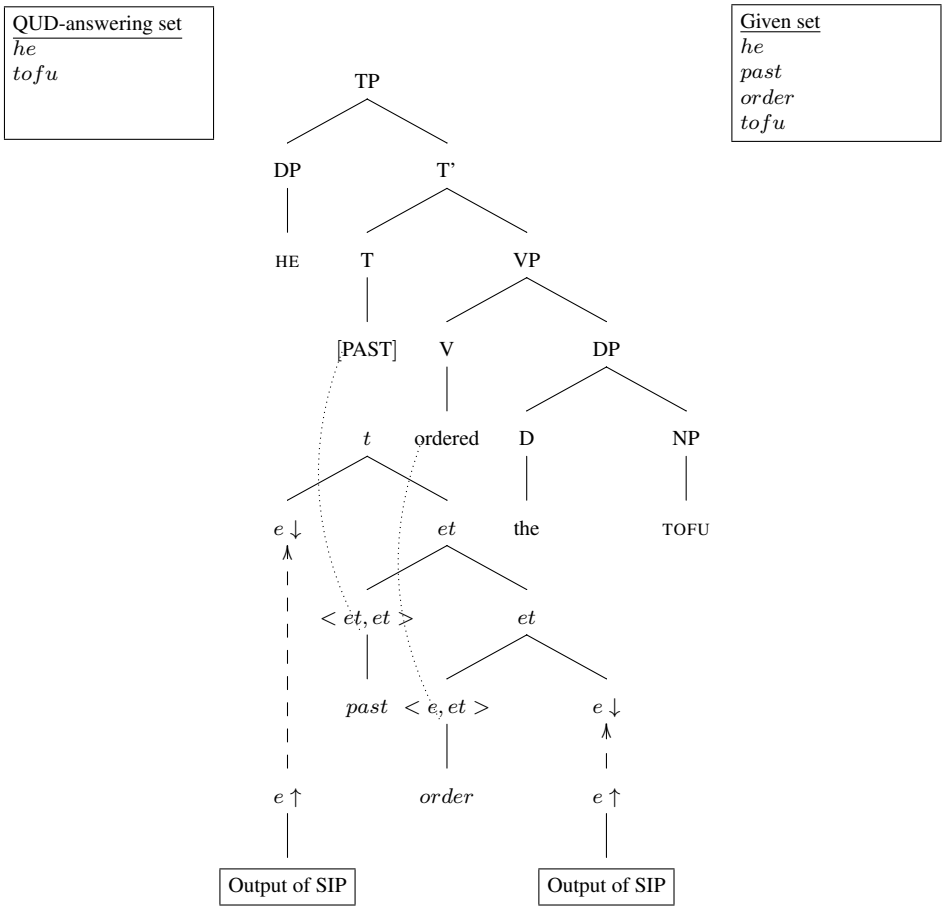

FIG. 5: WHO ORDERED WHAT

6 Summary

I have proposed a pragmatic account of Givenness that draws upon the insights of Vallduví (1990), Roberts (1996), Schwarzschild (1999), and others. This account conceives of Information Structure as a set of instructions for how to interpret utterances, and analyzes Givenness as a way of simplifying the interpretive process. I have modeled the interpretive process with a Partially Synchronous Tree Adjoining Grammar. Consistent with the paradigm of Game-theoretic pragmatics, this account allows general principles of rational behavior to explain discrepancies that trouble more traditional accounts. This represents an explanatory unification of the notions of Givenness and Focus, and I have tentatively suggested that Contrastive Focus should be handled in the same way. Hopefully further research will illuminate the strengths and weakness of this approach.

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