Gapping:

A Constraint-Based Syntax-Semantics Interface

by

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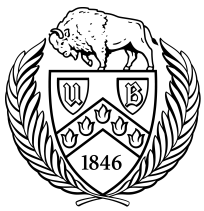

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Abstract

This dissertation takes a surface-based and semantic underspecification approach to ellipsis and offers an account of the syntax/semantics of Gapping sentences. These are sentences which consist of a full clause and an elliptical clause (called a *gapped clause*) that comprises two or more remnant constituents (e.g., *John read poems and [Mary novels]*). The approach taken in this dissertation analyzes gapped clauses as a syntactic unit independent from coordination, and formalizes them as a flat construction that includes all and only surface constituents. The analysis is based on novel data which provides evidence about the occurrence of Gapping in non-coordinate structures, as well as data that is not easily reconcilable with traditional analyses that postulate underlying full syntactic structures for gapped clauses. Phenomena that were previously attributed to the syntax of a putative underlying structure are explained to follow from constraints on surface structure. Furthermore, the various readings of gapped clauses are captured using semantic underspecification, combined with an independently motivated matching constraint that ensures semantic parallelism between gapped clauses and their respective source clauses.

The analysis of gapped clauses proposed in this dissertation is shown to interact with a general theory of coordination to generate scope ambiguities between the conjunction and scopal elements in the first conjunct. Often, multiple different derivations are required to account for these ambiguities. This dissertation argues against the need for this type of derivational ambiguity, which is empirically unsupported. Instead, it is proposed that

the scopally ambiguous readings of Gapping sentences result from various ways of resolving a single underspecified meaning, associated with a single syntactic analysis. This constraint-based, surface-oriented approach to Gapping accounts for phenomena that were problematic in other approaches.

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Contents

Chapter 1

Introduction

> Academic science can sometimes feel like self inflicted torture when that experiment just won't work. Everybody deals with it in different ways. *Some turn to partners, <u>others to alcohol</u>* and some just throw their lives at a problem.[1]

This dissertation is concerned with Gapping – elliptical sentences consisting of a *gapped clause* (exemplified by the underlined string above) and a preceding *source clause* which provides the interpretation for the missing material in the gapped clause. I explore how the syntax and semantics of gapped clauses interact with each other, and how they interact with the grammar of coordination and other complex constructions to generate Gapping sentences.

A great deal of research has been devoted to the topic of Gapping in generative grammar. Starting with Ross (1970) traditional analyses assumed that Gapping sentences derive from conjoined full sentences via a reduction process (deletion or movement operation). One persistent point of criticism has been that the alleged parallel between a gapped clause and its full-sentence counterpart does not always hold. Moreover, more recent research has shown that the syntactic relationship between gapped clauses and their respective source

[1] https://cheekyscientist.com/7-ways-phd-students-academics-deal-stress-anxiety-depression/

clauses is not restricted to coordination as previously assumed. As a consequence, efforts have been made to provide a proper analysis of the phenomenon by characterizing gapped clauses as *fragments* – sequences of words which lack a finite verb but nonetheless form a clause on their own (Sag *et al.* 1985, Culicover & Jackendoff 2005, Abeillé *et al.* 2014, among others). As I will show in this work, however, none of these efforts is entirely satisfactory in capturing all the generalizations of Gapping data. There are still major ongoing issues as to how the meanings of gapped clauses are best accounted for and how those meanings interact with the semantics of coordination to allow for various scopal readings.

This dissertation presents an analysis of Gapping which is able to account for a number of phenomena that have been problematic for previous analyses. My approach is based on prior fragment-based approaches to Gapping (Sag *et al.* 1985, Culicover & Jackendoff 2005, Abeillé *et al.* 2014), but it modifies and extends that research in several ways. In particular, the analysis proposed in this work integrates questions under discussion (Ginzburg 1996 et seq.; Roberts 1996/2012) to capture the context-dependence of gapped clauses (cf. Reich 2007) and utilizes semantic underspecification techniques to represent the semantics of gapped clauses as well as its interaction with coordination. The result is a constraint-based constructivist analysis of the syntax/semantics of Gapping in which gapped clauses interact with coordination and other complex structures. The analysis is developed in the framework of Head-Driven Phrase Structure Grammar (HPSG), combined with the underspecified semantic formalism Lexical Resource Semantics (LRS) (Richter & Sailer 2004). Nothing crucial hinges on these choices, however.

1.1 Phenomenon Overview

This introductory section lays out the basic characteristics of Gapping. It also defines what Gapping is not, by describing related phenomena that will not be dealt with in this work.

1.1.1 Basic features of Gapping

Gapping involves two clauses that are similar in some sense. The first clause is complete (called the *source clause*) while the second clause is missing a finite verb and optionally other material (called the *gapped clause*). In (1) the string *Chris played tennis* constitutes the source clause and the string *Bill volleyball* the gapped clause.[2] The overt constituents in the gapped clause are called the *remnants* and the source clause elements which correspond to the remnants are called the *correlates*; what is not a correlate in the source is the *antecedent* (of missing material).[3]

(1) [Chris played tennis]$_{\text{source}}$ and [Bill volleyball]$_{\text{gapped clause}}$

Remnants = *Bill*, *volleyball*

Correlates = *Chris*, *tennis*

Antecedent = *played*

(1) is interpreted as meaning that both Chris and Bill played some sports, each a different sport: Chris played tennis and Bill played volleyball. But how is this complete interpretation possible even though there is material missing in the gapped clause? And what qualifies as an appropriate source clause and how does it relate to the gapped clause? These questions are not new, and numerous answers have been offered in the literature from many different theoretical perspectives. Yet, many aspects of Gapping remain unaccounted for. This dissertation constitutes an attempt at filling in this research gap.

[2] All the data in this work has been validated by native speakers. Throughout this dissertation, I generally use the term 'acceptability' rather than 'grammaticality', in order to avoid the issue of whether the judgments discussed are the result of grammatical or extra-grammatical factors.

[3] Gapping sentences are usually pronounced with a particular intonation contour: the default intonation involves a rising pitch accent on the first remnant and its correlate, and a falling accent on the second remnant and its correlate (Oehrle 1987; Carlson 2001; Féry & Hartmann 2005; Winkler 2005; Repp 2009). See (i) from Carlson (2001:15) for an illustration.

(i) BOB insulted the guests during DINner and SAM ~~insulted the guests~~ during the DANCE.
L*H H* L-H% L*H H* L-L%

However, these accents are not obligatory and their precise shape can vary depending on the context.

To get started, I introduce below some key features of Gapping that the present work aims to account for, with some background on the issues they pose.

What makes a good gapped clause? As illustrated by (1) a well-formed gapped clause consists of two major components: two (or more) remnants and some missing material. In (1) what appears to be missing in the gapped clause corresponds to the finite verb in the source clause. But other material may additionally go missing along with the finite verb; see (2a-b) for example.

(2) a. Mary enjoys reading stories to her kids and Sally ~~enjoys reading stories~~ to her students.

b. Kim wants Hillary to win and John ~~wants~~ Trump ~~to win~~.

In (2a) the material missing in the gapped clause consists of a finite verb as well as a gerundive verb and its direct object; in (2b) the missing material corresponds to two non-contiguous strings. Moreover, as the examples in (3) show, what is missing in a gapped clause may even cross a finite-clause boundary.

(3) a. This doctor said I should eat more tuna fish, and that doctor ~~said I should eat~~ more salmon.

b. Robin believes that everyone pays attention to you when you speak French, and Leslie ~~believes that everyone pays attention to you when you speak~~ German.

((3a) is due to Pesetsky 1982; (3b) is due to Culicover & Jackendoff 2005)

In fact, virtually any string of elements can go missing in a gapped clause so long as the finite verb is missing as well. This property – i.e., the absence of a restriction on what can be missing additional to the finite verb – constitutes a major difference from other types of ellipsis such as VP-ellipsis and Pseudogapping, where what is missing is restricted to

material within the VP:[4]

(4) a. *VP-ellipsis*:

Robin might read the magazine, but Leslie won't.

b. *Pseudogapping*:

Robin might read the magazine, but she won't the novel.

A successful instance of Gapping requires that the missing material in the gapped clause be sufficiently identical to the antecedent in the source clause. Two different views have been taken on this matter: one view suggests that the relevant notion is formal identity (Sag 1976; Hankamer 1979; Potter *et al.* 2017) while another view suggests that the identity is semantic in nature (Coppock 2001; Culicover & Jackendoff 2005; Abeillé *et al.* 2014). The evidence seems mixed. In favor of the semantic identity are permitted mismatches. For example, Wilder (1994) and others noted that the alleged verb in the ellipsis site and the antecedent may differ in their agreement specifications:

(5) They live in London and she ~~lives~~ in Berlin. (Wilder 1994:308)

Tense specifications are usually required to match, as in (6), but mismatches are permitted in some cases, as in (7).

(6) #Kim arrived yesterday and Sue ~~will arrive~~ tomorrow.

(7) The Greeks believed in multiple gods and we ~~believe~~ in only one.

(Data and observation are due to Jean-Pierre Koenig, p.c.)

While this data suggests that the semantic identity view is correct, there is also data which has traditionally been argued to support the formal identity view. See §4.3.3 for examples and discussion.

[4] In this dissertation, I use the term ellipsis as a descriptive term, without advocating the view that what is missing in ellipsis is present at some level of syntactic representation.

Let us next consider the defining properties of the remnants. Traditionally, it was argued that the number of remnants in a gapped clause may not exceed two. This claim is based on examples such as the one in (8) (Hankamer 1973; Stillings 1975; Pesetsky 1982).

(8) *John persuaded Bill to see a movie and Harry Mary a TV show.
(Pesetsky 1982:657, ex. (159), his judgment)

However, it is unlikely that the oddness of (8) is due to a grammatical constraint on the number of remnants. Sag (1976:196-7) and Culicover & Jackendoff (2005:273), among others, reported that speakers find examples such as (9) to be fully acceptable.

(9) Betsy dances with a parasol in the living room on Fridays and Peter with a meat clever in the bar on Saturday nights. (Sag 1976:278)

The gapped clause in (9) contains four remnants – [*Peter*], [*with a meat clever*], [*in the bar*], and [*on Saturday nights*] – without inducing unacceptability. Given this data, it seems more plausible to assume that the oddness of (8) is due to processing difficulties associated with the recovery of the missing verb and the (semantic) roles of bare remnants, as Culicover & Jackendoff (2005:273) presume. I will not pursue this matter any further in this work.

Concerning the syntax of the remnants, some authors argued that well-formed remnants must be a 'Major Constituent': to simplify, a Major Constituent is a constituent which is a dependent of some verbal projection (Hankamer 1971, 1973; McCawley 1988; Abeillé *et al.* 2014). The intuition behind this argument is that remnants cannot be deeply embedded in the (reconstructed) gapped clause without inducing ungrammaticality. Compare for instance the second remnants in the following examples:

(10) a. ??George became ashamed of the Washington family's past and Martha *proud*.
(= Martha became proud of the Washington family's past)

b. George became ashamed of the Washington family's past and Martha *proud of it*. (= Martha became proud of it) (McCawley 1988:287)

Clearly, *proud* is more deeply embedded in (10a) than *proud of it* is in (10b). The notion of Major Constituent permits a simple characterization of the difference between those two remnants: *proud* does not qualify as a Major Constituent whereas *proud of it* does. The contrast in acceptability between (10a) and (10b) can then be said to follow from the assumption that only those elements that qualify as a Major Constituent make well-formed remnants.

However, this argument is flawed as it is based on a faulty empirical assumption. A wider set of data suggests that the presumed notion of Major Constituent is too restrictive to capture legitimate remnants. Consider for instance the examples in (11) from Hudson (1989).

(11) a. John thought about Jane and Bill Betsy.

b. Fred sat on a chair, Mary a stool, and Bill a bench.

In these examples the second remnants appear as the complement of a preposition, which does not, strictly speaking, qualify as a Major Constituent. The contextualizing questions in (12) below are provided for readers to whom the acceptability of (11a-b) is not immediately obvious. Note that the fact that the acceptability of cases such as (11) improves in the context of a suitable question was noted previously in Steedman (1990).

(12) a. Which boy thought about which girl?

b. Which student sat on what kind of chair?

Consider also the example in (13) from Huddleston & Pullum (2002:1139). The first remnant in this example, *of Pat*, is not a Major Constituent but a dependent of a noun whose maximal projection *is* a Major Constituent.

(13) His criticisms of Kim were inaccurate and, of Pat irrelevant.
(= his criticisms of Pat were irrelevant)

In this work I propose to explain the above examples by assuming that only *phrasal* constituents may serve as well-formed remnants in Gapping and fragments. There is a sense in which what survives Gapping constitutes a reduced 'answer' to a *wh*-question, as one can see from (11)-(12) above. Given that phrasal constituents are acceptable as such reduced answers but sub-phrasal constituents generally are not, it does not seem implausible to suppose that, due to their answer-like function, there is a grammatical constraint that remnants are restricted to phrasal constituents (cf. Schlangen 2003:210: fn. 16). The marginality of (10a) can then be regarded as a violation of this functionally motivated constraint.[5]

Since Kuno (1976) and Sag (1976:287), it has often been observed that the remnants in Gapping must contrast in some sense with their respective correlates in the source. The relevant notion of contrast comprises two distinct requirements: disjoint reference and parallelism. Data such as (14)-(15) can be explained in light of these notions: (14) shows that a given remnant must not be referentially identical to its correlate, and (15) shows that a remnant and its correlate must be parallel in the sense that they are semantically comparable.

(14) *John$_x$ eats peas and John$_x$/he$_x$ rice. (Kuno 1976:309)

(15) a. *Tom complains about the work load and Bill incessantly.
b. Tom complains about the work load and Bill about the pay.
(Hendriks 1991:44)

[5]Some speakers tend to accept sub-phrasal remnants such as the one in (i) from Park (2016) (small caps indicates focal accent).

(i) Many famous LINGUISTS have been DUTCH and HISTORIANS GREEK.
(= many famous historians have been Greek)

For these speakers the constraint against sub-phrasal remnants is optional.

In other words, each remnant and its correlate must form suitable alternatives with respect to each other in the sense of Rooth (1992), more specifically, mentioned alternatives rather than merely evoked ones. Explicitly mentioned alternatives are sometimes called *contrastive focus* (Jackendoff 1972; Rooth 1992; Krifka 1992; É. Kiss 1998; Vallduví & Vilkuna 1998; Molnár 2002; Selkirk 2008). Section §2.3 provides a discussion on the role of contrastive focus in Gapping; for discussion of the prosodic effects of contrastive focus in Gapping, see Carlson (2001), Féry & Hartmann (2005) and Winkler (2005), among others.

To summarize the discussion so far, I have shown that a well-formed gapped clause contains (i) some missing material which includes a finite verb and optionally any dependent of that verb and (ii) virtually an unbounded number of remnant phrases that are contrastive foci. The grammar imposes no further constraint on the remnants and missing material as well as how these are 'matched' with the source clause elements. As a consequence, ambiguity may arise because there can be more than one way to realize contrastive focus through such matches. As an illustration, consider the following example from Coppock (2001:22):

(16) John said he wants caviar for dinner, and Mary beans.

In (16) *Mary* can bear a contrastive focus with respect to either *John* or *he*, and this ambiguity in the way contrastive focus is set up results in an ambiguity in the interpretation of the missing material. The two possible construals for (16) are indicated below:

(17) a. JOHN said he wants CAVIAR for dinner and MARY ~~said she wants~~ BEANS ~~for dinner~~.

b. John said HE wants CAVIAR for dinner and MARY ~~wants~~ BEANS ~~for dinner~~.

One final point to mention about gapped clauses concerns their sensitivity to complementizers. Lasnik & Saito (1992), Chaves (2005) and others observed that embedding

a gapped clause under a complementizer results in ungrammaticality:

(18) I think that John saw Bill, and (*that) Mary Susan. (Chaves 2005:208, ex. (29))

However, it seems unclear whether the unacceptability of (18) is the result of a syntactic constraint. The speakers I consulted report that there is a contrast in acceptability between Gapping sentences with the complementizer *that* and those with the complementizer *if*: the former are completely out but the latter are marginally acceptable.[6] Compare for instance the example in (18) with the following example:

(19) ?I wonder if John will bring more dessert, and if Mary more wine.

Since *that* and *if* are uniform in their syntax – i.e., they are both complementizers – the contrast in acceptability between (18) and (19) cannot be attributed to a syntactic constraint. On the other hand, these complementizers have different semantic properties, and one important difference lies in their (non-)factivity. In §2.1.2, I will discuss another type of data which shows that Gapping is generally incompatible with a factive environment.

Having discussed the basic features of gapped clauses, I will next move on to aspects of Gapping that pertain to the the overall Gapping construction.

No implicit source. One familiar criterion for classifying ellipsis and fragments is the nature of the antecedent. A classification due to Hankamer & Sag (1976) suggests a distinction between surface and deep (elliptical) anaphors. Surface anaphors require a source that is linguistically present whereas deep anaphors can be rendered felicitous by a non-linguistic, implicit source. Similarly, Schlangen (2003) maintains a distinction between fragments whose interpretation can be retrieved from a prior utterance (fragments of type *resolution-via-identity*) and those whose interpretation requires inferences based on non-linguistic information (fragments of type *resolution-via-inference*). According to

[6] This observation is specific to English; it remains to be seen whether the same observation also holds for Gapping in other languages.

Schlangen's classification, Gapping is a *resolution-via-identity* type fragment because it requires a linguistic source:

(20) [Hankamer produces an orange, proceeds to peel it, and just as Sag produces an apple, says:] #And Ivan, an apple. (Hankamer & Sag 1976:410)

No backwards Gapping. Gapping is sensitive to ordering in that the source clause must be introduced prior to the gapped clause (Wilder 1994:305-6, Coppock 2001). The following example is an attempt at producing 'backwards Gapping':

(21) *Chris tennis and Bill played volleyball.
(Cf. Chris played tennis and Bill volleyball.)

Thus, only an overtly mentioned clause in the preceding context of a gapped clause qualifies as a legitimate source for the gapped clause.

Non-ATB distribution. As Kuno (1976), Sag (1976) and others observed, Gapping can apply iteratively to affect more than one conjunct in a given coordinate structure:

(22) Ray plays the clarinet, Lois the oboe, John the piano, Sandy the guitar, ...
(Sag 1976:193)

In (22) each non-initial conjunct contains some missing material. But this is not to be taken to suggest that Gapping is an 'across-the-board' (ATB) phenomenon. The following example is an instance of non-ATB Gapping.

(23) Leslie came with Chris, Sandy with Jimmy, and the others were alone.

Moreover, while Gapping is generally assumed to be restricted to coordinate structures, there is strong evidence against this assumption; see §2.1 for data and detailed discussion.[7] In the literature on Gapping there have been several proposals to characterize the

[7]Similarly, Right Node Raising has also been erroneously assumed to be restricted to coordinate structures; see Chaves (2014) for data and discussion.

phenomenon in terms of an ATB process, such as Williams (1977), Goodall (1984), Agbayani & Zoerner (2004) and Johnson (2009, 2014). However, counterexamples such as (23) suggest that this group of analyses are on the wrong track.

Non-causal readings. Levin & Prince (1986), Kehler (2002:§4) and Hendriks (2004), among others, noted that Gapping sentences lack causal readings which are available in supposed ungapped counterparts. As an illustration consider the following example:

(24) Sue's histrionics in public have always gotten on Nan's nerves, but it's getting worse. Yesterday, when she couldn't have her daily Egg McMuffin because they were all out,

a. Sue became upset and Nan became angry.

b. #Sue became upset and Nan angry.

(Levin & Prince 1986: their (4a) and (5a))

The situation described in (24) invites a causal interpretation which is found in (24a): Sue became upset and her being upset caused Nan to become angry. The oddness of the Gapping continuation in (24b) suggests that Gapping is infelicitous when a causal interpretation is expected.

There are mainly two different explanations that have been proposed for the contrast between (24a) and (24b): Kehler's (2002) syntactic account and Hendriks' (2004) information structure-based account. Kehler argues that the unacceptability of (24b) stems from a failure to reconstruct missing material at LF; the assumption behind this argument is that causal interpretations do not trigger the requisite inference that leads to a successful reconstruction of missing material. Hendriks, on the other hand, provides an account that is not dependent on any ellipsis-specific assumption. She argues that the unacceptability of (24b) is due to mismatches between the contrastive arguments and the interpretive bias resulting from these contrastive arguments. Hendriks regards the contrastive arguments as

contrastive topic/focus elements, which are partial answers to a common (implicit) question (Krifka 1999). Since two causally-related clauses are not easily construed as partial answers to a common question, the unacceptability of (24b) is expected. Hendriks' account is more convincing than Kehler's since it correctly predicts the lack of a causal reading in the context of contrastive arguments, irrespective of ellipsis:

(25) (What did Sue and Nan become?)
SUE became UPSET and NAN became ANGRY.

In §2.3.2, I will show that an account based on questions under discussion (Ginzburg 1996 et seq.; Roberts 1996/2012), which incorporates Hendriks' insight, can explain the unacceptability of (24b) as well as other distributional properties of Gapping.

Scope ambiguity. Finally, Gapping can interact with scopal operators in a way that is unexpected given the lack of ambiguity of the ungapped counterparts of Gapping sentences. As Siegel (1984, 1987), Oehrle (1987) and others noted, a scope ambiguity arises when the gapped clause contains missing material that corresponds to a negative or modal auxiliary in the source clause. This ambiguity is seen in (26), for instance.

(26) Ward can't eat caviar and Sue beans. (Siegel 1984:524)

a. Distributive-scope reading:

(i) $\neg\Diamond A \wedge \neg\Diamond B$

(ii) Ward cannot eat caviar and Sue cannot eat beans.

b. Wide-scope reading:

(i) $\neg\Diamond(A \wedge B)$

(ii) It is not possible (or desirable) for Ward to eat caviar and for Sue to eat (merely) beans.

Under the distributive-scope reading, (26) has the same meaning as its supposed ungapped

counterpart – i.e., *Ward can't eat caviar and Sue can't eat beans* – where each conjunct contains its own negated modal (see 26a). But, (26) can also have the wide-scope reading which is not available in the ungapped counterpart: in this reading, a single instance of the modal takes wide-scope over the entire coordinate structure (see 26b).[8]

Typically, negation and modals do not take scope beyond their local clauses: in *Leslie thinks that Ward can't eat caviar*, the negated modal contributed by *can't* cannot outscope the matrix verb *thinks*. If one assumes that semantic scope strictly mirrors syntactic structure, the wide-scope reading of (26) is not straightforwardly explained: it forces one to assume that, contrary to what surfaces, the string *Sue beans* is located in a position that is c-commanded by the auxiliary. This is one motivation for the claim made by Coppock (2001), Johnson (2009), Toosarvandani (2013) and others that Gapping involves a subsentential (vP) coordinate structure, a configuration in which the auxiliary outscopes the conjunction. But as we shall see, this vP coordination hypothesis is not without problems. This claim as well as other existing accounts on the phenomenon (e.g. Kubota & Levine 2016) will be examined in detail in subsequent chapters: in particular, §2.2 evaluates these accounts on the basis of syntactic data while §5.2 focuses on semantic aspects of the evaluation. In §5.3 I will show that a semantic account based on underspecified semantics can capture the scope ambiguities in (26a-b) without the problems plaguing previous accounts.

[8]The intonation contour typical of the wide-scope reading is somewhat different from the pattern discussed above in footnote 3 (Oehrle 1987; Winkler 2005; Repp 2009). According to an intonation elicitation study by Winkler (2005), in the wide-scope reading the strongest accent is placed on the finite auxiliary, and the accents on the remnants and correlates are weaker than in the distributive-scope reading. The typical intonation patterns correlated with distributive- and wide-scope readings are illustrated below (Winkler 2005:199-200):

(i) LEON can't eat CAVIAR and ANNA BEANS. (distributive-scope reading)
L*H H*L-L% L*H H*L-L%

(ii) LEON CAN'T eat CAVIAR and ANNA BEANS. (wide-scope reading)
(H*) H*+L H*+L H$^-$ (H*) H*+L H%

1.1.2 Gapping and other types of ellipsis

An important question often addressed in the literature on Gapping is its status in the grammar – where it fits in the typology of ellipsis. In this dissertation, I will not attempt to provide an exhaustive theory of ellipsis. My goal is more modest: to provide an analysis for Gapping, without precluding the possibility of a unified analysis. For a more comprehensive discussion of a variety of ellipsis phenomena, see Hankamer & Sag (1976), Sag (1976), Lobeck (1995), Merchant (2001, 2004), Culicover & Jackendoff (2005), Jacobson (2008), Sag & Nykiel (2011) and Kertz (2013), among others. Below I discuss some of the commonalities and differences between Gapping and other elliptical constructions to convince the readers why a non-unified approach is preferable in the current state of research.

Historically, numerous attempts have been made to assimilate Gapping to VP-ellipsis or some other ellipsis construction that is relatively well investigated. For instance, Jayaseelan (1990), Coppock (2001) and Toosarvandani (2013), among others, argued that Gapping is generated by the same mechanism that is responsible for VP-ellipsis. However, such a unified analysis is not empirically supported. For example, VP-ellipsis may find its source from non-linguistic context, but this is not so with Gapping (Hankamer & Sag 1976; Coppock 2001). The following examples illustrate this point (Hankamer & Sag 1976:409-10; (27b) is repeated from (15) above).

(27) a. [Hankamer brandishes cleaver, advances on Sag]
Sag: Don't! My god, don't!

b. [Hankamer produces an orange, proceeds to peel it, and just as Sag produces an apple, says:] #And Ivan, an apple.

Gapping and VP-ellipsis also behave differently with respect to backward ellipsis. While backward VP-ellipsis is possible in some cases, as in (28), backward Gapping is completely out, as seen in (21) above.

(28) Chris didn't, but Bill played volleyball.

Pseudogapping is another ellipsis phenomenon that has been often discussed in the context of Gapping (Jayaseelan 1990; Coppock 2001; Johnson 2004; Gengel 2007). There are both similarities and differences between the two phenomena. For instance, the following examples show that just like Gapping, Pseudogapping cannot have a non-linguistic source (29) and that it does not tolerate backwards ellipsis (30).[9]

(29) [Hankamer produces an orange, proceeds to peel it, and just as Sag produces an apple, says:] #And Ivan is, an apple.

(30) #Chris didn't tennis but Bill played volleyball.

However, there are several important differences between Pseudogapping and Gapping which challenge a unified analysis (Coppock 2001; Johnson 2004; Gengel 2007). One crucial difference lies in the nature of missing material: unlike in Gapping, the missing element in Pseudogapping does not include a finite verb and is restricted to material internal to the VP complement of finite auxiliaries. Another difference that distinguishes these two types of ellipsis lies in their sensitivity to complementizers. As discussed earlier Gapping does not welcome the complementizer *that* (see (18) above); however, this is not so with Pseudogapping, as the following example shows:

(31) [...] we want to treat your POWs with dignity and we hope **that** you do ours as well.
(Miller 2014:78, ex. (4b); COCA)

Furthermore, there is a crucial difference in the nature of the remnants: as seen above the remnants in Gapping necessary involve contrastive focus, but the remnants in Pseudogapping may be non-contrastive, as shown in (32) below (Sag 1976; Lasnik 1999). In

[9] However, there is one reported example of cataphoric Pseudogapping (Miller 2014:88):

(i) Behind them, disguising her desire, one catches a poignant glimpse of the youthful, shaved-headed Cather. As it did me, work rescued Willa Cather. (COCA: FIC)

fact, according to Miller's (2014) corpus research, the subject remnant in Pseudogapping is generally coreferential with its correlate.

(32) Mary$_x$ hasn't dated Bill, but she$_x$ has Harry. (Sag 1976:52)

Evidently, one must conclude from the above discussion that Gapping critically differs from both VP-ellipsis and Pseudogapping. In this dissertation, I will therefore not pursue a unified account for these phenomena and remain agnostic on how VP-ellipsis and Pseudogapping should be analyzed.

Several authors, such as Lobeck (1995), Reich (2007) and Boone (2014) have noticed some commonalities between Gapping and fragment constructions that involve a sole remnant such as Short Answer and Stripping:

(33) *Short Answer*:

A: Who left?

B: Maribel.

(34) *Stripping*:

John might be home, and Mary (too).

Short Answer is a case of intersentential ellipsis, as the elliptical answer and the source appear between sentences in a dialogue. Since Stripping is usually intrasentential and so is Gapping, these are sometimes regarded as instances of one and the same phenomenon. In fact, there are several other commonalities between Gapping and Stripping which suggest a unified analysis. For example, Stripping behaves the same way as Gapping in requiring a linguistic source (see 35a) and not permitting backward ellipsis (see 35b).

(35) *Stripping*:

a. [Hankamer produces an orange, proceeds to peel it, and just as Sag produces an orange too, says:] #And Ivan (too).

b. #Chris (too), and Bill played tennis.

Moreover, both Stripping and Gapping exhibit sensitivity to embedding under the complementizer *that* (Weir 2014:§5):

(36) *Stripping*:

John left, and I heard (*that) Mary, too.

(37) *Gapping*:

Bill likes Robin, and I heard (*that) John Leslie.

On the other hand, Short Answers which take the form of sentential complements must retain the complementizer:

(38) *(Sentential) Short Answer*:

A: What did they believe?

B: That they will be reassigned.

B′: #They will be reassigned. (Schlangen 2003:120, ex. (193))

The above data seems to suggest that a unified analysis is warranted at least for Gapping and Stripping, but there is also reason to consider a non-uniform analysis. To begin with, the issue of whether Stripping and Short Answer are distinct grammatical phenomena is controversial rather than settled. Note that the distinction between Stripping and Short Answer is based primarily on their illocutionary effects: answering vs. continuing or extending a previous discourse topic (Schlangen 2003; Ginzburg 2012). The question is whether this distinction should be maintained at the level of grammar or at the descriptive level only.[10] This is a matter of theoretical decision: there is nothing *a priori* that prevents either position. One piece of argument in favor of the latter position, though, comes from

[10]Schlangen (2003) argues that such distinctions should not bear much theoretical weight. This contrasts with the position in Ginzburg & Sag (2000) and Ginzburg (2012) that the illocutionary force of fragments (and utterances in general) should be represented in the grammar.

data such as (39)-(41) below: in (39), a Short Answer-like structure is used to raise a question rather than answer one; in (40) and (41), the 'stripped' conjuncts perform a questioning or answering function in addition to extending the topic set up by the preceding conjuncts.

(39) A: Someone just left.
B: Mary?

(40) You know Abby speaks passable Dutch, but not Ben? (Shin 2016)

(41) A: Who came to the party?
B: John came to the party, and Mary, too.

Note that Gapping, too, may perform various illocutionary functions:

(42) a. Who likes which musician?
b. Jenny likes BTS, and Krissy Ariana Grande.

(43) Which girl went to a BTS concert, and which (other) girl to Ariana Grande's?

Why-Stripping may also affect the overall typology of ellipsis. As the name suggests, *why*-Stripping is usually regarded as a subcase of Stripping (Nakao *et al.* 2012; Yoo 2014; Yoshida *et al.* 2015):

(44) A: John likes natto.
B: Why NATTO (but not something else)?

As shown in this example, a remnant in *why*-Stripping differs from Gapping and typical cases of Stripping in that it involves a non-contrastive remnant.

Since the status of Stripping and its connection with other elliptical phenomena are controversial at best, in this work I will restrict my analysis to Gapping. It should be stressed, though, that my analysis does not preclude the possibility of a unified analysis. If required, one can easily extend the analysis presented in this work to cover Stripping and Short Answer without major modifications, and that may be considered in future work.

1.2 Main Contributions and Claims

This dissertation presents new empirical observations and develops a novel account for the syntax and semantics of Gapping. The main contributions are summarized as follows:

- A major empirical contribution of this work is the finding that the widely assumed restriction against subordination is not a definitional property of Gapping. This finding is problematic to analyses that restrict Gapping to coordinate structures (Coppock 2001; Johnson 2009; Toosarvandani 2013; Kubota & Levine 2016, among others) and supports fragment-based analyses, in which gapped clauses are not syntactically constrained in their distribution (Sag *et al.* 1985; Culicover & Jackendoff 2005; Abeillé *et al.* 2014).

- A questions under discussion (QUD)-based account is proposed to account for the precise distribution of Gapping sentences. Building on a previous account by Reich (2007), this work argues that Gapping is felicitous only when the gapped clause addresses a QUD that is triggered by the information structure of the source clause. This account interacts with coordination and various subordinate structures, and captures differences between acceptable and unacceptable embedding of gapped clauses.

- With regards to the internal syntax and semantics of gapped clauses, a novel constructivist analysis is proposed which builds on previous work by Ginzburg & Sag (2000), Abeillé *et al.* (2014) and others. In particular, it is proposed that gapped clauses are assigned a flat syntactic structure consisting of all and only the remnants, and a meaning that includes the content contributed by the remnants and the content retrieved from the QUD. The syntactic and semantic parallelism observed between gapped clauses and their sources are accounted for by surface-based matching constraints, without resorting to underlying full syntactic form that has no substantial

empirical basis.

- Lastly, this dissertation provides a novel account of the wide- and distributive-scope readings of Gapping sentences. Evidence is provided that wide-scope readings are not specific to Gapping, contrary to widespread assumption. An independently motivated general theory of coordination is proposed, in which initial conjuncts are allowed to interact scopally with the coordinator to create various readings (cf., Chaves 2007). The absence of wide-scope readings in supposed ungapped conjoined sentences is suggested to follow from independent constraints on tense and scopal operators (de Swart 1998; Condoravdi 2002; Champollion 2015). Not only does this account avoid any Gapping-specific mechanism to derive wide-scope readings but, it also explains why the distributive/wide-scope ambiguity does not arise in Gapping in subordinate and embedded structures.

Overall, the constraint-based syntax/semantics of Gapping and coordination proposed in this dissertation avoids any Gapping-specific assumption that previous analyses posit and offers a uniform treatment for gapped clauses in various syntactic environment.

1.3 Outline

- **Chapter 2: On the Distribution of Gapping**

  This chapter provides an empirical assessment of the syntactic distribution of Gapping. In it, I discuss existing and novel data which disputes the widely held assumption that Gapping is excluded from non-coordinate and embedded contexts. Previous analyses are evaluated in light of this data as well as other empirical observations. Furthermore, it is argued that the (often) reduced acceptability of embedded and subordinate Gapping follows from constraints on information structure.

- **Chapter 3: Theoretical Background**

  This chapter offers an introduction to the theoretical frameworks this study is based on. It first discusses the basic assumptions and architecture of Head-Driven Phrase Structure Grammar (HPSG), a framework which is well-suited to account for the syntax-semantics-context interface of Gapping sentences. It also gives a general introduction to semantic underspecification and an overview of the underspecified semantic theory known as Lexical Resource Semantics (LRS).

- **Chapter 4: Gapped Clauses as Fragments**

  This chapter examines the syntactic and semantic aspects of gapped clauses, and develops a formal account in HPSG and LRS. It proposes to capture the form and meaning of gapped clauses with a new construction rule combined with underspecified semantic representations. The postulation of silent syntactic structure is avoided and the syntactic and semantic parallelism between remnants and their correlates is captured by surface-based matching constraints.

- **Chapter 5: On the Interaction between Gapping and Scopal Operators**

  This chapter discusses how the grammar of gapped clauses interact scopally with coordination and scopal operators to create the ambiguity between distributive- and wide-scope readings. Evidence is provided showing that the wide-scope readings are not specific to Gapping, contrary to what has been claimed. Based on this evidence a new coordination rule is proposed and is shown to interact with gapped clauses to produce the distributive- and wide-scope readings. A complete analysis of a conjunctive Gapping sentence is also provided in this chapter.

- **Chapter 6: Summary and Conclusion**

  This final chapter summarizes the main contributions of this thesis and discusses possible future research.

Chapter 2

On the Distribution of Gapping

This chapter investigates the distributional properties of Gapping. It has widely been assumed that Gapping is restricted to coordinate structures, but the data provided in this chapter suggests that this restriction does not exist. Instead, the data indicates that Gapping is possible in certain subordinate structures and embedded contexts. There are however crucial information structural differences which lead to the distinction between felicitous and infelicitous cases of subordination and embedding.

A detailed critique of previous analyses is provided. Analyses which connect Gapping to coordinate structures are rejected in light of the counterevidence provided in this chapter. The various kinds of data discussed in this chapter supports an approach which treats gapped clauses as an independent syntactic unit that is not restricted to a particular syntactic configuration.

This chapter argues that virtually all kinds of Gapping data – coordinate, subordinate and embedded – is subject to the same information-structural constraint, characterized in terms of QUD. This constraint interacts with general and construction-specific discourse-level constraints to account for the differences between felicitous and infelicitous cases of subordination and embedding. Thus, while Gapping is possible in principle in a variety of

syntactic structures, constraints introduced by subordinating conjunctions and embedding clauses may interact with the information-structural constraint on Gapping to restrict the occurrence of gapped clauses. This explains why gapped clauses do not easily embed under subordinating conjunctions or embedding clauses.

2.1 Putative Syntactic Conditions

Studies on Gapping have generally assumed the following two generalizations:

- NO SUBORDINATION: A gapped clause cannot be introduced by a subordinator.
- NO EMBEDDING: Neither a gapped clause nor its source can be embedded alone.

These assumptions, if true, suggest that Gapping is a fundamentally syntactic (as opposed to partially discourse-pragmatic) phenomenon whose licensing is determined mainly by syntactic structural factors. In this section, I consider existing and novel data which, ultimately, suggests that Gapping is possible in certain subordinate and embedded environment.

2.1.1 Gapping and coordination

Since Ross (1970), many authors have insisted on the idea that Gapping is a fundamentally syntactic phenomenon restricted to coordinate structures. And there is reason for initially thinking that this is a correct assessment. Consider the examples in (45)-(46), which are structurally similar except that (45a-c) involve a coordinating conjunction while (46a-b) involve a subordinating conjunction. This difference in clause conjoining seems to be what is responsible for the contrast in acceptability between these two groups of examples, as argued by Jackendoff (1971) and others.

(45) a. Sam plays the sousaphone and Max the saxophone.

b. Either Sam plays the sousaphone or Jekyll the heckelphone.

c. Sam doesn't play sousaphone nor Medusa sarrussophone.

(46) a. *Sam played tuba whenever Max Sax.

b. *McTavish plays bagpipe despite the fact that McCawley the contrafagotto d'amore. (Jackendoff 1971:22, his judgment)

The supposed generalization emerging from this sort of data – that Gapping is impossible outside of coordination – has been regarded as an important formal property that any account of the phenomenon must capture. Thus, in early transformation grammar accounts such as Ross (1970), Hankamer (1971) and Sag (1976), Gapping was characterized in terms of a deletion operation which applies specifically to non-initial conjuncts. Some researchers such as Williams (1977), Goodall (1984), Agbayani & Zoerner (2004) and Johnson (2009, 2014) on the other hand assimilated Gapping to ATB phenomena, hence (indirectly) deriving the supposed NO SUBORDINATION generalization. In sections §2.2.1-§2.2.3, I will discuss more recent accounts which make specific syntactic assumptions that restrict Gapping to coordinate structures.

All these analyses have to face an objection, however: there are acceptable instances of Gapping that involve a non-coordinate structure. For example, Huang (1977), Corver (1990) and Hendriks (1995) observed that Gapping is possible in comparative constructions (see also Culicover & Jackendoff (2005:278) and Huddleston & Pullum (2002:1340-1341) for examples and discussion). This is illustrated below in (47a-e), in which the gapped clauses are introduced by the comparative expression *than*:

(47) a. Robin speaks French better than Leslie German.

b. ?Robin thinks that it is harder to speak French than Leslie German.

c. ?Robin thinks that it is more fun to speak French than Leslie German.

d. Robin tried harder to learn French than Leslie German.

e. Robin no more speaks French than Leslie German.

(Culicover & Jackendoff 2005:278, ex. (77), their judgment)

In fact, there are a number of commonalities between Gapping in comparative structures and more typical cases that involve coordination. As the examples in (48)-(50) show, the missing element in comparative Gapping exhibits the same properties as the missing element in coordinative Gapping: it may span multiple, discontinuous constituents, and whichever material is affected by the gap, it must include the finite verb.

(48) a. Tom tried to eat broccoli and Mia ~~tried to eat~~ carrots.

b. Tom tried to eat more broccoli than Mia ~~tried to eat~~ carrots.

(49) a. Tom invited Jane to the party and Mia ~~invited~~ John ~~to the party~~.

b. Tom invited more boys to the party than Mia ~~invited~~ girls ~~to the party~~.

(50) a. *Kim tried to learn to speak French and Bill tried ~~to learn~~ to speak German.

b. *Kim tried harder to learn to speak French than Bill tried ~~to learn~~ to speak German.

Moreover, the remnants in comparative Gapping are subject to the same constraint that affects the remnants in coordinative Gapping – namely, they must bear contrastive focus with respect to their remnants (see §1.1 above):

(51) a. *Leslie$_x$ writes novels and she$_x$ poems.

b. *Leslie$_x$ writes more novels than she$_x$ poems.

(52) a. *Tom complains about the work load and Bill incessantly.

b. Tom complains about the work load and Bill about the pay.

(53) a. *Tom complains more about the work load than Bill incessantly.

b. Tom complains more about the work load than Bill about the pay.

(Hendriks 1991:44, ex. (17)-(18))

These commonalities suggest that comparative Gapping is a kind of Gapping.

The above data should have been sufficient to reject the assumption that Gapping is a 'coordination-only' phenomenon. But, the standard assumption was maintained in Huang (1977), Hendriks (1995) and others by resorting to an analysis in which comparative Gapping is assigned a coordination-like syntactic structure (see also Lechner 2008).[1] However, the reasoning is usually circular in that it presumes Gapping to be a diagnostic for coordinate structure. Moreover, a coordinate analysis of comparative Gapping leads to incorrect empirical predictions. First, assuming that comparative structures are underlyingly coordinate, it is expected that they would exhibit the properties characteristic of coordination, such as sensitivity to the Coordinate Structure Constraint (Ross 1967). But, as Chaves (2007) and others pointed out, the prediction is not borne out: non-ATB extraction is tolerated in comparative structures but not in (symmetric) coordination. For illustration compare the examples in (54a) and (54b).

(54) a. Which company hired more consultants than PARC hired programmers?

b. *Which company hired consultants and HP hired programmers?

As is well known, non-ATB extraction is tolerated in asymmetric coordination, e.g., *This is the store that I went to and bought a beer*. Note that the non-ATB extraction in (54a) has nothing to do with this phenomenon: the sentence cannot be understood to have an asymmetric construal.

Further differences between comparative and coordinate structures are illustrated by (55) and (56) below. These examples show that, unlike coordinate structures, comparatives are unable to iterate (as in (55a)) and that they are not compatible with a complementizer (as in (56a)).

[1]The idea that (at least some) comparative structures can be reanalyzed as coordination is suggested in McCawley (1964), Napoli (1983), and Moltmann (1992), among others.

(55) a. *More consultants work at HP than [as many engineers work at PARC [as programmers work in IBM]].

b. Sue is in London and [Tom used to live in Trento [but now he's in Nijmegen]].

(56) a. *I think that PARC hired more consultants than that HP hired programmers.

b. I think that PARC hired consultants and that HP hired programmers.

(Chaves 2007:38-39)

In fact, there are several indications which suggest that comparatives involve subordinate structures. One piece of evidence comes from tag questions. As Emonds (1970) and others noted, in tag questions the subject and auxiliary in the tag agree with those of the matrix clause and not those of an embedded clause.[2] The example in (57) is illustrative.

(57) *Bill wanted to know whether Mary had come, hadn't she? (Emonds 1970:13)

Consider now the following sentence:

(58) John found more magazines than Mary found books about cooking,

a. didn't he?

b. *didn't she?

The badness of (58b) suggests that the *than*-marked clause is likely to be a subordinate clause.

The distribution of subjunctive morphology provides another evidence for the subordinate status of the *than*-clauses in comparatives. In a matrix-subordinate structure, only the matrix clause may appear with subjunctive morphology (Culicover & Jackendoff 1999; Abeillé & Borsely 2008). Given this generalization, one would predict that subjunctive morphology should be not able to appear in the *than*-clause. Example (59) shows that this prediction is correct.

[2]This is of course a simplification which ignores tags that agree with the complement of certain verbs (e.g. *imagine*, *suppose*, etc.). Readers are referred to Emonds (1970) for examples and discussion.

(59) The doctor demands that John eat(s) more salmon than Mary {*eat/eats} kale.

Given the data above, it seems best to assume that comparatives involve a subordinate structure. This then means that the availability of Gapping in comparatives constitutes one piece of evidence that Gapping is not confined to coordinate structures.[3]

Still, a question remains to be answered: if Gapping is not limited to coordination, what might be the reason for the unacceptability of (46a-b) above? In this connection, it is worth considering the observation made by Levin & Prince (1986), Culicover & Jackendoff (2005) and Boone (2014:§3), among others. These authors regard Gapping as an essentially semantico-pragmatic phenomenon whose interpretation results in the context of a symmetric discourse relation: e.g., Kehler's (2002) Resemblance relations. Culicover & Jackendoff note that this is why Gapping is not banned in certain non-coordinating structures – more precisely, those in which some sort of semantic parallelism can be established between the gapped clause and its source. Culicover & Jackendoff provide the following examples as evidence supporting their view:

(60) a. Robin speaks French as well as / but not / not to mention Leslie German.

b. Robin doesn't speak French, let alone Leslie German.

(Culicover & Jackendoff 2005:278, ex. (76))

It should be pointed out, however, that the non-coordinates status of (60a-b) is assumed, rather than argued, by Culicover & Jackendoff. But Culicover & Jackendoff's assessment is not without controversy; see, however, Fillmore *et al.* (1988) and Toosarvandani (2008) for claims that *let alone* should be given a coordinate analysis.

In this dissertation I will not attempt to settle the issue of whether (60a-b) are true cases of non-coordinative Gapping. Instead, I provide more substantial evidence support-

[3]Several authors observed that comparatives also show coordination-like properties (Hendriks 1995; Chaves 2007; Lechner 2008, among others). I assume, following Chaves (2007), that these properties are general to non-headed structures, rather than indicative of coordinate syntax.

ing Culicover & Jackendoff's argument that Gapping is constrained by semantic parallelism rather than syntactic parallelism. Subordinating conjunctions such as *because* have meanings which are generally incompatible with parallel interpretation. Not all subordinating conjunctions are like this, however. If we carefully select the right subordinating conjunction and contrastive elements, it should in principle be possible to create the right context for Gapping. To test this hypothesis I conducted a COCA search for the subordinating conjunction *while* used in the context of correlative phrases such as *the former... the latter...* and *some... the other...*, using searches such as "while the latter" and "while the other". The results are provided below.

(61) a. So far one review study on Spectrum research has been published (Byra, 2000). However, reviewing the literature is something different from analyzing research in that the former focuses on synthesizing the results while the latter on categorizing research. (ACAD: Physical Educator)

b. My purpose here is not to resolve the crucial disagreement between two prominent theoreticians in a way that one would be declared true while the other one false. (ACAD: Style)

c. One of the activities is predominantly aerobic exercise-based while the other lab primarily skill-based. (ACAD: College Student Journal)

d. One half of heaven is day, while the other (is) night.
(NEWS: Atlanta Journal Constitution)

e. Emperor Benli divided us fourteen boys into two groups, one of which was to hold the eastern part of the yard while the other the western part.
(FIC: Kenyon Review)

f. One refers to giving explanations for behavior ... while the other to responsibility for consequences of particular actions. (ACAD: Current Psychology)

Another naturally occurring example of *while*-Gapping is given in (62).

(62) Merchant proposes that the VPE/pseudo-Gapping distinction is simply that the former involves deletion of VP, while the latter, of vP, such that the voice feature on the v head is subject to the identity constraint on ellipsis in the latter case but not the former. ('Morphological recoverability in Gapping', a PhD thesis by Michael Frazier (2015), p. 24)

These examples are conclusive evidence that Gapping is not excluded from subordinating contexts, contra the NO SUBORDINATION generalization.

Below, I provide additional data, collected from a Google search, which shows that Gapping is compatible with a wider variety of connectives than just Boolean conjunctions. To find these sentences, I used searches of the following sort: "CONJ PRONOUN PRONOUN", e.g. "before him us", and then inspected the results to filter out irrelevant data.

(63) We all agree on the value of ACTIVERAIN, posting, commenting and being known. The public remembers all that and usually recognizes us before we them.[4]

(64) They became bored with us before we them, and they moved away through the trees.[5]

(65) [R]eport of an enemy tank signals they've sighted us before we them.[6]

(66) The keynote of their relationship was set when Victoria, already a reigning queen, had to propose to Albert, rather than he to her. (History Extra: The official website for BBC History Magazine and BBC World Histories Magazine)[7]

(67) For he is good or worthy of praise by himself rather than on account of his works, and his works should be praised or good on account of himself, rather than he on

[4]https://activerain.com/blogsview/4360867/rain-rain-dont-go-away—lets-meet-up-and-get-to-play
[5]http://awayfromfourmarks.blogspot.com/2017/09/16th-august-tango-mar-beach-resort.html
[6]https://www.gameogre.com/world-of-tanks-first-impressions-2/
[7]https://www.historyextra.com/period/20th-century/prince-philip-a-life-of-duty-and-devotion/

account of his works.[8]

(68) He would have wanted to avoid me, like I him.[9]

(69) I know now that he was being polite when he said the date went well and clearly he did not feel the same way for me as I him.[10]

In sum, the empirical data discussed so far indicates that Gapping is not syntactically restricted to coordinate structures, contrary to a widespread assumption in the literature. The reason that some subordinating structures do not seem to allow Gapping is likely to be semantic, rather than syntactic, in nature: since coordinating conjunctions express semantic similarity or contrast between their conjuncts, it is natural that they are able to provide the requisite semantic parallelism needed for the contrastive remnants in Gapping. On the other hand, subordinating conjunctions are typically used to integrate one clause into another, and as such would generally not be able to provide sufficient semantic parallelism for the contrastive remnants in Gapping. In §2.3 I will elaborate on this informal account by placing it in recent theories of QUD.

2.1.2 Embedded Gapping

Another widely discussed distributional property of Gapping is its sensitivity to embedding. The relevant observation dates back to Hankamer (1973), where the following example was provided (see also Neijt (1979), Hankamer (1979), Johnson (2004, 2009) and Toosarvandani (2013) for data and discussion).

(70) *Jack claims that Max ate the potatoes, and George claims that Harry the fruitcake.

(Hankamer 1973:29, fn. 9, (vii), his judgment)

[8] Abelard, Peter, and Steven R. Cartwright. "Book Four", p. 331. In *Commentary on the Epistle to the Romans*. Washington, D.C.: Catholic University of America Press, 2011. URL: goo.gl/wKyHoJ

[9] Khan, Miriam. *The Lebrus Stone* Volume 1. URL:goo.gl/rxyeXH

[10] http://www.newnownext.com/ask-jt-gay-marriage-proposal/06/2013/

Scholars have generally regarded the difficulty with sentences like (70) to reflect a categorical restriction against embedded Gapping, known as the 'No Embedding Constraint' (Hankamer 1979; Johnson 2014). Several Germanic languages are known to obey the No Embedding Constraint: English (Johnson 2004, 2009), Dutch (Aelbrecht 2009; Neijt 1979) and German (Wyngaerd 2006), among others. However, recent studies show that the No Embedding Constraint does not hold cross-linguistically: counterexamples are known to exist in a number of typologically unrelated languages, including Persian (Farudi 2013), Romanian (Abeillé *et al.* 2014:fn. 3, Bîlbîie *et al.* 2018), Spanish (de Cuba & MacDonald 2013; Fernández-Sánchez 2016; Jung 2016), as well as Georgian, Iron Ossetic, Polish and Russian (Erschler 2018). Some studies suggest that the status of the No Embedding Constraint is controversial even for English (Weir 2014; Bîlbîie *et al.* 2019).

Farudi (2013) provided the first set of counterexamples to the No Embedding Constraint. She observed that in Farsi (the Tehrani variant of Modern Persian) it is possible to embed the gapped clause (as in (71)) or the source clause alone (as in (72)); (73) shows that it is also possible to embed both the source and gapped clauses simultaneously under different embedding verbs:

(71) māmān chāi xord va fekr mi-kon-am bābā qahve.
Mather tea ate.3SG and think IMPFV-do-1SG father coffee

'Mother drank tea and I think Father (drank) coffee.' (Farudi 2013:76, ex. (102a))

(72) Fekr mi-kon-am ke Nasrin gormeh sabzi-ro dorost kard va man adas polow-ro.
think IMPFV-do-1SG that Nasrin stew green-OBJ make did.3SG and I lentil rice-OBJ

'[I think that Nasrin made spinach stew] and [I (made) lentil rice].'

(ibid., p. 84, ex. (111))

(73) ?ajib nist ke Rādmehr māhi-ro xordo vali ajib-e
strange not-be.PRES.3SG that Rodmehr fish-OBJ eaten but strange-be.PRES.3SG

ke Ānāhitā gusht-ro.
that Anahita meat-OBJ

'It's not unusual that Rodmehr ate the fish, but it's strange that Anahita (ate) the meat.' (ibid., p. 85, ex. (113b))

Farudi observes that the presence of a complementizer does not render cases such as (71)-(73) ungrammatical. Example (74) is illustrative.

(74) Jiān be Sārā gol dād va fekr mi-kon-am **ke** Ārtur be Giti ketāb.
Jian to Sarah flower gave.3SG and think IMPRV-do-1SG **that** Arthur to Giti book

'Jian gave flowers to Sarah and I think **that** Arthur (gave) books to Giti.'

(ibid., p. 76, ex. (102b))

Embedding is possible under a relatively wide range of predicates and even those predicates that are negated (ibid., p. 81-2). Based on these observations Farudi argues that Farsi embedded Gapping involves true syntactic embedding. However, it should be kept in mind that Farudi's observations are based on constructed data.

A more extensive study on embedded Gapping was conducted by Bîlbîie *et al.* (2018) for Farsi and three Romance languages: French, Romanian and Spanish. Using experimental and corpus-based approaches, Bîlbîie *et al.* tested and confirmed the following two hypotheses: (i) embedded Gapping is acceptable (under certain predicates) in all these languages; and (ii) embedding is more acceptable under a non-factive predicate than a factive one (e.g., (75) vs. (76)).

(75) Embedding under a non-factive predicate (Spanish):

Alfonso robó las esmeraldas y {creo / imagino / supongo} que Mugsy las perlas.
Alfonso stole the emeralds and {think / imagine / suppose} that Mugsy the pearls

(76) Embedding under a factive predicate:

#Alfonso robó las esmeraldas y {lamento / me encanta / odio} que Mugsy las perlas.
Alfonso stole the emeralds and {regret / love / hate} that Mugsy the pearls

In a more recent study, Bîlbîie *et al.* (2019) found that embedded Gapping is also possible in English under non-factive predicates when the complementizer effect is controlled for (e.g., *At the bar, Paul ordered a beer and I imagine (*that) John a whisky*). Overall, these studies show that embedded Gapping is not categorically banned and that the phenomenon is governed essentially by semantic factors.

Bîlbîie *et al.* confirmed sparse observations in the literature that English permits embedded Gapping in certain contexts. For example, Weir (2014:§6.2) (a dissertation on fragments such as Short Answers and Stripping) briefly discussed relevant cases and noted that embedded Gapping is possible in English in the context of a 'bridge verb'. Note that this is in line with Bîlbîie *et al.*'s observation regarding factivity. Below are some examples and judgment from Weir:

(77) John ate oysters and

a. I {?think / ?believe / ??hope / suspect / ?was told / imagine} Mary swordfish.
b. I {?*found out / *remember / *deny / ?*know} Mary swordfish.
c. I {*am proud / *am angry / *am surprised} Mary swordfish.

(Weir 2014:333, ex. (680))

Boone (2014:§6) discussed similar cases but argued that ellipsis under bridge verbs constitutes a separate phenomenon from Gapping. Boone argues that Gapping does not permit embedding, based on examples like (78) (Boone 2014:83, his judgment).

(78) *Harry has invited Sue and I know (that) Bill Mary.

Acceptable ellipsis under bridge verbs, such as those in (77a), is then argued to be instances of a new ellipsis type – what Boone calls 'bridge verb ellipsis.' Many important details, including what mechanism is behind such ellipsis, are completely omitted, so it is hard to evaluate Boone's account. But, it should be clear that in Boone's account the commonalities between Gapping and bridge verb ellipsis are purely accidental rather than follow from a principled explanation. The examples in (79) show that bridge verb ellipsis patterns as Gapping in many important ways:

(79) a. *John$_x$ ate oysters and I suspect he$_x$ swordfish. (Disjoint reference)

b. *I suspect John oysters and Mary ate swordfish. (No backwards ellipsis)

c. John ate oysters and I suspect (*that) Mary swordfish. (No complementizer)

Thus, Boone's account does not seem to provide a plausible alternative to the null hypothesis that embedded Gapping is a kind of Gapping.

Wellstood (2015:7-8) provides a different kind of examples, such as (80)-(81), which constitute further evidence that embedded Gapping is possible in English. Note that in these sentences both the source and gapped clauses are embedded separately within their own conjuncts.

(80) Ask them which boy gave a present to a girl, but *don't ask* which girl to a boy. (...that's a secret.)

(81) (My friends John and Bill asked a third friend a question, but the third friend did not hear what John and Bill said. So, the third friend asks me...)

A: What did they ask?

B: I don't know, I think John asked which book you gave to Mary, and *Bill asked* which magazine to Sue.

Crucially, the gapped clauses here appear as the complement of the verb *ask*, which means that there is a direct syntactic relationship between that verb and the gapped clauses. Cases such as these are not amenable to an analysis in which the embedding clauses (italicized in (80)-(81)) are treated as a parenthetical.

Yet other cases of embedded Gapping were noted in an earlier work by Gazdar *et al.* (1982:668, ex. (8)):

(82) a. Did Waldo kiss Sabrina and Oscar hug Juliette, or Sabrina, Waldo, and Juliette, Oscar?

b. Dan Rather interviewed Trudeau and Canadians tuned in to CBS, and John Chancellor, Mitterand, and the French, to NBC.

c. Either English is verb-medial and Old English was verb-final, or English, verb-initial and Old English, verb-medial.

These sentences are schematized in Figure 2.1 below. Note that the conjuncts which contain missing material (indicated as the 'gap') or an antecedent of the gap are nested in another conjunct.

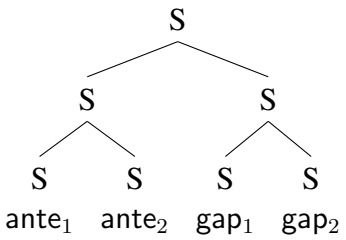


Figure 2.1: Syntactic parses for (82)

Finally, the following sentences are naturally occurring examples of embedded Gapping (collected using a Google search):

(83) a. The program started, we were assigned to Charles Miller. We immediately hit it off and both of us enjoyed our time with him and I think him with us.[11]

b. As time progressed, the more comfortable I got with him and I think him with me.[12]

d. When we talk music, I don't have any trouble with him at all, and I don't think him with me either.[13]

In sum, acceptable examples of Gapping violating the No Embedding Constraint are available cross-linguistically, at least when the predicate is non-factive. It thus seems plausible to conclude that examples such as (70) do not in fact reflect the effect of a syntactic constraint such as the No Embedding Constraint but rather (i) a language-specific requirement against an overt complementizer and (ii) difficulties with embedding gapped clauses under a factive predicate. In §2.3.2 I will propose an account as to why and how the possibility of embedding gapped clauses is affected by factivity.

2.2 Consequences for Theories of Gapping

The previous discussion has shown that putative restrictions against subordination and embedding do not in fact hold for Gapping, contrary to claims in the literature. This empirical fact raises an important question for theories of Gapping – precisely, what is a grammatically relevant unit of Gapping that theories of it should aim to model. Below, I discuss four recent approaches to this issue.

[11] http://www.quintonsmessages.com/?start=10
[12] https://419sports.com/mondays-with-matthews-cooper-enjoying-life-in-tennessee/
[13] http://www.blastersnewsletter.com/41144interview.htm

2.2.1 vP coordination accounts

Coppock (2001), Johnson (2004, 2009, 2014) and others assume that Gapping sentences involve a subsentential coordination of roughly vP category (see also Lin (2002), López & Winkler (2003) and Toosarvandani (2013)).[14] Details aside, such vP coordinate structure can be schematized as in Figure 2.2 (Δ indicates the gap site):

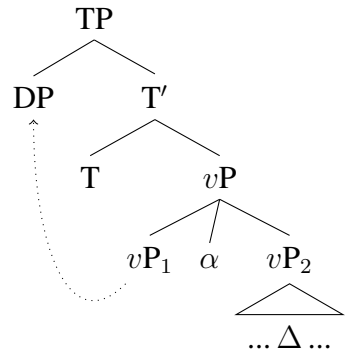


Figure 2.2: Generic vP coordination structure

There are two crucial aspects of this analysis. First, the structure in Figure 2.2 involves a single T node, which sits above two vP conjuncts. Since the gapped and source clauses are base-generated within these conjuncts, this analysis can capture the wide-scope reading. An example analysis is given in (84b) for (84a):

(84) a. John can't eat caviar and Sue beans.

b. [$_{\text{T}}$ can't [$_{v\text{P}}$ [$_{v\text{P}}$ John eat caviar] and [$_{v\text{P}}$ Sue eat beans]]]

Second, as indicated by the dotted arrow, the subject of the source clause moves from $v\text{P}_1$ to Spec, TP and gains wide-scope. One typical argument given for this movement is based on contrasts such as the one shown below in (85) (McCawley 1993; Coppock 2001; Johnson 2009).

[14] This group of analyses can be divided into two groups based on the specific ellipsis mechanism involved: ATB-movement analyses (Johnson 2004, 2009, 2014) and PF-deletion analyses (Coppock 2001; Lin 2002; Toosarvandani 2013). This distinction is immaterial to the present discussion.

(85) a. *No woman$_x$ can join the army, and her$_x$ girlfriend can join the navy.

b. No woman$_x$ can join the army, and her$_x$ girlfriend the navy.

(Johnson 2009:293, ex. (14a), his judgment)

The unacceptability of examples like (85a) is often taken to suggest that a bound pronoun must be c-commanded by an antecedent in its local clause. The assumption that Gapping involves asymmetric vP coordination provides one way to account for the acceptability of (85b), whose structure is indicated in (86).

(86) No woman$_x$ can [$_{v\text{P}}$ [$_{v\text{P}}$ t_x join the army] and [$_{v\text{P}}$ her$_x$ girlfriend the navy]]

Let us consider in more detail the consequences of the vP coordination analysis. Coppock (2001) and others argue that vP coordination alone suffices to capture the NO SUBORDINATION and NO EMBEDDING generalizations. Although these generalizations were shown to be false, let us continue for the sake of exposition. First, the NO SUBORDINATION generalization results as a corollary of the analysis in Figure 2.2: subordinating conjunctions such as *because* and *although* do not select a vP complement and as such would not be able to replace the α in Figure 2.2. Likewise, the assumption that the structure in Figure 2.2 is the only legitimate structure for Gapping gives rise to the prediction that gapped clauses cannot be embedded: embedding the gapped clause necessarily results in a coordination at the TP level, e.g., [$_{\text{TP}}$ *Some ate mussels*] *and* [$_{\text{TP}}$ *she claims others shrimp*]. On the other hand, as Johnson (2009) and Toosarvandani (2013) note, the vP coordination hypothesis does not by itself prevent the source clauses from being embedded. A Gapping sentence with an embedded source would still be analyzed as involving a conjoined vP, as illustrated by (87a-b): note that the relevant construal is one where *Peter* and *his peas* contrast with *Sally* and *her green beans*.

(87) a. *She's said Peter has eaten his peas, and Sally her green beans, so now we can have dessert. (Johnson 2009:300, ex. (29), his judgment)

b. She$_x$ has [$_{vP}$ [$_{vP}$ t_x said Peter has eaten his peas] and [$_{vP}$ Sally her green beans]]

Toosarvandani (2013) motivates an independent condition that requires symmetric focus structure between conjoined vPs, and argues that this condition correctly rules out instances of Gapping that contain embedded sources. I believe the basic idea behind this account is correct. However, I do not agree with the assumption behind Toosarvandani's claim that asymmetric embedding in coordinated phrases (as in (87a)) necessarily results in failure to establish symmetric focus structure (see §2.3 for relevant discussion).

Aside from the fact that vP coordination accounts are designed to capture the wrong empirical generalizations about the distribution of Gapping, there are other problems with these accounts. As many authors pointed out (Repp 2009; Kubota & Levine 2016, among others), elements within CP may appear as remnants in Gapping, which arguably suggests the possibility of CP-domain Gapping:

(88) a. Bill asked which books I gave to Mary and **which records** to John.

b. He asked where I bought the macaroni and **where** the spaghetti.

(Pesetsky 1982:646)

López & Winkler (2003) propose to accommodate examples such as (88a-b) by stipulating that *wh*-elements may optionally land at the edge of vP. Not only does this account lack independent evidence, it does not extend to cases which involve elements that are regarded as base-generated at the CP-level, such as *why* (Ko 2005; Repp 2009):

(89) Why did John go by train and **why** Mary by car? (Repp 2009:34)

Another serious problem with this analysis is semantic: assuming that Gapping sentences can only have a vP coordination parse, one can only predict the wide-scope readings. But as noted in §1.1.1 distributive-scope readings are also available:

(90) Ward can't eat caviar and Sue beans. (repeated from (26))

a. DISTRIBUTIVE-SCOPE READING:

(i) $\neg\Diamond A \wedge \neg\Diamond B$

(ii) Ward cannot eat caviar and Sue cannot eat beans.

b. WIDE-SCOPE READING:

(i) $\neg\Diamond(A \wedge B)$

(ii) It is not possible (or desirable) for Ward to eat caviar and for Sue to eat (merely) beans.

Yet another argument against the vP coordination analysis comes from Case. Toosarvandani (2013) offers the example in (91) and argues that vP coordination correctly rules out the nominative pronoun:

(91) He wanted to learn the piano and {her/*she} violin.

(Toosarvandani 2013:6, ex. (10), his judgment)

On the usual assumption that vPs do not include a position for a nominative case assigner (usually assumed to be T), the pattern in (91) is explained in the vP coordination analysis. But this line of reasoning is unsuccessful since it is based on an incorrect empirical generalization. A search in the Brown Corpus and other sources reveals that nominative remnants are in fact possible in Gapping:

(92) a. In their relations, she was the giver and **he** the receiver, nay the demander.

b. ... she was active in the Woman's Club and **he** in Lions, Rotary, and Jaycee...

c. I felt that her eyes were undressing me as if she were a painter and **I** a nude model. (Brown Corpus)

(93) We are in the lowest ranks and **they** the highest.[15] (Boston Review)

[15] http://bostonreview.net/blog/my-life-confronting-sexism-academia

(94) If we were to come across the artists of the Stadel Cave, we could learn their language and **they** ours. (*Sapiens*, by Yuval Harari)

Furthermore, there is evidence against the claim that vP coordination can be involved in Gapping in the first place, as Kubota & Levine (2016:122-5) discuss in detail: gapped clauses fail to pass basic constituency tests, and they exhibit the distributional properties of full S constituents rather than vPs. Consider the following example from Kubota & Levine (2016:125, ex. (37)):

(95) Robin commented only that our margins were too small, and {a. Leslie merely / b. *merely Leslie} that our footnotes were too long.

Given that *merely* is a vP modifier, it should be able to appear preceding the gapped clause, if a vP coordination parse is available. This prediction is not borne out as (95) shows: the fact that the ordering in (a) is acceptable while the one in (b) is not suggests that the gapped clause patterns as an S, not as a vP.

In sum, vP coordination accounts are too restrictive in that they cannot predict many of the essential syntactic and semantic properties of Gapping. In particular, since gapped clauses and their sources are required to be conjuncts of a vP coordinate structure, the possibility of subordinate and embedded Gapping (seen in §2.1) is unaccounted for. Moreover, results of the diagnostic tests for vP provided by previous research (Kubota & Levine 2016) cast serious doubts on the proposal that gapped clauses involve a vP structure.

2.2.2 Syntactic ambiguity accounts

One may hypothesize that the problems the vP coordination analysis faces do not indicate that the analysis has to be abandoned, but that it must be relaxed somehow to allow for full,

clause-level coordination for Gapping.[16] The accounts in Repp (2009:§4), Boone (2014) and Potter *et al.* (2017) (among others) are developed precisely to pursue this analytical approach. The essential idea of this approach is to assume that Gapping is syntactically ambiguous; what differs among different accounts in this group is the precise inventory of syntactic structures assumed for Gapping. For Repp, Gapping is ambiguous between coordination with and without a syntactic projection for illocutionary force (Rizzi 1997), and this syntactic ambiguity is assumed to be correlated with the distributive- and wide-scope readings. However, as Tomioka (2011) convincingly pointed out, the wide-scope readings are not always amenable to an analysis in terms of speech act negation. This is illustrated by the examples in (96a-b) below (from Tomioka 2011:223). Crucially, on the widely accepted assumption that *if*-clauses and relative clauses are incapable of embedding speech acts, the wide-scope reading of the negation in these sentences is not explained in Repp's analysis.

(96) a. If Jose **cannot** go out and his wife stay at home looking after their kids, why don't they try to go to a place where all of them can have fun?

b. Jose is the kind of guy who **wouldn't** go out and his wife stay at home.

Boone (2014) and Potter *et al.* (2017), on the other hand, entertain the possibility that Gapping is ambiguous between vP and CP coordination.[17] Since I already pointed out

[16] Gapping as a clausal (roughly, IP-level) coordination is the earliest analysis proposed (Jackendoff 1971; Jayaseelan 1990; Neijt 1979; Pesetsky 1982; Ross 1970; Sag 1976). This analysis has been criticized for its inability to handle wide-scope readings (Coppock 2001; Johnson 2009). However, as we shall see in §5.3, a clausal coordination analysis of Gapping does not necessarily preclude wide-scope readings, contra widespread assumptions.

[17] Boone (2014:41-7) additionally assumes that Gapping can be realized as TP coordination. However, the relevant examples he provides do not conclusively support this assumption, since these can have an alternative (complementizer-less) CP coordination parse. For example, there is no convincing argument against treating the α in [$_\alpha$ [$_\alpha$ *Ward can't eat caviar*] [$_\alpha$ *and Sue beans*]] as CP. More clear evidence for TP-domain Gapping arguably comes from ECM constructions such as (i):

(i) John wanted [Kim not to come along with her boyfriend] and [Robin (not to come) with her brother] (since he wanted to be the smartest guy in the group).

some problems with Boone's account (see §2.1.2, p. 45), I will focus on Potter *et al.* (2017) below. It should be noted, however, that some of these problems are not unique to Potter *et al.* but are common among analyses that assume vP coordination for (some instances of) Gapping.

Potter *et al.* characterize Gapping as a move-and-elide operation which applies precisely to vP and CP structures. The authors assume that these two distinct sites for Gapping are not stipulated but follow from the following independent assumptions: (i) the edges of vP and CP include functional projections for Topics or Foci (Rizzi 1997; Gengel 2007); and (ii) the remnants in Gapping are a Topic or Focus element, so they move to these functional projections to survive ellipsis (cf. Merchant 2001). More specifically, CP coordination Gapping is assumed to involved topicalization to CP-TopP (as well as focus movement to CP-FocP), while in vP coordination Gapping both remnants move to vP-FocP. These two possible structures are illustrated below:

(97) a. Gapping in CP coordination:

[$_{\text{CP}}$ John can't eat caviar] and [$_{\text{CP-TopP}}$ Sue$_x$ [$_{\text{CP-FocP}}$ beans$_y$ [$_{\text{TP}}$ ~~t_x can't eat t_y~~]]]]

b. Gapping in vP coordination:

John$_j$ [$_{\text{T}}$ can't [$_{v\text{P}}$ [$_{v\text{P}}$ t_j eat caviar] and [$_{v\text{P-FocP}}$ Sue$_x$ [$_{v\text{P-FocP}}$ beans$_y$ [$_{v\text{P}}$ ~~t_x eat t_y~~]]]]]

The availability of CP-level coordination for Gapping makes it possible to account for the distributive-scope readings, since each conjunct has its own T that can host a negative or modal auxiliary. It also allows, in principle, for the possibility of embedded Gapping: as noted in §2.2.1, embedded Gapping cannot be realized as a coordination of categories that are 'smaller' than TP, since the embedding clauses (as well as the source clauses they are

On the general assumption in current Minimalist work that the verb *want* takes a TP complement, (i) constitutes as an example of TP coordination Gapping. (Note that the negation is added here to prevent a vP coordination parse.) This assessment, if correct, provides one additional argument against Potter *et al.*'s claim that Gapping is restricted to just vP and CP coordination.

coordinated with) necessarily include a T element. Moreover, although Potter *et al.* do not discuss subordinative Gapping (see §2.1.1 above), nothing *a priori* in their analysis would preclude such cases.

However, since Potter *et al.*'s analysis preserves the basic ideas of the vP coordination analysis, some of the problems of the vP coordination analysis directly carry over to Potter *et al.*'s. As noted above in §2.2.1, traditional constituency tests and the distribution of fixed-position adverbs such as *merely* suggest that there is more evidence for gapped clauses being an S category than a vP (Kubota & Levine 2016). To see that this fact is also problematic for Potter *et al.*'s analysis, consider the example in (98).

(98) Robin didn't comment only that our margins were too small or {a. *merely Leslie/ b. Leslie merely} that our footnotes were too long.

(modified based on Kubota & Levine's (37))

This sentence can have both negation wide- and distributive-scope readings (i.e., ¬[A&B] vs. ¬A&¬B). In Potter *et al.*'s analysis the negation wide-scope reading entails vP-domain Gapping while the distributive-scope reading entails CP-domain Gapping. Given that *merely* is a vP modifier, this analysis predicts that the (a) and (b) orderings would be correct for the wide- and distributive-scope readings, respectively. This prediction is not borne out, however: the only legitimate ordering is the one in (b) for either reading.

Potter *et al.*'s analysis also has its own problems, too. Their analysis suggests that there is a correspondence between vP and CP coordination on the one hand and the wide- and distributive-scope readings on the other hand, but this does not always seem to be the case. For instance, there are cases where the CP coordination-parse is not available but the distributive-scope reading is. A case in point is topicalization environment. It is known that topicalization has the effect of preventing *wh*-extraction (Lasnik & Saito 1992; Boeckx &

Jeong 2004; Haegeman 2012). This is illustrated in (99).[18]

(99) a. *When did THIS BOOK everyone read?

b. *Who did you say that TO MARY John introduced?

If this assumption is correct, then a CP coordination parse is ruled out for (100) according to Potter *et al.*'s analysis: the only possibility here is one where *Bill* and *to Sue* have moved to vP internal positions for Foci.

(100) Who did you say that John introduced to Mary and Bill to Sue?

Potter *et al.* thus predict that, if a negation precedes the putative coordinated vP in (100), as in (101), the distributive-scope reading should be unavailable. However, this prediction is not borne out: (101) readily admits a distributive-scope reading, i.e., 'Who did you say that Bill wouldn't introduce to Sue and John wouldn't introduce to Mary?'

(101) Who did you say that Bill wouldn't introduce to Sue and John to Mary?

In §5.2 I will discuss more counterexamples to Potter *et al.*'s claim that there is a direct correspondence between the syntactic structure of Gapping and the available readings.

2.2.3 Categorial Grammar accounts

Analyses of Gapping developed within the tradition of Categorial Grammar (CG) are based on the notion of non-traditional constituents (Oehrle 1987; Steedman 1990; Kubota &

[18]The matter is complicated by the fact that *wh*-relatives seem to tolerate topic 'island' violations:

(i) A university is the kind of place in which, that kind of behavior, we cannot tolerate. (Haegeman 2012)

Moreover, topicalization across a *wh*-phrase seems possible in cases like (ii).

(ii) ?This book, to whom should we give? (Pesetsky 1982:13, attributed to A. Watanabe)

However, given that many speakers unanimously find the examples in (99) to be unacceptable, it seems plausible to conclude that the variability in (i)-(ii) does not affect my claim that the supposed topicalization of remnants cannot adequately predict the availability or absence of distributive-scope readings.

Levine 2012, 2016; Morill & Valentìn 2017). In this view, virtually any string of elements can be treated as constituents and as such are able to undergo the operation of coordination. This flexible notion of constituency makes it possible to characterize Gapping as a direct coordination between the remnants in the gapped clause and the corresponding constituents in the source (i.e., the correlates). For example, according to Steedman (1990) a Gapping sentence such as *Tom likes Sue and John Mary* involves a conjunction of two S\((S\NP)/NP) constituents (a clause looking for a transitive verb to its left), i.e., *Tom Sue* and *John Mary*; the resulting string then combines with the 'shared' verb.[19] This is essentially the core idea shared among CG-based analyses of Gapping.

Oehrle (1987) provided an analysis which was designed precisely to account for the wide- and distributive-scope readings of Gapping. In this analysis, Gapping is derived by first constructing conjoined 'argument pairs' (such as *Tom Sue and John Mary*) and subsequently combining the argument pairs with a main verb (and optionally a finite auxiliary). Since a finite auxiliary can be introduced in the derivation after all other elements have been composed, the wide-scope readings are explained. However, Oehrle's analysis is too restrictive in that it cannot deal with cases of Gapping that involve remnants that are not arguments of a verb: e.g., *On Monday Tom left at 10 AM and on Tuesday at 5 PM*.

More recently, Kubota & Levine (2012, 2016) developed an analysis which builds on and improves upon the analyses in Steedman (1990) and Oehrle (1987) outlined above. In Kubota & Levine's analysis, the surface asymmetry in Gapping (i.e., apparent coordination of a full clause with a string of remnants) and the scope ambiguity problem (i.e., the availability of distributive- and wide-scope readings) are handled by two separate, simultaneous derivations at the semantic and prosodic levels. To illustrate the details of this analysis, let us consider the derivation for (102), where a lexical verb as well as a finite auxiliary are

[19] In Steedman (1990), this verb is initially separated out from the source clause by a special rule (called the Left Conjunct Revealing Rule), which is designed specifically for this task.

missing in the second conjunct.

(102) John can't eat caviar and Mary (just) rice.

The first step in the derivation is the construction of the constituents that are being coordinated: *John caviar* and *Mary rice*. Figure 2.3 illustrates the derivation for *John caviar*. (Note that signs are written as triples of phonology, semantic translation and syntactic category; $/\text{E}$ and $\backslash\text{E}$ designate Elimination rules (i.e. rules of modus ponens), and $|\text{I}$ designates a rule of implication introduction called 'Hypothetical Reasoning'.)

$$\dfrac{\dfrac{\dfrac{[\varphi;\ P;\ ((\text{NP}\backslash\text{S})/\text{NP})]^1 \qquad \mathsf{caviar};\ \text{c};\ \text{NP}}{\mathsf{john};\ \text{j};\ \text{NP} \qquad \varphi \circ \mathsf{caviar};\ P(\text{c});\ \text{NP}\backslash\text{S}}\,/\text{E}}{\mathsf{john} \circ \varphi \circ \mathsf{caviar};\ P(\text{c})(\text{j});\ \text{S}}\,\backslash\text{E}}{\lambda\varphi.\mathsf{john} \circ \varphi \circ \mathsf{caviar};\ \lambda P.P(\text{c})(\text{j});\ \text{S}|((\text{NP}\backslash\text{S})/\text{NP})}\,|\text{I}^1$$

Figure 2.3: Derivation for *John caviar*

Roughly put, we first derive a complete clause by hypothetically assuming a transitive verb (whose phonology is indicated as φ). We then discharge this hypothesis, and introduce lambda binding at the phonological and semantic levels to assign the right surface form and meaning to the clause. Note that, by using lambda binding at the prosodic level, this analysis can keep track of the gap's position separately from its semantic contribution.

Kubota & Levine assume the following Gapping-specific conjunction to coordinate gapped clauses such as *John caviar* (ε stands for an empty string).

(103) $\lambda\sigma_2\lambda\sigma_1\lambda\varphi.[\sigma_1(\varphi) \circ \mathsf{and} \circ \sigma_2(\varepsilon)];\ \lambda W\lambda V.V \sqcap W;\ (\text{S}|X)|(\text{S}|X)|(\text{S}|X)$

This entry has the usual syntax and semantics assumed for conjunction words (cf. Partee & Rooth 1983). What is rather unusual is the asymmetry in phonology: this entry introduces a bound variable (φ) to the 'gap' in the first conjunct while introducing an empty string (ε) in the second conjunct, thereby capturing the surface asymmetry between gapped and source clauses.

The rest of the derivation for (102) proceeds as follows. First, we conjoin *John caviar* and *Mary rice* via the entry in (103). The resulting string *John caviar and Mary rice* is then combined with a TV-type constituent (which consists of the main verb and a variable corresponding to a hypothetical auxiliary) to yield the sign in (104), a clause which is missing an auxiliary. Note that the hypothetical auxiliary need only be introduced when there is a missing auxiliary; main verb Gapping which does not accompany an auxiliary gap does not require it.

(104) $\lambda\varphi_0.\mathsf{john} \circ \varphi_0 \circ \mathsf{eat} \circ \mathsf{caviar} \circ \mathsf{and} \circ \mathsf{mary} \circ \varepsilon \circ \mathsf{rice}$; $\lambda f.[f(\text{eat(c)})(\text{j}) \wedge f(\text{eat(r)})(\text{m})]$; S|(VP/VP)

In the next step we can either let the sign in (104) be combined with the basic, higher-order entry of *can't* (of category S|(S|(VP/VP))) and obtain the wide-scope reading, or derive a lower-order type (VP/VP) from the higher-order entry and then combine it with the sign in (104) to obtain the distributive-scope reading. Let us first consider the derivation for the wide-scope reading:

$$\frac{\begin{array}{ll}\lambda\sigma_0.\sigma_0(\mathsf{can't}); & \lambda\varphi_0.\mathsf{john} \circ \varphi_0 \circ \mathsf{eat} \circ \mathsf{caviar} \circ \mathsf{and} \circ \mathsf{mary} \circ \varepsilon \circ \mathsf{rice}; \\ \lambda\mathscr{F}\neg\Diamond\mathscr{F}(\mathsf{id}_{et})\text{;S|(S|(VP/VP))} & \lambda f.[f(\text{eat(c)})(\text{j}) \wedge f(\text{eat(r)})(\text{m})]\text{;S|(VP/VP)}\end{array}}{\mathsf{john} \circ \mathsf{can't} \circ \mathsf{eat} \circ \mathsf{caviar} \circ \mathsf{and} \circ \mathsf{mary} \circ \varepsilon \circ \mathsf{rice};\ \neg\Diamond[\text{eat(c)(j)} \wedge \text{eat(r)(m)}]\text{;S}}\ |\text{E}$$

Figure 2.4: Derivation for the wide-scope reading of (102)

Here, the two signs – i.e., the auxiliary and the conjoined clause with a medial gap – are composed via functional application (|E): the auxiliary introduces an identity function (id_{et} $=_{def}$ $\lambda P_{et}.P$) to the gap, while its actual semantic contribution (the negated modal operator $\neg\Diamond$) takes wide-scope over all other elements.

The derivation for the distributive-scope reading involves a VP/VP type auxiliary. Since the auxiliary is given as argument to each conjunct in this case, the negated modal ends up being included in each conjunct's semantics:

$$\frac{\begin{array}{ll}\mathsf{can't}; & \lambda\varphi.\mathsf{john} \circ \varphi \circ \mathsf{eat} \circ \mathsf{caviar} \circ \mathsf{and} \circ \mathsf{mary} \circ \varepsilon \circ \mathsf{rice}; \\ \lambda f \lambda x.\neg\Diamond f(x); \text{VP/VP} & \lambda h.[h(\text{eat(c)})(\text{j}) \wedge h(\text{eat(r)})(\text{m})]; \text{S}|(\text{VP/VP})\end{array}}{\mathsf{john} \circ \mathsf{can't} \circ \mathsf{eat} \circ \mathsf{caviar} \circ \mathsf{and} \circ \mathsf{mary} \circ \varepsilon \circ \mathsf{rice};\ \neg\Diamond\text{eat(c)(j)} \wedge \neg\Diamond\text{eat(r)(m)};\text{S}}\ |\text{E}$$

Figure 2.5: Derivation for the distributive-scope reading of (102)

Kubota & Levine's analysis overcomes the limitations of prior CG analyses (Oehrle 1987; Steedman 1990) as it can deal with cases that involve non-argument remnants and can also account for the distributive- and wide-scope readings of auxiliaries. There are, however, problems with this analysis. First, it is not clear how this analysis can account for cases that involve non-coordinating conjunctions such as *before* and *while* (see §2.1.1 above). Kubota & Levine posit a generalized lexical rule which provides a Gapping-type entry for *and* and other conjunction markers such as *or* and *but* (Kubota & Levine 2016:137). But this lexical rule can only be applied to markers which take two arguments – i.e., coordinating conjunctions (of category (Z\Z)/Z) – and there seems to be no obvious way that this rule can be extended to cover one-place functors such as *before* and *while*. Moreover, even if such a possibility existed, it would require rejecting the core analytical claim, maintained in all CG-based analyses, that Gapping is simply a kind of like-category coordination.

The existence of non-coordinative Gapping raises another problem, one that pertains to the distribution of wide-scope readings. Consider for instance the following sentence.

(105) Robin speaks French, not to mention Leslie German.

(Culicover & Jackendoff 2005:278)

In Kubota & Levine's analysis, the availability of wide-scope readings follows from (i) the mechanism that composes clauses that contain medial gaps (i.e., (103)) and (ii) the treatment of finite auxiliaries as a functor which composes with clauses that are missing an auxiliary. This seems to predict that wide-scope readings should be available even in Gapping that involves a non-coordinating conjunction, such as (106):

(106) Robin can't speak French, not to mention Leslie German.

However, (106) does not have an auxiliary wide-scope reading, i.e., 'It is not the case that [Robin speaks French, not to mention Leslie German]'. This suggests that Kubota & Levine's analysis is not restrictive enough in that it wrongly predicts wide-scope readings to be available whenever Gapping occurs. In §5.3.2 I point out further issues that undermine Kubota & Levine's analysis of auxiliary wide-scope readings, and I introduce examples that have hitherto gone unnoticed in the Gapping literature.

Another issue with Kubota & Levine's analysis is that it basically treats the absence of backward Gapping as a lexical accident, rather than providing a principled account of it. Nothing in Kubota & Levine's analysis would preclude a language from having another entry for *and* where the first conjunct had the empty string and the second a variable in the phonology for the insertion of the (hypothesized) verb. Furthermore, the postulation of a generalized lexical rule for Gapping-type conjunctions seems to implicate that Gapping should be available not just in English and related languages, but virtually in all languages that have conjunctions. Kubota & Levine's analysis does not seem to naturally predict that there might be cross-linguistic differences in the availability of Gapping or any language-specific constraints on Gapping, although such differences have previously been noted.[20]

2.2.4 Fragment-based accounts

The last group of analyses I discuss analyze Gapping as a fragment construction, i.e., one or more remnant phrases which are associated with a full propositional meaning (Stump 1978; Sag *et al.* 1985; Culicover & Jackendoff 2005; Abeillé *et al.* 2014). As will be clear from

[20]Some languages such as Japanese and Korean have a type of coordinate-ellipsis which appears to be the mirror image of Gapping. While this ellipsis type is often regarded as an instance of Gapping, it is not without controversy, given that it has been shown to receive a straightforward account as Right-Node Raising (Maling 1972; Kuno 1973; Saito 1987; Shiraishi 2018; Yatabe & Tanigawa 2018).

the discussion below, fragment-based accounts are equipped to deal with the distributional facts of Gapping discussed in §2.1 above.

Sag *et al.* (1985:§4.3) provided a Phrase Structure Grammar analysis in which Gapping is analyzed as a flat construction consisting of a conjunction and two remnants (e.g., *and Leslie German*). According to Sag *et al.*, the source and gapped clauses in Gapping are not required to enter into a syntactic relationship and may even occur as independent sentences, as in (107):

(107) A: I shall miss you.
B: And I you. (Sag *et al.* 1985:160, ex. (114))

In the literature it is often suggested that examples such as (107) can straightforwardly be analyzed as a collaborative utterance, where one speaker completes the utterance initiated by another speaker (Kubota & Levine 2016:140, fn. 23). However, as Sag *et al.* note, the deixis shift in (107B) makes such an analysis implausible (cf. *#I shall miss you and I you*). Cases such as (107) therefore constitute evidence against previous analyses in which gapped clauses are formally dependent on their source clauses (e.g., Johnson 2009, Kubota & Levine 2016, among others).

Based on Frech and Romanian data, Abeillé *et al.* (2014) offered a more elaborated analysis which preserves the basic insights of Sag *et al.* (1985). In Abeillé *et al.*'s analysis, the central mechanism for gapped clauses is a dedicated syntax/semantics rule called the *head-fragment-phrase*. The essential idea is to treat gapped clauses as a flat XP consisting of one or more remnants whose interpretation arises via the Higher-Order Unification (HOU) algorithm of Dalrymple *et al.* (1991). As an illustration, consider the following example:

(108) a. Dan likes golf and George tennis.
b. Dan likes golf = like′(dan, golf)

c. $\mathscr{F}$ = HOU(like′(dan, golf), P(dan, golf)) = $\lambda x \lambda y$.like′(y,x)

d. George tennis = $\mathscr{F}$(george)(tennis) = $\lambda x \lambda y$.[like′(y,x)](george)(tennis)
= like′(george, tennis)

HOU resolves the meaning of the missing verb (indicated as $\mathscr{F}$) in the gapped clause as the meaning of the verb in the source (indicated as P). The complete meaning of the gapped clause results from applying $\mathscr{F}$ to the content of the remnants.

To account for the overall syntax and semantics of Gapping sentences, Abeillé *et al.* assume a special 'asymmetric' coordination rule which coordinates a (non-empty) list of finite clauses and a subsequent (non-empty) list of fragments. This is too restrictive, however: as we saw in §2.1 gapped clauses need not be realized as conjuncts but can be embedded within their respective conjuncts. The examples in (77a) and (81) are repeated below:

(109) a. John ate oysters and I {?think/suspect/imagine} Mary swordfish.

b. I think John asked which book you gave to Mary, and Bill asked which magazine to Sue.

Abeillé *et al.* assume a coordinate-analysis for comparatives and constructions that involve expressions such as *though* and *as well as*, thereby predicting the availability of Gapping in these constructions. It unclear, however, whether this approach can be extended in a principled manner to cover Gapping with *before* and *while*, as the status of these expressions as coordinating conjunctions is controversial.

Culicover & Jackendoff (2005:§7.8) proposed an analysis in Simpler Syntax which, just as Sag *et al.* (1985) and Abeillé *et al.* (2014), assimilates Gapping to a general theory of fragments. Culicover & Jackendoff regard fragments as instances of all-focus constructions. Gapping is defined as fragments whose focal remnants are directly composed with

some non-focus semantic content $\mathscr{F}$.[21] This is encapsulated in the following construction schema for gapped clauses:

(110) Syntax: [XP_i $^{\texttt{ORPH1}}$ YP_j $^{\texttt{ORPH2}}$] CS: [$\mathscr{F}$($\begin{bmatrix} X_i \\ \text{C-FOCUS} \end{bmatrix}$, $\begin{bmatrix} Y_j \\ \text{C-FOCUS} \end{bmatrix}$)]

This rule states that gapped clauses consist of two 'orphan' daughters each of which is connected to some semantic content associated with contrastive focus. The non-focal meaning $\mathscr{F}$ is the content that is shared between a gapped clause and its source; however, Culicover & Jackendoff do not provide details about precisely how the interpretation of $\mathscr{F}$ results. According to (110), the interpretation of a gapped clause results by applying $\mathscr{F}$ directly to the semantics of the daughters.

Note that the Gapping rule in (110) says nothing about the relationship between gapped clauses and their sources. According to Culicover & Jackendoff, this is entirely a matter of CS, i.e., the establishment of contrastive foci. Culicover & Jackendoff's analysis therefore allows Gapping to occur in subordinate structures and embedded contexts, while restricting those cases to where contrastive focus can be licensed. But, this analysis fails to account for the required presence of an initial set of contrastive foci: e.g., #DAN, GOLF (without an overt source clause).

Furthermore, it is not at all clear how this analysis in its current form can capture the various readings of Gapping sentences. Culicover & Jackendoff briefly discuss cases that involve wide-scope auxiliaries (e.g., *John can't eat caviar and Mary (just) rice*) and only offer speculative remarks about how the wide-scope readings can be derived:

[21] Culicover & Jackendoff call $\mathscr{F}$ the 'presupposition' of the source. To avoid confusion, I reserve the term presupposition for background assumptions (Strawson 1950), and use a more descriptive term such as 'non-focus'.

> On our analysis, there is a single modal or negation that takes scope over the entire S, which includes both the antecedent and the fragment sequence as coordinate. (Culicover & Jackendoff 2005:279)

However, nowhere in Culicover & Jackendoff's analysis are details provided which would clarify how such an account can be formalized.

2.2.5 Interim Summary

The previous two sections have examined existing claims about the distribution of Gapping and have shown that Gapping is not syntactically restricted but possible in a wide range of constructions. These sections have also suggested that an account in terms of contrastive focus such as Culicover & Jackendoff's can lead us to a better prediction about where Gapping can occur: the distribution of gapped clauses correlates with that of contrastive focus rather than coordination. An approach consistent with these observations is one which treats gapped clauses as a syntactic unit independent from a particular syntactic configuration.

In the present section I show how Culicover & Jackendoff's insights can be developed into a more predictive theory that explains away the data in §2.1. I will first introduce some basic notions of information structure that are relevant for my purposes and briefly discuss QUD-based accounts of focus (§2.3.1). I will then discuss Reich's (2007) QUD-based account of Gapping and argue that his account, when combined with recent proposals on discourse relations and QUD, makes predictions that are consistent with the data in §2.1 (§2.3.2).

2.3 Information Structure

2.3.1 Focus and QUD

I take focus to be a primitive category of information structure – the organization of sentences based on what is given (i.e., previously known or recoverable from context via accommodation) and what is new. The particular notion of focus adopted in this work is that laid out in Rooth (1985, 1992), where focus evokes *alternatives* which are relevant for the interpretation of sentences relative to their context; the part of a sentence that does not bear focus is called the background. As many authors have noted, the term focus has been a source of confusion in the field, as different authors tend to use the term differently. I would like to stress that my use of Rooth's notion of focus is mainly for exposition purposes and that nothing crucial in my analysis hinges on this choice. Following Selkirk (1984), I assume that in every sentence, at least one constituent bears focus, and that an entire sentence may be focused. On this view, then, every sentence provides some clues as to which alternatives are evoked.

There are several different uses of focus; see Krifka (2007) for a comprehensive overview. Below, I restrict my discussion to those uses that are of importance for Gapping. The familiar, classical use of focus is to highlight that part of an answer that corresponds to the *wh*-phrase of an explicit question. This is illustrated below in (111).

(111) A: Who's watching Game of Thrones?
B: JOHN is watching Game of Thrones.

In (111B) the focus accent on *John* indicates that a set of salient alternatives which can possibly substitute *John* are under consideration even if only *John* is selected as an answer to the question. According to Rooth (1992) all instances of focus have this basic function of evoking a set of alternatives. I will provide more details about Rooth's theory of focus

shortly.

Focus may also be used to make explicit the contrast between alternatives that are mentioned rather than merely implicit in the context as in example (111B). A case of explicitly contrasted focus is provided in (112), where *John* and *Mary* are explicit alternatives to each other and so are *violin* and *flute*.

(112) A: Who is playing which musical instrument?
B: JOHN is playing the VIOLIN and MARY is playing the FLUTE.

In addition to highlighting the contrast between alternatives, contrastively marked focus indicates partial answerhood (Krifka 1999, 2007). In the context of the question in (112A), *John is playing the violin* and *Mary is playing the flute* are each a partial answer. According to Krifka partial answers are answers to a common question. Another view, consistent with Roberts (1996/2012) and Büring (2003), is to consider the conjuncts in (112B) as addressing their own (sub-)questions, which are connected to a common *super*-question. I see no reason to reject one or the other of these two views.

The two kinds of focus just discussed are sometimes distinguished as *information focus* and *contrastive focus*, respectively. Whether these must be considered as truly distinct categories is currently a matter of debate; see for example Selkirk (2008) and Féry & Krifka (2008) for discussion and references therein. I will keep the term contrastive focus as it is useful for my purposes, without committing myself to any particular claim about its status with respect to information structure.

I now turn to the notion of *question-answer congruence* (Halliday 1967; Paul 1980; Rooth 1985; von Stechow 1990; Rooth 1992). The idea is that in a congruent question-answer pair, the constituent in the answer that corresponds to the *wh*-phrase in the question is the focus. As an illustration consider the following example:

(113) A: Which student did James introduce to Sue?

B′: James introduced ROBIN to Sue.

B″: #James introduced Robin to SUE.

After question (113A), only an answer with the focus articulation in (113B′) is felicitous.

Rooth (1992) proposes a formulation of question-answer congruence relevant to the phenomenon in (113) by building on Hamblin's (1973) semantics for questions. According to Rooth, the focus-background partition of a sentence is interpreted on a separate layer of the sentence's interpretation where *focus semantic values* are calculated. To simplify, the focus semantic value for a sentence S is the set of propositions obtained from the ordinary semantic value of S by substituting the position corresponding to the focus constituent with suitable alternatives. As shown in (114b) below, in the case of (113B′) the focus semantic value is a set of propositions of the form *James introduced x to Sue* where x ranges over a set of individuals. In the case of (113B″) substitution is made for the indirect object, resulting in the form *James introduced Robin to* x.

(114) a. $[\![(113\text{A})]\!]$ = $\{p; \exists x[x$ is a student & p = that James introduced x to Sue$]\}$

b. $[\![(113\text{B}')]\!]_{\text{F}}$ = $\{p; \exists x[x{\in}D_e$ & p = that James introduced x to Sue$]\}$

c. $[\![(113\text{B}'')]\!]_{\text{F}}$ = $\{p; \exists x[x{\in}D_e$ & p = that James introduced Robin to $x]\}$

Note that the denotation of the question (113A) in (114a) is a subset of the felicitous answer (113B′) but not a subset of the infelicitous answer (113B″). Thus, in Rooth's theory, question-answer congruence is a matter of subset relations between a question's ordinary semantics and the focus semantics of the answer.

More recent studies use a theoretical device called questions under discussion (QUD) to account for how a focused sentence fits in its surrounding discourse (Ginzburg 1996; Roberts 1996/2012; Ginzburg 1999; Umbach 2001; Büring 2003; Beaver & Clark 2008; Ginzburg 2012). QUD is roughly defined as a stack of questions that have been accepted by interlocutors at a given point in a conversation. Questions in a QUD stack are ordered,

and the topmost question in a QUD stack has a distinguished status as the *maximal* QUD (Ginzburg & Sag 2000) or the *immediate* QUD (Roberts 1996/2012), which designates the question that must be immediately answered. In what follows I will call questions in a QUD simply 'QUDs'.

QUDs may correspond to actual questions, but they can also be merely implicit or even reconstructed retrospectively on the basis of the utterance which serves as answer to the reconstructed question (Roberts 1996/2012; Ginzburg 1999; Umbach 2001; Büring 2003; Ginzburg & Cooper 2004; Fernández 2006).[22] Thanks to this assumption, it is possible to account for all focused sentences in a uniform way, irrespective of whether they are presented as answers to explicit questions or not. For example, the focus-marking on *Fred* in (115) indicates that the sentence is an answer to the implicit question *Who went to Paris?* The acceptability of (115) then depends on whether that question is supported contextually (i.e., accepted by interlocuters).

(115) FRED went to Paris.

In the literature there have been several discussions about what principles or conditions guide the construction of implicit QUDs, but much is left for further investigation (Beaver & Clark 2008; Beaver *et al.* 2017; Riester *et al.* 2018).

This ends my brief introduction to information structure and QUD. In the next subsection, I will introduce an account of Gapping that is based on the research tradition outlined above, Reich (2007), and show how this account can be extended to explain the data discussed in §2.1.

2.3.2 Gapped clauses as answers to an implicit QUD

Reich (2007) offers a PF-deletion account for Gapping and Short Answer, in which the PF-

[22] Umbach (2001) distinguishes such reconstructed questions as *quaestio* after Klein & von Stutterheim (1987).

deletion is conditioned by the Rooth-style condition for question-answer congruence outlined above. According to Reich there is however one crucial difference between Gapping and Short Answers: in Short Answer the antecedent is an explicit question, i.e., an object of type $\langle\langle s,t\rangle,t\rangle$ (a question) – whereas in Gapping the antecedent is the focus semantic value of the preceding clause. Reich suggests that these differences can be abstracted away through the use of QUD: whereas Short Answers find their antecedents from an explicit QUD, in Gapping the first conjunct triggers an implicit QUD via its information structure, and this implicit QUD serves as the antecedent for the gapped conjuncts.[23] Accordingly, deletion in Short Answers and Gapping can be uniformly licensed by an equality requirement between the QUD and the focus-semantic value of the deleted clause, argues Reich.[24]

To show how this analysis works, consider (116).

(116) John likes Mary and Mary ~~likes~~ John.

a. [JOHN]$_F$ likes [MARY]$_F$

$[\![\text{QUD}]\!] = \{p;\ \exists x \exists y[x,y \in D_e\ \&\ p = \text{that } x \text{ likes } y]\}$

b. and [MARY]$_F$ likes [JOHN]$_F$

[23] Short Answers need not find their antecedents from an explicit QUD, however. For example, in (i) the Short Answer does not directly answer A's question, but answers an implicit one that is reconstructed based on A's question (Engdahl *et al.* 2000).

(i) A: Did Peter come to the party?
B: (No,) Paul. (QUD = Who came to the party?)

[24] Weir (2014:71-81) notes that there are cases where the semantic type of the Short Answer differs from the semantic type that the antecedent question ranges over:

(i) How many students came to the party? – Only Mary / John and Mary. (Weir 2014:79)

In (i), a *how many* question is answered with a Short Answer which does not state a number, but instead lists the students that came to the party. I believe this problem is specific to Short Answers. Compare for instance (i) with the example below in (ii).

(ii) Several students attended the colloquium last Friday and only Mary Today.

Under a standard generalized quantifier-treatment of NPs, there is no type mismatch between remnants and correlates in (ii).

$$[\![\text{Mary likes John}]\!] = \{p;\ \exists x \exists y[x,y \in D_e\ \&\ p = \text{that } x \text{ likes } y]\}$$

The implicit question triggered by the first conjunct is roughly *Who likes what?*, whose QUD is as in (116a). Note that this QUD is equivalent to the focus semantic value of the gapped clause, provided in (116b), therefore deletion is licensed.

Reich stipulates that the 'answer' part in Gapping (i.e., the gapped clause) is restricted to non-initial conjuncts, but this stipulation is empirically unsupported. As we saw in §2.1 above, Gapping is possible in certain subordinate structures and may be embedded within a conjunct. We also saw, however, that not all instances of subordination and embedding lead to an acceptable result. In what follows I will argue that the crucial ingredient missing in Reich's account is general and construction-specific discourse-level constraints that exist independently of Gapping. These independent factors, together with Reich's antecedent condition on Gapping, suffice to rule out unacceptable embedding.

Recent studies such as Jasinskaja (2007), Hunter & Abrusán (2015), Onea (2016), Velleman & Beaver (2016) and Riester (2019) suggest that some discourse relations (or units of discourse characterized by these relations) can be analyzed in terms of QUDs. Viewed in this light, subordinating conjunctions, which may trigger particular discourse relations, can be seen as addressing their own QUDs rather than the main clauses' QUD. For example, *because*-clauses can be treated as an answer to a *why*-question, and *after* as an answer to a *when*-question. On the other hand, certain subordinating conjunctions, such as *while*, introduce clauses which can plausibly be understood as answering the same question addressed by their main clauses, just as coordinating conjunctions are.[25] These assumptions predict that Gapping would be possible with *while* but much less so with *because*, which is borne out as the following data shows:

[25]Hornstein (1990:206) noted that *while* receives an interpretation similar to *and*, and therefore *while*-clauses behave like a root clause. Furthermore, Knoeferle (2007) provided experimental evidence that *while* prefers the conjoined elements to be parallel in syntax and semantics, just as *and* does. It does not therefore seem implausible to assume that *while*-conjoined clauses address the QUD triggered by their main clauses.

(117) a. The first hypothesis is true **while** the other false.

b. #The first hypothesis is true **because** the other false.

In (117b) the subordinator *because* triggers the QUD *Why is the first hypothesis true?* whereas the information structure of the gapped clause reflects a different QUD, the same as that of the source clause (roughly, of the form *which hypothesis is x*?, where x is the property of being true or false). Importantly, the unacceptability of (117b) does should not be attributed to the fact that it addresses two different QUDs simultaneously.[26] Rather, it results from the difficulty of constructing a coherence discourse representation where both QUDs are at stake, i.e., where *the other (is) false* provides a reason for the result ('The first hypothesis is true') and at the same time is considered as a possible substitute for that result.

Basically the same account can be applied to the Levin-Prince data discussed in §1.1, repeated below in (118).

(118) Sue's histrionics in public have always gotten on Nan's nerves, but it's getting worse. Yesterday, when she couldn't have her daily Egg McMuffin because they were all out,

a. Sue became upset and Nan became angry.

b. #Sue became upset and Nan angry.

The conjunction *and* in (118a-b) implicates a causal relation: Sue became upset (*cause*) and therefore/as a result Nan became angry (*result*). The second conjuncts are therefore an answer to a *what-happens-as-a-result* question (cf. Velleman & Beaver 2016). In (118b), however, the information structure of the gapped conjunct indicates that a different question is currently under discussion, roughly *Which person became in what mood?* It is therefore

[26] In a natural discourse, one and the same utterance can possibly address multiple QUDs simultaneously; this is precisely why QUD is defined as a *partially* ordered stack in Ginzburg (1996) and others.

unsurprising that a causal interpretation of *and* leads to an unacceptable Gapping sentence: a causal interpretation does not cohere with the question evoked by the gapped clause.

In §2.1.2 we saw that non-factive predicates can embed a gapped clause more easily than factive predicates do. Below, I provide relevant examples (based on Weir's (2014) example in (77)):

(119) John ate oysters and

a. #I {know/deny} Mary mussels.

b. I {suspect/imagine} Mary mussels.

Factive predicates presuppose the truth of their complement (Karttunen 1974). Thus, in a factive statement (e.g., *x knows p*), it is the embedding clause rather than the complement that carries the main point of the utterance. But in a non-factive statement (e.g., *x believes p*), the embedding clause may be intended as making a secondary statement or contributing 'non-at-issue' content (in the sense of Potts 2005) while the complement contributes the main point of the utterance. Recent work such as Amaral *et al.* (2007) suggests that non-at-issue material is not related to a QUD. If we take this position, the contrast between (119a) and (119b) is expected: the factive clause in (119a) triggers the construction of a new QUD, but the non-factive clause in (119b) may or may not.[27] Likewise, the difficulty with the factive complementizer *that* is also predicted by the present account: in (120) the main clause triggers the QUD *Who will bring what?* but this isn't likely to be the QUD addressed by the second conjunct.

(120) #John will bring more dessert and I think that Mary more wine.

Furthermore, the present account extends naturally to the data from Wellstood (2015), repeated below:

[27] Alternatively, non-at-issue material may have an information structure of its own, and hence its own QUD, but such QUDs may not be intended as contributing to the main information the utterance (Simons *et al.* 2010).

(121) (My friends John and Bill asked a third friend a question, but the third friend did not hear what John and Bill said. So, the third friend asks me...)

A: What did they ask?

B: I don't know, I think John asked which book you gave to Mary, and Bill asked which magazine to Sue.

Note that the contextualizing sentence, together with the question *What did they ask?*, makes it clear that the main point of B's utterance is conveyed via the embedded clauses *which book you gave to Mary* and *which magazine to Sue*. The embedding clause *Bill asked* conveys given information, hence it is not likely to trigger the construction of a new QUD that is different from the one associated with the source clause.

In sum, my main claim has been that a previously motivated constraint on Gapping (i.e., gapped clauses must address the QUD triggered by their respective sources) and independent discourse constraints work together to restrict the distribution of Gapping. In particular, I have argued that the acceptability of embedding under a subordinating conjunction or a main clause is a function of whether and to what degree the QUD triggered by the source remains open and therefore serves as the QUD of the gapped clause.

There are two remaining distributional restrictions that are not covered by the account proposed so far:

- No implicit source: e.g., #*And Ivan, an apple*
- No backwards Gapping: e.g., #*Ivan, an apple and Jorge peeled an orange.*

To account for these restrictions, I appeal to the idea that the construction of an implicit QUD is based on limited resources (Ginzburg 1996; Roberts 1996/2012; Ginzburg 1999; Engdahl *et al.* 2000): (i) the information-structure of the utterance for which the implicit QUD has to be constructed, (ii) the information-structure of the previous utterance of the

utterance for which the implicit QUD has to be constructed (i.e., the most recent issue discussed), and (iii) conventionally associated script information (e.g., *A cappuccino, please* to a barrister) or contextual information relevant for the utterance's discourse goal (such as clarification requests).[28] Evidently, the background of a gapped clause is not known unless its source clause is present. Moreover, gapped clauses are not conventionally associated with a particular discourse frame or script. This means that (ii) is likely to be the only resource for the QUD of gapped clauses, which explains why the No implicit source and No backwards Gapping constraints are in effect.

2.4 Summary

The main contribution of this chapter is twofold. On the empirical side, this chapter provided novel data which challenges previous claims that Gapping is a primarily syntactic phenomenon restricted to coordinate structures. On the theoretical side, it was argued that all kinds of Gapping data – coordinate, subordinate and embedded – is subject to the same information-structural constraint, and that this information-structural constraint interacts with independent discourse constraints to restrict the occurrence of data beyond what is permitted by the syntax. The account proposed in this chapter makes no additional assumption than what has independently been proposed, while providing a principled account to data that has been problematic in previous accounts.

[28] Discourse markers and conjunctions provide information that is not necessarily sufficient for the construction of the QUD: e.g., the utterance *Because I woke up late* indicates that the QUD is a *why*-question, but does not indicate what this *why*-question is.

Chapter 3

Theoretical Background

This chapter introduces the theoretical assumptions the present study is based on, to prepare the reader for later chapters where a formal account of Gapping is presented. It first discusses the basic concepts and core architecture of HPSG, a grammar theory that is well-suited to model the syntax-semantics-context interface of Gapping sentences. The chapter also provides a general introduction to underspecified semantics, followed by an overview of LRS, the semantic underspecification approach adopted in this dissertation.

3.1 Head-Driven Phrase Structure Grammar

The account of Gapping put forth in this dissertation is formalized within the framework of Head-Driven Structure Grammar (HPSG).[1] Here, I briefly outline the basic concepts and core architecture of the framework that are relevant for my purposes. A more detailed discussion of current HPSG analyses of ellipsis, coordination and information structure – which play an important role in the account developed in this work – will be provided where appropriate in subsequent chapters.

[1] See Pollard & Sag (1994), Ginzburg & Sag (2000) and Boas & Sag (2012) for details.

HPSG is a constraint-based, lexicalist approach to grammar theory. It does not include movement operations; instead, a set of descriptive statements (or constraints) which hold simultaneously determine what are the admissible linguistic objects. As a lexicalist theory, it takes the view that a large portion of linguistic information is derived from lexical entries. Phrase structure in HPSG is determined by the interaction between highly articulated descriptions of lexical items and a set of general and case-based principles of grammatical well-formedness.

The basic linguistic objects that HPSG is concerned with is the *sign* (in Saussure's sense). A sign is a combination of form and meaning. In HPSG signs are modeled as typed feature structures, typically using attribute-value matrices (AVMs). All signs – lexical and phrasal – encapsulate fine-grained information about phonology (PHON(OLOGY)), syntax and semantics (SYN(TAX-)SEM(ANTICS)).[2] These different kinds of information are simultaneously present, as illustrated in the following lexical description of the verb *like* (x and y are the INDEX information relevant for linking (Koenig & Davis 2003)):

$$\begin{bmatrix} \textit{word} & & & & & & \\ \text{PHON} & \langle \text{like} \rangle & & & & & \\ \text{SYNSEM} & \begin{bmatrix} \textit{synsem} & & & & & \\ \text{LOCAL} & \begin{bmatrix} \textit{local} & & & & \\ \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{verb} & & \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \langle \boxed{1}\text{NP}_x \rangle \\ \text{COMPS} & \langle \boxed{2}\text{NP}_y \rangle \end{bmatrix} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \textit{like-rel} & \\ \text{LIKER} & x \\ \text{LIKED} & y \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{1}, \boxed{2} \rangle & & & & & \end{bmatrix}$$

Figure 3.1: Partial description of the word *like*

[2]Since the present work is not concerned with phonological details, orthographic representations are used instead of phonological representations.

As seen in Figure 3.1, the attribute SYNSEM takes a *synsem* object as its value, which consists of a set of attributes including LOCAL. The attribute LOCAL encodes appropriateness constraints on a sign's syntactic category (CAT(EGORY)) as well as semantic content (CONT(ENT)); these are information that is shared between a trace and the filler in an unbounded dependency.[3] The attribute VAL(ENCE) specifies which of a sign's syntactic/semantic arguments is yet to combine in its syntactic projection. For instance, Figure 3.1 has nonempty specifications for the VAL features SUBJ(ECT) and COMP(LEMENT), which means that the verb *like* has the potential to combine with a subject and a complement. The attribute ARG(UMENT)-ST(RUCTURE) encodes argument structure information. In Figure 3.1, ARG-ST contains two elements, which are *structure-shared* with the subject and complement valents as indicated by the tags (1 and 2).[4] All this information is derived, rather than stipulated, by courtesy of (lexical) types, type inheritance, and relevant grammar principles (e.g., Argument Realization Principle; see, for example, Ginzburg & Sag 2000:23). A grammar in HPSG is nothing more than a system of constraints which jointly define the signs of a given language.

In HPSG, the notion sign comprises not only lexical descriptions such as the one in Figure 3.1 but also phrase-structure rules (or *constructions*). Phrasal signs are additionally specified for the attribute DAUGHTERS (DTRS) and are divided into two subtypes, *headed-phrase* and *non-headed-phrase*. These ontological assumptions are expressed in the type hierarchy of *sign*, shown in Figure 3.2. Note that each subtype in Figure 3.2 inherits all constraints (in terms of attributes and their values) of its supertypes.

[3] CONTEXT is another feature under LOCAL, and it encodes appropriateness constraints on the use of linguistic expressions (Green 1996).

[4] Structure-sharing means that the value of two features is the same.

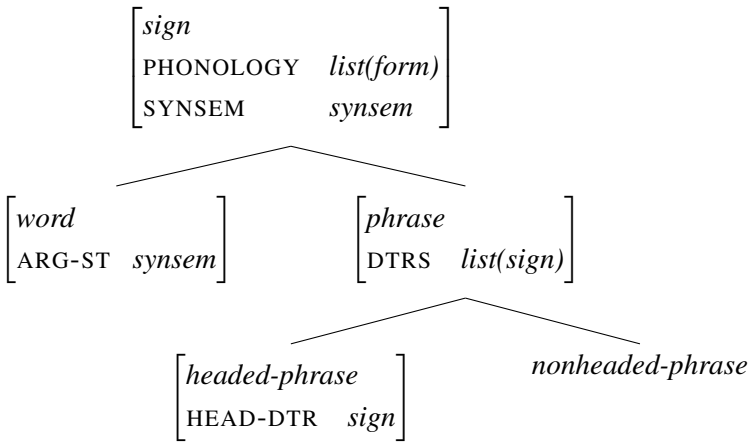


Figure 3.2: The sign type hierarchy and its features

The attribute DTRS encodes the phrase-structure representation of the (immediate) constituents of a sign as a proper part of that sign. It thus plays roughly the same role as what branches do in conventional tree representations. In addition to DTRS, all headed phrasal signs are also specified for the attribute HEAD-DAUGHTER (HD-DTR), which singles out the head daughter. The head daughter is what determines the combinatorial properties of the sign.

As an illustration, an example description for the sentence *John likes Leslie* is provided in AVM in Figure 3.4 (see next page) along with the tree notation in Figure 3.3.

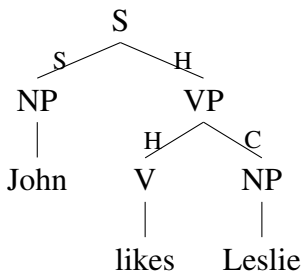


Figure 3.3: A tree structure for *John likes Leslie*

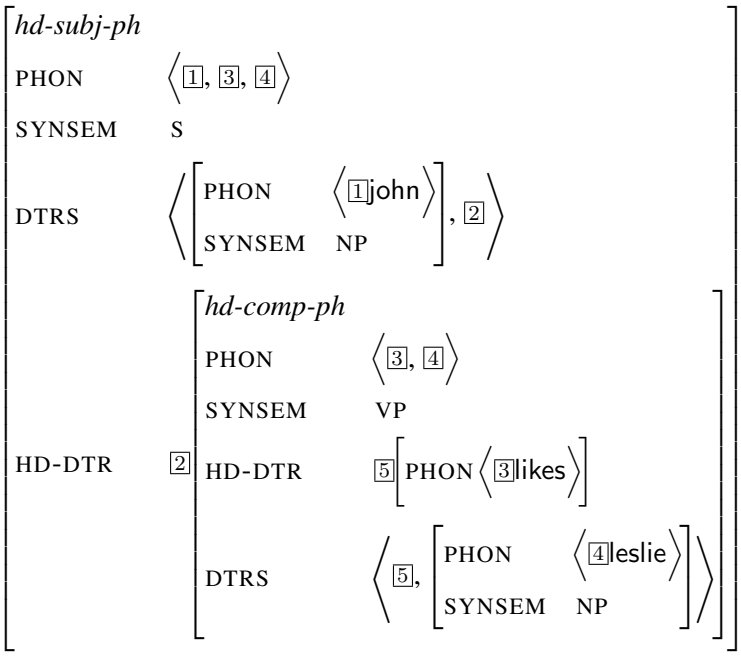


Figure 3.4: Partial description for *John likes Leslie*

Figure 3.4 expresses the fact that the sentence *John likes Leslie* consists of two daughters, the NP *John* and the VP head *likes Leslie* (tagged 2); the latter in turn consists of two daughters, the V head (tagged 5) and the NP *Leslie*. Note that the linear order of elements in each DTRS list is identical to the surface order of the constituents.

As is reflected in Figure 3.4, HPSG assumes phrasal types, such as *head-subject-phrase* (*hd-subj-ph*) and *head-complement-phrase* (*hd-comp-ph*). Phrasal types in HPSG are organized according to the type hierarchy of *phrase*. A fragment of the type hierarchy under *phrase* is shown in Figure 3.5 for illustration (see next page). Type hierarchies are widely used in HPSG; these make it possible to express relevant linguistic generalizations (in terms of constraints on maximal or intermediate phrasal types).

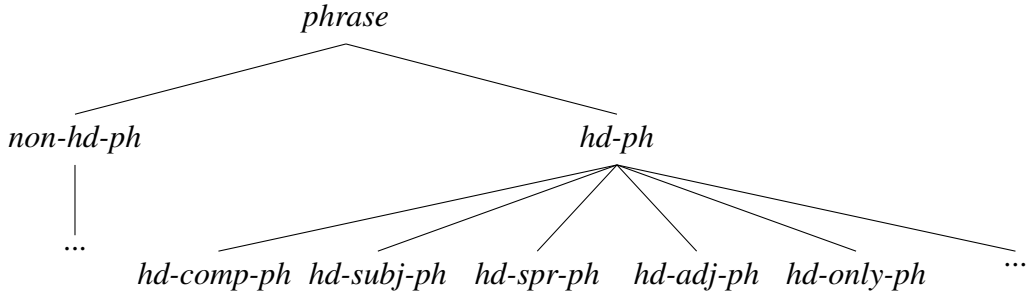


Figure 3.5: A partial type hierarchy for *phrase*

Unlike transformational approaches, HPSG does not need to postulate phonologically null 'empty' elements in the analysis of ellipsis, as phrasal signs can directly introduce semantic material additional to what is contributed by the daughters (see Ginzburg & Sag 2000, Sag & Nykiel 2011, among others).[5] The account of Gapping developed in this dissertation makes use of this analytical tool. In addition, the monostratal nature of HPSG makes it easy to express and examine the effect of simultaneous constraints on syntax, semantics as well as discourse-pragmatics, all of which are crucial for any adequate account of Gapping.

3.2 Semantic underspecification

In this subsection I briefly discuss some basic concepts of the semantic approach adopted in this dissertation: semantic underspecification. One of the central issues in natural language semantics is dealing with ambiguities in meaning. One major source of semantic ambiguity comes from scope-bearing elements such as quantifiers, modals and negation. Consider for example the widely cited sentence in (122) from Poesio (1994).

[5]Certain varieties of peripheral ellipsis (such as Right Node Raising) have been analyzed in HPSG in terms of unpronounced syntactic structure; see Yatabe (2003), Beavers & Sag (2004), Chaves (2005) and Chaves (2014), among others. For an overview of ellipsis in HPSG, see Ginzburg & Miller (2018).

(122) A politician can fool most voters on most issues most of the time, but no politician can fool all voters on every single issue all of the time.

Each conjunct in this sentence contains five scopal elements, which interact to generate 5!*5! = 14400 permutations.[6] This is usually taken to mean that 14400 fully specified semantic representations have to be built and considered in the grammar. The question is whether this is the *only* analytical choice available to us. Research in natural language processing over the past few decades has suggested that the answer is no: it has emphasized the need to include *partially specified representations* as a crucial ingredient of an efficient and cognitively plausible theory of semantic interpretation (Tunstall 1998; Sanford & Sturt 2002; Anderson 2004; Filik *et al.* 2004; Dwivedi *et al.* 2008).

Semantic underspecification approaches have emerged as a technique for the treatment of ambiguity, in particular ambiguity of semantic scope (Alshawi 1992; Reyle 1993; Bos 1995; Egg *et al.* 2001; Richter & Sailer 2004; Copestake *et al.* 2005, among others).[7]

The essential idea is to deliberately omit differences among several different readings and thereby provide a single representation which subsumes those different readings. For illustration, let us consider the sentence in (123). Under one reading, this sentence means that each boy chased a possibly different girl; this is the case where the universal quantifier outscopes the existential ($\forall > \exists$). But the sentence can also mean that there is a particular girl which all boys chased; in this case, the existential outscopes the universal quantifier ($\exists > \forall$). These readings are usually represented by two different formulas, such as (123a-b).

(123) Every boy chased read a girl.

a. $\forall x[\mathsf{boy}'(x) \rightarrow \exists y[\mathsf{girl}'(y) \wedge \mathsf{chase}'(x,y)]]$

[6] Not all permutations correspond to actual readings, however. As Hobbs & Shieber (1987) pointed out, some permutations result in ill-formed or contradictory logical expressions; moreover, two distinct permutations may correspond to semantically equivalent readings (see also Chaves (2003) for discussion).

[7] See Bunt (2007) and Egg (2011) for an overview.

b. $\exists y[\mathsf{girl}'(y) \wedge \forall x[\mathsf{boy}'(x) \rightarrow \mathsf{chase}'(x,y)]]$

Note that (123a) and (123b) contain exactly the same three sub-formulas, which coincide with the semantic contribution of the verb and its two quantifier arguments; what differs between the two formulas is the permutations of the quantifiers involved. Compare this with the underspecified representation of (123), provided below, where the ordering between the quantifiers is left unspecified:

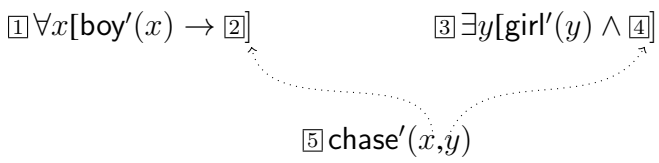


Figure 3.6: Underspecified representation of (123)

The dotted arrows here indicate *subformula constraints*: $\boxed{\phi} \dashrightarrow \boxed{\psi}$ means that $\boxed{\phi}$ is a (proper) part of $\boxed{\psi}$; boxed integers are used to identify formulas as well as slots (or *holes*) that can be filled with formulas. Thus, the description in Figure 3.6 amounts to saying that, no matter how the scope of the quantifiers is determined, the semantics of the verb (represented by $\boxed{5}$) must be included in the scope of both quantifiers ($\boxed{2}$ and $\boxed{4}$). There are two different ways this requirement (as well as all other 'constraints' stated in Figure 3.6) can be satisfied: (i) $\boxed{3}$ is identical to $\boxed{2}$ and $\boxed{5}$ is identical to $\boxed{4}$; (ii) $\boxed{1}$ is identical to $\boxed{4}$ and $\boxed{5}$ is identical to $\boxed{2}$. Each of these possibilities correspond to (123a) and (123b), respectively.

(123) fulfills what Egg (2011) calls *semantic* and *syntactic homogeneity* conditions for prototypical semantic underspecification. That is, the readings in (123a) and (123b) comprise the same semantic pieces and are amenable to a single syntactic analysis. As Egg notes, semantic underspecification has also proved useful in capturing two readings which consist of the same semantic pieces but differ in that one reading contains more than one

instance of a specific piece. He provides examples from Antecedent-Contained Deletion (Sag 1976) and Afrikaans past tense (Sailer 2004b) for illustration:

(124) John wanted to greet everyone that Bill did. (Sag 1976)

a. = John wanted to greet everyone Bill greeted.

b. = John wanted to greet everyone that Bill wanted to greet.

(125) Jan wou gebel het.
Jan want.PAST called have

'Jan wanted to call/Jan wants to call/Jan wanted to have called' (Sailer 2004b)

In (124) the two readings in (a) and (b) differ in that there is one instance of the semantic contribution of *want* in (a) but two instances in (b). In (125) the inflected verb *wou* as well as the auxiliary *het* introduces a past tense meaning but either one or two instances of the past tense meaning appear in the interpretation. See Egg *et al.* (2001) and Sailer (2004b), for instance, for underspecified accounts of these phenomena.

There are several advantages of using semantic underspecification for a theory of ellipsis. First, it provides us a means to distinguish between information made available by (overt) syntactic constituents vs. information that is *yet to be determined*, ultimately on the basis of discourse-pragmatic context. Accordingly, a grammar with underspecified semantics can be (sufficiently) restrictive, as it can confine itself to describing exactly the information that is contributed by the syntax of an utterance, while leaving to discourse-pragmatics a complete specification of semantic information (Schlangen 2003). Another reason to adopt semantic underspecification comes from the interaction between ellipsis and scope. Ellipsis is known to be a potential source of scope ambiguity (Shieber *et al.* 1996; Egg *et al.* 2001): since the way elided meaning is recovered may affect how scopal relations are determined, a treatment of ellipsis in terms of semantic underspecification is attractive. My account of Gapping proposed in this work takes advantage of these benefits

by incorporating semantic underspecification into its semantic analysis.

Finally, although the account of Gapping presented in this work does not hinge on any particular semantic underspecification formalism, for expository purposes I will adopt Lexical Resource Semantics (LRS) (Richter & Sailer 2004; Richter & Kallmeyer 2009a; Iordăchioaia & Richter 2015). The next section lays out the basic ideas of LRS.

3.3 Lexical Resource Semantics

LRS is a constraint-based theory of the syntax-semantics interface which combines techniques of semantic underspecification (Reyle 1993, Bos 1995, Pinkal 1996, Egg *et al.* 2001, Copestake *et al.* 2005, among others) with the HPSG approach to grammar as descriptions of structures (Pollard & Sag 1994; Ginzburg & Sag 2000; Boas & Sag 2012). The following introduction is primarily based on Richter & Sailer (2004), but it also incorporates discussions and developments from Sailer (2004a), Richter & Kallmeyer (2009a) and Iordăchioaia & Richter (2015).

In LRS, the logical form of sentences is an expression of a standard semantic representation language called Ty2 (Gallin 1975, Zimmermann 1989). Zimmermann (1989) provides two types for the variant of Ty2 presented in this section: e for individual entities and s for possible worlds. Since my analysis of Gapping does not consider intensional contexts, I will assume two kinds of entities: individuals (e) and events (v); type t is assigned to truth-values. Expressions in Ty2 provide the usual logical operations, functional application, lambda abstraction and quantifiers. In LRS, Ty2 expressions are defined as objects of the sort *meaningful expression* (*me*).

Ty2 expressions can be encoded using familiar HPSG feature structure descriptions, as illustrated below in Figure 3.7 (Richter & Sailer 2004:(3)): the feature TYPE specifies the type of the abstracted variable and the type of the output of the function; the feature

VAR corresponds to the abstracted variable and its type; ARG corresponds to the nucleus of the formula ($\mathsf{student}'_{\mathsf{et}}(x_{\mathsf{e}})$).

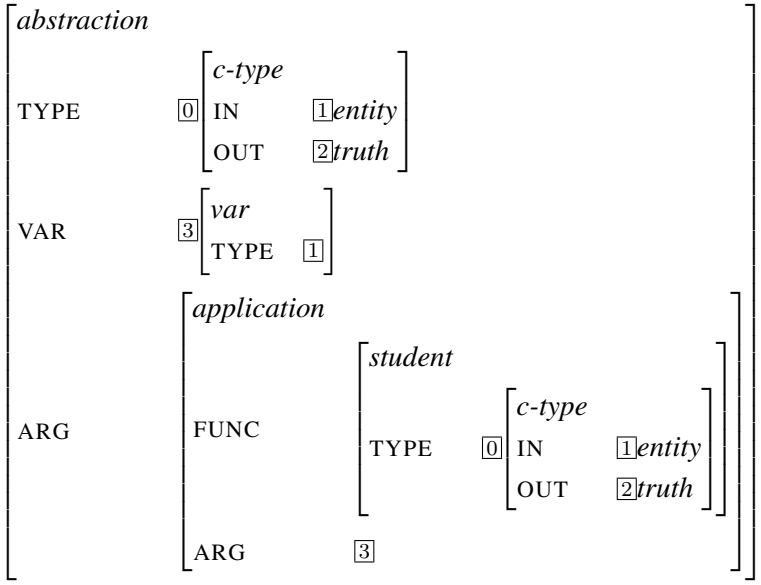


Figure 3.7: An HPSG encoding of the term $\lambda x_{\mathrm{e}}.\mathsf{student}'_{\mathrm{et}}(x_{\mathrm{e}})$

For the purposes of exposition, in this work I will omit the AVM descriptions of the logical expressions, and write the expressions themselves inside AVMs (Richter & Sailer 2004).

Like many other semantic underspecification theories, LRS assumes *discontinuous representations*. What this means is that the semantic contribution of a sign is not a single content formula, but rather a collection of subformulas which may be discontinuously distributed over the logical form of syntactic units in which the sign is realized. A simple exposition of this idea was sketched in Figure 3.6 above, where the semantic contributions of the lexical items *boy*, *girl* and *chase* are represented as discontinuous meaning fragments. How these subformulas fit together to form a well-formed formula is constrained by their semantic types, as well as general and case-based principles which restrict for each phrase how the semantic contributions of the daughters may combine. To simplify, the dotted arrows in Figure 3.6 are licensed by the restrictions triggered by the phrase-structure

rule for the combination of a quantified NP and the head. Since any combination that is not ruled out by such restrictions is allowed, more than one well-formed logical form may be appropriate for a single syntactic structure.[8]

A grammar with LRS distinguishes between local (lexical) and nonlocal (combinatorial, truth-condi-tional) semantics. Local semantics concerns lexical properties and the relation between a head and its dependents such as selectional restrictions and semantic role assignments. Nonlocal semantics, on the other hand, concerns structural properties that go beyond head-dependent relations such as the scope of semantic operators. This distinction between local and nonlocal semantics parallels the distinction in syntax between local phenomena (e.g., category selection and case assignment) and nonlocal phenomena (e.g., extraction). To accommodate the local-nonlocal distinction in semantics, the feature CONT(ENT) is reserved for the local semantic representation, and the new feature LOGICAL FORM (LF) is introduced to encode the nonlocal semantic representation. Accordingly, the appropriate conditions for the type *sign* are now as specified in the following figure (Sailer 2004a:203):

$$\begin{bmatrix} \textit{sign} & \\ \text{PHON} & \text{phonological structure} \\ \text{SYNSEM} & \begin{bmatrix} \text{LOCAL} & \begin{bmatrix} \text{CAT} & \text{local syntactic structure} \\ \text{CONT} & \textbf{local semantic structure} \end{bmatrix} \end{bmatrix} \\ \text{LF} & \textbf{logical expressions associated with the sign} \\ \text{DTRS} & \text{constituent structure} \end{bmatrix}$$

Figure 3.8: Appropriateness conditions for the sort *sign*

Starting with the local semantic component, the feature CONT takes as its value ob-

[8] While most work on LRS introduces the assumption that only lexical items contribute to the logical form of the utterance (i.e., they provide all the *semantic resources* of the utterance), the notion of phrasal signs (or constructions) is not incompatible with the framework. See, for instance, Richter & Sailer (2009b) for "phrasal lexical entries", which license phrasal units that contribute semantic resources.

jects of the sort *content*, whose appropriateness conditions are specified in Figure 3.9.

$$\begin{bmatrix} \textit{content} & \\ \text{INDEX} & \textit{extended-index} \\ \text{MAIN} & \textit{me} \end{bmatrix}$$

Figure 3.9: Appropriateness conditions for the sort *content*

Thus, all *content* objects are specified for the features INDEX and MAIN. The value of the feature MAIN of a sign is the main semantic constant contributed by that sign, and it is defined as an object of type *me*. The value of the feature INDEX is of the sort *extended-index*, which is defined in Figure 3.10.

$$\begin{bmatrix} \textit{extended-index} & \\ \text{PHI} & \textit{index} \\ \text{VAR} & \textit{me} \end{bmatrix}$$

Figure 3.10: Appropriateness conditions for the sort *extended-index*

The sort *extended-index* has two features, PHI and VAR. The values of PHI are indices of sort *index*, which is specified for three agreement features, PERSON, NUMBER and GENDER (Pollard & Sag 1994). The values of the feature VAR are Ty2 expressions, and they correspond roughly to the referential semantic argument of the value of MAIN. For example, the VAR value of a verb is typically an event variable, and the VAR value of a quantified NP is the variable bound by the quantifier.[9]

Let us now turn to the nonlocal semantics, which is encoded within the feature LF. LF takes as its value objects of the sort *lrs*, which contain the features EXCONT, INCONT, and PARTS:

[9]Unlike in Pollard & Sag (1994), the feature INDEX is defined for all parts of speech, including verbs. Sailer (2004a) mentions that it is unclear whether phi-features are needed for verbs and suggests that a new subsort of *index*, called *no-phi*, can be introduced as the PHI value of verbs.

$$\begin{bmatrix} \textit{lrs} & \\ \text{EXCONT} & \textit{me} \\ \text{INCONT} & \textit{me} \\ \text{PARTS} & \textit{list(me)} \end{bmatrix}$$

Figure 3.11: Appropriateness conditions for the sort *lrs*

The value of the feature PARTS of a sign is a list of all the subexpressions contributed by that sign. The subexpressions of a sign can be conceived of as the semantic pieces that are part of the logical form of that sign which are combined according to the syntax of the logical representation language. The subexpressions collected in the PARTS list together constitute the value of the feature EX(TERNAL)-CONT(ENT), i.e., the overall logical form associated with a sign. The feature IN(TERNAL)-CONT(ENT) specifies the scopally lowest part of the logical form associated with the sign. As we shall see, these features play an important role in scope underspecification.

To illustrate the local and nonlocal semantics, Figures 3.12-3.14 describe the lexical entries of a quantifying determiner, a noun, and a lexical verb.

$$\begin{bmatrix} \textit{word} & \\ \text{PHON} & \langle \text{every} \rangle \\ \text{SS} \mid \text{LOC} & \begin{bmatrix} \text{CAT} & \textit{determiner} \\ \text{CONT} & \begin{bmatrix} \text{INDEX} & \begin{bmatrix} \text{PHI} & \begin{bmatrix} \text{PER} & \textit{3rd} \\ \text{NUM} & \textit{sg} \end{bmatrix} \\ \text{VAR} & x \end{bmatrix} \\ \text{MAIN} & \boxed{3a}\forall \end{bmatrix} \end{bmatrix} \\ \text{LF} & \begin{bmatrix} \text{EXCONT} & \textit{me} \\ \text{INCONT} & \boxed{3}\forall x[\alpha \rightarrow \beta] \\ \text{PARTS} & \left\langle x, \boxed{3a}, \alpha \rightarrow \beta, \boxed{3} \right\rangle \end{bmatrix} \end{bmatrix}$$

Figure 3.12: The lexical entry of *every*

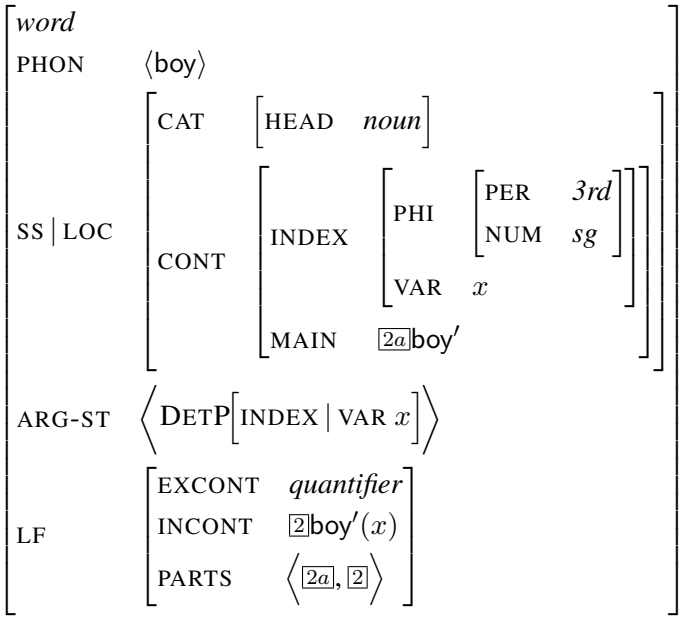


Figure 3.13: The lexical entry of *boy*

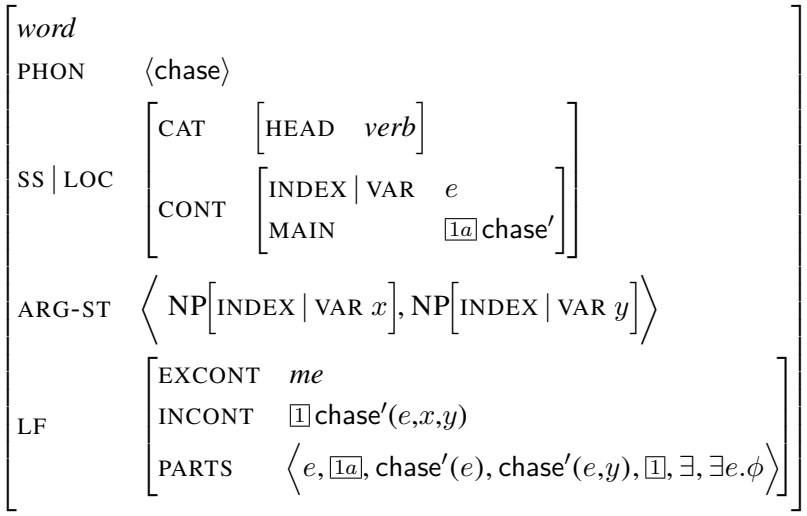


Figure 3.14: The lexical entry of *chase*

In the lexical entry of the determiner *every* (shown in Figure 3.12), the value of the LOC(AL) feature specifies that the main semantic contribution of that determiner is a universal quantifier, which binds the variable x. The INCONT value (under the LF feature) does not uniquely

identify an expression of Ty2 but only indicates parts of the expression that is being described. The expression starts with the universal quantifier $\forall$, and the variable x which has scope over an implication. The restrictor and scope are not described further and are represented using Greek letters.[10] The PARTS list contains the variable (x), the quantifier ($\boxed{3}\forall$), the implication ($\alpha\rightarrow\beta$) and the quantified formula ($\boxed{3a}\forall[\alpha\rightarrow\beta]$).

The lexical entry of the noun *boy* in Figure 3.13 illustrates how the local and nonlocal semantics are interconnected. The value of the LOCAL feature specifies that the lexical meaning of the noun is boy' (the MAIN value) and that its variable (x) comes from the determiner the noun selects (notated as DETP[INDEX|VAR x]) via the ARG-ST feature: as shown in Figure 3.12, this variable originates from the PARTS value of the determiner. To confirm the fact that the variable x does not come from the lexical contribution of the noun, we can inspect the noun's PARTS value: it contains two objects, the constant boy' (indicated by tag $\boxed{2}$) and the application of boy' to an argument ($\boxed{2a}$), but not the variable x. The EXCONT feature indicates nothing more than that there will be some generalized quantifier in the phrase in which the noun occurs. By this specification, it is determined that the noun's maximal projection denotes a quantifier, but at this point it is not known which quantifier it is.

The lexical entry of *chase* (shown in Figure 3.14) indicates that the main lexical meaning of the verb is chase' and that its INCONT value is the application of the predicate chase' to its arguments: these include the eventuality argument e and the variables or constants contributed by the valents selected by the verbs (notated as x and y), which appear in the verb's ARG-ST list. Note that x and y do not appear in the PARTS list of the verb, which indicates that these are not the semantic contribution of the verb. The verb instead contributes the eventuality variable e and the application expressions $\mathsf{chase}'(e)$, $\mathsf{chase}'(e,y)$

[10] The Greek letters are tags that describe expressions of the semantic representation language. Variables (x in Figure 3.12) are also tags: these sometimes appear inside boxes (e.g., $\boxed{x}$) to indicate their character as tags.

and $\mathsf{chase}'(e,x,y)$. The existential quantifier $\exists$ and the existential quantifier over the eventuality variable $\exists e.\phi$ are also contributed by the verb. The event quantifier is assumed to have the narrowest possible scope (Sailer 2004a:205, fn. 7).

The nonlocal semantics of phrasal expressions are governed by the following general principles: the INCONT PRINCIPLE, the EXCONT PRINCIPLE and the LRS PROJECTION PRINCIPLE. The INCONT PRINCIPLE and the EXCONT PRINCIPLE define admissible values of the INCONT and the EXCONT features in syntactic structures ($\lhd$ encodes the relation '*is a subexpression of*'):

(126) THE INCONT PRINCIPLE (Richter & Kallmeyer 2009a:47):

In each *lrs*, the INCONT value is an element of the PARTS list and a component of the EXCONT value.

$$\textit{lrs} \rightarrow \left(\begin{bmatrix} \text{EXCONT} & \boxed{1} \\ \text{INCONT} & \boxed{2} \\ \text{PARTS} & \boxed{3} \end{bmatrix} \wedge \mathtt{member}(\boxed{2},\boxed{3}) \wedge \boxed{2} \lhd \boxed{1} \right)$$

(127) THE EXCONT PRINCIPLE (Richter & Kallmeyer 2009a:47):

1. In every phrase, the EXCONT value of the non-head daughter is an element of the non-head daughter's PARTS list.

$$\textit{phrase} \rightarrow \left(\text{NH-DTR} \mid \text{LF} \begin{bmatrix} \text{EXCONT} & \boxed{1} \\ \text{PARTS} & \boxed{2} \end{bmatrix} \wedge \mathtt{member}(\boxed{1},\boxed{2}) \right)$$

2. 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.

$$\textit{u-sign} \rightarrow \forall\boxed{1}\forall\boxed{2}\forall\boxed{3}\forall\boxed{4} \left(\left(\left[\text{LF} \begin{bmatrix} \text{EXCONT} & \boxed{1} \\ \text{PARTS} & \boxed{2} \end{bmatrix} \right] \wedge \boxed{3} \lhd \boxed{1} \wedge \mathtt{member}(\boxed{4},\boxed{2}) \right) \rightarrow \left(\mathtt{member}(\boxed{3},\boxed{2}) \wedge \boxed{4} \lhd \boxed{1} \right) \right)$$

The INCONT PRINCIPLE requires two things. First, the INCONT value of a sign (i.e., its scopally lowest meaning contribution) must appear in the PARTS list of the sign; that is, the INCONT value of a sign should be a meaning contribution of the sign itself. Second, the INCONT value of a sign must be a subexpression of the sign's EXCONT value. Because the EXCONT value must be identical along syntactic head projections (see (128) below), it is ensured that the scopally lowest meaning contribution of a head is included within the maximal projection of the head.

The EXCONT PRINCIPLE has two clauses, which refer to two kinds of maximal projections. The first clause (Clause 1) is specific to (sub-utterance) phrases, and it requires that the EXCONT of a non-head daughter originate from within that non-head daughter. Note that non-headed signs are maximal projections, i.e., projections whose semantic (as well as syntactic) possibilities have all been exhausted. Clause 1 of the PROJECTION PRINCIPLE ensures this by requiring that the overall logical form of a non-head daughter be a semantic contribution of its own. The second clause (Clause 2) is a closure principle for utterances; it says that the external content of an utterance comprises all and only those subexpressions which are contributed by lexical elements in the utterance.

In a phrase, the mother's nonlocal semantics (expressed via the LF feature) inherits properties of the nonlocal semantics of the daughters. The LRS PROJECTION PRINCIPLE defines what are admissible values of the mother's EXCONT, INCONT and PARTS values given those of the phrase's syntactic daughters:

(128) PROJECTION PRINCIPLE (Richter & Kallmeyer 2009a:47-8): In each phrase,

1. the EXCONT values of the head and the mother are identical,

$$\textit{phrase} \rightarrow \begin{bmatrix} \text{LF} \mid \text{EXCONT} & \boxed{1} \\ \text{HD-DTR} \mid \text{LF} \mid \text{EXCONT} & \boxed{1} \end{bmatrix}$$

2. the INCONT values of the head and the mother are identical,

$$\textit{phrase} \rightarrow \begin{bmatrix} \text{LF} \mid \text{INCONT} & \boxed{1} \\ \text{HD-DTR} \mid \text{LF} \mid \text{INCONT} & \boxed{1} \end{bmatrix}$$

3. the PARTS value of the mother contains all and only the elements of the PARTS values of the daughters.

$$\textit{phrase} \rightarrow \left(\begin{bmatrix} \text{LF} \mid \text{PARTS} & \boxed{1} \\ \text{HD-DTR} \mid \text{LF} \mid \text{PARTS} & \boxed{2} \\ \text{NH-DTR} \mid \text{LF} \mid \text{PARTS} & \boxed{3} \end{bmatrix} \wedge \texttt{append}(\boxed{2},\boxed{3},\boxed{1}) \right)$$

The first and second clauses of the LRS PROJECTION PRINCIPLE require that the EXCONT and INCONT values be identical along syntactic head projections. The third clause concerns the specification of PARTS, and it says that the semantic contributions of all daughters (i.e., the PARTS lists of the daughters) must be collected in the PARTS list of the mother. In general, the semantic contribution of phrases must be made based exclusively and exhaustively on the semantic contributions of their daughters; phrases only trigger restrictions on how the semantics of the daughters are put together. However, cases such as idioms and headless phrases, due to their idiosyncratic syntactic and semantic properties, are exceptions to this generalization and are thus exempted from ordinary semantic combinatorics.[11]

In addition to the general principles introduced so far, LRS assumes a set of case-based constraints collected in the SEMANTICS PRINCIPLES. These constraints define the relationship between the EXCONT and the INCONT values of the head and non-head daughters in a particular syntactic structure:

(129) SEMANTICS PRINCIPLE:

In each headed-phrase,

1. if the nonhead is a quantifier then its INCONT value is of the form $Qx[\rho \circ \nu]$, the INCONT value of the head is a component of ρ, and the INCONT value of the non-head daughter is identical to the EXCONT value of the head daughter,

[11] For detailed accounts of idioms, see Richter & Sailer 2009b, for example.

$$[\text{NH-DTR SS LOC CAT HEAD } \textit{det}] \rightarrow$$

$$\left(\left[\begin{array}{l}\text{HD-DTR LF}\left[\begin{array}{l}\text{EXCONT } \boxed{1}\\ \text{INCONT } \boxed{2}\end{array}\right]\\ \text{NH-DTR LF } \boxed{1}\left[\text{INCONT}\left[\begin{array}{l}\textit{quantifier}\\ \text{SCOPE}\left[\begin{array}{l}\textit{l-const}\\ \text{ARG 1 } \boxed{3}\end{array}\right]\end{array}\right]\right]\end{array}\right] \wedge \boxed{2} \lhd \boxed{3}\right)$$

2. if the nonhead is a quantified NP with an EXCONT value of the form $Qx[\rho \circ \nu]$, then the INCONT value of the head is a component of ν,

$$\forall \boxed{1}\left(\left[\text{NH-DTR}\left[\begin{array}{l}\text{SS LOC CAT}\left[\begin{array}{l}\text{HEAD } \textit{noun}\\ \text{SUBCAT } \langle\rangle\end{array}\right]\\ \text{LF EXCONT}\left[\begin{array}{l}\textit{quantifier}\\ \text{ARG2 } \boxed{1}\end{array}\right]\end{array}\right]\right] \rightarrow \exists \boxed{2}\left(\begin{array}{l}\left[\text{H-DTR LF INCONT } \boxed{2}\right]\\ \wedge\ \boxed{2} \lhd \boxed{1}\end{array}\right)\right)$$

3. ...

The first clause of the SEMANTICS PRINCIPLE governs the combination of a quantifying determiner and a nominal head, and requires two things: first, the scopally lowest semantic contribution of the head (i.e., the head's INCONT value) must be included in the restrictor of the quantifier; second, the non-head daughter's INCONT value must be identical to the EXCONT value of the head daughter. This latter requirement ensures that the quantifier meaning ($Qx[\rho \circ \nu]$) determines the overall logical form of the projection of the nominal head. The second clause of the SEMANTICS PRINCIPLE specifies how a quantified NP and its head can be combined. It requires that the INCONT value of the head be a component of the scope of the quantifier. For example, if the head is a verb, the scopally lowest meaning contributed by this verb is part of the scope of the quantified NP.

We are now ready to consider how these principles work together to derive the semantic representation of a scopally ambiguous sentence (130a), whose two readings are

provided in (130b-c). The underspecified representation for this sentence is shown in Figure 3.15 below.

(130) a. Every boy chased a girl.

b. $\forall x[\mathsf{boy}'(x) \rightarrow \exists y \exists e[\mathsf{girl}'(y) \wedge \mathsf{chase}'(e,x,y)]]$

c. $\exists y[\mathsf{girl}'(y) \wedge \forall x \exists e[\mathsf{boy}'(x) \rightarrow \mathsf{chase}'(e,x,y)]]$

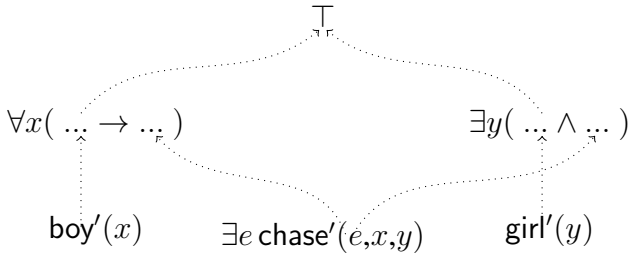


Figure 3.15: Underspecified representation of (130a)

A syntactic analysis of this sentence, along with LRS, is provided in Figure 3.16 (see next page). In this figure, each node of the tree specifies the LF values, and the scope restrictions imposed by the SEMANTICS PRINCIPLE are added to the relevant nodes ($\phi \lhd \psi$ means ϕ is a component of ψ). The LF values of the lexical nodes are as in Figures 3.12-3.14 above, and the LF values of *some* and *girl* are analogous to those of *every* and *boy*. At each mother node, the value of PARTS is collected from the PARTS values of the daughters (per Clause 3 of the PROJECTION PRINCIPLE).

As an effect of Clause 1 of the SEMANTICS PRINCIPLE (129), the INCONT values of the determiners are identical to the EXCONT values of the nominal heads, and the INCONT values of the nominal heads fall within the restrictor of the universal and existential quantifiers contributed by the determiners ($\boxed{2} \lhd \alpha$ and $\boxed{1} \lhd \delta$). The EXCONT values of the determiners are identical to their INCONT values, and this results from the interaction between Clause 1 of the EXCONT PRINCIPLE (127) and the INCONT PRINCIPLE (126). For

example, Clause 1 of the EXCONT PRINCIPLE requires that the EXCONT value of *every* be some element within its PARTS list. Due to the INCONT PRINCIPLE, that element also has to include the INCONT value as its component. Since the INCONT value ($\forall x[\alpha \rightarrow \beta]$) includes all other elements in the PARTS list, it follows that this INCONT value is also the value of EXCONT. Following the LRS PROJECTION PRINCIPLE, the EXCONT and INCONT values of the nominal heads are identified with those of their mothers.

Each projection of the verb inherits the EXCONT and INCONT values of the verbal head, by courtesy of the PROJECTION PRINCIPLE. At each verb projection, Clause 2 of the SEMANTICS PRINCIPLE imposes restrictions on the interpretation of the INCONT value: it must be within the nuclear scope of the universal and existential quantifiers contributed by the determiners ($\boxed{1} \lhd \beta$ and $\boxed{1} \lhd \delta$). At the S node, Clause 2 of the EXCONT PRINCIPLE applies. Thus, the elements in the PARTS list must specify exactly all the subexpressions of the resulting logical form, i.e., the EXCONT value $\boxed{6}$. There are exactly two possible logical forms for $\boxed{6}$ that satisfy this requirement: (i) $\forall x[(...\mathsf{boy}'(x)...) \rightarrow (...\exists e\, \mathsf{chase}'(e,x,y)...)]$ and (ii) $\exists y[(...\mathsf{girl}'(y)...) \wedge (...\exists e\, \mathsf{chase}'(e,x,y)...)]$. By adding the other subexpressions from the PARTS we obtain two results which are exactly the readings in (130a) and (130b) above.

In this section I have introduced some basic assumptions of LRS. LRS assumes a division between local and nonlocal semantics: local semantics deals with lexical properties of heads and how they relate to their dependents, and nonlocal semantics deals with compositional semantics. The nonlocal semantics of phrases are governed by a set of general and case-specific principles. It was shown how these principles work together to constrain the readings of a scopally ambiguous sentence.

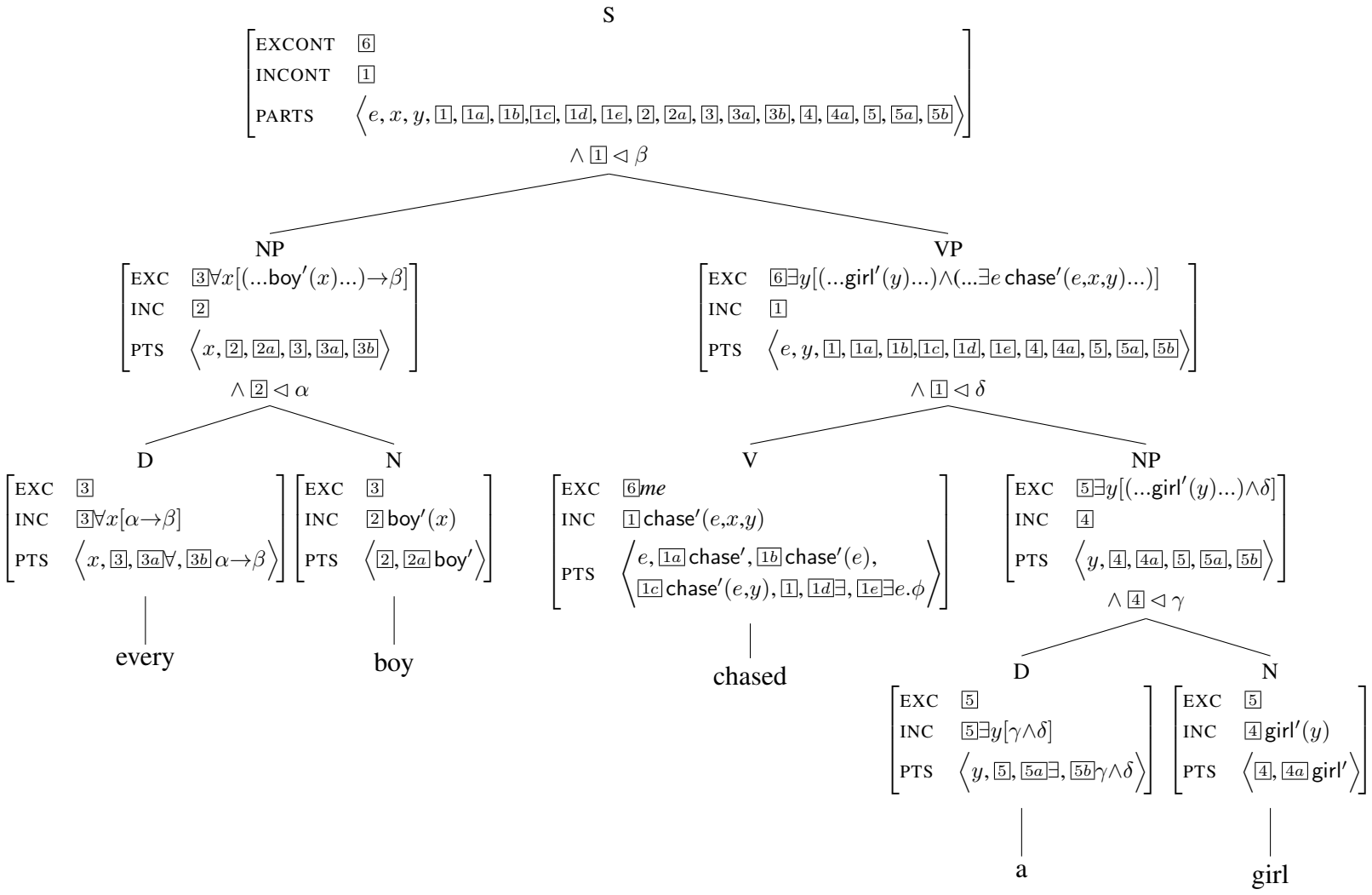


Figure 3.16: LRS analysis of the sentence *Every boy chased a girl*

Chapter 4

Gapped Clauses as Fragments

This chapter focuses on the characterization of the syntax and semantics of gapped clauses. Their basic aspects are discussed, and a novel analysis is proposed which unifies prior constructivist analyses of fragments (Ginzburg & Sag 2000; Abeillé *et al.* 2014) and an underspecification-based approach to semantics (LRS, Richter & Sailer 2004). It is shown that the widely endorsed reductionist hypothesis – i.e., that gapped clauses involve a full, sentential syntax – entails unnecessary complications in the syntax. Moreover, those syntactic phenomena which have been claimed to support the reductionist hypothesis are shown to follow from a general mechanism for ellipsis constructions and fragments that does not rely on the notion of underlying sentential syntax.

This chapter proposes to capture the syntactic and semantic properties of gapped clauses by introducing a new construction rule (i.e., a phrase-structure type) into the grammar. This rule assigns a flat, non-headed syntactic structure to gapped clauses and ensures that their semantics is constructed in an appropriate way. This novel constructivist analysis avoids undesirable syntactic complications that previous reductionist analyses posit, and provides an explicit semantic analysis that has been lacking in previous constructivist accounts (Culicover & Jackendoff 2005; Abeillé *et al.* 2014).

4.1 Introduction

This chapter examines the syntax and semantics of gapped clauses. Gapping – and ellipsis constructions in general – have posed a difficult challenge to theories of the syntax-semantics interface because these have a complete, propositional meaning despite the absence of form. For Gapping, two major approaches have emerged in the literature to deal with this apparent mismatch between form and meaning:

- The Reductionist Approach: Gapped clauses are generated as full sentential structures and later undergo a reduction process which produces the surface form (Ross 1970; Hankamer 1973; Sag 1976; Jayaseelan 1990; Hartmann 2000; Chaves 2005; Coppock 2001; Johnson 2009; Repp 2009; Toosarvandani 2013; Boone 2014; Frazier 2015; Potter *et al.* 2017).
- The Constructivist Approach: Gapped clauses involve no more syntactic structure than what surfaces (Stump 1978; Sag *et al.* 1985; Culicover & Jackendoff 2005; Abeillé *et al.* 2014).

Between these approaches, the reductionist approach has generally been considered as a simpler approach since the usual rules of the syntax and semantics are sufficient to account for the complete meaning of gapped clauses (however, see §4.2 for some of the problems for reductionist accounts). The constructivist approach, on the other hand, is seen as more cumbersome because it has to rely on a construction-specific syntax/semantics rule to account for the form and meaning of gapped clauses. In this chapter I will not attempt to settle the debate as to which approach is simpler; rather, my main goal is to fill in the gap in prior research by providing a more complete constructivist account than has previously been available.

As of today, there is no constructivist analysis available which captures all the essen-

tial syntactic and semantic properties of gapped clauses. Previous analyses by Culicover & Jackendoff (2005) and Abeillé *et al.* (2014) do not provide details as to how the complete content of gapped clauses results. Besides these studies, however, little attempt has been made recently to investigate gapped clauses from a constructivist view. On the other hand, there has been a more lively discussion about fragments within the constructivist literature which may shed light on the nature of gapped clauses (Ginzburg 1996 et seq., Ginzburg & Sag 2000, Schlangen 2003, Ginzburg & Cooper 2004, Fernández 2006, Stainton 2006 among others), but this line of research is restricted mainly to unary fragment utterances whose analysis does not immediately extend to gapped clauses.

In this chapter, I develop a novel account of gapped clauses which builds on and improves upon prior constructivist analyses of Gapping and fragments. I adopt Ginzburg & Sag's (2000) theory of discourse and fragments as my general approach, as it is equipped to deal with the context-dependent nature of the syntax and semantics of gapped clauses. My analysis also incorporates some insights from Abeillé *et al.*'s (2014) analysis, which overcomes some limitations of Ginzburg & Sag's. In my account, the grammar of gapped clauses boils down to a single constructional rule, coupled with underspecified semantics. In particular, the construction rule I propose assigns a flat syntactic structure to gapped clauses and requires that their content be built on the basis of the semantic contribution of the remnants as well as the content retrieved from the QUD. These semantic contents are allowed to combine in various ways, provided that the resulting semantic form satisfies a matching constraint.

This chapter is structured as follows. In §4.2 I point out that, contrary to widespread assumption, reductionist accounts of gapped clauses necessarily require complications in the syntax that do not arise in constructivist accounts. In §4.3 I introduce some background literature which serves as a foundation on which my analysis of gapped clauses is based. Section §4.4 contains my account of gapped clauses. Finally, section §4.5 summarizes and

concludes the chapter.

4.2 Problems for Reductionist Accounts

Scholars pursuing the reductionist approach argue that there is unpronounced syntactic structure in the position of the gap. More precisely, on a reductionist account, gapped clauses have the same syntactic structure as their ungapped counterpart at some stage of derivation and later undergo a reduction process (i.e., deletion or movement). Since gapped clauses are associated with the usual rules for ordinary sentential constituents, their complete, proposition-like meaning is explained. But, as we shall see, this apparent advantage on the semantics side comes with complications in the syntax.

In this section I discuss some of the problems with the reduction processes previously claimed to derive the surface representations of Gapping sentences. In doing so, I focus on two specific kinds of proposals:

- Deletion-based accounts:
  Ross (1970), Sag (1976), Hankamer (1979), Jayaseelan (1990), Coppock (2001), Lin (2002), Toosarvandani (2013), Chaves (2005), Frazier (2015), Potter *et al.* (2017)
- Movement-based accounts:
  Johnson (2004, 2009, 2014)

4.2.1 Problems with deletion-based accounts

Hartmann (2000) proposed a simple deletion analysis in which gapped clauses are derived as the result of phonological deletion only. However, this analysis cannot deal with non-constituent Gapping – i.e., cases where the supposed target of deletion does not form a

constituent:[1]

(131) Max writes poetry in the bathroom, and Schwarz ~~writes~~ radical pamphlets ~~in the bathroom~~. (Jackendoff 1972:24, ex. (18b))

The existence of non-constituent Gapping presents a problem to *all* varieties of reductionist analysis because the phenomenon is not consistent with the usual way that deletion and movement operations are taken to operate: these operations can apply only once in a given syntactic domain. To avoid this problem, virtually all extant reductionist analyses postulate an additional derivational step: a preparatory reordering movement of the remnants. This movement is then generalized to all instances of Gapping.

Jayaseelan (1990) and Toosarvandani (2013) posit two distinct movement operations for gapping remnants: left-adjunction of the first remnant and right-adjunction of the second remnant. In what follows I will limit my discussion to Jayaseelan's analysis, but essentially the same critique applies to Toosarvandani's. To see some details of Jayaseelan's analysis, let us consider an example analysis, provided in (132), for the gapped clause in (131).

(132) *Jayaseelan's left- and right-adjunction analysis*:

[$_{\text{IP}}$ Schwarz$_x$ [$_{\text{IP}}$ [$_{\text{IP}}$ ~~t_x writes t_y in the bathroom~~] [radical pamphlets]$_y$]]

As can be seen in (132), Jayaseelan assumes that remnants are generated as elements within the IP. The second remnant undergoes rightward movement to adjoin to the IP, and the first remnant then moves leftward to also adjoin to the IP. Deletion then applies to the lowest IP and produces the surface form.

Jayaseelan contends that the putative rightward movement of the second remnant is an instance of an A-bar movement known as Heavy NP Shift (HNPS, hereafter). However,

[1]Ellipsis operations are assumed to affect only constituents (and only once) in the transformational literature.

there are reasons to be suspicious about this hypothesis. First, Jayaseelan (1990:66) assumes that HNPS obligatorily pied-pipes a preposition when the complement of the preposition is moved. He provides the following example as supporting evidence (Jayaseelan 1990:66, ex. (7a-c)):

(133) a. John counted [on a total stranger] for support.
b. John counted for support [on a total stranger].
c. *John counted on for support [a total stranger].

This assumption, if correct, leads us to the expectation that, if the second remnants in Gapping undergo HNPS, they would not be able to occur as the complement of a preposition. According to Jayaseelan this prediction is borne out by the following data (p. 74, ex. (32b-c); his judgment):

(134) a. *John depends on his wife and Bill his secretary.
b. John depends on his wife, and Bill on his secretary.

However, this line of reasoning is unsuccessful because there are perfectly acceptable instances of Gapping which do not satisfy the aforementioned pied-piping requirement. The following example from Steedman (1990:248) shows that gapping remnants need not pied-pipe:

(135) a. A: Which city did each man go to?
B: Harry went to London and Barry Detroit.
b. The syntactic representation of *Barry Detroit*, according to Jayaseelan:
$[_{\text{IP}}\ \text{Barry}_x\ [_{\text{IP}}\ [_{\text{IP}}\ \sout{t_x\ \text{went to}\ t_y}]\ [\text{Detroit}]_y]]$

Another argument that HNPS is unlikely to be responsible for the putative rightward movement of second remnants comes from differences with regards to iterability. As has been known due to Stowell (1981) and others, HNPS is generally unable to target multiple

constituents within the same VP. This is illustrated by the contrast between examples such as (136a) and (136b):

(136) a. It proved [his guilt] to the jury [that John was seen with the murder weapon].
b. *It proved to the jury [his guilt] [that John was seen with the murder weapon].
(Stowell 1981:161)

One would therefore predict that a felicitous instance of Gapping cannot contain more than one remnant which has supposedly been affected by HNPS. As pointed out by Kubota & Levine (2016), however, this prediction is contradicted by data such as (137), where three remnants have moved out of the VP according to Jayaseelan's account.

(137) a. I bet ten dollars with Robin that the game will go into overtime, and you, thirty euros with Terry that the final score would be a tie, and we both won.
b. The syntactic representation of the gapped clause in (137a):
[$_{\text{IP}}$ you$_x$ [$_{\text{IP}}$[$_{\text{IP}}$[$_{\text{IP}}$ [$_{\text{IP}}$ ~~t_x~~ [$_{\text{VP}}$ ~~bet t_y t_z t_w~~]] [thirty euros]$_y$] [with Terry]$_z$] [that the final score would be a tie]$_w$]]
(Kubota & Levine 2016:119, ex. (21))

One might attempt to rebut this argument by assuming that only one remnant in (137b) undergoes HNPS and others are associated with a different movement operation. But as far as one can see nowhere in Jayaseelan's account is such a possibility discussed. Thus, Jayaseelan fails to provide compelling evidence that HNPS is involved in the derivation of Gapping sentences. However, without the nature of putative rightward remnant movement explained, Jayaseelan's analysis cannot be considered as successful in providing a principled account.

Some reductionist accounts, such as Coppock (2001), Boone (2014) and Potter *et al.* (2017), assume that all remnants in Gapping move leftward to escape out of the ellipsis

site. Here again, I will limit my discussion to Potter *et al.* (2017) but my arguments apply to other analyses in this group. Potter *et al.* hypothesize that remnants in Gapping undergo the kind of movement typically associated with information structurally prominent elements such as Topic and Focus (Rizzi 1997). Ellipsis then applies to those structures below the landing sites of the remnant movement. Below, I repeat the examples in (97) above to provide some details of Potter *et al.*'s analysis.

(138) a. Gapping in CP coordination (distributive-scope reading):
[$_{\text{CP}}$ John can't eat caviar] and [$_{\text{CP-TopP}}$ Sue$_x$ [$_{\text{CP-FocP}}$ beans$_y$ [$_{\text{TP}}$ ~~t_x can't eat t_y~~]]]]

b. Gapping in vP coordination (wide-scope reading):
John$_j$ [$_{\text{T}}$ can't [$_{v\text{P}}$ [$_{v\text{P}}$ t_j eat caviar] and [$_{v\text{P-FocP}}$ Sue$_x$ [$_{v\text{P-FocP}}$ beans$_y$ [$_{\overline{v\text{P}}}$ ~~t_x eat t_y~~]]]]]

One immediate prediction of this analysis is that those restrictions which are related to focus/topic movement would carry over to Gapping data. This prediction is not borne out, however. As is well-known, focus/topic movement is highly restricted in languages such as English in that it usually affects only a single constituent in the sentence (Lasnik & Saito 1992).[2] Although judgments are subtle, the examples in (139) illustrate this point.

(139) a. *John$_j$ [this book]$_k$ t_j likes t_k. (Lasnik & Saito 1992:96)

b. *Bill$_j$ [to Mary]$_k$ t_j has never introduced John t_k.

c. *Which book did John give to Mary and [which magazine]$_j$ [to Leslie]$_k$ did John give t_j t_k?

With this background, consider the examples in (140), where the gapped clauses have basically the same structure as their counterparts in (139) in Potter *et al.*'s analysis.

(140) a. James likes this magazine and Robin$_j$ [that novel]$_k$ ~~t_j likes t_k~~.

[2]However, see Rochemont & Culicover (1990) and Culicover (1991), for exceptions.

b. Bill has never introduced John to Mary and Peter$_j$ [to Sue]$_j k$ ~~t_j has never introduced John t_k~~.

c. Which book did John give to Mary and [which magazine]$_j$ [to Leslie]$_k$ ~~did John give t_j t_k~~?

The difference in acceptability between data in (139) and (140) is unexpected if one and the same movement is involved in both cases, as Potter *et al.* argue. For further evidence against the assumption that remnant movement in Gapping is driven by focus/topic movement, see example (137), repeated below in (141), which involve *four* instances of focus/topic movement, according to Potter *et al.*'s analysis:

(141) I bet ten dollars with Robin that the game will go into overtime, and [you], [thirty euros] [with Terry] [that the final score would be a tie], and we both won.

Again, the purported remnant movement in (141) is not supported independently: **You thirty euros with Terry that the final scope would be a tie, bet*.

Furthermore, it is unclear what prevents the supposed Topic/Focus movement from applying also to the source clauses:

(142) *Harry London went and Barry Detroit ~~went to~~.

Given that gapped clauses and their source clauses are information structurally parallel (Culicover & Jackendoff 2005; Reich 2007), these is no reason to believe that these clauses would behave differently with respect to topic/focus movement.

The forgoing discussion by no means covers all possible ways of implementing a deletion-based analysis for Gapping, but it casts doubt on the reductionist claim that the usual rules of syntax and a general mechanism for ellipsis suffice to restrict Gapping data: in many cases the supposed reordering movement operations produce ungrammatical results if Gapping does not also occur. One possible way to overcome this problem would

be to assume that ellipsis ameliorates illicit movement (cf. Merchant 2001). But a simpler explanation, which does not require any stipulation at all, would be that the remnants do not move at all.

4.2.2 Problems with Johnson's movement-based analysis

In a series of work, Johnson (1996, 2000, 2009) laid out an analysis in which Gapping sentences are derived by across-the-board (ATB) movement. Consider the example analysis of (143) in Figure 4.1:

(143) Kim likes apples and Sue pears.

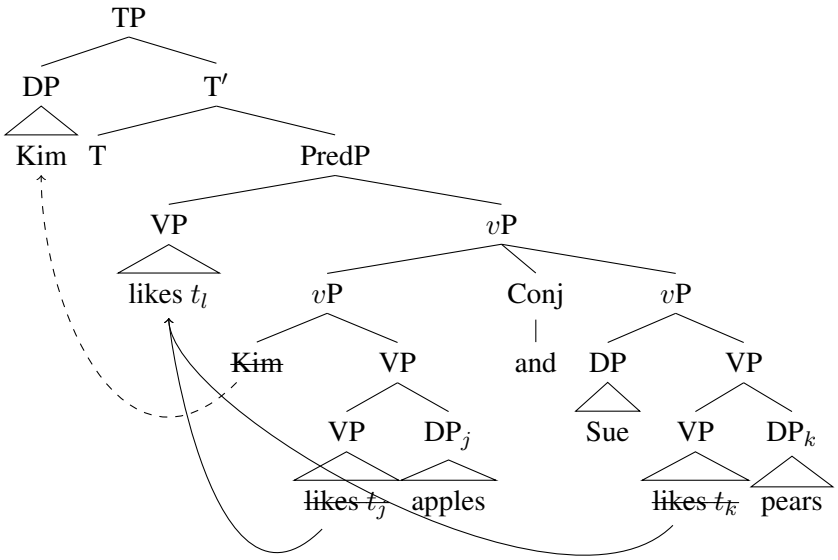


Figure 4.1: A syntactic tree for (143)

In this analysis, the remnants and their correlates are generated within the conjoined vP (see §2.2.1 for details about this particular assumption). The derivation then proceeds as follows: first, the second remnant as well as its correlate in the source undergoes HNPS to

adjoin to one's own hosting VP; next, the lower VP in each conjunct (which contains material to be gapped) moves in an ATB fashion to a position immediately above vP (roughly, PredP). As a corollary of the ATB movement and small vP coordination, the subject in the first conjunct has to move so as to yield the correct surface order. This is done by non-ATB movement of the first subject to Spec, TP (indicated by the dashed arrow in (143b)).[3]

This analysis suffers from exactly the same problems as Jayaseelan's since it relies on the problematic HNPS to derive the evacuation movement of remnants. But there are also additional problems that are specific to the ATB movement hypothesis. First, the mechanism behind Gapping need not affect every conjunct in coordinate structure, which implicates that it cannot be an ATB rule:

(144) a. I ate fish, Bill salad, and Harry just drank a soda.

b. Leslie came with Chris, Sandy with Jimmy, and the others were alone.

Moreover, as Toosarvandani (2013) and Kubota & Levine (2016) discuss in detail, ATB movement has difficulties in producing licit surface order in the source clause. The problem occurs precisely in cases where there is additional material than a finite verb to be moved out of both clauses.

(145) a. John should put ice cream on the table, and Mary cake.

b. Max has handed in his final on Tuesday, or Liz her term paper.

(Toosarvandani 2013:fn. 10, (ii)-(iii))

To illustrate, let us consider a step-by-step derivation for (145a), which begins with the following structure:

(146) [$_{\text{TP}}$ should [$_{\text{PredP}}$ [$_{v\text{P}}$ [$_{v\text{P}}$ John [$_{\text{VP}}$ put ice cream on the table]] and [$_{v\text{P}}$ Mary [$_{\text{VP}}$ put cake on the table]]]]]

[3] It is unclear what guarantees the proper indexing of the traces and their binders in (143b). For example, the highest VP here contains a trace t_l, which must be bound by both DP$_j$ and DP$_k$. This means that the index l must be the sum of j and k, but nothing in Johnson's analysis guarantees this indexing.

Next, we apply HNPS to the second remnant and its correlate:

(147) [$_{TP}$ should [$_{PredP}$ [$_{vP}$ [$_{vP}$ John [$_{VP}$ [$_{VP}$ put _ on the table] **ice cream**]] and [$_{vP}$ Mary [$_{VP}$ put _ on the table] **cake**]]]]

Then we move the lower VP out from each conjunct in an ATB-manner:

(148) [$_{TP}$ should [$_{PredP}$ [$_{VP}$ **put _ on the table**] [$_{vP}$ [$_{vP}$ John [$_{VP}$ _ ice cream]] and [$_{vP}$ Mary _ cake]]]]

Finally, non-ATB movement applies to the first subject, producing the following result:

(149) [$_{TP}$ **John** should [$_{PredP}$ [$_{VP}$ put _ on the table] [$_{vP}$ [$_{vP}$ _ [$_{VP}$ _ ice cream]] and [$_{vP}$ Mary _ cake]]]]

Clearly, the result is not consistent with the surface order in (145a).

Thus, Johnson's ATB movement analysis not only fails to provide compelling evidence for the supposed HNPS of the second remnants, but it also suffers from linearization problems which are fundamental to the ATB hypothesis.

4.2.3 Lack of locality effects

Proponents of the reductionist approach to Gapping (and ellipsis in general) from time to time have relied on data that purports to show the effect of island violations. Examples in (150) are from Neijt 1979:132-8 (see also Hankamer (1971), Jayaseelan (1990), Johnson (2004) and others for examples and discussion):

(150) a. *John must be a fool to have married Jane, and Bill ~~must be a fool to have married~~ Martha. (Adjunct Condition)

b. *Charles lost a picture of his mother, and Peter ~~lost a picture~~ of his father. (Complex NP Constraint)

c. *John wondered what to cook today and Peter ~~wondered what to cook~~ tomorrow. (Wh-Island Constraint)

d. *Stories about Frankenstein terrified John, and ~~stories~~ about Dracula ~~terrified~~ Peter. (Subject Condition)

The argument usually goes as follows: if remnants show effects of island constraints, that means there is structure in the ellipsis site from which the remnants originated.

However, it is suspicious that examples such as (150a-c) is best explained in this way. As Culicover & Jackendoff (2005:274–5), Abeillé *et al.* (2014), Kubota & Levine (2016) and others have noted, the distribution of gapping remnants does not always fit the profile of island effects, as seen by the following examples:

(151) a. Robin believes that everyone pays attention to you when you speak French, and Leslie, German. (Adjunct Condition)

b. Robin knows a lot of reasons why dogs are good pets and Leslie, cats. (Complex NP Constraint)

c. One lab assistant needs informants who speak Japanese, and the other German. (Complex NP Constraint)

d. I don't think we need worry about John harassing us. Threats directed at me would offend his wife, and at you, everyone else! (Subject Condition)

e. [Wife of a couple discussing who decides what to cook for which meal:] Ok, how about this: I get to decide what to cook for lunch, and you, for dinner. (Wh-Island Constraint)

((a-b) are due to Culicover & Jackendoff (2005:273); (c)-(e) are due to Kubota & Levine (2016:120-1))

Given this data, proponents of the reductionist approach have two choices: they must either give up the argument from island effects all together, or they are forced to take the burden

of proving that in the case of acceptable violations, there is no violation of island constraint at all. The first choice would lead to a weakening of reductionist theories; the second is not desirable because one needs to treat differently what is essentially the same phenomena.

Besides island constraints, so-called 'clause-mate condition' has also been invoked in the reductionist literature (Neijt 1979; Boone 2014).[4] Applied to Gapping, this condition requires that the two remnants in a Gapping sentence originate from the same clause – i.e., they must be underlyingly clause-mates. According to Boone, the ungrammaticality of (152a) results as a violation of this condition; note that the relevant structure is indicated in (152).

(152) a. *John claims that Mary will invite Bill and Peter Martin.

b. ... Peter ~~claims that Mary will invite~~ Martin. (Boone 2014:31, ex. (13); his judgment)

However, Boone's argument is flawed since it is based on a faulty empirical generalization. Acceptable instances of 'cross-clausal' Gapping have been noted at least since Pesetsky (1982):

(153) a. This doctor said I should eat tuna fish and that doctor salmon.

b. ... that doctor ~~said I should eat~~ salmon

(154) a. Robin believes that everyone pays attention to you when you speak French and Leslie German.

b. ... Leslie ~~believes that everyone pays attention to you when you speak~~ German

((153a) and (154a) are due to Pesetsky (1982:645) and Culicover & Jackendoff (2005:273), respectively)

[4]The idea that some syntactic relations cannot cross a clause boundary has a wide currency in the generative literature (see Lasnik (2002) for an overview).

Thus, neither island data nor cross-clausal gapping adequately support the reductionist approach to gapping.

To summarize this section, the reductionist assumption that gapped clauses are underlyingly full sentential constituents has to be supplemented with reordering movement of the remnants to produce the correct surface form. Several proposals have been made to clarify the nature of such reordering movement, but they are not without a problem. It seems therefore fair to conclude that a complete reductionist analysis which clarifies the necessary details has yet to be proposed. My goal in the remainder of this chapter is to provide an alternative, constructivist account for gapped clauses that do not suffer from the aforementioned problems of reductionist analyses, while at the same time achieving a comparable empirical coverage.

4.3 General Approach

In §2.3, I argued that the distributional properties of gapped clauses is best characterized in terms of QUD: that is, a gapped clause is licensed at the point in the discourse where the QUD triggered (and answered) by the source clause is raised again. But what exactly is the role of the QUD? Following Ginzburg & Sag (2000) and others, I hypothesize that QUDs provide an information repository from which missing material is retrieved. Following Ginzburg & Sag, I also assume that semantic as well as syntactic information of an utterance may persist in subsequent discourse.

As an initial step towards developing these ideas into a constructivist account of the syntax/semantics of gapped clauses, this section provides an overview of the constructivist approach to ellipsis developed by Jonathan Ginzburg and others. §4.3.1 outlines the theory of discourse organization called KOS, and §4.3.2 introduces an implementation of this theory in HPSG (Ginzburg & Sag 2000). §4.3.3 discusses how Ginzburg & Sag's approach

can be extended to deal with so-called syntactic parallelism effects.

4.3.1 KOS: A theory of discourse

KOS is a theory of discourse representation developed in a series of papers by Ginzburg and his colleagues (Ginzburg 1996, 1999; Ginzburg & Cooper 2004, among others). In KOS, the state of the dialogue at a given point is a collection of the individual information states of the dialogue participants. After a conversation move is made, each dialogue participant updates one's own *dialogue-gameboard* (DGB), a publicly accessible information repository relativized to each dialogue participant (Hamblin's (1970) individual commitment state). The DGB is represented as a data structure that includes the following features:

- QUD: 'questions under discussion', i.e., a set of currently discussable questions
- FACTS: a set of facts corresponding to the information accepted by dialogue participants
- LATEST-MOVE: content of the latest moved made

Questions in a QUD set is partially ordered, and the question which takes precedence over all other questions and so requires an immediate resolution is distinguished as the maximal question. A question q in QUD determines what can next be uttered and coherently integrated into the current state of the dialogue: the follow-up utterance after q must be 'about' q, by either (partially) answering it or raising a new question q' that 'depends' on q. To simplify, 'about' amounts to (partial) answerhood and 'depend' is a relation between questions which corresponds to 'is a subquestion of' (Ginzburg 1995a,b).

At any point of conversation, a dialogue participant may choose to introduce an issue that has not yet been raised. An utterance introducing a new issue is coherent at a given point in a conversation if a question relevant at that point of conversation can be constructed and taken up by dialogue participants. A question is downdated from QUD if

sufficient information that can resolve that question has been accumulated in the FACTS. The following example is taken from Ginzburg & Cooper (2004:326) for an illustration:

(155) A1 : Who's coming tomorrow?
B2 : Several colleagues of mine.
A3 : I see.
B4 : Mike is coming too.

A's initial utterance (A1) causes an update in her QUD with the queried question q_1, $\lambda x.$*come-tomorrow*(x). B updates his QUD with q_1, and then asserts a proposition p_1 that provides information about q_1 (B2). The assertion of p_1 also raises the issue $?p_1$ (i.e., *whether several colleagues of B is coming tomorrow*), which causes the addition of $?p_1$ to A's QUD. At this stage there are two questions in A's QUD – q_1 and $?p_1$ – with $?p_1$ being the maximal question ($q_1 \prec ?p_1$; $\prec$ means 'take conversational precedence'). As indicated by utterance A3, A accepts p_1 and therefore updates her FACTS with p_1, which results in the removal of $?p_1$ from A's QUD. q_1 becomes maximal in QUD again and allows for providing more information about q_1, as B does (B4).

4.3.2 Fragments in Ginzburg & Sag (2000)

In Ginzburg & Sag (2000), KOS is integrated into the CONTEXT component (Green 1996) of HPSG feature structures. Since Ginzburg & Sag focus on the treatment of fragments, two particular features play an important role: MAX-QUD, whose value is an object of sort *question*, and SALIENT UTTERANCE (SAL-UTT), whose value is a set of elements of type *local*. MAX-QUD is the maximal question among questions in QUD; values of SAL-UTT are the focal sub-utterances or parallel elements in the source which correspond to the remnants in fragment utterances.

Some background remarks are in order before discussing Ginzburg & Sag's analysis

of fragments in some more detail. In Ginzburg & Sag, questions (namely, objects of sort *question*) are modeled as propositional abstracts, for which the following two features are appropriate: PARAM(ETER)S, whose values correspond roughly to λ-abstracted variables, and PROP(OSITION), the proposition that is abstracted over. Following Barwise & Perry (1981), propositions are modeled as a structured object which consists of a SIT(UATION) and a state-of affair (SOA). SOA in turn contains a list of quantifiers (QUANTS) and scope (or nucleus, NUCL). As an illustration, Figure 4.2 presents the content of the unary question in (156).

(156) Who left?

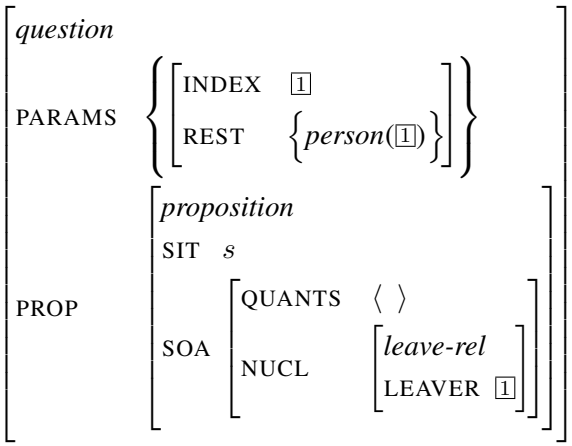


Figure 4.2: The semantic contribution of *Who left?*

This AVM has a singleton PARAMS set and an open proposition, and expresses that, ignoring tense, some person left and who that person is is currently under discussion.

Ginzburg & Sag deal with several different kinds of fragments, such as fragment answers, sluices, and polar answers (*yes*/*no*). These different kinds of fragments are analyzed by means of dedicated construction schemas. For example, fragment answers such as (157B) are accounted for by assuming a unary construction schema called *headed-*

fragment-phrase (*hd-frag-ph*), which 'raises' a nominal remnant directly to a fully saturated finite verbal projection.

(157) A: Who left?
B: John.

Ginzburg & Sag assume a type hierarchy of phrases which cross-classifies phrasal signs according to two dimensions, *Clausality* and *Headedness* (see Figure 4.3; Ginzburg & Sag 2000:333). Fragment answers are associated with the type *declarative-fragment-clause* (*decl-frag-cl*), which inherits the specifications from *hd-frag-ph* (in the Headedness dimension) and *declarative-clause* (in the Clausality dimension) as well as from their supertypes. Figure 4.4 shows the full specification (or grammatical constraints) of the type *decl-frag-cl*.

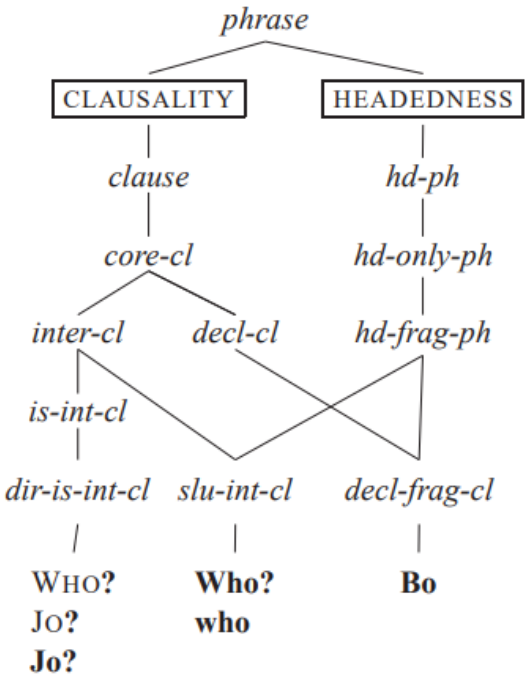


Figure 4.3: Multiple Inheritance Hierarchy

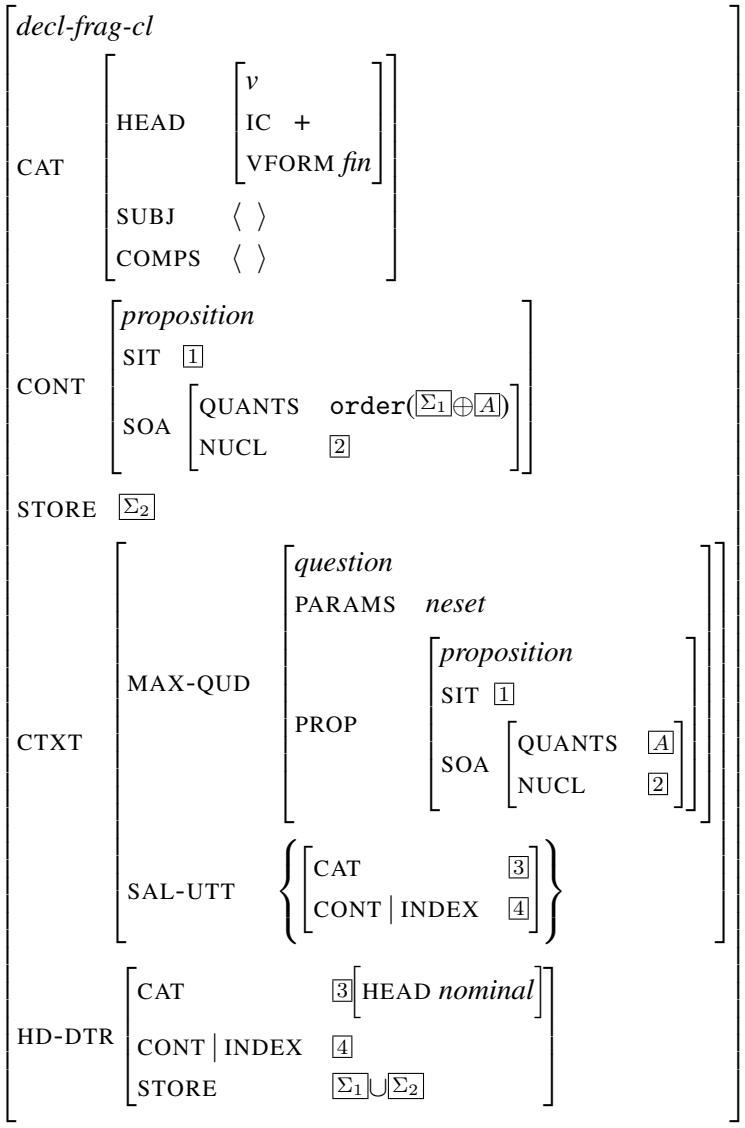


Figure 4.4: Declarative-fragment-clause

This construction says that a nominal sign (the remnant daughter) may directly form an independent finite clause (as indicated by [IC +] and [VFORM *fin*]). The content of the mother is built based on the propositional content contributed by the contextual question (specified in MAX-QUD|PROP) as well as the quantificational semantic contribution of the remnant daughter.[5] The contextual question also makes available a salient utterance, i.e.,

[5]The feature STORE temporarily stores away quantified elements so that scope considerations are detached

the sub-utterance corresponding to the *wh*-phrase. Note that the CAT and INDEX values of the salient utterance are required to be identical to those of the remnant daughter. This identity constraint ensures that the remnant bears a resemblance to the salient utterance with respect to category and case specifications (see more discussion in §4.3.3).[6] With these constraints in place, the fragment answer in (157B) can be analyzed as follows:

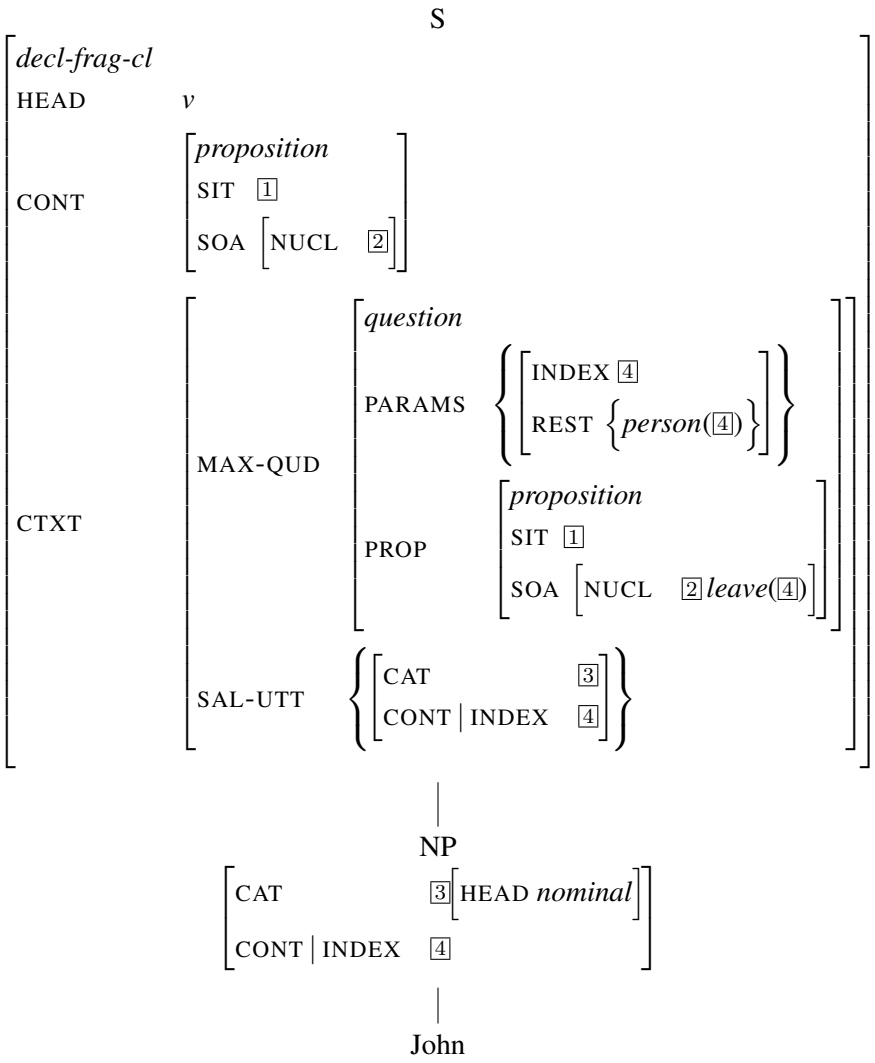


Figure 4.5: *John (left)*

from syntactic issues; the stored quantifiers are retrieved at the sentence level to generate scoped representations. This technique is due to Cooper (1983).

[6]Features that express information about category and case are subsorts of CAT and INDEX, respectively.

Other fragment types such as sluices and polar answers are dealt with by introducing additional unary constructions. In sum, the hallmarks of Ginzburg & Sag's analysis are: (i) a direct enrichment of a fragment's meaning with a contextual meaning (MAX-QUD) and (ii) a surface mechanism ensuring syntactic congruence between (sub-utterances of) the source and the fragment (SAL-UTT). Due to (i) and (ii) it is possible to account for the form and meaning of fragment utterances without postulating the reconstruction of the syntax of a putative underlying structure, which is often unsupported empirically (see §4.2).[7]

One obvious limitation of Ginzburg & Sag's analysis is that it does not straightforwardly extend to fragments that consist of more than one remnant daughters. In fact, there are several issues that arise if one were to extend Ginzburg & Sag's analysis to deal with gapped clauses. A first issue is concerned with the treatment of fragment clauses as a headed structure. Note that this treatment is already problematic for unary fragment answers because the remnant daughter does not behave as the head: the mother has the properties of a clause, which is determined by the construction rule rather than by the remnant daughter. Furthermore, such headed analysis is untenable for gapped clauses since neither remnant behaves as the head.

A second aspect of Ginzburg & Sag's analysis that is not compatible with gapped clauses is the finiteness requirement (i.e., [VFORM *fin*]. As Culicover & Jackendoff (2005) and Abeillé *et al.* (2014) pointed out, gapped clauses can be introduced by a constituent negation (158a) and connectives such as *as well as* and *not to mention* (158b), which are unable to combine with a finite clause (examples are from Abeillé *et al.* 2014:ex. (21)):

(158) a. Bill invited Jane and **not** Jane (*invited) Bill.

b. Bill wanted to meet Jane **as well as/not to mention** Jane (*wanted to invite)

[7]The strategy in (i) has been employed widely in non-derivational approaches to ellipsis. For example, Van Valin (2005) and Shimojo (2008), in a Role and Reference Grammar set-up, show how the semantic representation of sentences that include missing material can be linked directly with a discourse representation structure, bypassing the syntax of the elliptical clause.

him.

Note that fragment answers may also be introduced by a constituent negation:

(159) A: Who is leaving tomorrow?

B: **Not** John.

A third issue concerns the identity requirement between the remnant and the salient utterance. As mentioned above, Ginzburg & Sag require that the remnant and the salient utterance have exactly the same CAT values. However, this requirement does not correctly predict the range of grammatical remnants. As (160B) shows, the required identity is weaker than an identity of maximal part-of-speech categories.

(160) A: What did John become (after being shown up as a con-artist)?

B: Crazy.

Since category selection is expressed via a CAT feature called HEAD, it follows that differences in category leads to mismatches in CAT values. Since the remnant in (160B) is an AP with the HEAD value *adj* whereas the salient utterance is an NP ([HEAD *noun*]), ungrammaticality is predicted, contrary to fact.

In this chapter, I propose to deal with the first two issues by introducing a new construction type in the grammar specifically for gapped clauses. Regarding the third issue, I adopt the account proposed by Abeillé *et al.* (2014). In the next subsection I will first discuss data on syntactic parallelism in Gapping, and then introduce Abeillé *et al.*'s account for category mismatches.

4.3.3 Syntactic parallelism

3.2.2.1 Data

As is well-known, fragments exhibit some sort of syntactic dependence on their sources:

(161) A: Whose car did you take?

B: Jo's.

B′ *Jo.

In the reductionist literature (Hankamer 1973; Merchant 2001), this sort of data is accounted for by assuming a full, sentential syntax for fragments. On this assumption, the ungrammaticality of (161B′) follows from that of the corresponding full sentence, i.e., **Jo car I took*. However, it should be noted that a reductionist analysis is not always warranted for all kinds of data. As Culicover & Jackendoff (2005) and Abeillé *et al.* (2014) noted, there are examples of Gapping which do not have a grammatical ungapped counterpart:

(162) a. Robin speaks French {as well as/but not/not to mention} Leslie German.

b. Robin doesn't speak French, let alone Leslie German.

(Culicover & Jackendoff 2005:278)

Note that examples of this sort also exhibit matching effects:

(163) a. Sally is fond of Tim but not Tim {of/*to} Sally.

b. Max has become upset as well as his wife {downright angry/*in bad spirit}.

In the fragment literature (Ginzburg & Sag 2000; Schlangen 2003; Abeillé *et al.* 2014) the phenomenon is characterized in terms of syntactic parallelism or congruence between a remnant and the corresponding salient utterance, usually captured via identity constraints (as in Figure 4.4 above). Precisely which set of features display syntactic parallelism is a complex matter; see for instance Ginzburg & Sag 2000 for discussion of cross-linguistic differences in case identity patterns. In Gapping, syntactic parallelism centers around category and preposition/verb form (Hankamer 1973; Sag *et al.* 1985). Some examples are provided below: (164) displays category parallelism, and (165)-(166) exhibits preposition- and verb-form identity, respectively.

(164) a. Pat has become [crazy] and Chris [depressed]

b. *Pat has become [crazy]$_{\text{AP}}$ and Chris [in good spirits]$_{\text{PP}}$ (Sag *et al.* 1985:160)

(165) a. Bill depends [on Alex] and Alex [on Bill]

b. *Bill depends [on Alex] and Alex [of Bill] (Hankamer 1973:22)

(166) a. Pat wanted [to go to Berne] and Chris [to go to Rome]

b. *Pat wanted [to go to Berne]$_{inf}$ and Chris [going to Rome]$_{prp}$.

(Sag *et al.* 1985:159)

In HPSG, preposition and verb forms are indicated as the values of the features P-FORM and V-FORM (under CAT|HEAD). If we assume, as in Ginzburg & Sag (2000), that a remnant and the corresponding salient utterance must have identical CAT values, the patterns in (164)-(166) are explained: the HEAD values of the second remnants and their correlates are as follows:

(167) a. [HEAD *adj*]

b. [HEAD|PFORM *on*]

c. [HEAD|VFORM *infinitive*]

However, the matter is complicated by examples such as the following:

(168) Pat has become [crazy]$_{adj}$ and Chris [an incredible bore]$_{noun}$ (Sag *et al.* 1985:160)

The identity constraint in Ginzburg & Sag (2000) is too strong in that it wrongly rules out (168): since the HEAD value of the second remnant is *noun* but that of the corresponding correlate is *adjective*, this sentence should be ungrammatical according to Ginzburg & Sag.

Before I introduce one possible way to accommodate mismatched cases like (168), I will say a few words about syntactic parallelism in Gapping. First, it is often observed that a remnant in fragments must obey a case identity constraint. Hankamer (1973:20) provided relevant examples for German data:

(169) Das Kind folgte mir und der Hund meinem/*meinen Vater.
The child followed me.DAT and the dog my.DAT/my.ACC father.
'The child followed me and the dog followed my father.'

However, the situation for English is less clear. As mentioned in §2.2.1, a subject remnant may appear in either nominative or accusative case:

(170) She admires Monet and {he / him} – Picasso.

As Ginzburg & Sag (2000:299) note, English NP fragments appear routinely in accusative case, rather than agreeing with their correlates in case:

(171) a. [choosing players for a pick-up soccer games, players gather around team captains, shouting advice and gesturing toward prospective players]:
#I / Me / #He / Him / #She / Her.

b. A: Who did Bo insult yesterday?
B: Mo / #I / Me / #He / Him / #She / Her.

I will not attempt to develop a full account for case assignment in Gapping, but assume that remnant NPs in English are assigned accusative case by default. In Gapping, the default accusative case may be overridden to produce matching effects.

Another point to mention here concerns the nature of CAT identity, which is required in Ginzburg & Sag (2000). As was mentioned in 3.1, there are two features under CAT: HEAD and VAL (the latter in turn comprises SUBJ and COMPS). The feature VAL encodes information about a sign's valents yet to be combined in that sign's syntactic projection. Thus, an identity requirement for the CAT values between a remnant and its correlate means that the remnant and correlate have the potential to share subject and complements. The values of SUBJ and COMPS are defined as objects of type *synsem*, i.e., a sign's syntactic and semantic information. Sharing of these features thus entails not only identity of syntactic

category and form, but also identity of number and person information, which is encoded via CONT|INDEX.

To see why this is problematic for Gapping, consider the following example:

(172) Max is in the kitchen and the kids in the basement.

The PP remnant selects a plural subject (SUBJ ⟨NP[*3, sg*]⟩) whereas its correlate selects a singular subject (SUBJ ⟨[*3, pl*]⟩), so their INDEX values are not identical. An account of syntactic parallelism in terms of identity of CAT values would wrongly predict (172) to be ungrammatical. I propose to avoid this problem by requiring that a remnant and its correlate share HEAD values only.[8]

3.2.2.2 A weaker version of syntactic identity: Abeillé *et al.* (2014)

Abeillé *et al.* (2014) adopt Ginzburg & Sag's account of syntactic parallelism, but also incorporate a proposal in Sag (2003) to deal with mismatched cases such as (168). Sag's proposal is concerned with phenomena such as coordination of 'unlikes' and case syncretism, which involve issues similar to the one exhibited by (168). (173) illustrates the problem for coordination of unlikes.

(173) Kim is wealthy and a Republican. [AP & NP] (Sag 2003)

In (173), constituents of different categories are conjoined. As Sag notes, this sort of examples pose a problem as to what feature structure to associate with the mother of the coordinate structure: the mother's HEAD value cannot simply be identified with either daughter. Sag proposes to avoid this problem by relaxing a foundational assumption in HPSG, which requires that feature structures be 'totally well-typed' (i.e., bear a specification for all fea-

[8]The requirement of HEAD identity for gapping remnants was suggested earlier in Abeillé *et al.* (2014), but the requirement was assumed rather than argued for.

tures appropriate for that type of feature structure) and 'sort-resolved' (i.e., instantiate a maximal type).[9]

Sag assumes the following type hierarchy for part-of-speech categories:

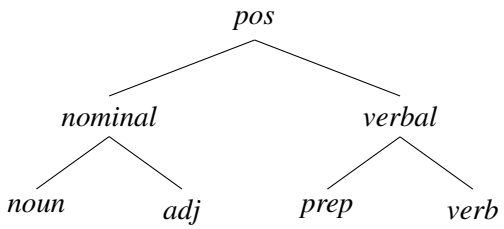


Figure 4.6: Type hierarchy of pars-of-speech

In a totally well-typed and sort-resolved version of HPSG, only the maximal types of this hierarchy are appropriate for well-formed feature structures. This means that in (173), the conjuncts have distinct specifications for HEAD: *adj* vs. *noun*. Most accounts of coordination in HPSG assume that the CAT values of the coordinated elements and the mother should (Pollard & Sag 1994; Sag *et al.* 2003). Since this requirement cannot be fulfilled by the coordinate structure in (173), ungrammaticality is predicted, contrary to fact.

The solution Sag proposed is to allow non-maximal part-of-speech types to be appropriate values of the HEAD feature.[10] The following lexical specifications are provided for illustration (the notation $\boxed{1} \leq \boxed{2}$ means that $\boxed{1}$ is a supertype of $\boxed{2}$).

(174) a. wealthy: [HEAD $\boxed{1} \mid \boxed{1} \leq$ *adj*]

b. Republican: [HEAD $\boxed{1} \mid \boxed{1} \leq$ *noun*]

Given this analysis and the standard HPSG analysis of coordination, the grammar would allow exactly one possibility for *became wealthy and a Republican*: the HEAD values of the conjuncts and the mother would be *nominal*.

[9]These terminologies are due to Carpenter (1992).

[10]This idea was inspired by Type-Logical Grammar solutions for coordination of unlikes in terms of conjunctive/disjunctive categories (Bayer & Johnson 1995; Bayer 1996).

Abeillé *et al.* propose to combine Sag's account with a surface identity theory of syntactic parallelism in Gapping, captured in terms of identity of the HEAD values. Let us consider how this proposal accommodates both acceptable and unacceptable mismatches, exemplified by (175a-b).

(175) a. John became wealthy and Mary a Republican.

b. *John grew wealthy and Mary a Republican.

The verb *become* selects for an AP or NP complement while *grow* selects for an AP complement only, so the following specifications are appropriate:

(176) a. become: [COMPS ⟨[HEAD *nominal*]⟩]

b. grow: [COMPS ⟨[HEAD *adj*]⟩]

The lexical specifications in (176) and (174), coupled with a requirement of HEAD value identity between remnants and their correlates, predict the (un)grammaticality of (175a-b): the HEAD values of *wealthy* and *a Republican* can be unified to yield *nominal*, which is consistent with the selectional requirement of *become* but not that of *grow*.

In sum, syntactic parallelism in Gapping boils down to a surface identity between remnants and their correlates. In HPSG terms, the surface identity corresponds to the identity of HEAD values. Recalcitrant cases involving category mismatches can be accommodated by assuming a weaker notion of sort-resolvedness that is motivated independently, without resorting to hidden, silent syntactic structure.

4.4 An HPSG of Gapped Clauses

This section is devoted to an analysis of gapped clauses. After some additional assumptions about the HPSG theory adopted in this work are introduced (§4.4.1), a new construction rule for gapped clauses is proposed (§4.4.2).

4.4.1 Some additional assumptions

The grammar of gapped clauses developed in this section is couched within the HPSG theory outlined in §3.1 augmented with LRS (see §3.3). To equip the theory with the necessary tools needed to analyze gapped clauses, some additional assumptions must be introduced.

As has been noted previously, remnants in gapped clauses must be focal elements. How do we express this requirement? First of all, we need to decide where information structure belongs in the HPSG sign. Engdahl & Vallduví (1996) incorporate information structure using the feature INFO-STRUC (under CONTEXT) that is appropriate for the sort *sign* (see also de Kuthy 2002). There are also proposals to encode information structure within the semantic component; see for example Webelhuth (2007) and Hasegawa & Koenig (2011). In this work, I introduce a new feature IS-CONT (INFORMATION STRUCTURE CONTENT) under LOCAL to encode information structure:

$$\begin{bmatrix} \textit{local} & \\ \text{CAT} & \text{local syntactic structure} \\ \text{CONT} & \text{local semantic structure} \\ \text{IS-CONT} & \begin{bmatrix} \text{QUD} & \textbf{question under discussion} \\ \text{FOC} & \textbf{list of focal elements} \end{bmatrix} \\ \text{CTXT} & \begin{bmatrix} \text{PAIRING} & \textbf{list of target-correlate pairs} \end{bmatrix} \end{bmatrix}$$

Figure 4.7: Appropriateness conditions for the sort *local*

As is well-known there is a connection between information structure and QUD: the non-focus (or background) of a sentence is generally available as the resource for the construction of (implicit) QUDs (Roberts 1996/2012; Ginzburg 1999). Given this connection between information structure and QUD, it seems reasonable to pair the QUD and focal constituents as part of the IS-CONT feature (cf. Ginzburg 2012:237-9). Figure 4.8 specifies

the appropriateness conditions on this feature.

$$\begin{bmatrix} \textit{is-cont} & \\ \text{QUD} & \begin{bmatrix} \text{QUD-CONT} & \textit{me} \\ \text{QUD-VAR} & \textit{list(me)} \end{bmatrix} \\ \text{FOC} & \left\langle \ldots, \begin{bmatrix} \text{FOC-CONT} & \textit{me} \\ \text{VAR} & \textit{me} \end{bmatrix} \ldots \right\rangle \end{bmatrix}$$

Figure 4.8: Appropriateness conditions for the sort *is-cont*

This description says that the value of the IS-CONT feature is a new sort called *is-cont*, for which the features QUD and FOC are appropriate. The feature QUD in turn includes two new features, QUD-CONT (the QUD-proper) and QUD-VAR (a collection of the variables included in the value of the QUD-CONT).

As reflected in Figure 4.7, I assume a new CONTEXT feature called PAIRING to encode the pairing of each 'target' and its correlate. These are encoded via the features CORR and TARG, as specified in Figure 4.9.

$$\begin{bmatrix} \text{PAIRING} \left\langle \ldots, \begin{bmatrix} \text{CORR} & \textit{synsem-obj} \\ \text{TARG} & \textit{synsem-obj} \end{bmatrix} \ldots \right\rangle \end{bmatrix}$$

Figure 4.9: The feature PAIRING and its value

The term target is used here as a general term that applies not only to remnants in fragment utterances but also expressions that naturally come in pairs, such as contrastive focus, certain kinds of anaphora, and fixed expressions such as *the former..., the latter* and *vice versa*. The PAIRING feature plays a role akin to the role played by *parallel elements* in HOU-based approaches to ellipsis (Dalrymple *et al.* 1991); and *parallel arguments* in Kehler (2002), which are arguments that must be recognized in the inference process leading to a Resemblance Relation (see also the definition of Parallel in Hobbs 1985). The various phenomena

discussed in Culicover & Jackendoff (2012) which involve SAME-EXCEPT relations are also candidates for an analysis in terms of the PAIRINGS feature.

Another matter to mention here concerns the semantics of non-headed phrases and (headed) phrases whose semantics does not follow from the principles of ordinary semantic combinatorics. Recall that the semantic principles in LRS exploit the distinction between heads and nonheads, as well as generalizations about how they participate in semantic composition. However, certain expressions, such as idioms and non-headed phrases, have a construction-specific semantics and must therefore be exempt from ordinary semantic combinatorics. To account for the difference between ordinary and idiosyncratic modes of semantic composition, I introduce a new feature C(OMBINATORIAL)-MODE on the sort *lrs*. This feature has a boolean value, + (ordinary semantic combinatorics) and - (idiosyncratic semantic combinatorics). Phrases that have construction-specific semantic combinatorics have the specification [C-MODE -] and are exempt from the general semantic principles in LRS (see Sailer (2003) and Richter & Sailer (2009b) for similar ideas).[11]

4.4.2 A new construction type for gapped clauses: *gap-ph*

For convenience, I will begin by providing an informal characterization of my approach to gapped clauses:

- Exocentric syntax: The syntax of the mother is unlike that of its daughters.
- Context-based ellipsis resolution: The missing material is retrieved via QUD.
- Surface-based constraints on the syntax of the remnants: The remnants are required to match their respective correlates in their HEAD values.
- A matching mechanism that ensures the correct semantic construals for gapped clauses

[11] Richter & Sailer (2009b) and related work uses a feature called COLL (CONTEXT OF LEXICAL LICENSING) to exempt idioms from ordinary syntactic and semantic combinatorics. This feature is also the locus where the idiosyncratic properties of an idiom (e.g., in terms of their syntactic and phonological behavior) are encoded.

First, in gapped clauses the syntax of the mother is unlike that of the remnant daughters, and the syntactic relation between the remnants is not specified; that is, gapped clauses have a non-headed syntactic structure. This means that gapped clauses should be modeled as instances of the type *nonheaded-phrase*. Second, as I have argued in this dissertation, there are reasons to avoid postulating an underlying complex syntactic structure for gapped clauses and to derive the meaning of the missing material directly from the QUD. Third, the remnants in gapped clauses must agree with their correlates in syntactic form. This can be ensured by assuming a surface-based matching constraint in terms of HEAD identity (see §4.3.2-§4.3.3). Lastly, the semantics of gapped clauses must be constrained so that, for each gapped clause, its overall semantic contribution amounts to some combination of the semantic contributions of the daughters and the content introduced via the QUD. To provide more details about this last point, let us consider the example in (177a).[12]

(177) a. Jenn invited Mary and Robin Sue.

b. QUD of the gapped clauses in (177a): $\lambda y \lambda x.\exists e\, \mathsf{invite}'(e,x,y)$

c. The logical form associated with the gapped clauses in (177a): $\exists e\, \mathsf{invite}'(e,\mathsf{r},\mathsf{s})$

The semantic resource of the gapped clause in (177a) consists of two constants r (for Robin) and s (for Sue), and the content retrieved via the QUD, $\lambda y \lambda x.\exists e\, \mathsf{invite}'(e,x,y)$. Considering semantic types alone, one cannot rule out combinations leading to the inadmissible result, $\exists e\, \mathsf{invite}'(e,\mathsf{s},\mathsf{r})$. The reason that this logical form cannot be associated with the gapped clause in (177a) seems to be because it breaks up the expected parallelism between the QUD and the logical forms associated with it (i.e., the semantic representation of gapped and source clauses): for convenience, let us call this the QUD-LF PARALLELISM. The issue currently under discussion suggests that QUD identity alone cannot adequately constrain what is the admissible logical expression a given gapped clause can be associated with; we

[12]The use of λ in (177b) is for expository purposes; the formal analysis presented below does not require the QUD to be a λ-expression.

also need to ensure that the QUD and the focused constituents (which 'reduce' the variables in the QUD) are composed in a parallel manner between a gapped clause and its source such that there are correspondences between QUD variables and the focused constituents (i.e., the remnants and their correlates).

It is important to stress that providing a well-defined notion of QUD identity of any sort, is a general problem that is not specific to ellipsis. Although the need for such a notion has often been evoked in the literature, its precise definition is still under question. QUDs are often conveniently and conventionally expressed as lambda abstracts; but lambda expressions are not equipped to deal with information beyond that needed for compositional semantics. This is unfortunate given that one main appeal of QUDs as a theoretical device is that it allows one to capture the interpretation of an utterance that is not reflected in the semantic representation of the utterance. The lack of a suitable representation language for QUDs is one major source of difficulties in providing a simple characterization of the QUD-LF PARALLELISM.

It should also be pointed out that the issue behind the QUD-LF PARALLELISM is not specific to constructivist theories of ellipsis. Any adequate theory of ellipsis must have a notion of 'possible ellipsis sites', and this position is widely held among Gapping researchers (Coppock 2001; Culicover & Jackendoff 2005; Toosarvandani 2013; Kubota & Levine 2016; Potter *et al.* 2017). Given that missing material in Gapping is best characterized in terms of QUD identity, and given that there is no perfect correspondence between the syntax and QUD, reductionist approaches are in no better position in providing a simple definition of a QUD identity between gapped and source clauses. In addition, as we saw above in §4.2, postulating a full, underlying syntactic structure for gapped clauses creates complications in the syntactic component. I therefore suggest one possible way of ensuring the QUD-LF PARALLELISM between gapped clauses and their sources is to introduce a surface-based matching constraint in the specification of the construction for gapped

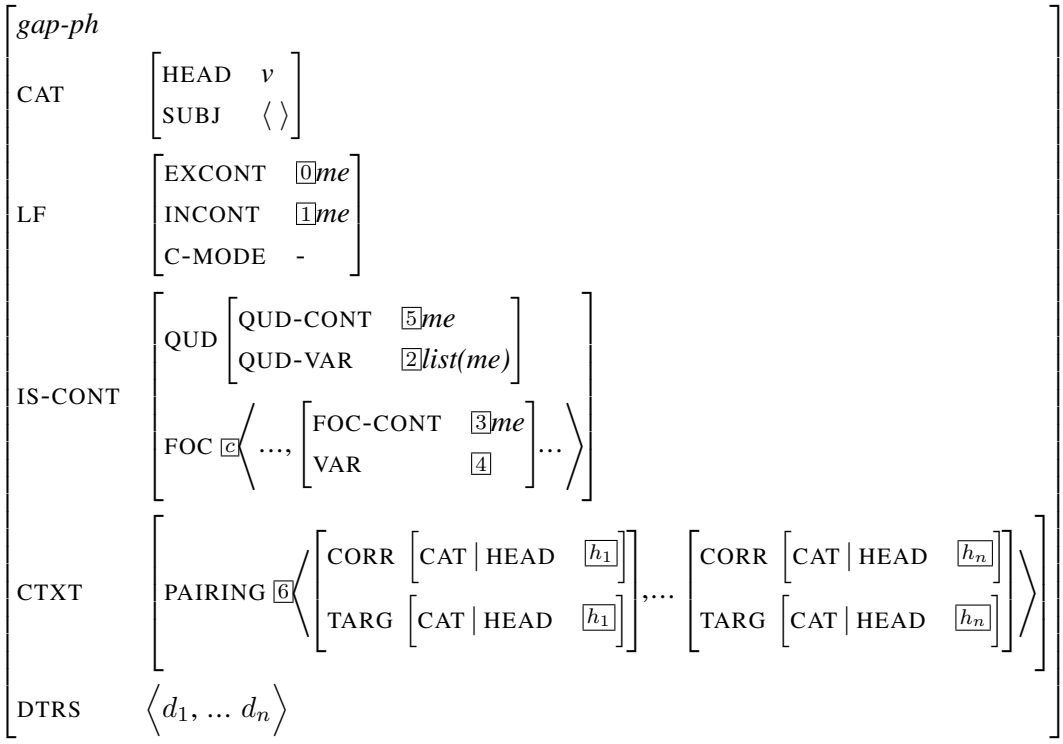
clauses.

I will now proceed to the formal analysis. I propose to analyze gapped clauses by introducing a language-specific construction called *gapped-phrase* (*gap-ph*) (see next page). My analysis inherits some aspects of Ginzburg & Sag's analysis of fragment answers: the HEAD value of the mother is *verb*, and the SUBJ value is empty, which indicates that gapped clauses are clausal constituents whose subcategorization requirements have all been fulfilled. But my analysis departs from Ginzburg & Sag's in substantial ways. Starting with the syntax, the VFORM of the mother is unspecified to allow gapped clauses to combine with functors that select a non-finite clause (Abeillé *et al.* 2014), such as those in (158), repeated below in (178), which is the logical form associated with the sentence *Sue invited Mary*.

(178) a. Bill invited Jane and **not** Jane (*invited) Bill.

b. Bill wanted to meet Jane **as well as** Jane (*wanted to invite) him.

Because gapped clauses can occur as a (conjoined) root clause or a subordinate clause, the value of the feature IC (INDEPENDENT CLAUSE) is unspecified. Since I restrict my analysis to gapped clauses only, – i.e., fragments which involve at least two non-head daughters – the DTRS list is required to contain at least two members (indicated by $n \geq 2$). If desired, one can extend the current analysis to other n-ary fragment types by lifting this requirement and making other necessary adjustments.



$n \geq 2$
$\forall x$**member(**x**,**$\boxed{2}$**)** $\Rightarrow x \lhd \boxed{5}$
$\boxed{4} \lhd \boxed{3}$
match($\boxed{c}$**, 2, var)** (**match(a, b, F)** iff the list of values of **F** in order in **a** matches **b**)
match($\boxed{6}$**,** $\boxed{c}$**, targ)**
y-copy($\boxed{5}$**,qud**$_s$**)** (**qud**$_s$ is the value of the QUD of the source clause if there is one)

Figure 4.10: Gapped-Phrase

Let us next turn to the nonlocal semantics of *gap-ph*, specified under LF. Since gapped clauses are non-headed, they are exempt from ordinary semantic combinatorics (indicated by [C-MODE -]). The following construction-specific principles are required to account for their combinatorial properties:

(179) The EXCONT PRINCIPLE (specific to *gap-ph*):

In every gapped phrase, every element of the mother's PARTS list is a subexpression of its EXCONT value.

(180) The PROJECTION PRINCIPLE (specific to *gap-ph*):

In every gapped phrase, (a) the INCONT value of the mother contains the value of the QUD-CONT, as well as the INCONT values of all of the daughters; and (b) the PARTS value of the mother contains all the elements of the PARTS of the daughters, the value of the QUD-CONT, and the EXCONT and INCONT value of the mother.

(179) restricts the EXCONT value of the mother; i.e., the mother's overall logical form. The principle says that the mother's semantic contribution must be made based exclusively and exhaustively on the semantic contributions collected in its PARTS. (180) requires two things. Clause (a) requires that the mother's INCONT be a logical form that consists exclusively of the QUD-CONT and the internal content of all of the daughters. Clause (b) ensures that the mother's PARTS value include all the semantic contributions collected in its PARTS list, the value of the QUD-CONT and the EXCONT and INCONT values of the mother. From (179) and Clause (b) of (180), it follows that the EXCONT of the mother of a gapped clause contains all of the semantic contributions of the daughters as well as the content retrieved via the QUD.

Moving on to the constraints imposed on the information structure and context of gapped clauses, the feature QUD specifies the QUD-proper (via QUD-CONT) and the variables associated with it: these variables are required to be part of the logical form that is the value of the QUD-CONT feature (indicated by $\forall x \mathbf{member}(x,\boxed{2}) \Rightarrow x \lhd \boxed{5}$). The list-valued feature FOC encodes the logical form of each focal constituent and the individual variable associated with it. Due to the subexpression constraint $\boxed{4} \lhd \boxed{3}$, the variable of a focused constituent is required to be part of the value of FOC-CONT. For now, I assume that the value of the FOC-CONT is identical to the INCONT of a focused constituent.[13] In gapped

[13]The reason that the EXCONT of a focused constituent cannot be defined as the value of FOC-CONT is obvious when we consider focused generalized quantifiers:

(i) A: Who invited Mary?
B: EVERY BOY (invited Mary). (EXCONT = $\forall x\, \mathbf{every}'(x) \rightarrow \beta$)

clauses, the focused constituents coincide with the remnant daughters.

As noted above the feature PAIRING is introduced to encode pairs of correlates and targets, and also the linear order these pairs. I assume that it is the context, not syntax, that is mainly responsible for pairing each target with its correlate, as well as how the resulting pairs are linearized.[14] This lack of constraint is desirable, given that the linear orders of the correlates and their corresponding targets need not match:

(181) a. A policeman walked in at 11, and at 12, a fireman. (Sag *et al.* 1985)

b. Mary gave Johanna a book and Bill FLOWERS to Jack.

Note that the syntactic identity requirement between each remnant/target and the corresponding correlate is expressed also via PAIRING (in the form of HEAD identity).

Figure 4.10 contains two 'match' constraints which work together to ensure a correspondence between the semantic contributions of the daughters and the right variables in the QUD (i.e., the value of the QUD-CONT). The constraint **match(**$\boxed{c}$**,** $\boxed{2}$**, var)** requires that each variable of a focused constituent (i.e., members of the FOC list) match in order each QUD variable (i.e., members of the QUD-VAR list). This has the effect that, whichever position the QUD variables appear in the QUD, they are associated with the right focused constituent. The constraint **match(**$\boxed{6}$**,** $\boxed{c}$**, targ)** ensures one-on-one correspondences between each focused constituent and each target/remnant (i.e., the value of the TARG). Since each target element is paired with its correlate, the focused constituents are also matched with the correlates in the source. If we assume that the QUD-CONT of a gapped clause is constructed based on the source clause's QUD-CONT (which in turn is constructed based on the source clause's EXCONT and FOC), we have a way of keeping track of the focused

Equating the focus-semantic content of *every boy* with its EXCONT value amounts to assigning focus to the entire sentence.

[14] In spoken English, contrastive accent provides a helpful cue as to the pairing (Jackendoff 1972; Büring 2003). Case-marking and other morphological cues (in morphologically rich languages) may also help pairing a target with its correlate.

constituents in the source clause and the QUD variables they are associated with. Since we know which focused constituent corresponds to which QUD variable, and since we know which focused constituent corresponds to which correlate or target, by requiring that all these variables and elements are perfectly aligned, we can restrict the possible interpretation of gapped clauses to where the interpretation reflects parallel semantic composition between the gapped clauses and their sources.

I now show how the constraints I have discussed so far work together to license the simple gapped clause in (177a), whose analysis is provided in Figure 4.11.[15]

$$\left[\begin{array}{ll}
\textit{gap-ph} & \\
\text{LF} & \left[\begin{array}{ll}
\text{EXCONT} & \boxed{0} \\
\text{INCONT} & \boxed{0}\exists e\ \mathsf{invite}'(e,\mathsf{r},\mathsf{s}) \\
\text{PARTS} & \left\langle \mathsf{r}, \mathsf{s}, \boxed{0}, \boxed{1} \right\rangle
\end{array}\right] \\
\text{IS-CONT} & \left[\begin{array}{ll}
\text{QUD} & \left[\begin{array}{ll}
\text{QUD-CONT} & \boxed{1}\exists e\ \mathsf{invite}'(e,x,y) \\
\text{QUD-VAR} & \langle x, y \rangle
\end{array}\right] \\
\text{FOC} & \left\langle \left[\text{FOC-CONT} \quad \mathsf{r}\right], \left[\text{FOC-CONT} \quad \mathsf{s}\right] \right\rangle
\end{array}\right] \\
\text{CTXT} & \left[\text{PAIRING} \left\langle \left[\begin{array}{ll}
\text{CORR} \mid \text{LF} \mid \text{VAR} & \mathsf{j} \\
\text{TARG} \mid \text{LF} \mid \text{VAR} & \mathsf{r}
\end{array}\right], \ldots \left[\begin{array}{ll}
\text{CORR} \mid \text{LF} \mid \text{VAR} & \mathsf{m} \\
\text{TARG} \mid \text{LF} \mid \text{VAR} & \mathsf{s}
\end{array}\right] \right\rangle\right] \\
\text{DTRS} & \left\langle \left[\text{PARTS} \left\langle \mathsf{r} \right\rangle\right], \left[\text{PARTS} \left\langle \mathsf{s} \right\rangle\right] \right\rangle
\end{array}\right]$$

Figure 4.11: (Jenn invited Mary,) *Robin Sue*

Starting from the bottom, this AVM says that the gapped clause consists of two remnant daughters whose semantic contributions are the constants r (for Robin) and s (for Sue). Each remnant is paired with its correlate, as indicated by the PAIRING feature. The value of

[15] I assume that the INCONT of a gapped clause include the existential quantifier over the event variable. This assumption is consistent with the fact that event quantifier always has the lowest possible scope (Sailer 2004a:205, fn. 7, Champollion 2015). Although this might suggest rewriting the lexical entries of verbs to incorporate the existential quantifier in their INCONT values, I delay such a possibility.

the QUD-CONT corresponds roughly to the QUD of the source (details will follow shortly). It includes two unknown variables x and y, which are also the members of the QUD-VAR list.

The principles in (179)-(180) impose constraints on the values of EXCONT, INCONT and PARTS. Due to Clause (b) of (180), the mother's PARTS list includes the semantic contributions introduced via the PARTS of the daughters and the QUD-VAR. The INCONT value of the mother (indicated as $\boxed{0}$) is as dictated in (180). It is a single logical form that contains the INCONT values of the daughters (r and s) and the QUD-CONT ($\exists e\,\mathsf{invite}'(e,x,y)$). Because the INCONT and EXCONT of the daughters are identical, $\boxed{0}$ also satisfies (179), which means it is also the value of the EXCONT. By considering (179) and (180) alone, we predict two possible logical forms that can be associated with $\boxed{0}$: (i) $\exists e\,\mathsf{invite}'(e,\mathsf{r},\mathsf{s})$, and (ii) $\exists e\,\mathsf{invite}'(e,\mathsf{s},\mathsf{r})$. However, only (i) satisfies the match constraints associated with gapped clauses (see Figure 4.10): these constraints require that correspondences between the correlates and the QUD variables associated with the source be preserved in the correspondences between the targets/remnants and the QUD variables associated with the gapped clause, which predicts that (i) is the unique logical representation that can be associated with the gapped clause.

One final point to be clarified is the specification of the QUD content (i.e., the value of QUD-CONT). The relevant generalization established §2.2.4 was that the QUD associated with a gapped clause is one that is triggered by its source. We can now formalize this idea by assuming the relation **y-copy** and requiring that the QUD of the gapped clause be a **y-copy** of the source clause's QUD. **Y-copy** is defined as follows:

(182) The Y-COPY PRINCIPLE:

$$\forall\boxed{1}\forall\boxed{2}\left(\begin{array}{l}\textbf{y-copy}(\boxed{1},\boxed{2}) \leftrightarrow \\ \left(\begin{array}{l}\bigvee\left\{\boxed{1}[\sigma]\wedge\boxed{2}[\sigma] \mid \sigma \in \mathcal{S}_{Ty2}\right\}\wedge \\ \bigwedge\left\{\forall\boxed{3}\left(\begin{array}{l}\boxed{1}[\alpha\ \boxed{3}] \rightarrow \\ \exists\boxed{4}(\boxed{2}[\alpha\ \boxed{4}] \wedge \textbf{y-copy}(\boxed{3},\boxed{4}))\end{array}\right) \mid \alpha \in \mathcal{A}_{Ty2}\right\}\end{array}\right)\end{array}\right)$$

$\mathcal{S}_{Ty2}$ is defined as the set of maximally specific sorts of the signature of Ty2; $\mathcal{A}_{Ty2}$ is the set of attributes of the signature of Ty2 (see, e.g., Penn & Richter (2004)). Thus, two Ty2 objects $\boxed{1}$ and $\boxed{2}$ are in the **y-copy** relation if and only if they specify the same attributes as well as the maximal sorts that are values of these attributes. The Y-COPY PRINCIPLE is adapted from Penn & Richter's (2004) COPY PRINCIPLE, which describes token identity rather than type identity (see also Sailer 2003:116). Two feature structures are token identical if and only if two paths point to the the same node on a graph (or to the same feature structure model). The feature structures associated with the QUDs of gapped and source clauses are only structural-identical, not token identical, and are therefore in the **y-copy** relation.

Let us consider how the analysis presented so far accounts for the complex Gapping sentence in (183), in which the main verb as well as an embedded verb are missing in the gapped clause.

(183) (What did the boys began to read?)

MAX began to read a NOVEL and TIM a MAGAZINE.

The QUD of the source clause is that part of the logical form associated with this clause that does not correspond to the focused constituents, *Max* and *a novel*; the QUD of the gapped clause is a Y-COPY of the QUD of the source. The semantic representations of these QUDs as well as the QUD variables they are associated with are shown in (184) below.

(184) a. QUD-CONT of the source = $\exists e\,\mathsf{begin}'[e, \exists s\,\mathsf{read}'(s, x, y))]$

b. QUD-VAR of the source = $\langle x, y \rangle$

c. QUD-CONT of the gapped clause = Y-COPY of (184) =

$\exists e' \, \mathsf{begin}'[e', \exists s' \, \mathsf{read}'(s', x', y'))]$

d. QUD-VAR of the gapped clause = $\langle x', y' \rangle$

Figure 4.12 presents the analysis of the gapped clause in (183).

$$\left[\begin{array}{ll}
\textit{gap-ph} & \\
\text{LF} & \left[\begin{array}{ll}
\text{EXCONT} & \boxed{5}\exists e' \, \mathsf{begin}'[e', \exists y'(\mathsf{magazine}'(y) \wedge \exists s' \, \mathsf{read}'(s,\mathsf{t},y))] \\
\text{INCONT} & \boxed{4}\exists e' \, \mathsf{begin}'[e', \mathsf{magazine}'(y), \exists s' \, \mathsf{read}'(s', \mathsf{t}, y))] \\
\text{PARTS} & \left\langle \mathsf{t}, \boxed{1}, y, \boxed{3}, \boxed{3a}, \boxed{3b}, \boxed{3c}, \boxed{4}, \boxed{5} \right\rangle
\end{array}\right] \\
\text{IS-CONT} & \left[\begin{array}{ll}
\text{QUD} & \left[\begin{array}{ll}
\text{QUD-CONT} & \boxed{1}\exists e' \, \mathsf{begin}'[e', \exists s' \, \mathsf{read}'(s', x', y'))] \\
\text{QUD-VAR} & \boxed{2}\langle x', y' \rangle
\end{array}\right] \\
\text{FOC} & \left\langle \left[\begin{array}{ll}
\text{FOC-CONT} & \mathsf{t} \\
\text{FOC-VAR} & \langle \mathsf{t} \rangle
\end{array}\right], \left[\begin{array}{ll}
\text{FOC-CONT} & \boxed{3}\mathsf{magazine}'(y) \\
\text{FOC-VAR} & \langle y \rangle
\end{array}\right] \right\rangle
\end{array}\right] \\
\text{CTXT} & \left[\text{PAIRING } \boxed{6} \left\langle \left[\begin{array}{ll}
\text{CORR} \mid \text{LF} \mid \text{VAR} & \mathsf{m} \\
\text{TARG} \mid \text{LF} \mid \text{VAR} & \mathsf{t}
\end{array}\right], \ldots \left[\begin{array}{ll}
\text{CORR} \mid \text{LF} \mid \text{VAR} & y'' \\
\text{TARG} \mid \text{LF} \mid \text{VAR} & y
\end{array}\right] \right\rangle\right] \\
\text{DTRS} & \left\langle \left[\text{PARTS} \left\langle \mathsf{t} \right\rangle\right], \left[\text{PARTS} \left\langle y, \boxed{3}, \boxed{3a}\exists, \boxed{3b}\alpha \wedge \beta, \boxed{3c}\mathsf{magazine}' \right\rangle\right] \right\rangle
\end{array}\right]$$

Figure 4.12: (Max began to read a novel,) *Tim a magazine*

In (183) the first remnant and correlate contrast each other, and so are the second remnant and correlate. This contrast (or correspondence) is captured in Figure 4.12 via PAIRING. Due to the matching constraints, correspondence relations are defined between focused constituents and remnant/correlate pairs, and between the variables of the focused constituents and the QUD variables. These correspondences ensure that each remnant and its correlate are associated with the same argument position in the QUD-CONT. All these, as well as the principles in (179) and (180) work together to constrain the possible values of the EXCONT, INCONT, and PARTS: the PARTS value of the mother is a collection of the

PARTS values of the daughters and the QUD ($\boxed{1}\exists e'\,\mathsf{begin}'[e', \exists s'\,\mathsf{read}'(s', x', y')]$); the EXCONT value of the mother is the logical form that includes all and only the semantic contributions accumulated in its PARTS, which is consistent with the correspondences defined by the matching constraints (expressed as $\exists e'\,\mathsf{begin}'[e', \exists y'(\mathsf{magazine}'(y) \wedge \exists s'\,\mathsf{read}'(s,\mathsf{t},y))]$); the INCONT value is that part of the EXCONT that makes the scopally lowest semantic contribution (expressed as $\exists e'\,\mathsf{begin}'[e', \mathsf{magazine}'(y), \exists s'\,\mathsf{read}'(s', \mathsf{t}, y))]$).

4.5 Summary

This chapter defended a constructivist approach to fragments and developed an analysis of gapped clauses that expands on prior fragment-based accounts and an underspecification-based approach to semantics (LRS). The chapter argued that previous analyses that assign a full underlying syntactic structure to gapped clauses entail complications in the syntax. In response to this observation, this chapter proposed a surface-based constructional analysis in which gapped clauses are assigned a flat syntactic structure. The interpretations of gapped clauses are obtained by directly enriching their meanings with a contextual meaning (QUD), rather than via the syntax of putative underlying structure. The logically possible set of readings of gapped clauses are captured through underspecification of the semantics of gapped clauses, while the actual construals permitted by the context are restricted by surface-based matching constraints. All in all, the results of this chapter overcome limitations in prior research and provide a characterization of QUD identity that is needed for constructivist and reductionist theories alike.

Chapter 5

On the Interaction between Gapping and Scopal Operators

In this chapter, I turn to how the analysis developed so far can account for distributive- and wide-scope ambiguities in Gapping sentences. All previous accounts argue that these ambiguities result from a derivational ambiguity, but, as we have seen, the evidence is not compelling. Moreover, wide-scope readings are usually assumed to be restricted to Gapping, but counterexamples have been noted in the literature, suggesting that they are not so restricted.

This chapter proposes a novel account of distributive- and wide-scope ambiguities in terms of semantic underspecification. My central claim is that distributive- and wide-scope readings are the results of different ways of specifying a *single*, *underspecified* description of the semantics of conjoined clauses (Reyle 1993; Bos 1995; Egg *et al.* 2001; Richter & Sailer 2004; Copestake *et al.* 2005). The new coordination rule developed in this chapter interacts with independent constraints on gapped clauses to predict the various scopal readings of Gapping sentences. It is argued that the absence of wide-scope readings in ungapped counterparts of Gapping sentences is not due to a grammatical constraint on coordination

but follows from independent constraints on tense and scopal operators (de Swart 1998; Condoravdi 2002; Champollion 2015).

5.1 The Scope Ambiguity Puzzle

This chapter is concerned with the scope ambiguity phenomenon introduced earlier in §1.1. The classic example in (26), from Siegel (1984:524), is repeated below:

(185) Ward can't eat caviar and Sue beans.

a. distributive scope reading = $\neg\Diamond A \wedge \neg\Diamond B$

b. wide-scope reading = $\neg\Diamond(A \wedge B)$

This sentence is ambiguous between distributive- and wide-scope readings. In the distributive reading, each conjunct's interpretation includes its own negated modal (see (185a)); in the wide-scope reading, on the other hand, there is a single negated modal which takes wide-scope over both conjuncts (see (185b)).[1] Note that the wide-scope reading in (185b) is not available when Gapping does not occur. The ungapped counterpart of (185b), given in (186), illustrates this.

(186) Ward can't eat caviar and Sue can't eat beans.

The scope ambiguity in (185) presents two kinds problems to theories of the syntax-semantics interface. The first is that two different interpretations are matched with a single

[1] Siegel (1987:56) notes that cases where the auxiliary alone is absent, without the lexical verb also missing, do not exhibit the same kind of ambiguity as (185):

(i) a. Ward can't eat caviar and Sue eat beans.
b. John isn't in the pantry and the baby in the boiler room. (Siegel 1987:56, ex. (7))

Siegel observes that these examples unambiguously have only a wide-scope reading. My consultants agree with this observation.

In this work, I assume that the grammar makes available both wide- and distributive-scope readings for all Gapping sentences, and that the fact that some readings are missing is due to extragrammatical factors, such as the presence of redundant material (as in (ia)) and a lack of 'retrieval point' that corresponds to the long pause typically associated with distributive-scope readings (as in (ib)).

syntactic structure, raising a problem for compositionality. The second problem concerns the syntax/semantics of the wide-scope reading. As seen in (185), there is a mismatch between the conjunct-internal position of the auxiliary and its wide-scope. In general, auxiliaries do not take scope beyond their clauses; the absence of a wide-scope reading in (186) illustrates this. It thus seems that, whatever mechanism that is responsible for the wide-scope reading is due to some property of Gapping.

Previous solutions to the above problems have all relied on *two distinct derivations*, each leading to a unique scope relation (see §2.2.2-§2.2.3). In syntactic representational analyses (Repp 2009; Boone 2014; Potter *et al.* 2017), the auxiliary is introduced during the generation of each conjunct (producing the distributive-scope reading) or after the coordinate structure has been generated (producing the wide-scope reading). In Kubota & Levine's (2016) Type-Logical Categorial Grammar-based analysis, the account of the ambiguity in (185) exploits an ambiguity in the auxiliary: either the semantics of the auxiliary applies to the entire coordination (wide-scope reading) or to the semantics of each conjunct (distributive-scope reading). As we have seen in this work, however, these analyses cannot deal successfully with simple Gapping sentences. In the present chapter, I point out that these previous analyses also fail to predict correctly on the distribution of distributive- and wide-scope readings in Gapping sentences and in coordinated sentences that do not involve Gapping.

The goal of this chapter is to present an analysis of scope ambiguities in Gapping that does not rely on putative derivational ambiguities. I show that a semantic account of the ambiguity in (185) is possible if we take an underspecified view of semantic scope (Reyle 1993; Bos 1995; Egg *et al.* 2001; Richter & Sailer 2004; Copestake *et al.* 2005). My claim is that the two readings of (185) are the results of different ways of specifying a *single*, *underspecified* semantic description. Since this underspecified description is associated with a uniform syntactic analysis, there is no problem for compositionality. Based on evidence

showing that wide-scope readings exist independently of Gapping, a new coordination rule is proposed in which scopal operators in the first conjuncts are allowed to interact with the conjunction. This accounts for wide-scope readings in both Gapping sentences and coordinations without Gapping. The lack of wide-scope readings in (186) is shown to follow from independent constraints on tense and scopal operators (de Swart 1998; Condoravdi 2002; Champollion 2015), rather than from a Gapping-specific constraint.

This chapter is structured as follows. The next two subsections (§5.1.1-§5.1.2) provide an empirical assessment of the scope ambiguity phenomenon exemplified by (185). Previous syntactic accounts and their problems are discussed in §5.2. Sections §5.3-§5.4 constitute my own account: §5.3 introduces the general approach and some basic assumptions about coordination; §5.4 presents a formal analysis in HPSG and shows how gapped clauses interact with coordinate structures to produce wide- and distributive-scope readings in Gapping sentences and coordinate structures without Gapping. §5.5 summarizes and concludes this chapter.

5.1.1 Basic data

Let us begin by considering in some detail the basic descriptive facts about wide- and distributive-scope readings. As Oehrle (1987) and others noted, the ambiguity between distributive- and wide-scope readings is not restricted to a particular modal or conjunction meaning, and does not require the presence of negation (see also Siegel 1987 and Potter *et al.* 2017).[2] The example in (185) above showed that distributive- and wide-scope ambiguities may arise between a negated possibility modal and a coordinating conjunction. Other combinations of a modal, negation and conjunction meaning are possible in Gapping scope ambiguities. The following examples are illustrative:

[2] As Potter *et al.* (2017:p. 1130, fn. 5) point out, the distributive- and wide-scope readings of a necessity modal in conjunctive Gapping, when there is no negation, mutually entail each other: $\Box(p \wedge q) \Leftrightarrow \Box p \wedge \Box q$.

(187) *epistemic modal + conjunction*

a. Ward **might** have ordered caviar **and** Sue beans.

b. $\Diamond A \wedge \Diamond B$: Ward and Sue have different preferences for food. Ward likes expensive food, so it is possible that he ordered caviar. Mary is vegetarian, so it is possible that she ordered beans.

c. $\Diamond(A \wedge B)$: Ward and Sue never order the same dish. So it might have been that Ward ordered caviar and Sue ordered beans.

(188) *root modal + disjunction*

a. Robin **must** eat more salmon **or** Leslie more kale.

b. $\Box A \vee \Box B$: Robin and Leslie are under a strict diet, but I can't remember which: either Robin must eat more salmon, or Leslie must eat more kale.

c. $\Box(A \vee B)$: In order to receive their monthly allowance, one thing must be done: Robin eats more salmon or Leslie eats more kale.

(189) *negation + conjunction*

a. James **didn't** order caviar **and** Sally beans.

b. $\neg A \wedge \neg B$: James didn't eat caviar, and Sally didn't eat beans.

c. $\neg(A \wedge B)$: It is not that James ordered caviar and Sally ordered beans. James didn't want to get an expensive dish when Sally is almost broke, so they both ended up ordering the beans.

Auxiliaries are not the only elements that induce scope ambiguity in Gapping: adverbs that operate at the clause-level can interact with Gapping to create a similar ambiguity:

(190) *modal adverb + conjunction*

a. Mia **possibly** went to the museum **and** Kim to the beach.

b. *possibly*$(A)\wedge$ *possibly*(B): Mia and Kim possibly went to their favorite places: Mia possibly went to the museum and Kim possibly went to the beach.

c. *possibly*$(A\wedge B)$: Kim doesn't like spending time in a museum, so it is possible that Mia went to the museum alone and Kim went to the beach.

(191) *temporal adverb + disjunction*

a. Pat **seldom** goes to the museum **or** Terry to the beach.

b. *seldom*$(A)\vee$ *seldom*(B): Pat seldom goes to the museum or Terry seldom goes to the beach. (We don't know which between these is true.)

c. *seldom*$(A \vee B)$: The event of Pat going to the museum or Terry going to the beach seldom happens.

On the other hand, adverbs that have fixed-scope, which operate at the VP-level, do not seem to have a wide-scope reading:

(192) *manner adverb + conjunction*

a. Simon **quickly** cooked an instant noodle *and* Jack a lasagna.

b. *quickly*$(A)\wedge$ *quickly*(B): Simon quickly cooked an instant noodle and Jack quickly cooked a lasagna.

c. Impossible:
quickly$(A \wedge B)$: Quickly, Simon cooked an instant noodle and Jack cooked a lasagna.

(193) *constituent negation + conjunction*

a. Tom can **not** eat the spinach *and* Lee the broccoli.

b. *not*$(A)\wedge$ *not*(B): It is possible that Tom not eat the spinach, and it is possible that Lee not eat the broccoli.

c. Impossible:

not($A \wedge B$): For Tom to eat the spinach and Lee to eat the broccoli is impossible.

To make sure that these examples truly lack a wide-scope reading, let us consider, for each sentence, a situation in which one reading is true and the other is false, starting with (192a). Let's say that cooking an instant noodle takes 4 minutes on average while cooking a lasagna generally takes one and a half hours. If Simon took 10 minutes to cook an instant noodle and Jack took an hour to cook a lasagna, the overall time spent on cooking would still be less than the average time spent for cooking an instant noodle and a lasagna. Such a situation is compatible with (192c) but not with (192b). But, (192a) is judged false in that situation, which indicates that (192c) is not available. Let us next consider (193a). A situation in which Tom has to eat the spinach but Lee may or may not eat the broccoli is compatible with (193c) but not with (193b). In this situation, however, (193a) can only be judged false, which suggests that (193c) is not available.

To summarize, scopal expressions that operate at the clause-level, which are introduced by a finite auxiliary or a sentential adverb, can take either distributive- or wide-scope in Gapping sentences. These elements form a semantically homogeneous group: they operate at the 'propositional'-level, rather than on the predicative level.

5.1.2 Constructions that allow for Gapping scope ambiguity

One important empirical fact about Gapping is that it is not specific to coordination (see §2.1.1). One may therefore wonder whether Gapping in comparatives and other non-coordinating structures would display the same kind of scope ambiguity observed in coordinate Gapping. Interestingly, there are several different possibilities in non-coordination data.

First, expressions such as *not to mention* and *let alone*, which are not *sensu stricto* coordinating conjunctions, do not seem to have a wide-scope reading. For example, the following sentence cannot be understood as meaning that 'It is not the case that [Robin speaks French, not to mention Leslie German]', which indicates that the wide scope reading is absent.[3]

(194) Robin doesn't speak French, not to mention Leslie German.

Comparative Gapping exhibits the opposite behavior: it seems to allow for only a wide-scope reading. Huddleston & Pullum (2002:1340-1341) noted this pattern in discussing the following example:

(195) Max didn't love Jill as much as she him.

According to Huddleston & Pullum, this sentence does not have a reading in which the missing material is interpreted as "didn't love", although such a reading is permitted in the conjunctive counterpart of this sentence: *Max didn't love Jill and she (didn't love) him*. The authors conjecture that the absence of the distributive reading in sentences such as (195) is likely due to the fact that a subordinate structure is involved: the comparative-marked clause is syntactically outscoped by the negative auxiliary in the main clause.

Note that the wide-scope reading in (195) is *not* made available by Gapping. As the example in (196) shows, the presence of a finite verb or auxiliary in the comparative-marked clause does not preclude the wide-scope reading.

(196) Max didn't love Jill as much as she {loved him / did}.
≈ It is not the case that Max loved Jill as much as she loved him.

[3]It should be noted that expressions like *not to mention* and *let alone* have a pragmatic import (conventional implicature or pragmatic presupposition) on top of their truth-conditional meaning. It might therefore be that the absence of a wide-scope reading in the context of these expressions reflects pragmatic conditions rather than a grammatical constraint.

Finally, let us consider scopal patterns in embedding Gapping. As the data in (197) shows, when gapped clauses are embedded under a main clause, wide-scope readings are unavailable.

(197) a. Ward didn't order caviar and I think Sue beans.
≠ ¬(Ward ordered caviar and I think Sue ordered beans)

b. Mia possibly went to the museum and I think Kim to the beach.
≠ *possibly*(Mia went to the museum and I think Kim to the beach)

One possible conclusion from the above data is that there are two independent mechanisms which interact to create distributive- and wide-scope readings: (i) Gapping (which is responsible for the absence of a finite element) and (ii) coordination (which conjoins a finite clause directly with a gapped clause). While Gapping is possible in both coordinate and non-coordinate structures, it is only when the gapped clause is (directly) coordinated with the source that the distributive/wide-scope ambiguity occurs. This empirical fact has not been previously acknowledge. The next section discusses the consequences of this fact for previous syntactic analyses and provides a detailed assessment of these analyses that pertain to Gapping scope ambiguity.

5.2 Against Syntactic Ambiguity

Recent syntactic representational analyses account for the distributive- and wide-scope readings by postulating two distinct syntactic configurations for Gapping (Repp 2009; Boone 2014; Potter *et al.* 2017): distributive-scope readings result from coordination of full, finite clauses (typically, TP or CP) and wide-scope readings result from coordination of categories which lack a position for a finite element (vP). Consider for instance the following analyses à la Potter *et al.* (2017):

(198) John can't eat caviar and Sue beans.

a. Gapping in CP coordination (distributive-scope reading):

[$_{\text{CP}}$ John can't eat caviar] and [$_{\text{CP-TopP}}$ Sue$_x$ [$_{\text{CP-FocP}}$ beans$_y$ [$_{\text{TP}}$ ~~t_x can't eat t_y~~]]]]

b. Gapping in vP coordination (wide-scope reading):

John$_j$ [$_{\text{T}}$ can't [$_{v\text{P}}$ [$_{v\text{P}}$ t_j eat caviar] and [$_{v\text{P-FocP}}$ Sue$_x$ [$_{v\text{P-FocP}}$ beans$_y$ [$_{\overline{v\text{P}}}$ ~~t_x eat t_y~~]]]]]

In order for this sort of analysis to be successful, it is important to show that the distributive- and wide-scope readings are syntactically constrained, such that examples which lack a distributive-scope reading do not also have a CP coordination parse, and those which lack a wide-scope reading do not also have a vP coordination parse. Potter *et al.* (pp. 1141-9) attempt to establish that these readings are so constrained. The authors consider several syntactic contexts which allegedly have either a CP or vP coordination parse and argue that in those contexts only one reading is available. The relevant syntactic contexts are schematized below (where $\mathbf{C}_{\text{Topic}}$ stands for a fronted topical constituent):

- Context conditioning distributive-scope only:

  [$\mathbf{C}_{\text{Topic}}$ ...] $\wedge$ [$\mathbf{C'}_{\text{Topic}}$ ...]
- Context conditioning wide-scope only:

  $\mathbf{C}_{\text{Topic}}$ [... $\wedge$ ...]

Following Rizzi (1997) and others, Potter *et al.* assume that a left peripheral topic occupies the edge of CP. It thus follows that, if a left peripheral topic occurs as a remnant, vP coordination should not be available. According to Potter *et al.*, this prediction is borne out by the following example, which lacks a wide-scope reading:

(199) CP coordination Gapping:

Caviar, James can't order and chili, Mary. (p. 1146, ex. (50a))

Potter *et al.* also argue that sentences in which a non-contrastive left peripheral topic appears, such as (200), do not have a legitimate CP coordination parse.

(200) vP coordination Gapping:
With only ten dollars between them, James could get a sandwich, and Mary a bowl of soup. (p. 1141, ex. (39b))

According to Potter *et al.*, the CP coordination parse of (200) is ill-formed:

(201) *[$_{\text{TopP}}$ [With only ten dollars between them] James could get a sandwich] and [$_{\text{TopP}}$ [Mary] [a bowl of soup] ~~could get with only ten dollars between them~~]

However, it is unclear why (200) cannot have the CP coordination parse in (202).[4]

(202) [$_{\text{CP}}$ [$_{\text{TopicP}}$ With only ten dollars between them]$_x$ [James could get a sandwich t_x]] and [$_{\text{CP}}$ [$_{\text{TopicP}}$ ~~with only ten dollars between them~~]$_y$ [Mary ~~could get~~ a bowl of soup t_y]]

Potter *et al.* (p. 1142, fn. 14) in fact point out that (202) was suggested by an anonymous reviewer. They argue, however, that such an analysis is ruled out by a prohibition against non-constituent ellipsis. But this explanation requires a commitment to a theory-dependent assumption about ellipsis of doubtful validity, given that what is elided in Gapping sentences need not be a constituent, as shown in (203).

(203) a. Max writes poetry in the bathroom, and Schwarz ~~writes~~ radical pamphlets ~~in the bathroom~~.

b. Kim wants Hillary to win and John ~~wants~~ Trump ~~to win~~.

In any case, there are counterexamples to the claimed parallel between available coordination parses and distributive/wide-scope readings. Note first that in general, symmetric

[4]Certainly, (202) is semantically odd because of the PP *between them*, which sets up an expectation that this expression will be followed by a statement about both James and Mary.

topicalization, such as in (199), naturally supports a distributive-scope reading, since each conjunct elaborates a different topic. But if there is a single topic and the conjuncts together elaborate this common topic, as in (200), the conjuncts are more tightly connected, through both coordination and the common topic. In this case, the events described by the conjuncts are easily construed as a single complex event to which a negation or modal can apply. One can see that cases which seem to support Potter *et al.*'s predictions are simply artifacts of these interpretive biases. With this in mind, consider an instance of CP coordination which nonetheless has a wide-scope reading:

(204) CP coordination Gapping & $\neg\Diamond(A \vee B)$ reading:

These assignments, James can't finish by tomorrow or **any of them**, by the end of semester (for that matter).

$\approx$ It is impossible for James finish these assignments by tomorrow or any of them by the end of semester.

In this sentence, each conjunct contains its own topicalized element, which suggests that only a CP coordination-parse is available for this sentence, according to Potter *et al.*. Yet, (204) admits a wide-scope reading: the NPI in the second conjunct (*any of them*), which is licensed by the negation in the first conjunct, helps disambiguate the sentence in favor of the wide-scope reading.

Let us consider the opposite case. In (205) a single topic is shared between the conjuncts, and yet, a distributive-scope reading is available.

(205) vP coordination Gapping & $\neg\Diamond A \wedge \neg\Diamond B$ reading:

With ten dollars each, James can't get a steak and Mary a lobster. (A steak and a lobster are each $30.)

$\approx$ With then dollars each, James can't get a steak and Mary can't get a lobster.

Thus, Potter *et al.*'s argument that the distributive- and wide-scope readings are syntactically constrained is not supported empirically. But since this argument constitutes the only empirical attempt thus far to establish the claimed syntactic dependence of those readings, we are forced to conclude that there is currently no compelling empirical support for the syntactic ambiguity of Gapping sentences.

The analysis in Kubota & Levine (2016) does not suffer from the lack of evidence for a syntactic ambiguity because the distinct syntactic categories (or types) assumed for the distributive- and wide-scope readings of Gapping correspond to two inference rules, not two distinct syntactic representations (see §2.2.3). It is unclear, however, whether Kubota & Levine's analysis can explain the absence of wide-scope readings in cases such as (194), where the gapped clause is not conjoined with its source clauses. On the one hand, this sort of data suggests that a Gapping-type entry must be assumed for certain subordinators. On the other hand, in Kubota & Levine's analysis, the distributive- and wide-scope ambiguity follows from (i) two distinct derivations (or proofs) associated with auxiliaries and (ii) a Gapping-specific conjunction, which composes clauses that contain medial gaps. This seems to predict that wide-scope readings should be available in all cases of auxiliary-Gapping, contrary to fact. Kubota & Levine's analysis does not seem to offer a motivated account as to why this is the case.

5.3 An Account Based on Semantic Underspecification

I now turn to my own analysis for the distributive and wide-scope readings of Gapping sentences. My analysis draws on a semantic distinction between eventuality descriptions and tensed propositions which is entailed by previous syntactic analyses based on vP vs. TP/CP coordination (Boone 2014; Potter *et al.* 2017), but without assuming the presence of a syntactic ambiguity. To conceptualize Gapping scope ambiguity this way, a different

view of the syntax-semantics interface is required. This is where a semantic underspecification approach to the syntax-semantics interface can be useful (Egg *et al.* 2001; Richter & Sailer 2004; Copestake *et al.* 2005). Instead of assuming that the distributive- and wide-scope readings of Gapping sentences correspond to two distinct syntactic structures, we can assume that these readings are associated with two different specifications of a single, underspecified meaning. Since this underspecified meaning can be linked to a uniform syntactic structure, the various scopal readings of Gapping sentences can be accounted for without the need to posit a syntactic ambiguity. This is one major advantage over previous syntactic analyses in which different scopal relations of a sentence require assigning multiple syntactic structures or derivations to that sentence.

In my analysis, one major departure from previous analyses lies in the treatment of coordination. I assume that the semantics of coordination is underspecified in that what is being conjoined between the first and second conjuncts can be a subexpression of the first conjunct, provided that the conjoined terms match in their semantic type. The distributive- and wide-scope readings arise as the result of specifying this underspecified meaning in accordance with independent constraints (clarified below): (i) a distributive-scope reading results when the gapped clause denotes a tensed proposition, and (ii) a wide-scope reading results when it denotes an eventuality description. The remainder of this section is devoted to introducing the details of this proposal.

5.3.1 A type-driven semantics for the Gapping scope ambiguity

I assume a type-logical distinction between eventuality descriptions and tensed propositions along the lines of Champollion (2015) (see Comrie (1976), de Swart (1998) and Condoravdi (2002) for similar ideas). Below, I introduce the details of Champollion's semantics that are relevant for my purposes.

Champollion's semantics is broadly Neo-Davidsonian but with one major difference: the event quantifier is introduced in the lexical entry of the verb rather than via existential closure at the sentence-level. This innovation captures the empirical generalization that the event quantifier always takes narrow scope with respect to all other quantifiers and scopal operators introduced in the same clause (cf. Sailer 2004a:fn. 7). Accordingly, verbs and their projections up to the sentence level are uniformly treated as existential quantifiers over events (of type $\langle vt, t\rangle$, a function from a set of events to a truth value; v stands for the type of event). Below, (206) illustrates the semantics of a simple predicate in this analysis (f ranges over event predicates):

(206) $[\![\text{rain}]\!] = \lambda f \exists e[\text{rain}'(e) \wedge f(e)]$ (Champollion 2015:39)

The predicate "rain" is true of any set of events f as long as f contains an event that satisfies that predicate. For illustration, ignoring tense and assuming the "true" operator, the truth condition of the sentence *it is raining* can be obtained by inspecting whether the set of all events, $\lambda e.\text{true}'$, has the property denoted by the predicate "rain" (Champollion 2015:39):

(207) $[\![\text{It is raining}]\!]$

a. $= \lambda f \exists e[\text{rain}'(e) \wedge f(e)](\lambda e.\text{true}')$

b. $= \exists e[\text{rain}'(e) \wedge (\lambda e.\text{true}')(e)]$

c. $= \exists e[\text{rain}'(e) \wedge \text{true}']$

d. $= \exists e[\text{rain}'(e)]$

For simple past sentences like *it rained*, Champollion assumes the sentence-level operator in (208), where $\subseteq_T$ and $\prec$ represent temporal inclusion and temporal precedence, respectively; t_r stands for the reference time and τ is the temporal trace function from Krifka (1989), a function from events to their runtime.

(208) $[\![\text{[past-closure]}]\!] = \lambda V[t_{\text{r}} \prec \text{now} \wedge V(\lambda e[\tau(e) \subseteq_T t_{\text{r}}])]$

The truth condition for *it rained* obtains as follows:

(209) ⟦It rained⟧

a. $= \lambda V[t_{\mathrm{r}} \prec \mathsf{now} \wedge V(\lambda e'[\tau(e') \subseteq_T t_{\mathrm{r}}])](\lambda f \exists e[\mathsf{rain}'(e) \wedge f(e)])$

b. $= t_{\mathrm{r}} \prec \mathsf{now} \wedge \lambda f \exists e[\mathsf{rain}'(e) \wedge f(e)](\lambda e'[\tau(e') \subseteq_T t_{\mathrm{r}}])$

c. $= t_{\mathrm{r}} \prec \mathsf{now} \wedge \exists e[\mathsf{rain}'(e) \wedge \lambda e'[\tau(e') \subseteq_T t_{\mathrm{r}}](e)]$

d. $= t_{\mathrm{r}} \prec \mathsf{now} \wedge \exists e[\mathsf{rain}'(e) \wedge \tau(e) \subseteq_T t_{\mathrm{r}}]$

Champollion treats sentential operators such as negation and modals as modifiers of eventuality descriptions (of type $\langle\langle vt, t\rangle, \langle vt, t\rangle\rangle$). Tense is introduced after all other operators have done their work: it maps the interpretation of the sentence to a truth value (de Swart 1998). Taken together, these assumptions require that semantic scope in a simple sentence be as specified in (210):

(210) [Tense [{modal, negation, adverbs of quantification, ...} [eventuality description]]]

Thus, tense has maximal scope, and the eventuality description has minimal scope. Scopal operators take scope between tense and the eventuality description.

All these assumptions work together to predict the distributive- and wide-scope readings of Gapping sentences: because clauses can generally be of two types in Champollion's system, t or $\langle vt, t\rangle$, we predict the (simplified) semantic structures in (211b-c) which we may associate with the two readings of (211).

(211) a. John can't live in Buffalo and Mary New York.

b. Semantic structure under the distributive-scope reading:
$\mathsf{Tense}[\neg\Diamond(\mathsf{live}'(\mathsf{j}, \mathsf{b}))] \wedge \mathsf{Tense}[\neg\Diamond(\mathsf{live}'(\mathsf{m}, \mathsf{ny}))]$

c. Semantic structure under the wide-scope reading:
$\mathsf{Tense}[\neg\Diamond(\mathsf{live}'(\mathsf{j}, \mathsf{b}) \wedge \mathsf{live}'(\mathsf{m}, \mathsf{ny}))]$

Figure 5.1 presents the underspecified representation of (211). The left-side of the figure depicts the semantic contributions of the first conjunct, which includes a tense meaning, a negated possibility modal, and the description live′(j, b). The right-side of the figure shows the semantic contribution of the second conjunct, where the missing content is underspecified as $\mathscr{R}$.

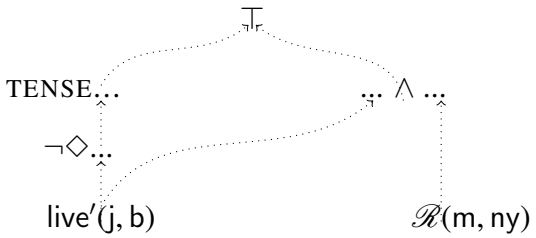


Figure 5.1: Underspecified representation of (211)

Since there are two possible ways of specifying $\mathscr{R}$ in accordance with the constraints in Figure 5.1, the two readings of (211) are predicted: (i) the distributive-scope reading in (211a) results when $\mathscr{R}$ = TENSE¬◇live′ (and the conjoined terms are tensed propositions of type t); (ii) the wide-scope reading in (211b) results when $\mathscr{R}$ = live′ (and the conjoined terms are eventuality descriptions of type $\langle vt, t\rangle$, taking scope below a shared negated modal and tense meaning).

Finally, on the present account, the lack of the wide-scope reading in the ungapped counterpart of (211), given in (212a), follows from the usual constraint that the semantic type of conjuncts must match (Partee & Rooth 1983) and the fact that tensed propositions are of type t. (212b) illustrates an ill-formed attempt at conjoining an eventuality description (of type $\langle vt, t\rangle$) and a tensed proposition (t).

(212) a. John can't live in Buffalo and Mary can't live in New York.

b. Ill-formed representation for (212a):

*Tense[¬◇(live′(j, b) ∧Tense[¬◇(live′(m, ny))]]

5.3.2 The semantics of coordination

In this subsection, I present empirical evidence supporting my treatment of coordination briefly outlined above, according to which there are two legitimate scopal possibilities: (i) the conjuncts can be interpreted scopally independent, or (ii) a scopal element within the initial conjunct may outscope the entire coordination. In particular, I show that (ii) is not restricted to (wide-scope) Gapping, contrary to widespread assumptions.

Huddleston & Pullum (2002:1332-3) noted cases of non-elliptical coordination in which some feature of an initial conjunct affects the semantics of the entire coordination. This is exemplified by (213) below.

(213) Did you make your own contributions to a complying superannuation fund and your assessable income is less than $31,000?

(Huddleston & Pullum (2002:1332); originally from a tax form)

In this example, an interrogative clause is coordinated with a declarative clause, but the sentence as a whole expresses a single question.

Huddleston & Pullum also discuss cases in which a modal auxiliary within the initial conjunct is interpreted as having wide-scope over the entire coordination (ibid., p. 1333, fn. 53):

(214) It might be up there and I can't see it.

(Paraphrase: It might be that it is up there and I still can't see it.)

Note that the above sentences have an asymmetric, consequential reading (similar to *Cause-Effect* reading in Kehler (2002) and *Result* in Asher & Lascarides (2003)). If we assume that the conjoined terms in asymmetric coordination need not be alike in semantic type, the wide-scope of the question meaning in (213) and the modal in (214) would follow from the treatment of coordination I propose.

Chaves (2007:§3.6) also provided a number of examples which show that conjuncts are not scope island, such as those in (215).

(215) a. I usually open the window and the dog starts barking.
≈ *usually*(I open the window and the dog starts barking)
b. I usually cry and he gets me a Kleenex.
≈ *usually*(I cry and he gets me a Kleenex)
(Chaves 2007:89, ex. (90))

Chaves compares these sentences with the following example from Copestake *et al.* (2005), and rejects Copestake *et al.*'s claim that adverbs cannot outscope their local conjuncts:

(216) Sandy stayed and probably fell asleep.
$\not\approx$ *probably*(Sandy stayed and fell asleep)

As Chaves notes, the scopal patterns in (215)-(216) suggest that there is an asymmetry between initial and non-initial conjuncts with respect to scope: initial conjuncts allow nested scopal operators to outscope both conjuncts, but non-initial conjuncts are not likely to do so.

Another piece of evidence supporting a scopal asymmetry between initial and non-initial conjuncts comes from the distribution of NPIs. In (217a) the NPI *any* in the second conjunct is licensed by the negation *no* in the first conjunct. If the ordering between the conjuncts is reversed, as in (217b), ungrammaticality ensues, which suggests that the negation in the second conjunct is unable to outscope the entire coordination.[5]

(217) a. There is no medicine or any treatment whatsoever.
b. *There is any treatment or no medicine whatsoever.

[5]I thank François Mouret for alerting me to this possibility.

In sum, the above data is consistent my empirical claim that initial and non-initial conjuncts behave differently with respect to scope: scopal elements within initial conjuncts can outscope the entire coordination but those in non-initial conjuncts cannot, irrespective of Gapping.

Let us briefly consider the implications of the above data for previous analyses. In Potter *et al.* (2017), wide-scope readings are dependent on the availability of a vP coordination parse. Once we have a tensed element in the non-initial conjunct, however, a vP coordination parse is not possible, which erroneously predicts the absence of a wide-scope reading in all cases. A similar problem arises for Kubota & Levine's (2016) analysis. In their analysis, auxiliaries are assumed to combine with an untensed clause to yield a tensed clause (Kubota & Levine 2016:141, fn. 24). This has the consequence that auxiliary Gapping is restricted to where the "gaps" can be hypothesized in all conjuncts of a coordination, and this possibility is excluded if the non-initial conjuncts already contained a tensed element. This means that the only legitimate derivation for (214), for instance, is one where the conjuncts are generated as ordinary, gap-less clauses with the semantics of the auxiliary *might* applying to the first conjunct's VP.

On the other hand, the account of Gapping presented in this work does not stipulate that wide-scope readings are restricted to Gapping sentences, and therefore can accommodate data problematic to other analyses.

5.4 Gapping: HPSG Syntax-Semantics Interface

5.4.1 Coordinate structures

I now turn to a formal account of coordinate structures. There are two basic assumptions that pertain to the syntactic structure of coordination: (i) the analysis of coordinators, and

(ii) the combination of a coordinator and its conjuncts. Regarding (ii) there are well-known reasons that the coordinator forms a constituent with one of the conjuncts. As Ross (1967) noted, there is a natural intonation break before the coordinator, and not between the coordinator and the following conjunct. Chaves (2007) also noted that in many languages coordinators are not independent words but are suffixes attached to a conjunct to form a new constituent. Moreover, a coorindator-marked constituent can appear as a stand-alone utterance: e.g., *And now he comes*, *And you think that's good?* With regards to the syntactic relation between a coordinator and its conjunct, I follow the general approach in HPSG and assume that the coordinator is the functor and its conjunct is the head Beavers & Sag 2004; Chaves 2007, 2012). Coordinator-marked conjuncts and unmarked conjuncts are treated as non-headed phrases, as is standard in HPSG.

The analysis sketched above can be accounted for by assuming a binary branching n-ary structure (Yngve 1960), depicted in Figure 5.2.

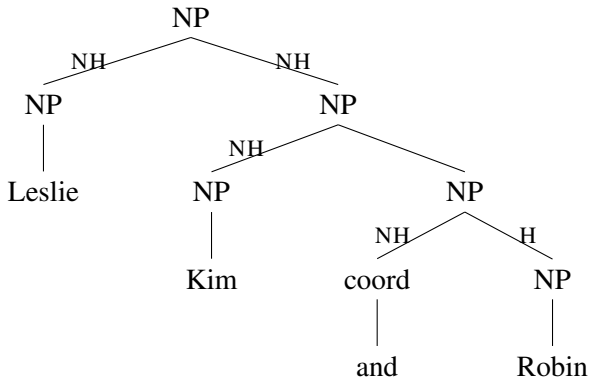


Figure 5.2: NP coordination [*Leslie* [*Kim* [*and Robin*]]]

This structure can be accounted for by two phrase-structure rules, which are shown below:

(218) a. $X_{crd+} \rightarrow$ *coord* X_{crd-}

b. $X \rightarrow X_{crd-}\ X_{crd+}$

(218a) allows a coordinator to combine with an unmarked head (e.g., [*Robin*]) to yield a coordinator-marked constituent (e.g., [*and Robin*]). (218b) in turn allows the coordinator-marked constituent to combine with an unmarked constituent to form a coordinate phrase. The feature CRD is adopted from Beavers & Sag (2004) to indicate that a constituent has already been combined with a coordinator ([CRD +]) or not ([CRD -]).

Before I discuss more details about this analysis, it is necessary to make some modification to the version of LRS introduced in §3.3. Note that LRS in the current form contains assumptions that are not consistent with how coordination works. Currently, the value of the INCONT feature is defined as a Ty2 term (i.e., meaningful expression (*me*)), but the INCONT value of a coordinate phrase is not a single logical form but a collection of multiple logical forms, given that logical operators such as conjunction and disjunction are scopal elements and thus are not part of a coordinate sign's INCONT. For example, the INCONT of the NP coordination *some books and some magazines* amounts to two discontinuous logical forms, $\mathsf{book}'(x)$ and $\mathsf{magazine}'(y)$, i.e., the scopally lowest semantic contribution of the NP conjuncts. I therefore require that the appropriateness conditions for the sort *lrs* be changed to allow a list of *me*s to be an appropriate value for the feature INCONT (Fast 2005):

$$\begin{bmatrix} \textit{lrs} & \\ \text{EXCONT} & \textit{me} \\ \text{INCONT} & \textit{list(me)} \\ \text{PARTS} & \textit{list(me)} \\ \text{C-MODE} & \textit{bool} \end{bmatrix}$$

Figure 5.3: Appropriateness conditions for the sort *lrs*

Let us next move on to the analysis of coordinators. With regards to the syntactic status of coordinators, I assume that these are a type of functor that selects the unmarked head and passes that head's MARKING value onto the mother node (Beavers & Sag 2004; Chaves 2007, 2012). Thus, if the head is specified as [MARKING *that*] (e.g., *that Mary*

left), so is the mother. Figure 5.4 shows the set of constraints that a coordinator word must satisfy. The feature SPEC allows expressions such as coordinators and determiners to impose constraints on the head they combine with.[6]

$$\begin{bmatrix} \textit{coord} & & & & \\ \text{CAT} & \begin{bmatrix} \text{MARKING} & \boxed{1} & & \\ \text{SPEC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{MARKING} & \boxed{1} \end{bmatrix} \\ \text{CRD} & - \end{bmatrix} \end{bmatrix} \\ \text{CRD} & + \end{bmatrix}$$

Figure 5.4: Constraints on the type *coord*

The conjunctive coordinator *and* must satisfy all these constraints, as well as additional constraints specific to this word. Figure 5.5 describes the constraints specified in the lexical entry of *and* and those inherited from the type *coord*.

$$\begin{bmatrix} \textit{word} & & & & \\ \text{PHON} & \langle \text{and} \rangle & & & \\ \text{SYNSEM} \mid \text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{MARKING} & \boxed{1} & & \\ \text{SPEC} & \begin{bmatrix} \text{MARKING} & \boxed{1} \\ \text{CRD} & - \end{bmatrix} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{MAIN} & \wedge \end{bmatrix} \\ \text{CRD} & + \end{bmatrix} \\ \text{LF} & \begin{bmatrix} \text{EXCONT} & \alpha \wedge \beta \\ \text{INCONT} & \textit{list}(\textit{me}) \\ \text{PARTS} & \langle \alpha \wedge \beta \rangle \end{bmatrix} \end{bmatrix}$$

Figure 5.5: Lexical description for *and*

[6]Here and throughout I generally abstract away from issues that pertain to the local semantics of coordinate structures.

This description expresses that the conjunction *and* contributes a conjunction meaning ($\alpha \wedge \beta$) via the PARTS, and that this conjunction meaning is also the external content of the conjunction (Fast 2005). The INCONT value of the coordinator is underspecified as *list*(*me*); additional restrictions on this INCONT value will be introduced via the relevant phrasal construction (details below). Syntactically, *and* combines with an expression that has not yet combined with a conjunction marker ([SPEC|CRD -]) but the conjunction itself has a [LOC|CRD +] specification.

We can next proceed to the analysis of coordinator-marked phrases. The relevant rule for these structures is shown in Figure 5.6, which states that a phrase of type *coord(inator)-h(ea)d-ph(rase)* is formed with a coordinate nonhead daughter and a head daughter (see Figure 5.6 for an example analysis). The mother inherits the MARKING and CRD values from the coordinate daughter. Moreover, the mother has a [C-MODE -] specification, which means that instances of type *coord-hd-ph* are not governed by the general semantic principles of LRS. This accounts for the fact that, coordinator-head phrases do not have the usual semantic relations between heads and nonheads: much of the semantic potential of a coordinator-head phrase is determined by the coordinator non-head, rather than by the head daughter.

$$\left[\begin{array}{ll} \textit{coord-hd-ph} & \\ \text{CAT} & \left[\text{MARKING } \boxed{1}\right] \\ \text{CRD} & \boxed{2} \\ \text{LF} & \left[\text{C-MODE } -\right] \\ \text{HD-DTR} & \boxed{0} \\ \text{DTRS} & \left\langle \left[\begin{array}{ll} \text{CAT} & \left[\begin{array}{ll} \text{MARKING} & \boxed{1} \\ \text{SPEC} & \boxed{0} \end{array}\right] \\ \text{CRD} & \boxed{2} \end{array}\right], \boxed{0} \right\rangle \end{array}\right]$$

Figure 5.6: Coordinator-Head Phrase

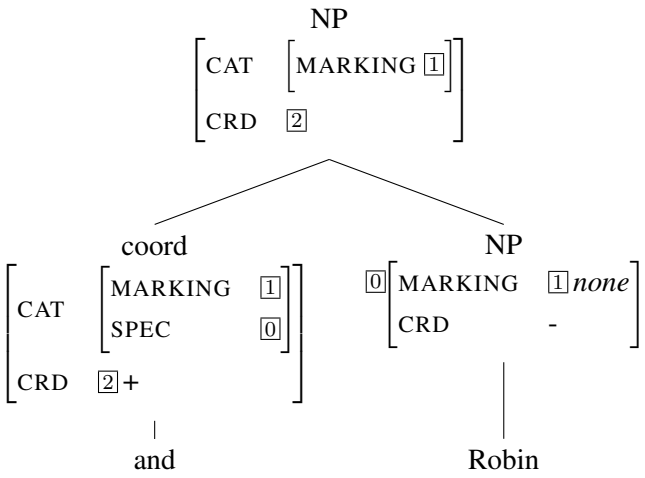


Figure 5.7: Coordinator-marked NP [*and Robin*]

I assume that the nonlocal semantics of structures of type *coord-hd-ph* are governed by the following semantic principles.

(219) THE SEMANTICS PRINCIPLE (specific to *coord-hd-ph*):

In every coordinator-head phrase, if the coordinator daughter's EXCONT value is of the form $\alpha \circ \beta$ (where $\circ$ represents boolean conjunctions $\wedge$ and $\vee$), then (a) the INCONT value of the coordinator is identical to the INCONT value of the head, and (b) the EXCONT value of the head must be a subexpression of β.

(220) LRS PROJECTION PRINCIPLE (specific to *coord-hd-ph*):

In every coordinator-head phrase, (a) the EXCONT and INCONT values of the mother are identical to the EXCONT and INCONT values of the coordinator daughter, and (b) the PARTS value of the mother contains all and only the elements of the PARTS values of the daughters.

(219) governs the combination of a coordinator and a head, and requires two things: first, the scopally lowest semantic contribution of the head (i.e., the head's INCONT value) must be identical to the coordinator's INCONT value; second, the overall logical form of the

head must be a subexpression of the second argument (represented as β) of the conjunction meaning contributed by the coordinator. The second requirement captures an empirical generalization argued for in §5.3: it ensures that the conjunction meaning takes wide-scope over all semantic contributions of the conjunct head. (220) defines the admissible values of the EXCONT, INCONT and PARTS values of the mother relative to its daughters. It requires that the mother's EXCONT and INCONT values be identical to those of the coordinator daughter and that all the semantic contributions of the daughters be collected in the mother's PARTS value.

The effects of these semantic principles are illustrated in Figure 5.8. Starting from the coordinator daughter, its EXCONT and INCONT values are as specified in Figure 5.5 above, and its INCONT value is identical to the INCONT value of the head daughter, due to (219). This principle also ensures that the EXCONT value of the head daughter is a subexpression of the second argument of the coordinator ($\boxed{2} \lhd \beta$). (220) imposes constraints on the mother and requires that the EXCONT and INCONT of the mother be inherited from the coordinator daughter.

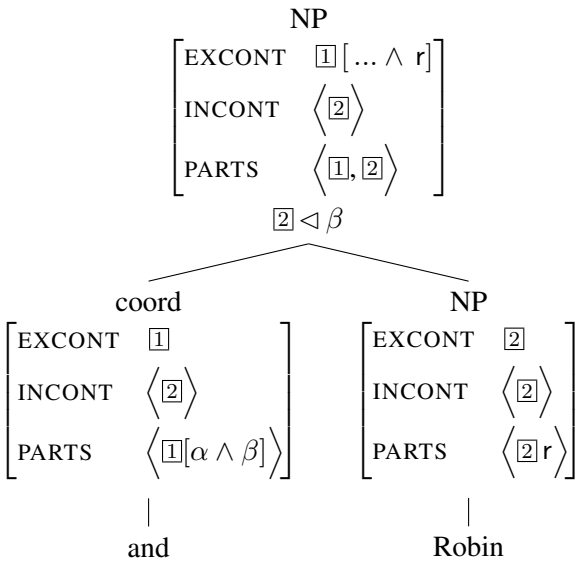


Figure 5.8: Coordinator-marked NP [*and Robin*] with LRS constraints

Let us next turn to the analysis of coordinate phrases. I assume that coordinate phrases are associated with a new type called *coor(dinate)-ph(rase)*, which is formed with two nonhead daughters (cf. Beavers & Sag 2004; Chaves 2007, 2012). Since coordinate phrases are non-headed structures, they are not governed by the general principles of LRS. Syntactically, the mother and the daughters share their core syntactic properties: i.e., they have identical CAT values. The mother has a [CRD *unmarked*] specification, which means that it has the potential to combine with a coordinator to form a coordinator-marked phrase (e.g., [*and* [*Kim* [*and Robin*]]]).

$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{CAT} & \boxed{1} \\ \text{LF} & \begin{bmatrix} \text{C-MODE} & - \end{bmatrix} \\ \text{CRD} & \textit{unmarked} \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \text{CAT} & \boxed{1} \\ \text{CRD} & - \end{bmatrix}, \begin{bmatrix} \text{CAT} & \boxed{1} \\ \text{CRD} & + \end{bmatrix} \right\rangle \end{bmatrix}$$

Figure 5.9: Coordinate-Phrase

This set of constraints are illustrated in Figure 5.10.

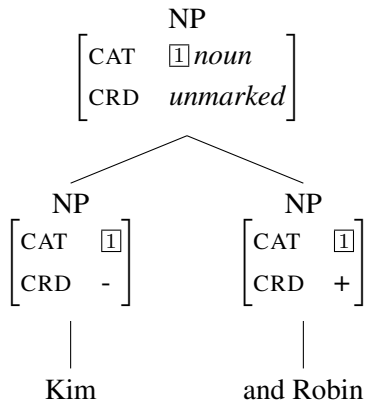


Figure 5.10: NP coordination [*Kim* [*and Robin*]]

An additional SEMANTICS PRINCIPLE specific to *coord-ph* must be introduced to

constrain the EXCONT and INCONT values of the daughters. In addition, the mother's nonlocal semantics relative to the daughters' needs to be constrained by a new LRS PROJECTION PRINCIPLE. These semantic principles are stated in (221) and (222), respectively (cf. Fast 2005).

(221) THE SEMANTICS PRINCIPLE (specific to *coord-ph*):

If the CRD-marked daughter has an EXCONT value of the form $\alpha \circ \beta$, then every element in the INCONT value of the CRD-unmarked daughter is a subexpression of α.

(222) LRS PROJECTION PRINCIPLE (specific to *coord-ph*):

In a coordinate phrase, (a) the INCONT value of the mother contains all and only the elements of the INCONT values of the daughters, and (b) the PARTS value of the mother contains all and only the elements of the PARTS values of the daughters.

(221) requires that every logical form that corresponds to the scopally lowest semantic contribution of the unmarked (initial) conjunct be included a subexpression of the first argument of the conjunction operator. This captures an empirical generalization argued for in §5.3 above: scopal elements contributed by the initial conjunct can possibly outscope the conjunction. (222) constrains the mother's INCONT and PARTS values such that these contain all and only the INCONT and PARTS values of the daughters. As an illustration of how these principles work, consider the analysis in Figure 5.11 its underspecified representation in Figure **??**, where the scopal relations between the semantic contribution of each conjunct (the constants k and r) as well as the semantic contribution of the conjunction (... $\wedge$ ...) are arranged in a hierarchical manner to reflect their relative scope.

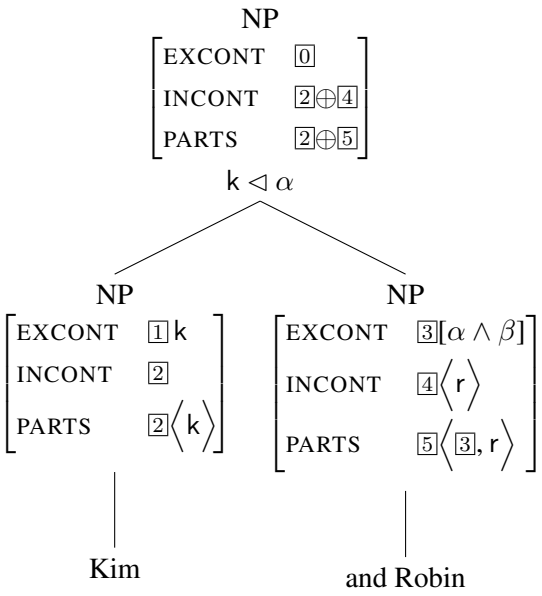


Figure 5.11: NP coordination [*Kim* [*and Robin*]] with LRS

In Figure 5.11, the mother's INCONT and PARTS values are collected from those of the daughters, as dictated by (222); i.e., the mother's scopally lowest semantic contribution amounts to $\langle \mathsf{k}, \mathsf{r} \rangle$. The subexpression constraint $\mathsf{k} \lhd \alpha$ is introduced by (221), and it has the effect that the scopally lowest semantic contribution of the first conjunct is outscoped by the conjunction.[7] Since the grammar imposes no further constraint on the mother's EXCONT, it is left underspecified as $\boxed{0}$. Since the initial conjunct does not contain any scopal element, there is only one logical form that corresponds to $\boxed{0}$: $\mathsf{k} \wedge \mathsf{r}$.

5.4.2 Scope ambiguity in conjunctive Gapping

In this section, I show how the grammar developed so far accounts for the scope ambiguities in Gapping. To accommodate the distinction between tensed propositions and event descriptions that are crucial for the account of distributive- and wide-scope ambiguities,

[7] The effect of this constraint is not trivial when there is a scopall expression in the first conjunct that interacts with the conjunction. We will consider such a case in the next section.

I replace Ty2 and use Champollion's (2015) quantificational event semantics introduced above as the logical representation language for LRS. This change mainly affects the analysis of verbs and their projections. Below I present the analysis of verbs and illustrate the consequences of combining LRS with Champollion's (2015) event semantics.

One crucial ingredient missing so far is the analysis of auxiliary verbs. Following previous proposals within the LRS literature, I propose to treat auxiliaries as 'internal content raisers', who share with their complement the subject and the internal content (Richter & Sailer 2004, 2008). This, auxiliaries combine with a VP complement and inherit the complement's INCONT value. The relevant constraint can be introduced by adding Clause 3 to the (general) SEMANTICS PRINCIPLE (129):

(223) SEMANTICS PRINCIPLE, Clause 3.
if the head is an auxiliary and the nonhead is a VP, then the INCONT values of the head and the nonhead are identical.

I also assume that auxiliaries introduce, via PARTS, a tense semantics as well as (optionally) a negation or modal meaning. These assumptions are encoded in the lexical entry of auxiliaries, illustrated in Figure 5.12 (see next page). This figure expresses the following information. First, the auxiliary *didn't* takes two arguments, a NP subject and a VP complement, which are encoded in the ARG-ST. The tag $\boxed{1}$ indicates that the subject of the complement (the second member in the ARG-ST) is also the subject of the auxiliary. With regards to the nonlocal semantics, this auxiliary introduces via PARTS a negation meaning $\neg\psi$ (ψ indicates the scope of the negation), as well as a past tense meaning, which is represented discontinuously: $t \prec \mathsf{now} \wedge \phi$ (which locates the reference time before the time of utterance) and $\tau(e) \subseteq t$ (which expresses the relation between the time of event $\tau(e)$ and the reference time). The event variable e comes from the VP complement the auxiliary selects.

$$\begin{bmatrix} \textit{word} & \\ \textsc{phon} & \langle \textsf{didn't} \rangle \\ \textsc{ss}\,|\,\textsc{loc} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textit{verb} \\ \textsc{aux} + \end{bmatrix} \end{bmatrix} \\ \textsc{cont} & \begin{bmatrix} \textsc{main} & \neg \end{bmatrix} \end{bmatrix} \\ \textsc{arg-st} & \left\langle \boxed{1}\textsc{np},\ \textsc{vp}\begin{bmatrix} \textsc{cat}\,|\,\textsc{head}\,|\,\textsc{subj} & \boxed{1} \\ \textsc{cont}\,|\,\textsc{index}\,|\,\textsc{var} & e \end{bmatrix} \right\rangle \\ \textsc{lf} & \begin{bmatrix} \textsc{excont} & \textit{me} \\ \textsc{incont} & \textit{list}(\textit{me}) \\ \textsc{parts} & \left\langle t \prec \textsf{now} \wedge \phi_{\langle vt,t \rangle},\ \neg\psi_{\langle vt,t \rangle}, \tau(e) \subseteq t \right\rangle \end{bmatrix} \end{bmatrix}$$

Figure 5.12: The lexical entry of the auxiliary *didn't*

Since lexical verbs denote event descriptions (of type $\langle vt, t \rangle$) in the current system, it is predicted that the scopally lowest semantic contribution of the VP complement, when combined with the auxiliary, would fall within the scope of the negation as well as tense semantics contributed by the auxiliary. Moreover, since tense takes widest scope in simple clauses (see §5.3.2), this predicts the following relative scope among the semantic contributions of the auxiliary (Δ indicates the scopally lowest semantic contribution of the complement): $t \prec \textsf{now} \wedge (...\neg(...\Delta(...\tau(\boxed{s}) \subseteq t...))$.

Next, a simple untensed transitive verb such as *eat* contribute the main lexical meaning, an event variable, and the existential quantifier over the variable. In addition, verbs also introduce a conjunction $\beta \wedge \gamma$, where β includes the scopally lowest semantic contribution of the verb (i.e., its INCONT) and γ an 'open position' where (part of) the tense meaning introduced in a projection of the verb will fall within (Champollion 2015). As an illustration, consider the following lexical entry for *eat*:

$$\left[\begin{array}{ll}
\textit{word} & \\
\textsc{phon} & \langle \mathsf{eat} \rangle \\
\textsc{ss}\,|\,\textsc{loc} & \left[\begin{array}{ll}
\textsc{cat} & \left[\textsc{head} \left[\begin{array}{l}\textit{verb}\\ \textsc{aux}\ \text{-}\end{array}\right]\right] \\
\textsc{cont} & \left[\begin{array}{ll}\textsc{index}\,|\,\textsc{var} & e \\ \textsc{main} & \boxed{1a}\,\mathsf{eat}'\end{array}\right]
\end{array}\right] \\
\textsc{arg-st} & \left\langle \textsc{np}\left[\textsc{index}\,|\,\textsc{var}\ x\right], \textsc{np}\left[\textsc{index}\,|\,\textsc{var}\ y\right]\right\rangle \\
\textsc{lf} & \left[\begin{array}{ll}
\textsc{excont} & \textit{me} \\
\textsc{incont} & \left\langle \boxed{1}\,\mathsf{eat}'(e,x,y)\right\rangle \\
\textsc{parts} & \left\langle e,\ \exists,\ \exists e.\phi,\ \boxed{2}\,[\beta \wedge \gamma],\ \boxed{1},\ \boxed{1a},\ \boxed{1b}\,\mathsf{eat}'(e),\ \boxed{1c}\,\mathsf{eat}'(e,y)\right\rangle
\end{array}\right]
\end{array}\right]$$

$$\wedge\, \boxed{1} \lhd \beta$$

Figure 5.13: The lexical entry of the verb *eat*

This lexical entry indicates that the main lexical meaning of the verb is eat' and that its INCONT value is the application of the predicate eat' to its arguments: these include the eventuality argument e and the variables or constants contributed by the arguments selected by the verbs (notated as x and y), which appear in the verb's ARG-ST list. Note that x and y do not appear in the PARTS list of the verb, which indicates that these are not the semantic contribution of the verb. The verb contributes the eventuality variable e, the event quantifier $\exists$ and the application expressions $\mathsf{eat}'(e)$, $\mathsf{eat}'(e,y)$ and $\mathsf{eat}'(e,x,y)$.

Let us consider how the analyses of auxiliaries and lexical verbs just described work to derive the semantic representation of a simple sentence. Figure 5.14 presents a syntactic analysis of (224a) along with the LRS. Figure 5.15 depicts the scopal relations among the semantic contributions of the sentence (see next page).

(224) a. John didn't eat caviar.

b. $t \prec \mathsf{now} \wedge \neg\exists e(\mathsf{eat}'(e,x) \wedge \tau(e) \subseteq t)$

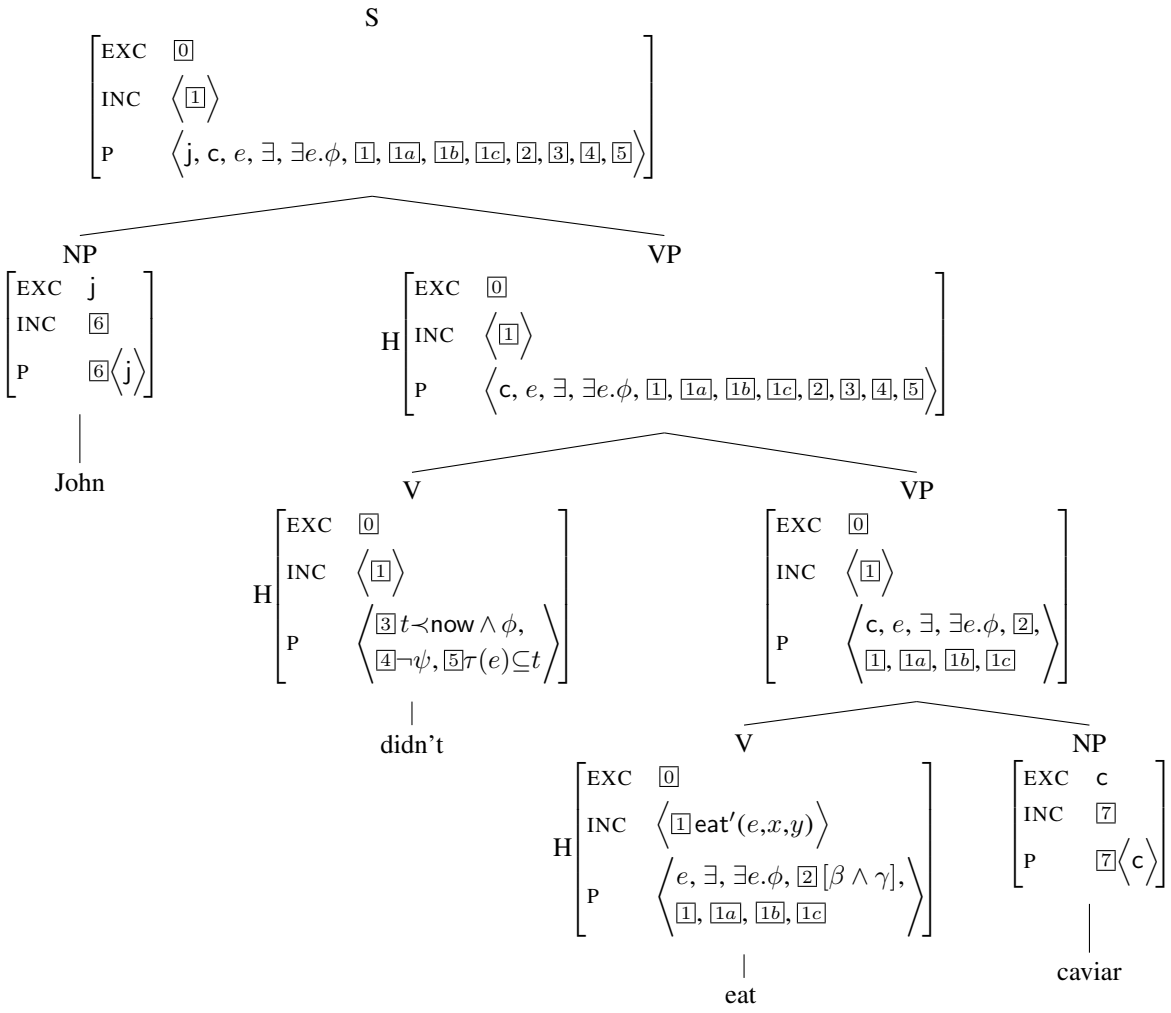


Figure 5.14: The syntactic analysis of [*John didn't eat caviar*] with LRS

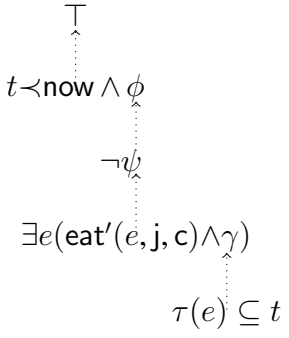


Figure 5.15: Underspecified representation of [*John didn't eat caviar*]

In Figure 5.14 each node of the tree specifies the LF values; the LF values of the auxiliary and the lexical verb are as specified in (5.12) and (5.13) above. The EXCONT and INCONT values are shared along the head projection, and elements within a daughter's PARTS is accumulated in the PARTS value of its respective mother (due to the general LRS PROJECTION PRINCIPLE; see (128) in §3.3). The INCONT values of the auxiliary verb and its complement are identical; this follows from Clause 3 of the SEMANTICS PRINCIPLE (see fn. 8). At the S node, Clause 2 of the EXCONT PRINCIPLE (127) applies and requires that the elements in the PARTS must specify exactly all the subexpressions of the resulting logical form, i.e., the EXCONT value $\boxed{0}$. Since the tense expression ($\boxed{3}$) is the 'biggest' logical form that includes all other subexpressions contributed by the sentence, it follows that $\boxed{0} = \boxed{3} = t \prec \mathsf{now} \wedge \neg \exists e[\mathsf{eat}'(e,\mathsf{j},\mathsf{c}) \wedge \tau(e) \subseteq t]$.

With everything in place, we can now proceed to the analysis of the Gapping sentence in (225), whose two readings are represented in (226) (to make the descriptions more readable the logical forms that correspond to *didn't* and *and* are highlighted in boldface.) Since I already provided the analysis of the source clause (see Figure 5.14), I proceed to the analysis of the gapped clause and its composition with the conjunction *and*, which are shown in Figure 5.16 below (see next page).

(225) John didn't eat caviar and Mary pizza.

(226) a. Distributive-scope reading ($\neg A \wedge \neg B$):

$[t \prec \mathsf{now} \wedge \neg(\exists e(\mathsf{eat}(e,\mathsf{j},\mathsf{c})) \wedge \tau(e) \subseteq\ t)] \wedge [t' \prec \mathsf{now} \wedge \neg(\exists e'(\mathsf{eat}'(e',\mathsf{m},\mathsf{p}) \wedge \tau(e') \subseteq t')]$

$\approx$ 'John didn't eat caviar and Mary didn't eat pizza.'

b. Wide-scope reading ($\neg[A \wedge B]$):

$t \prec \mathsf{now} \wedge \neg([\exists e(\mathsf{eat}'(e',\mathsf{j},\mathsf{c}) \wedge \tau(e) \subseteq\ t] \wedge [\exists e'(\mathsf{eat}'(e',\mathsf{m},\mathsf{p}) \wedge \tau(e') \subseteq\ t])$

$\approx$ 'What didn't happen is: John eating caviar and Mary eating pizza. (...That

would have been unfair!)'

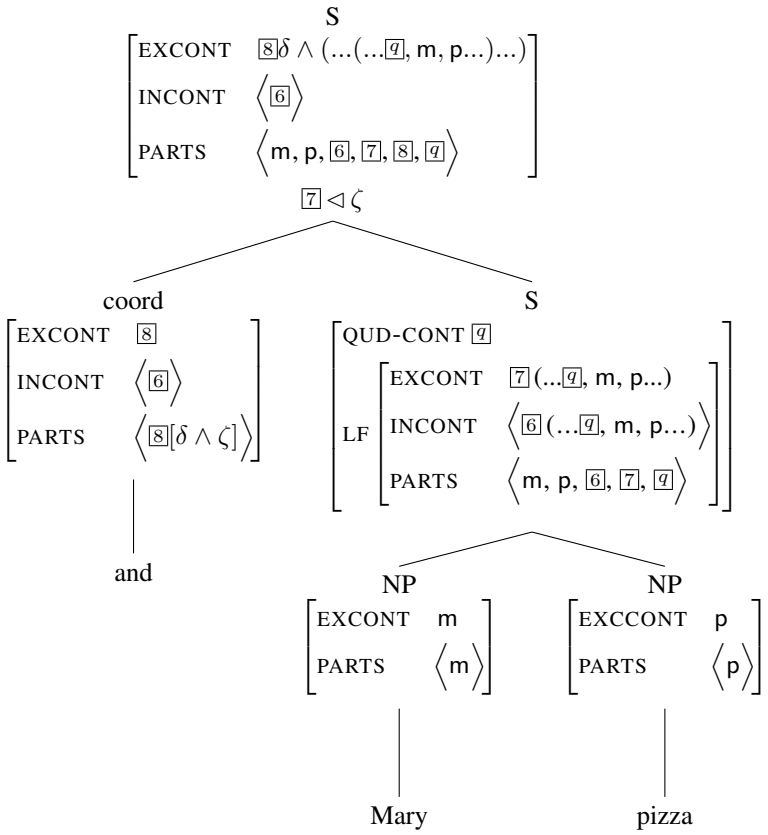


Figure 5.16: The syntactic analysis of *and Mary pizza* with LRS

Let us first inspect the lower S, which shows the syntactic analysis of the gapped clause and the LF values of each node. First, the PARTS values of the gapped clause-mother contains the semantic contributions of the daughters and the QUD-CONT $\boxed{q}$, the QUD retrieved from the context. The EXCONT and INCONT of the gapped clause-mother are also underspecified, and all we know is that they must include the semantic contributions gathered in the PARTS. To give an intuitive idea about what these specifications mean, let us imagine a case where the gapped clause *Mary pizza* follows the simple source sentence *John ate pizza*. In this case, the QUD would amount to 'x ate y', which can be expressed in the following form: $t \prec \mathsf{now} \wedge \exists e(\mathsf{eat}(e,x,y)) \wedge \tau(e) \subseteq\ t)$. The INCONT value of the gapped clause is ob-

tained by reducing x and y with m and p, and the result would mean roughly: 'Mary ate pizza'. Since this INCONT value exhausts all the semantic contributions the clause, this is also the EXCONT of the clause.

The conjunction *and* introduces a conjunction meaning ($\boxed{8}[\delta \wedge \zeta]$), which is also its EXCONT value. The INCONT value of the conjunction is identical to the INCONT of its conjunct, and this follows from the SEMANTICS PRINCIPLE specific to the type *coord-hd-ph* (see (219)). The subexpression constraint $\boxed{7} \lhd \zeta$ is also introduced by this principle; it requires that the overall semantic contribution of the gapped conjunct be introduced within the scope of the conjunction. As an effect of the LRS PROJECTION PRINCIPLE introduced for *coord-hd-ph* (see (220)), the mother's EXCONT and INCONT values are identical to the coordinator daughter.

Finally, the analysis of the entire sentence *John didn't eat caviar and Mary pizza* is obtained by combining the analysis presented in Figure 5.14 and 5.16. Figure 5.17 presents the underspecified representation of this sentence. The left-side of the figure depicts the semantic contributions of the first conjunct, which includes a tense meaning, a negation, and the eventuality description $\exists e\, \mathsf{eat}(e,\mathsf{j},\mathsf{c}) \wedge \gamma$. The right-side of the figure expresses the semantics of the gapped conjunct and the conjunction. The relative scope between the tense expression $t \prec \mathsf{now} \wedge \phi$ and the conjunction is not known yet.

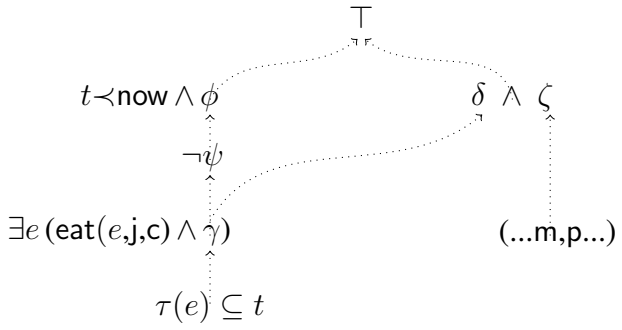


Figure 5.17: Underspecified representation of (225)

Since what may be conjoined (indicated as δ and ζ) may correspond to a tensed proposition or an eventuality description, the two fully resolved representations in (226a-b) are predicted: (i) (226a) results if the QUD is an open tensed proposition (QUD = $t' \prec \mathsf{now} \wedge \neg(\exists e'$ ($\mathsf{eat}'(e',x,y) \wedge \tau(e') \subseteq t'$); (ii) (226b) results if it is an open event description (QUD = $\exists e'(\mathsf{eat}'(e',x,y) \wedge \tau(e') \subseteq t$). These represent the distributive- and wide-scope readings of (226).

The analysis presented so far is encapsulated in Figure 5.18 (see next page). To remind the reader the key ideas behind the analysis, I have argued that coordinate structures have two semantic potentials: (i) either each conjunct is outscoped by the conjunction and hence interpreted independently or (ii) the conjoined meaning is a subexpression of the initial conjunct's semantic contribution. My analysis captured these possibilities through the underspecification of the semantics of the coordinate mother, and an unequal requirement for initial and non-initial conjuncts: while the entire semantic contribution of the non-initial conjunct is required to be outscoped by the conjunction (indicated as $\boxed{7} \lhd \zeta$ in Figure 5.18), for the initial conjunct, only the scopally lowest semantic contribution is required to be outscoped by the conjunction (indicated as $\boxed{1} \lhd \delta$ in Figure 5.18). This ambiguity in the semantics of coordination interacts with the ambiguity of the gapped clause to predict multiple possible readings. In one possible case, the missing content (indicated as $\boxed{Q}$ in Figure 5.18) corresponds to the entire semantic contribution of the source clause, except those semantic contributions made by the correlates. In this case, the gapped conjunct denotes a tensed proposition of type t. In another case, the missing content may correspond just to the main predicate (and its arguments) of the source. In this case, the gapped conjunct denotes an eventuality description of type $\langle vt, t\rangle$. The two representations in (226) correspond to these possibilities.

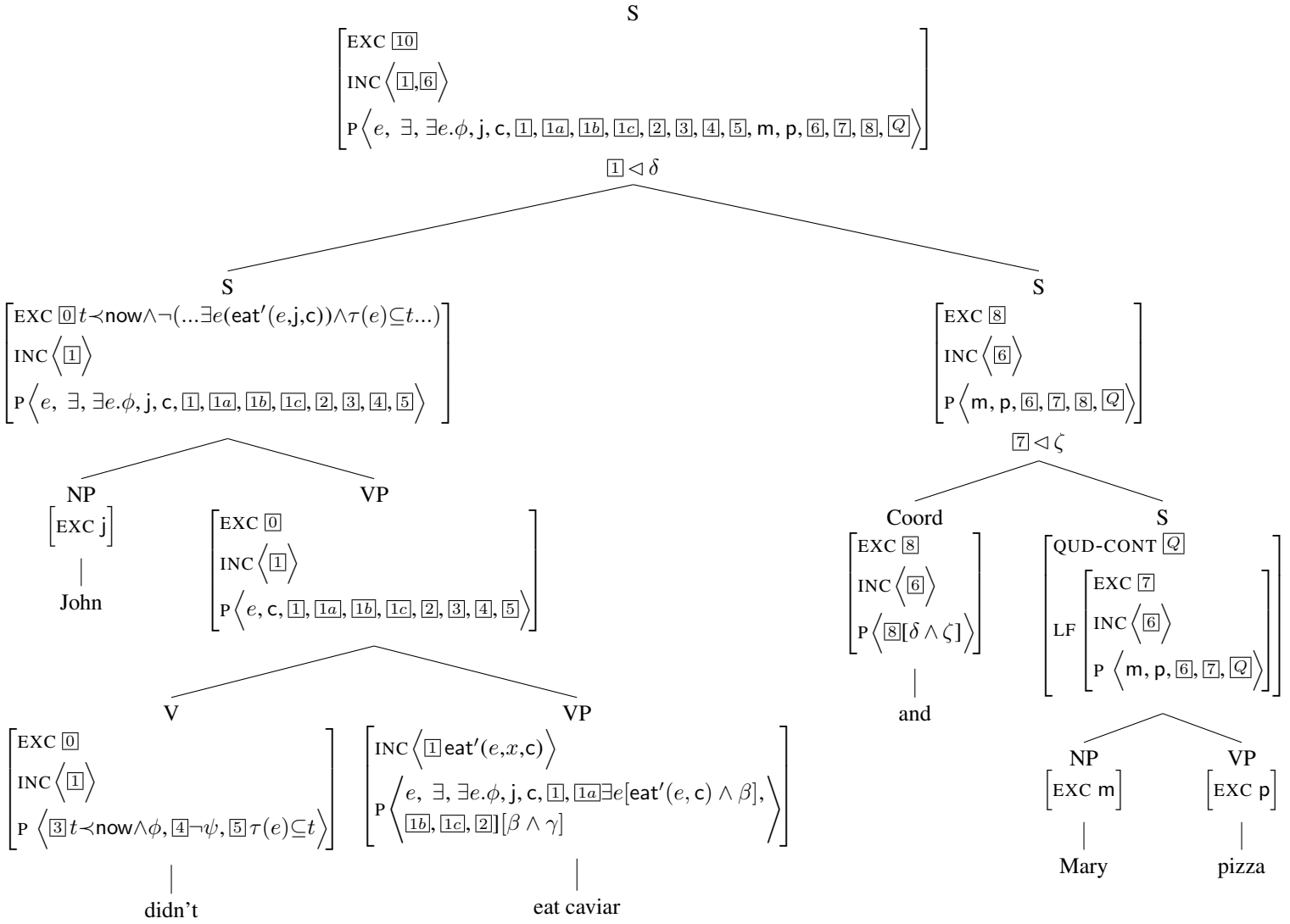


Figure 5.18: A conjunctive gapping sentence [*John didn't eat caviar and Mary pizza*]

Below I indicate the key metavariable assignments under each reading of (225):

(227) LRS constraints for the distributive-scope reading of (225):

$\boxed{10} = [t \prec \mathsf{now} \wedge \neg(\exists e(\mathsf{eat}(e,\mathsf{j},\mathsf{c})) \wedge \tau(e) \subseteq\ t)] \wedge [t' \prec \mathsf{now} \wedge \neg(\exists e'(\mathsf{eat}'(e',\mathsf{m},\mathsf{p}) \wedge \tau(e') \subseteq t')]$

$\boxed{8} = \delta \wedge [t' \prec \mathsf{now} \wedge \neg(\exists e'(\mathsf{eat}'(e',\mathsf{m},\mathsf{p}) \wedge \tau(e') \subseteq\ t')]$

$\boxed{7} = \zeta = t' \prec \mathsf{now} \wedge \neg(\exists e'(\mathsf{eat}'(e',\mathsf{m},\mathsf{p}) \wedge \tau(e') \subseteq\ t')$

$\delta = t \prec \mathsf{now} \wedge \neg(\exists e(\mathsf{eat}(e,\mathsf{j},\mathsf{c})) \wedge \tau(e) \subseteq\ t$

(228) LRS constraints for the distributive-scope reading in (225):

$\boxed{10} = t \prec \mathsf{now} \wedge \neg([\exists e(\mathsf{eat}'(e',\mathsf{j},\mathsf{c}) \wedge \tau(e) \subseteq\ t] \wedge [\exists e'(\mathsf{eat}'(e',\mathsf{m},\mathsf{p}) \wedge \tau(e') \subseteq\ t])$

$\boxed{8} = \delta \wedge \exists e'(\mathsf{eat}'(e',\mathsf{m},\mathsf{p}) \wedge \tau(e') \subseteq\ t])$

$\boxed{7} = \zeta = \exists e'(\mathsf{eat}'(e',\mathsf{m},\mathsf{p}) \wedge \tau(e') \subseteq\ t])$

$\delta = \exists e(\mathsf{eat}'(e',\mathsf{j},\mathsf{c}) \wedge \tau(e) \subseteq\ t$

5.5 Summary

This chapter examined the distributive- and wide-scope readings of Gapping sentences. Previous accounts all relied on a derivational ambiguity specific to Gapping to deal with these readings, but these accounts are shown to be empirically inadequate. In particular, evidence discussed in this chapter showed that wide-scope readings are independent from Gapping, contrary to widespread assumption. This chapter argued that this empirical fact follows if we assume that conjuncts need not always make an equal contribution to the overall semantics of coordination. It was shown that this semantic ambiguity in coordination, together with well-justified assumptions about tense and scopal operators correctly predicts the various readings of conjoined sentences with or without Gapping.

Chapter 6

Summary and Conclusion

6.1 Summary of Contributions

This dissertation has explored the syntax-semantics interface of Gapping sentences. It has taken a surface-driven semantic underspecification approach to ellipsis and extended the approach to account for phenomena that have been problematic to previous accounts. The main findings and claims of this dissertation are as follows.

- Accumulating evidence indicates that Gapping is not confined to a particular syntactic environment. This fact is directly captured by a fragment-based analysis that characterizes gapped clauses as a syntactic unit independent of coordination. Previous syntactic approaches provide a coordinate-analysis for Gapping and they therefore do not account for the basic syntactic properties of Gapping sentences.
- Although Gapping is not restricted to coordinate structures, it is often unwelcome in subordinate and embedded structures. This pattern is not the result of a syntactic constraint; it reflects the consequence of the interaction between the information structure of Gapping sentences and independent discourse constraints.

- Reductionist approaches to Gapping posit covert syntactic structures which are increasingly complex. Furthermore, syntactic and semantic matching phenomena are not fully understood in terms of these covert structures. A surface-based constructional approach can avoid the problems of reductionist approaches and are able to accommodate recalcitrant phenomena.

- Derivational ambiguity is often invoked to explain the scope ambiguities observed in Gapping sentences, but the evidence is not compelling. Constructional approaches, when combined with underspecified semantic techniques, can provide a more plausible account for these ambiguities.

- A novel generalization about scopal patterns in both Gapping and ungapped coordination suggests that there is an inherent semantic asymmetry between initial and non-initial conjuncts. Gapping can exploit this asymmetry and produce scope ambiguities that are not allowed otherwise.

6.2 Future Research

As is well-known, various kinds of elliptical structures exhibit syntactic dependence on their sources (Ginzburg & Sag 2000; Merchant 2001). This means that the syntactic identity requirement in Gapping is better seen as the effect of a general constraint on ellipsis rather than one specific to Gapping. I believe that the account propose proposed in this dissertation can be simplified by providing a more general theory of surface identity for various ellipsis phenomena.

There are less well-known instances of coordination and adverbial structures that are superficially similar to Gapping. Although these have not been dealt with in this dissertation, the analysis proposed in this work may be able to accommodate without major

changes:

(229) a. As for the trek itself, I like to think that my fiancé and I are fairly fit (although, him more than I), ...[1]

b. My brother and I also became really addicted to Prince of Tennis, although me more than him.[2]

(230) Liz goes running 6 times a week, and Alex lifts weights 3 times a week, but neither every day. (Coppock 2001)

(231) a. If something went wrong, the crew would die, and the Ares Program with them. (The Martian, Andy Weir)

b. Where I go, she goes – and the kids with us. (Brown Corpus)

(232) Imagine meeting incredible people who love supporting you and you, them.[3]
Cf. *Imagine meeting incredible people who love supporting you and you support them.

There is so-called determiner Gapping which share several major properties with auxiliary Gapping:

(233) a. Too many Irish setters are named Kelley, German shepherds Fritz, and huskies Nanook.

b. The duck is dry and mussels tough. (McCawley 1993:245)

(234) Few dogs ate Whiskas or cats Alpo. (Johnson 2000)

These examples lack a determiner in the second conjuncts in addition to the main verb. Semantically, these sentences seem to allow a reading in which the determiner within the

[1] https://goo.gl/YZAYXm
[2] https://standingonmyneck.com/2017/10/25/my-memories-of-shonen-jump/
[3] http://bit.ly/1AK6doz

first conjuncts takes wide-scope over the entire coordination (McCawley 1993; Johnson 2000; Kubota & Levine 2016).

While the analysis of Gapping scope ambiguity can be applied to the above examples to provide a straightforward account, there are reasons to delay any firm conclusion. First, as Kubota & Levine (2016) point out, determiner Gapping is not necessarily dependent on 'tense' Gapping (Kubota & Levine 2016:125-6):

(235) a. No dog barked or donkey brayed last night. (credited to Carl Pollard, p.c.)

b. No dinosaurs ate wheat (then) or crocodiles eat cabbage (now).

Second, wide-scope readings like the one in (236) do not seem to be amenable to a simple compositional analysis: the semantic contribution of the determiner *five* applies to the 'sum' of boys and girls (who sang and danced, respectively), but each set of boys and girls composes with different predicates ('sing' and 'dance', respectively).

(236) (In total,) five boys sang and girls danced.

Because the status of determiner Gapping is unclear, it was not included in the scope of this dissertation.

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