The Syntax and Semantics of Relative Clause Attachment

Inauguraldissertation
zur Erlangung des Grades einer Doktorin der Philosophie
im Fachbereich Neuere Philologien
der Johann Wolfgang Goethe-Universität
zu Frankfurt am Main

vorgelegt von
Heike Walker
aus Leer

2017

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Tag der mündlichen Prüfung: 10. Juli 2013

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Acknowledgments

This dissertation would not have been possible without the professional and personal support of a number of people. First of all, I would like to express my most sincere gratitude to Gert Webelhuth for his unfailing support, encouragement and guidance during all stages of this project. I have largely benefited from his great expertise and enlightening instruction. I could not have imagined having a better adviser and mentor.

I am also sincerely grateful to my other adviser, Manfred Sailer, who supported and encouraged me throughout my dissertation project. His insightful comments, advice, and help, especially with the semantic aspects of the project, have been invaluable to me.

I am deeply indebted to Bob Levine for his interest in my work, for stimulating discussions, valuable feedback, and for joining the dissertation committee.

I am also grateful to my colleagues and friends at the Departments of English Linguistics of the Universities of Frankfurt and Göttingen who contributed in one way or other, either discussing or commenting on my work, offering support and help, or providing welcome distraction. I would especially like to thank Janina Radó, Michaela Menken, Dirk Buschbom, Pia Weber, Dianne Jonas, Hildegard Farke, and Regine Eckardt.

My special thanks go to my friends, among whom Gesa Rombald, Yvonne Karacic, Stefanie Müller, and Claudia Georgi deserve a special mention, and, of course, my family.

Chapter 1

Introduction

This book is concerned with the grammatical phenomenon of relative clause extraposition in English. An *extraposed relative clause* is a relative clause which appears to the right of the position where–given its grammatical and semantic functions–it is expected to occur. An example is shown in (1). In (1a), the relative clause is adjacent to its antecedent; this position is referred to as the *canonical position*. In (1b), the relative clause appears to the right of its canonical position at the end of the sentence, and the verb phrase intervenes between the relative clause and the antecedent it modifies; this position is referred to as the *extraposed position*.[1]

(1) a. **A girl** *who was singing a song* came in.
    b. **A girl** came in *who was singing a song*.

There is a long and sophisticated research tradition on the topic of relative clause extraposition in generative grammar. Traditionally, starting with Ross (1967/1986), it has been assumed that an extraposed relative clause is derived in terms of rightward movement. However, the attempts to subsume relative clause extraposition under a general theory of movement face important problems. One point of criticism has been that relative clause extraposition displays properties that are distinct from those of leftward movement. As a consequence, various efforts have been made to find a proper analysis of the phenomenon, and a wide range of diverse theories have been proposed. Among others, these include approaches that base-generate a relative clause in extraposed position, approaches in terms of leftward movement (i.e., the antecedent is moved leftward and the relative clause is stranded in the "extraposed" position), post-syntactic movement accounts, and combinations of several methods like movement and deletion, or base-generation and deletion. The state of research is nicely characterized by Haider: "Current analyses of extraposition have exhausted all options compatible with the generative theory of grammar" (1997, 115). However, as

[1] In this book, I restrict my attention to restrictive relative clauses, and I use the term *relative clause* to exclusively refer to this class. In the examples, I often mark the relative clause in italics and its antecedent NP in boldface.

I will show in this work, none of the theories is entirely satisfactory in capturing all the generalizations and in covering all the data of relative clause extraposition.

In this book, I develop an analysis of relative clause extraposition which is able to account for a number of phenomena that have been problematic for the previous theories. In fact, it is a general analysis of relative clause attachment, since the same syntactic and semantic constraints license relative clauses in canonical and in extraposed positions. The basic assumption is that a relative clause can be attached to any phrase which contains a suitable antecedent of the relative pronoun. The proposed theory modifies and considerably extends a prior analysis by Kiss (2005). In line with Kiss, I will call it the theory of *Generalized Modification*. It is developed within the constraint-based grammatical framework of *Head-Driven Phrase Structure Grammar* (HPSG), enhanced with the underspecified semantic theory of *Lexical Resource Semantics* (LRS) (Richter and Sailer, 2004).

Among the data covered by the proposed analysis are the scope effects of relative clause extraposition noticed by Fox and Nissenbaum (1999) and going back to Williams (1974). As Fox and Nissenbaum's examples in (2) illustrate, extraposed relative clauses act as overt scope markers for their antecedent. The ungrammaticality of (2b) results from two conflicting scope requirements of the 'free choice' element *any*: On the one hand, it must be within the scope of a modal operator, which here is the verb *looked (for)*. On the other hand, its scope must be as high as the phrase to which the extraposed relative clause is adjoined, that is the VP.

(2) a. I looked very intensely for **anything** *that would help me with my thesis*.
b. * I looked for **anything** very intensely *that will/would help me with my thesis*.

Furthermore, the new theory of Generalized Modification captures the phenomenon of obligatory relative clauses. A striking example is constituted by a determiner class in German which requires the presence of a restrictive relative clause, be it extraposed or not:

(3) a. **diejenige (Frau)** *(*die dort steht*)
the+that woman who there stands
'the very woman who is standing there'

b. Ich habe **diejenige (Frau)** bewundert, *(*die dort steht*).
I have the+that woman admired who there stands.
'I have admired the very woman who is standing there.'

In addition to the new analysis of relative clause attachment, I propose a simplification and an extension of the valence-based HPSG binding theory developed by Hukari and Levine (1995). The latter have argued that Principle C of the HPSG binding theory must not only be based on obliqueness, as proposed by Pollard and Sag (1994), but that configuration must play a role, too. I will show that in combination with the proposed analysis of relative clause attachment, the valence-based HPSG binding theory accounts for the coreference effects of

relative clause extraposition which various authors have claimed to exist. As illustrated by the examples from Culicover and Rochemont (1990) in (4), relative clause extraposition may change the coreference options within a sentence. In a double-object construction, a name within an object-related relative clause must not be coreferential with a preceding object pronoun when the relative clause is in canonical position. Principle C of the binding theory is violated. Extraposing the relative clause, however, makes coreference possible.

(4) a. * I sent her$_i$ **many gifts** *that Mary$_i$ didn't like* last year.
b. I sent her$_i$ **many gifts** last year *that Mary$_i$ didn't like*.

When the coindexed pronoun is in subject position, an extraposed relative clause does not escape a Principle C violation, as illustrated in (5a). But when the antecedent is *wh*-moved, coreference between *John* and *he* is allowed, as in (5b).

(5) a. * He$_i$ invited **several girls** to the party *that John$_i$ dated in high school*.
b. [**How many girls**]$_k$ did he$_i$ invite _$_k$ to the party *that John$_i$ dated in high school*?

These observations, among others, have been taken as evidence in support of the claims that (i) an object-related relative clause must be attached no higher than the minimal VP containing its antecedent, and (ii) that it is the surface rather than the base position of the antecedent that determines the position of the extraposed relative clause.

The valence-based binding theory, in interaction with the analysis of Generalized Modification developed in this book, captures all these effects. Moreover, it is able to explain the contrast that complement extraposition, as opposed to relative clause extraposition, does not circumvent a Principle C violation. Finally, the (anti)reconstruction effects noticed by Van Riemsdijk and Williams (1981) and discussed by Freidin (1986) and Lebeaux (1988/2000) fall out from the revised binding theory, as already observed by Hukari and Levine (1995).

The theory developed in this book is the first theory that comprehensively accounts for all of the above-mentioned phenomena of relative clause extraposition. None of the theories previously proposed, including the HPSG analyses, has been able to capture all of these generalizations.

One chapter of this book is devoted to another aspect of relative clause extraposition, which has been subject to debate in the theoretical literature: the question of whether the definiteness of the determiner of the antecedent NP (the *definiteness restriction*) and the choice of the matrix predicate (the *predicate restriction*) have an influence on the acceptability of relative clause extraposition. I will show that the debate is characterized by conflicting acceptability judgments. To scrutinize the data, I conducted a psycholinguistic experiment in the form of an acceptability judgment study. The results empirically validate both restrictions, but they also show that the effects are relatively weak. The study thus provides empirical evidence and sheds light on an area of relative clause extraposition which has previously been afflicted with contradictory judgments in the theoretical literature.

The book is structured as follows. In Chapter 2, I discuss the main properties of relative clause extraposition in English. Based on a systematic review of the literature, I present an overview of the data which have served as an empirical basis for the formulation of the theoretical analyses of this phenomenon. The data are captured within the domains of construal, locality, binding, and scope. Drawing on this evidence, I formulate ten descriptive generalizations which I believe a successful theory of relative clause extraposition should be able to capture.

Chapter 3 presents the empirical study. I carefully survey the data which have been given in the literature in support of the definiteness restriction and the predicate restriction. It will be shown that the evidence is contradictory. I then report on the psycholinguistic experiment and discuss its results.

In Chapter 4, I present a review of the major theories of relative clause extraposition in English that have been proposed in the literature of formal grammar. I systematically investigate the theories and test them against the empirical generalizations formulated in the first chapter. It will be shown that none of the theories is successful in explaining all the relevant phenomena.

In Chapter 5, I first give a brief introduction to HPSG and provide a standard syntactic HPSG-fragment of English in which my analysis of relative clause attachment will be implemented. Then, I present the analyses of English relative clauses and relative clause extraposition that have been previously proposed within this framework. I discuss the theory of Generalized Modification developed by Kiss (2005) in some detail, since my own theory of relative clause attachment is based on this analysis. Although the latter theory is promising, none of the HPSG analyses is able to capture all the generalizations and cover all the data of relative clause extraposition.

Chapter 6 gives an introduction to the framework of LRS, which I will employ for the semantic analysis of my theory of relative clause attachment. LRS is an underspecified semantic theory for HPSG. I briefly present its main ideas, its architecture, and some basic principles. An example analysis of relative clause modification is given in order to explicate the semantic composition mechanism of LRS.

In Chapter 7, I develop my new analysis of relative clause attachment in the framework of HPSG, enhanced with an LRS semantics. I introduce a new phrasal schema that syntactically and semantically licenses both extraposed and non-extraposed relative clauses. The relation between the relative pronoun and its antecedent is established by means of an *anchor* which basically consists of the index of the head noun and which is projected almost freely throughout the tree structure up to a clausal boundary. It serves to establish the correct intersective interpretation of the relative clause. In order to allow for cases with obligatory relative clauses, I propose that the determiner of the antecedent NP introduces the anchor and, additionally, that an anchor must be bound off by a relative clause. Further constraints are introduced which make it possible to account for the scope effects, for the clause-boundedness

of relative clause extraposition, for the interaction of extraposition with *wh*-movement and topicalization, and for the restriction that a relative clause modifying a VP-internal nominal must be attached within the VP.

Chapter 8 deals with the binding theory in HPSG. I will show that the binding theory as proposed by Pollard and Sag (1994) cannot account for the binding-theoretic interaction between main clause and adjunct-internal elements. Instead, the valence-based binding theory proposed by Hukari and Levine (1995) proves successful in this respect. I propose a simplification of the latter theory and extend its coverage. Among others, I will show that it accounts for the coreference effects displayed by relative clause extraposition.

Chapter 9 summarizes and concludes the main results of this book.

Chapter 2

Empirical Facts and Generalizations

In this chapter, I present the main characteristics of relative clause extraposition in English and some properties of relative clauses in general. I give an overview of the most important data in the literature which have served as the empirical basis for the formulation of descriptive generalizations and the theoretical analyses of relative clause extraposition. As will become evident, the data–and the empirical claims derived from them–haave not always been uncontroversial. I will summarize and discuss the controversial assumptions and bring to light some central empirical generalizations that must be captured under any account of relative clauses and relative clause extraposition.

The following sections are organized in such a way that they cover the empirical domains in which the generalizations can be captured. As will become clear, the domains are not independent of each other. The first domain to be covered deals with the semantic construal of extraposed and non-extraposed relative clauses. Besides some simple cases, I discuss some complex phenomena which make it more difficult to account for the correct semantic construal and thus pose a challenge for the theories of relative clauses and relative clause extraposition (Section 2.1). In Section 2.2, I discuss the question of locality, that is, the question of what counts as a syntactic boundary for relative clause extraposition and in which structural position an extraposed clause is attached. I present the different locality constraints that have been proposed in the literature and provide and discuss the empirical evidence on which the partially conflicting assumptions have been based. Section 2.3 characterizes the behavior of relative clauses with respect to the binding theory. It will be shown that the coreference options of relative clauses may be influenced by extraposition, which means that extraposition influences the semantic interpretation of a sentence. The so-called anti-reconstruction effects demonstrate a similar semantic effect with leftward movement. The behavior of relative clauses with respect to variable binding, however, is different and is not affected by extraposition. Finally, in Section 2.4, I show that relative clause extraposition influences the scope of logical operators.[1]

[1]The discussion in this chapter is based on parts of Webelhuth, Sailer, and Walker's introduction of a collective volume on rightward movement (Webelhuth, Sailer, and Walker, 2013a), but it is presented here in

2.1 Construal

The correct semantic construal of extraposed and non-extraposed relative clauses is not always easy to achieve. There exist structural relationships between relative clauses and their antecedent NPs which are problematic for some theories of relative clauses and relative clause extraposition. Moreover, the data are somewhat conflicting, for example as concerns the question of whether the antecedent NP can be embedded within other NPs or PPs (Section 2.1.1). I will present further challenging phenomena, namely relative clauses with conjoined and split antecedents (Section 2.1.2), cases in which the presence of a relative clause is obligatory (Section 2.1.3), and relative clauses whose antecedent NPs are elliptical (Section 2.1.4). Finally, I discuss the possibility of extraposition from fronted constituents (Section 2.1.5).

2.1.1 Embedded Antecedents

The most basic requirement that a theory of relative clause extraposition has to fulfill is that the restrictive relative clause must be correctly construed with its antecedent NP. A relative clause denotes a property which must be intersectively combined with the property denoted by the noun it modifies. Both the noun and the relative clause contribute a restriction to the quantifier of the NP. This construal must be correctly achieved for relative clauses in situ and in extraposed position. For illustration, in both sentences in (6), the meaning of the relative clause *which I had read* must be integrated with the components of the meaning of the NP *every book* so that it contributes to determining the restriction of the quantifier *every*.

(6) a. I gave **every book** *which I had read* to my sister.
b. I gave **every book** to my sister *which I had read*.

While this criterion is relatively easy to fulfill for extraposed relative clauses in configurations like (6b), in which the structural relationship between the relative clause and its antecedent is relatively simple, there are more complex cases which pose a somewhat bigger challenge to some theories. In the following examples, the antecedent NP is embedded within a prepositional phrase:[2]

(7) a. I saw it [$_{PP}$ in **a magazine**] yesterday *which was lying on the table*.
b. I arrived [$_{PP}$ at **a house**] yesterday *which was in a shambles*.
(Baltin, 1978/1985, 115)

(8) I spoke [$_{PP}$ to **everyone**] yesterday *who I liked*. (Jacobson, 1987, 63n30)

some more detail.

[2]Throughout this work, I will often adjust and/or add labeled bracketing in order to make the relevant structure of an example clearer.

It should be noted that Baltin (1978, 1978/1985, 82) claims that a relative clause cannot be extraposed from a prepositional phrase when the PP is fronted, which he illustrates with the example shown in (9). However, there is evidence against this claim. Jacobson (1987, 63n30), for example, argues that extraposition from a fronted PP is possible and provides the sentence in (10). Strunk and Snider (2013, 106) cite the examples in (11) from large corpora of naturally occurring sentences, "which are confirmed as grammatical and natural by native speakers."

(9) * [$_{PP}$ In **which magazine**] did you see it *which was on the table*?

(10) [$_{PP}$ To **whom**] did you speak *who you liked*?

(11) a. [$_{PP}$ In **what noble capacity**] can I serve him *that would glorify him and magnify his name*?

b. If you need to manage your anger, [$_{PP}$ in **what ways**] can you do that *which would allow you to continue to function*?

c. What do I know about the disease and [$_{PP}$ to **whom**] can I turn *who is familiar with the disease*?

Even though the evidence appears to be contradictory for English, it is uncontroversial that in German, a relative clause can be extraposed from a fronted PP. This is demonstrated by the sentences in (12), the first of which is the German equivalent of (9), and the other two are examples from corpora cited by Strunk and Snider (2013).[3] A theory of relative clause extraposition that lays claim to generality thus needs to be able to allow for extraposition from fronted prepositional phrases as well as from PPs in situ.

(12) a. [$_{PP}$ In **welcher Zeitschrift**] hast Du es gesehen, *die auf dem Tisch lag*?
in which magazine have you it seen which on the table lay
'In which magazine which was on the table did you see it?'

b. [$_{PP}$ An **wen**] kann ich mich wenden, *der mir kluge Tips aus der Praxis*
to whom can I myself turn who me clever tips from the practice
geben kann?
give can
'To whom can I turn who can give me clever tips from practice?'

c. [$_{PP}$ In **welches SKigebiet**] kann man über die Osterferien fahren, *das noch*
in what skiing region can you over the spring break drive that still
Schneesicher ist ?
snow-sure is
'To what skiing region can you travel over spring break that is guaranteed to have snow?'

[3]The spelling is displayed here as provided by Strunk and Snider (2013), who quote the examples as they found them in the corpora, including misspellings.

There is further controversy in the literature about whether extraposition is possible from an NP embedded within a larger NP. Akmajian (1975, 118n3) provides the example in (13) for PP extraposition and argues that while the complex PP *of a book about French cooking* can be extraposed from the subject NP *a photograph* (13b), it is not possible to extrapose the PP *about French cooking* out of the NP *a book*, which is embedded within the subject NP (13c).

(13) a. A photograph of a book about French cooking was published last year.
b. [$_{NP}$ **A photograph**] was published last year *of a book about French cooking*.
c. * [$_{NP_1}$ A photograph of [$_{NP_2}$ **a book**]] was published last year *about French cooking*.

The following examples from Jacobson (1987, 62) demonstrate the same behavior for relative clauses. An extraposed relative clause can be related to the subject NP in (14a) or the *wh*-element in (14b), but it cannot modify an NP that is embedded within these constituents ((14c)–(14d)).

(14) a. [$_{NP}$ **Everyone**] came *who I invited*.
b. [$_{NP}$ **Who**] came *who you invited*?
c. * [$_{NP_1}$ That picture of [$_{NP_2}$ **everybody**]] was ugly *who I liked*.
d. * [$_{NP_1}$ Which picture of [$_{NP_2}$ **everybody**]] did you see *who you liked*?

Chomsky (1986, 40) provides the example in (15) and claims that the relative clause *that I wanted to read* can only take the higher NP *many books with stories* as its associate but not the lower NP *stories*.

(15) [$_{NP_1}$ Many books with [$_{NP_2}$ stories]] were sold *that I wanted to read*.

Further examples are given by Rochemont and Culicover (1990, 41):

(16) a. * [$_{NP_1}$ Plots by [$_{NP_2}$ **many conspirators**]] have been hatched *that the government has jailed*.
b. * [$_{NP_1}$ Autographed pictures of [$_{NP_2}$ **many famous people**]] were for sale *that have made donations to our organization*.

Yet, there is again evidence which suggests that it is indeed possible to extrapose a relative clause from an NP embedded within another NP. In (17), I have listed a number of examples from different sources of the literature. Naturally occurring examples which Strunk and Snider (2013) have found in corpora are shown in (18).

(17) a. [$_{NP_1}$ The construction of [$_{NP_2}$ **a bridge**]] was proposed *which would span the Delaware River*. (Guéron, 1980, 647n11)

b. "Guéron argues that [$_{NP_1}$ only the complements of [$_{NP_2}$ **those NP's**]] may be extraposed, *that are new information in a discourse*."
(cited by Guéron (1980, 647n11) from the text of Koster (1978b, 49))

c. [$_{NP_1}$ The names of [$_{NP_2}$ **all the painters**]] are unknown *whose work is being exhibited in the Chicago Art Institute next week*. (Stucky, 1987, 391)

d. [$_{NP_1}$ Only letters from [$_{NP_2}$ **those people**]] remained unanswered *that had received our earlier reply*. (Uszkoreit, 1990, 2333)

(18) a. We drafted [$_{NP_1}$ a list of [$_{NP_2}$ **basic demands**]] that night *that had to be unconditionally met or we would stop making and delivering pizza and go on strike*.

b. I had [$_{NP_1}$ a memory of [$_{NP_2}$ **my dear old grandma**]] yesterday *who used to buy the EXACT same outfit in every color available (down to the shoes!)*

c. A wreath was placed in [$_{NP_1}$ the doorway of [$_{NP_2}$ **the brick rowhouse**]] yesterday, *which is at the end of a block with other vacant dwellings*.

d. For example, we understand that Ariva buses have won [$_{NP}$ a number of [$_{NP}$ contracts for [$_{NP}$ **routes** in [$_{NP}$ London]]]] recently, *which will not be run by low floor accessible buses*.

So, while the evidence for English whether a relative clause can modify an NP embedded within a larger NP seems to be conflicting, we cannot ignore the fact that there are native speakers who take at least some of these structures to be grammatical. Furthermore, for German, and also for Dutch (see Koster (1978b, 48–57, 2000)), such a structural relationship between the extraposed relative clause and its antecedent seems to be commonly accepted, even when the modified NP is deeply embedded. Some examples constructed by Müller (1999, 211, 2004, 10) are shown in (19). Note that the antecedent NP in (19b) is embedded three levels down. Strunk and Snider's (2013) corpus study confirms that constructions like this occur quite frequently in natural language production. Two of the examples they have found are shown in (20). The reader is also referred to Kiss (2005) and Crysmann (2013) for further evidence.

(19) a. weil [$_{NP_1}$ viele Schallplatten mit [$_{NP_2}$ **Geschichten**]] verkauft wurden, *die ich noch lesen wollte*.
because many records with stories sold were that I yet read wanted
'because many records with stories that I still wanted to read were sold.'

b. Karl hat mir [$_{NP_1}$ eine Kopie [$_{NP_2}$ einer Fälschung [$_{NP_3}$ des Bildes [$_{NP_4}$ **einer Frau**]]]] gegeben, *die schon lange tot ist*.
Karl has me a copy a.GEN forgery the.GEN picture a.GEN woman given who already long dead is
'Karl gave me a copy of a forgery of the picture of a woman who has been dead for a long time.'

(20) a. Und dann sollte ich [$_{NP_1}$ Augenzeuge [$_{NP_2}$ der Zerstörung [$_{NP_3}$ **einer**
and then should I eyewitness the.GEN destruction a.GEN
Stadt]]] werden, *die mir am Herzen lag* – Sarajevo.
city become that me at the heart lay Sarajevo
'And then I was about to become an eyewitness of the destruction of a city that was dear to my heart – Sarajevo.'

b. [...] es sei ihm nicht gelungen, [$_{NP_1}$ genug Unterstützung für [$_{NP_2}$ die
it be him not succeeded enough support for the
Bildung [$_{NP_3}$ **einer Übergangsregierung**]]] zu bekommen, *die das*
formation a.GEN interim.government to obtain which the
Wahlsystem reformieren solle.
election.system reform should
'...he didn't succeed in finding enough support for the formation of an interim government which should reform the election system.'

Thus, any theory of relative clauses and relative clause extraposition that strives to claim generality must be able to license extraposed relative clauses whose antecedents may be embedded within PPs or within larger NPs. Compared to the examples shown above in (6), these latter cases are structurally more complex and therefore more challenging for the correct semantic construal of extraposed relative clauses.

2.1.2 Conjoined and Split Antecedents

The biggest construal problem arises with respect to the phenomena of multiply-headed relative clauses as shown in (21), which Link (1984) calls "hydras", and relative clauses with split antecedents as illustrated by the example in (22) from Perlmutter and Ross (1970):

(21) **A man and a woman** [$_{RC}$ *who were quite similar*] entered the room.

(22) **A man** entered the room and **a woman** went out [$_{RC}$ *who were quite similar*].

Syntactically, the conjoined antecedent in (21) is not necessarily problematic. But it poses a problem for a semantic analysis in terms of a compositional treatment, where it is assumed that a restrictive relative clause and the noun it semantically modifies must combine via the semantic composition rule of predicate modification (see Partee (1973, 511–513, 1975, 229-231), and Heim and Kratzer (1998, 88)). It is not obvious how the rule of predicate modification would apply when two NPs are conjoined that exclude the relative clause.

Relative clauses with split antecedents, as in (22), pose an even bigger problem. The plural agreement on the verb (*were*) and the semantics of the predicate (*similar*) in the relative clause require its subject to be plural. Hence, neither of the singular NPs can serve as the antecedent of the relative clause. Perlmutter and Ross (1970, 350) nicely characterize the dilemma:

> The only possible antecedent of the relative clause in [22] would seem to be the discontinuous noun phrase *a man…(and) a woman*. But how can a discontinuous noun phrase be the antecedent of a relative clause? No analysis of relative clauses that has yet been proposed in the theory of generative grammar is able to account for sentences like [22]. Their existence thus presents the theory with a new paradox.

When I discuss the individual theories of relative clause extraposition in Chapters 4 and 5.3, I will show that to this day, no satisfactory solution to this problem has been found.

2.1.3 Obligatory Relative Clauses

A further aspect of theoretical relevance is that in certain cases a relative clause is obligatorily required. In German, for example, there exists a certain determiner class, e.g., *derjenige/diejenige/dasjenige* ('the (very)'), which enforces the presence of a restrictive relative clause (see Alexiadou, Law, Meinunger, and Wilder (2000, 8) and Sternefeld (2008, 378-379)). The latter can either appear in situ or in extraposed position, as demonstrated by the following examples:

(23) a. **diejenige (Frau)** *(*die dort steht*)
the+that woman who there stands
'the very woman who is standing there'

b. Ich habe **diejenige (Frau)** bewundert, *(*die dort steht*).
I have the+that woman admired who there stands.
'I have admired the very woman who is standing there.'

These cases suggest that there is a close relationship between the restrictive relative clause and the determiner.[4] Note that the noun does not even have to be overtly expressed.[5]

Similar cases in which the presence of a restrictive relative clause is required can be found in English, as illustrated by the following examples from (Alexiadou et al., 2000, 8):

(24) a. She is that kind of person
b. She is the kind of person *(that is always helpful)

(25) a. He did it in that way
b. He did it in a way *(that annoyed me)

[4]Examples like these provide a strong argument for analyses in which the relative clause is assumed to be selected by the determiner. See, among others, Smith (1964), Vergnaud (1974), Kayne (1994), Bianchi (1999), Schmitt (2000), Bhatt (2002), Sauerland (2003), Hulsey and Sauerland (2006), and Sternefeld (2008). See also Andrews (1975/1985, 189).

[5]Andreas Blümel (p.c.) has pointed out that, like the noun, the relative clause can be elided when the antecedent is highly salient in the discourse. Semantically, both seem to be obligatory, however.

Such data suggest that there is some kind of interpretive dependency between determiners and relative clauses (Alexiadou et al., 2000, 8).

Furthermore, although names can normally neither occur with a determiner nor be modified by a restrictive relative clause, the latter can be adjoined to a name when a determiner is present (see Vergnaud (1974, 264–265), Kayne (1994, 103)):

(26) a. * the Paris
b. * Paris that I love
c. the Paris that I love

Vergnaud (1974, 264–265), however, observes that the same construction is also possible with a PP:

(27) the Paris of my youth

According to Kayne (1994, 103), English *ones* has a similar distribution:

(28) a. * John remembers the ones.
b. John remembers the ones he had last night. (“dreams”)
c. John remembers the ones of his youth.

Given that in most cases a relative clause is optional and therefore commonly considered a modifier, these examples call for a special analysis. A particularly striking case is the German determiner *derjenige/diejenige/dasjenige* mentioned above.

2.1.4 Relative Clauses with Elliptical NPs

Another challenge for the construal of relative clauses is posed by structures in which the head noun of the relative clause is not overtly expressed. In German, many determiners can appear without a phonologically realized nominal (see Lobeck (1995), Netter (1996, ch. 4.6), Nerbonne and Mullen (2000), among others). As shown in (29), the elliptical NPs can still be modified by a relative clause.

(29) a. **die/eine/jede/jene (Frau)** *die dort steht*
the/a/each/that woman who there stands
‘the/a/each/that woman who is standing there’

b. Ich habe **die/eine/jede/jene (Frau)** bewundert, *die dort steht*.
I have the/a/each/that woman admired who there stands.
‘I’ve admired the/a/each/that woman who is standing there.’

While most determiners in English must combine with an overt noun, as shown in (30), there are certain determiners that allow the noun to be elided (31) (see Lobeck (1995), Netter

(1996, ch. 4.6), Nerbonne and Mullen (2000), Beavers (2003), among others). The determiner *none* in fact must not combine with an overt noun at all (32), but it can still be modified by a relative clause. Note that in all cases, the relative clause can either appear in situ (the (a)-sentences) or be extraposed (the (b)-sentences).

(30) a. I saw **the/a/every *(woman)** *who is standing over there* yesterday.
b. I saw **the/a/every *(woman)** yesterday *who is standing over there*.

(31) a. **Many/Some/Those (guests)** *that arrived early* are drunk already.
b. **Many/Some/Those (guests)** are drunk already *that arrived early*.

(32) a. **None (*flowers)** *that I know of* are in the window.[6]
b. **None (*flowers)** are in the window *that I know of*.

As explained above, in order to correctly construe the relative clause with its antecedent, the meanings of the relative clause and the antecedent noun must be combined in an intersective way. When the noun is not overtly expressed, however, it is not a straightforward matter of how to achieve this.

2.1.5 Extraposition from Fronted Phrases

A final property I would like to mention concerns the behavior of relative clauses when their antecedent is contained in a preposed phrase. As we will see, English and German relative clauses behave differently in this respect.

For English, it is commonly acknowledged that an extraposed relative clause can be related to an element that has been *wh*-moved to the front of the sentence:

(33) a. **How many people** actually like him *who know John really well*?
(Taraldsen, 1981, 480)
b. **How many girls** did John invite to the party *that he dated in high school*?
(Culicover and Rochemont, 1990, 42)

(34) a. **Which book** did she write last year *that takes only two hours to read*?
(Keller, 1995, 2)
b. **Which argument** do you know *that Sandy thought was unconvincing*?
(Kiss, 2003, 110)
c. **Who** do you know *that you can really trust*? (Kiss, 2003, 110)

However, when the antecedent is within a topicalized constituent, the relative clause cannot be extraposed from the preposed phrase. This is demonstrated with the following examples displaying VP-topicalization ((35)–(36)) and *though*-preposing (37). When the

[6] Example (32a) is adapted from Nerbonne and Mullen (2000, 139).

VP is preposed, the relative clause modifying the direct object must be fronted along with the VP, as in the (a)-sentences. Note that it can be extraposed to the end of the VP. However, it cannot appear outside of the fronted VP, i.e., it cannot be stranded, as shown in the (b)-examples.

(35) a. John said that he would call people up who are from Boston, and [$_{VP}$ call **people** up *who are from Boston*]$_i$ he will $\__i$.

b. * John said that he would call people up who are from Boston, and [$_{VP}$ call **people** up]$_i$ he will $\__i$ *who are from Boston*. (Baltin, 1981, 269)

(36) a. John said he would meet a man at the party who was from Philadelphia, and [$_{VP}$ meet **a man** at the party *who was from Philadelphia*]$_i$ he did $\__i$.

b. * John said he would meet a man at the party who was from Philadelphia, and [$_{VP}$ meet **a man** at the party]$_i$ he did $\__i$ *who was from Philadelphia*.[7]

(Culicover and Rochemont, 1990, 28)

(37) a. [$_{VP}$ Call **people** up *who are from Boston*]$_i$ though he may $\__i$, he's generally pretty cheap about long-distance calls.

b. * [$_{VP}$ Call **people** up]$_i$ though he may $\__i$ *who are from Boston*, he's generally pretty cheap about long-distance calls. (Baltin, 1981, 269)

Thus, a relative clause must not be extraposed from a fronted VP. The same observation is made when the antecedent NP itself is topicalized. The relative clause has to be fronted along with it, but it cannot be stranded:

(38) a. [$_{NP}$ **Micro brews** *that are located around the Bay Area*]$_i$ I like $\__i$.

b. * [$_{NP}$ **Micro brews**]$_i$, I like $\__i$ *that are located around the Bay Area*.

(Kiss, 2003, 110)

(39) * [$_{NP}$ **That man**], Bill didn't invite to his party *who drinks heavily*.

(Rochemont and Culicover, 1990, 168n20)

In German, such a contrast between *wh*-movement and topicalization is not manifested. A relative clause may be extraposed from a *wh*-moved constituent (40) as well as from a topicalized phrase (41):[8]

[7] Culicover and Rochemont (1990, 28n11) claim that the example is somewhat improved when the extraposed relative clause is focused:

(i) ? John said he would meet a man at the party who was from Philadelphia, and [$_{VP}$ meet **a man** at the party] he did, *who was from New York.*

[8] Example (40a) is from Kiss (2003, 113), example (41a) is from Keller (1995, 2), and example (41b) is from Keller (1994, 6). In the examples from Keller as well as in the following examples, the glosses and translations are provided by H. W.

(40) a. **Wen** hat sie gesehen, *den ich gestern getroffen hatte*?
who has she seen who I yesterday met had
'Who did she see that I had met yesterday?'

b. **Welches Buch** hat sie gekauft, *das sie schon immer lesen wollte*?
which book has she bought that she already always read wanted
'Which book did she buy that she has always wanted to read?'

(41) a. **Ein Buch** war erschienen, *das ihn weltberühmt gemacht hat*.
a book had appeared which him world-famous made has
'A book had appeared which has made him world-famous.'

b. **Ein Buch** hatte Planck geschrieben, *das ihn später weltberühmt machte*.
a book had Planck written which him later world-famous made
'Planck had written a book which later made him world-famous.'

Keller (1994, 7) has claimed that extraposition from a topicalized phrase becomes less acceptable when the antecedent is embedded, and that this effect increases with the number of embeddings. This is demonstrated by the (b)-sentences of the following examples. The (a)-sentences from Müller (1999, 211) show that the equivalent cases with extraposition from non-topicalized objects are grammatical:

(42) a. Karl hat mir ein Bild **einer Frau** gegeben, *die schon lange tot ist*.
Karl has me a picture a.GEN woman given who already long dead is
'Karl gave me a picture of a woman who has been dead for a long time.'

b. ? Ein Bild **einer Frau** hat mir Karl gegeben, *die schon lange tot ist*.
A picture a.GEN woman has me Karl given who already long dead is
'Karl gave me a picture of a woman who has been dead for a long time.'

(43) a. Karl hat mir eine Fälschung des Bildes **einer Frau** gegeben, *die schon lange tot ist*.
Karl has me a forgery the.GEN picture a.GEN woman given who already long dead is
'Karl gave me a forgery of the picture of a woman who has been dead for a long time.'

b. * Eine Fälschung des Bildes **einer Frau** hat mir Karl gegeben, *die schon lange tot ist*.
A forgery the.GEN picture a.GEN woman has me Karl given who already long dead is
'Karl gave me a forgery of the picture of a woman who has been dead for a long time.'

However, Stefan Müller has pointed out that extraposition in these cases is possible when the antecedent is focused (Keller, 1994, 7). The following sentences from Keller (1994, 7) are grammatical:

(44) a. Ein Bild **DER** **Frau** hat mir Karl gegeben, *die schon lange tot ist*.
A picture the.GEN woman has me Karl given who already long dead is
'Karl gave me a picture of that woman who has been dead for a long time.'

b. Eine Fälschung **DES** **Bildes** wurde mir gegeben, *das 100 000 Mark wert sein sollte*.
A forgery the.GEN picture was me given that 100 000 Deutschmark worth be should
'I was given a forgery of that picture that was supposed to be worth 100 000 Deutschmark.'

Keller therefore suggests that extraposition from embedded antecedents in topicalized phrases must in principle be allowed, but that it is subject to conditions on information structure.

To sum up the discussion of the construal problem, any successful theory of relative clauses and relative clause extraposition must be able to account for the correct semantic construal of an extraposed (and non-extraposed) restrictive relative clause. The antecedent NP can be embedded within a PP or within another NP. As we have seen for German, the embedding can even involve several levels. Furthermore, a relative clause can have conjoined and split antecedents. A comprehensive theory must also be able to account for the determiners with obligatory restrictive relative clauses as well as for the cases where the antecedent noun is covert. Finally, extraposed relative clauses must be allowed to be construed with antecedents that are fronted or contained within fronted constituents, but this property is subject to language-particular distinctions: while German allows for extraposition from both *wh*-moved and topicalized constituents, extraposition in English is only allowed from fronted *wh*-elements.

We will see in the following section that some of the observations summarized above have served as a basis for further empirical generalizations about relative clause extraposition. Specifically, the observations about the possible structural positions of the antecedent NP and whether an extraposed relative clause can be related to it have been used to support claims about the possible attachment sites of relative clauses.

2.2 Locality

In this section, I turn to the question of locality, that is, how far can an extraposed relative clause be moved, or how many and what kind of nodes can appear between the extraposed relative clause and its antecedent.[9] Related to this is the question in which structural position an extraposed relative clause is attached. As will become evident, the assumptions that

[9]I will sometimes use the traditional 'movement-based' terminology, in particular when discussing the movement analyses. It offers a succinct and well-established way of talking about the dislocation phenomenon. However, in this dissertation I will argue against a movement approach and instead propose an analysis that base-generates a relative clause in extraposed position.

have been proposed in the literature are to some extent diverging, partly being based on controversial evidence. Since they represent central claims in the history and development of analyzing relative clause extraposition, and rightward movement in general, I will present the proposed locality constraints (Section 2.2.1) and provide the evidence they are based on (Section 2.2.2) in some detail.

2.2.1 Locality Constraints

Ross (1967/1986) was the first to establish a locality constraint on extraposition, which, due to Grosu (1973, 294), came to be known as the *Right Roof Constraint (RRC)*. It says that a phrase cannot be extraposed out of the clause in which it appears canonically, or which contains its antecedent. That is, extraposition is "upward bounded" (Ross, 1967/1986, 174), or clause-bounded: "The fact is that an extraposed clause may never be moved outside 'the first sentence up', in the obvious interpretation of this phrase" (Ross, 1967/1986, 5). Ross accounts for this fact with the following generalization, employing Langacker's (1969) notion of *command*[10]: "In all rules whose structural index is of the form ... A Y, and whose structural change specifies that A is to be adjoined to the right of Y, A must command Y" (Ross, 1967/1986, 203).

The upward-boundedness of relative clause extraposition is exemplified with the sentences shown below. In (45)–(47), the relative clause cannot be extraposed out of the subject *that*-clause which contains its antecedent. In (48), the antecedent is in an object clause, from which the relative clause cannot be extraposed.

(45) a. [$_S$ That [$_{NP}$ **a gun** *which I had cleaned*] went off] surprised noone.

b. * [$_S$ That [$_{NP}$ **a gun**] went off] surprised noone *which I had cleaned*.

(Ross, 1967/1986, 4)

(46) a. [$_S$ That Sam didn't pick [$_{NP}$ **those packages**] up *which are to be mailed tomorrow*] is possible.

b. * [$_S$ That Sam didn't pick [$_{NP}$ **those packages**] up] is possible *which are to be mailed tomorrow*. (Ross, 1967/1986, 166–167)

(47) a. [$_S$ That [$_{NP}$ **all the men** *who took part in the robbery*] will be prosecuted] just isn't clear.

b. [$_S$ That [$_{NP}$ **all the men**] will be prosecuted *who took part in the robbery*] just isn't clear.

c. * [$_S$ That [$_{NP}$ **all the men**] will be prosecuted] just isn't clear *who took part in the robbery*. (Akmajian, 1975, 116)

[10] "A node *A* 'commands' another node *B* if (1) neither *A* nor *B* dominates the other; and (2) the *S*-node that most immediately dominates *A* also dominates *B*" (Langacker, 1969, 167).

(48) * John believes [$_S$ that [$_{NP}$ **a man**] was here] despite the evidence to the contrary *who comes from Philadelphia*. (Chomsky, 1973, 271)

That the Right Roof Constraint also holds for extraposition from infinitival clauses is demonstrated by the example below. The relative clause cannot leave the infinitival clause which is a complement of the control adjective *eager*.

(49) a. Just how eager [to call **people** up *that live in Reno*] are you?

b. * Just how eager [to call **people** up] are you *who live in Reno*?

(Baltin, 1978/1985, 72)

In subsequent works, several authors have claimed that extraposition is not only clause-bounded, but that it is also subject to stricter locality constraints within the clause. Although we have already seen in Section 2.1.1 above that these subclausal locality constraints have been called into question, and many counterexamples have been provided–among them naturally occurring examples found in corpora and confirmed in psycholinguistic experiments–I will briefly present these constraints and the relevant data in the following, as they have played a central role in the development of the analyses of relative clause extraposition (and rightward movement in general).

There have been attempts to capture the subclausal locality contraints as well as the clause-boundedness in terms of notions like *Subjacency* (Chomsky, 1973), *Generalized Subjacency* (Baltin, 1981), and the *Barriers* approach (Chomsky, 1986). These constraints restrict extraposition in terms of the number and the type of categories that may intervene between the extraposed phrase and its canonical position/the position from which it has been extraposed. Chomsky's Subjacency Condition does not allow an extraposed phrase to be moved across more than one phrasal category of type NP or S.[11] Baltin's Generalized Subjacency is even stricter in that it disallows extraposition across more than one maximal projection of any major category.[12]

Thus, both constraints account for the clause-boundedness of relative clause extraposition shown in (45)–(49), since the extraposed relative clause moves across two boundary nodes, namely the NP projection of its antecedent and the S node of the subject/object clause.

[11] Chomsky's (1973, 271) *Subjacency Condition* is defined as follows:

(i) No rule can move an item from position Y to position X in the structure
$\ldots[_\beta \ldots[_\alpha \ldots \mathrm{Y} \ldots] \ldots] \ldots \mathrm{X} \ldots$
where $Y \neq \alpha$ and α, β are cyclic categories [...]

Chomsky (1973, 235n8) and Akmajian (1975) assume the cyclic categories to be NP and S.

[12] Baltin's (1981, 262) *Generalized Subjacency* (see also Baltin (1981, 155)):

(i) In the configuration $\mathrm{A} \ldots[_\alpha \ldots[_\beta \ldots \mathrm{B} \ldots] \ldots] \ldots \mathrm{A}'$,

i. A′ cannot be related to B where α and β are maximal projections of any major category;

ii. [...]

I have omitted the second clause here since it only refers to leftward movement.

In addition, the constraints also restrict extraposition within a clause. Since NPs count as bounding nodes, it is predicted that an element cannot be extraposed from an NP that is embedded within another NP. Chomsky (1973, 271) claims that the sentence in (50a), where the antecedent of the relative clause is intended to be *one*, cannot be derived since the extraposed relative clause cannot cross the two NPs. Akmajian (1975, 118n3) argues on the basis of the example in (50b) (= (13)) that extraposed phrases, in this case a prepositional phrase, cannot be moved across two NPs, and hence establishes NP as a bounding node in the condition of Subjacency.

(50) a. * [$_{NP_2}$ [$_{NP_1}$ **One**] of the men] will meet you at the station *who is a friend of mine*.
b. * [$_{NP_2}$ A photograph of [$_{NP_1}$ **a book**]] was published last year *about French cooking*.

Baltin (1978, 1978/1985, 82) and, independently, Van Riemsdijk (1978) moreover propose that PPs have to be counted as bounding nodes for extraposition.[13] Baltin's argument is based on the ungrammaticality of the sentence in (51) (= (9)), in which a relative clause is extraposed from a fronted PP. Under the assumption that PP is a boundary node, the extraposed relative clause has to cross the two bounding nodes NP and PP and thus violates Generalized Subjacency.

(51) * [$_{PP}$ In [$_{NP}$ **which magazine**]] did you see it *which was on the table*?

Sentences like (52) (= (7a)), however, show that a relative clause can be extraposed from a PP that stays within the VP, and are therefore problematic for Baltin's Generalized Subjacency, which includes PPs as bounding nodes. To analyze these cases, Baltin assumes a reanalysis account that incorporates the preposition into the verb so that the PP is eliminated as a bounding node (see Baltin (1978/1985, 115)). In later work, however, Baltin and Postal (1996) argue that reanalysis of prepositions within the VP does not occur (see also Baltin (2006, 246)), but no solution is provided of why examples like (52) allow extraposition out of a PP.

(52) I saw it [$_{PP}$ in [$_{NP}$ **a magazine**]] yesterday *which was lying on the table*.

Finally, Baltin (1981) establishes that VP and AP must be regarded as bounding nodes for rightward movement. Providing evidence based on VP-deletion and VP-fronting (which I present further down below), he argues that constituents extraposed from the subject position must be attached to S, while constituents extraposed from within the VP must be adjoined to VP. This, he claims, is only possible if VP is regarded as a bounding node.[14] For establishing

[13] Note, however, that Van Riemsdijk (1978, 146) also mentions cases like (i), in which the relative clause is extraposed out of a PP. He provides equivalent examples for Dutch.

(i) I spoke [$_{PP}$ with [$_{NP}$ **most people**]] yesterday *who were there*.

[14] Another piece of evidence that VP is a bounding node for rightward movement is based on the observation that a constituent cannot be extraposed out of an embedded infinitival clause (see Baltin (1981, 270–273)).

AP as a bounding node, he provides evidence from *though*-preposing. Baltin thus concludes that not only S and NP count for subjacency, but maximal projections of all major categories are boundaries for extraposition, which he states in his condition of Generalized Subjacency. Accordingly, a relative clause is not moved "to a defined structural position within the sentence but, rather, ...as far as it can go without violating the bounding constraint" (Baltin, 1981, 290).[15]

Baltin's Generalized Subjacency thus predicts that only one maximal category may intervene between an extraposed relative clause and its canonical position. This is also explicitly stated by Asakawa (1979, 505): "The element which is extracted out of NP is adjoined to the node which immediately dominates that NP,"[16] and more recently by Baltin (2006, 241) himself in a survey article: "An extraposed phrase is adjoined to the first maximal projection that dominates the phrase in which it originates."[17]

According to Chomsky's (1986) *Barriers* approach,[18] maximal projections are not inherently considered as barriers for movement. Instead, Chomsky distinguishes between arguments and adjuncts. More precisely, a barrier is either a maximal projection that is not directly θ-marked by a lexical category ("L-marked"), or a maximal projection that immediately dominates the latter, i.e., it is a barrier by inheritance (Chomsky, 1986, 14–15). While movement across one barrier is allowed, crossing two or more barriers results in ungrammaticality (Chomsky, 1986, 30). Thus, in the following example from Chomsky (1986, 40), the extraposed relative clause can only be interpreted as modifying the higher NP *many books with stories*. It cannot be related to the lower NP *stories* since it would have crossed two barriers: the PP, which is an adjunct and therefore not L-marked, and NP_2, which immediately dominates the PP barrier and therefore is a barrier by inheritance.

(53) $[_{NP_2}$ Many books $[_{PP}$ with $[_{NP_1}$ stories]]] were sold *that I wanted to read*.

The previous paragraphs gave a brief summary of the development of the locality constraints on extraposition in terms of subjacency (Chomsky's (1973) Subjacency, Baltin's

[15] In fact, Baltin (1981) assumes that all rightward movements that are subsumed by his movement rule called "Detachment", e.g., extraposition from NP and rightward movement of Ss and PPs from APs and VPs, are subject to Generalized Subjacency.

[16] By "extracted" Asakawa actually means extraposed. With the term "Extraposition out of NP" he refers to "Extraposition from NP, Extraposition of PP, and Extraposition from *the claim*" (Asakawa, 1979, 505).

[17] Similar generalizations are also given by Akmajian (1975, 119), Jacobson (1987, 62), and Rochemont and Culicover (1997, 283, 285) for English, by Wiltschko (1997, 360) for German, and by Keller (1995, 303) for both languages.

[18] A *barrier* is defined in terms of a *blocking category (BC)* (Chomsky, 1986, 14):

(i) γ is a BC for β iff γ is not L-marked and γ dominates β.

(ii) γ is a barrier for β iff (a) or (b):

a. γ immediately dominates δ, δ a BC for β;

b. γ is a BC for β, $\gamma \neq$ IP.

"L-marking" is construed as "direct θ-marking by a lexical category." γ is understood to be a maximal projection, and "immediately dominate" is regarded as a relation between maximal projections.

(1981) Generalized Subjacency, and Chomsky's (1986) Barriers approach to subjacency). I have provided the evidence that led to the various formulations of the subjacency conditions on rightward movement, specifically the claim that NPs and PPs must be counted as bounding nodes. However, I would like to reemphasize that these subclausal locality constraints on extraposition have been subject to debate. It was already shown in Section 2.1.1 that a number of counterexamples exist in the literature which provide evidence that extraposition from fronted PPs and out of (deeply) embedded NPs is indeed possible. Above that, authentic examples drawn from corpora have been provided in a study by Strunk and Snider (2013) which show that relative clause extraposition clearly violates these constraints. Strunk and Snider therefore reasonably conclude that the subclausal locality constraints on extraposition cannot be upheld as categorical syntactic constraints.[19]

I will now turn to the question of how many verbal boundaries may intervene between an extraposed phrase and its associate and, related to that, in which structural position the extraposed constituent is attached. As will be seen, this question has led to considerably many diverging claims in the literature. Here is a short overview of the positions that have been suggested for relative clauses extraposed from the subject and from objects: Williams (1974) attaches all extraposed relative clauses to the S node, and Reinhart (1980) attaches relative clauses extraposed from the subject to S. Emonds (1976, 145–146), following Rosenbaum (1967), and Rochemont (1986, 121–125) adjoin all extraposed relative clauses to VP. According to Asakawa (1979), Baltin (1978/1985, 1981, 1983), Guéron (1980), and Rochemont and Culicover (1997), elements extraposed from the subject must be adjoined to S, while elements extraposed from object positions are attached to VP. Culicover and Rochemont (1990) and Rochemont and Culicover (1990) argue that subject-related phrases must be allowed to attach to VP as well as S, while object-related phrases are adjoined to VP.

As mentioned above, in order to capture these structural properties of extraposed relative clauses, attempts have been made to formulate constraints in terms of bounding nodes, which restrict across how many boundaries an extraposed relative clause may be moved, and thus predict their "landing sites" (cf. Akmajian (1975), Asakawa (1979), Baltin (1978/1985, 1981, 1983), and Chomsky (1973, 1986)). Guéron (1980) and Guéron and May (1984) also consider extraposition to be a movement operation. However, instead of postulating bounding nodes, they assume that a head-complement relation defined in terms of government must hold between the extraposed phrase and its associate at the level of Logical Form, in order for the extraposed constituent to be interpreted.[20] It follows from this principle that relative clauses (or PPs) extraposed from the subject position must be attached to S, while elements extraposed from within the VP are adjoined to the VP.

[19]However, based on a more systematic corpus study and an acceptability experiment, Strunk and Snider (2013) show that there is a robust but gradient effect of subclausal locality and conclude that syntactic locality should be regarded as a soft constraint which is subject to processing factors.

[20]The "complement" is a phrase that is an adjunct or an argument of the head of the phrase it takes as antecedent.

Culicover and Rochemont (1990) and Rochemont and Culicover (1990) follow Guéron and May and propose a similar head-complement relation, formulated as their *Complement Principle*. In contrast to Guéron and May, however, Culicover and Rochemont argue that the extraposed constituents are base-generated in their S-structure positions and that the Complement Principle applies at S-structure. Furthermore, contrary to all prior work in this regard, they claim that phrases extraposed from subjects must be allowed to attach to VP or to IP (S), while object-related phrases are adjoined to VP.

2.2.2 Empirical Evidence on Locality

I will now present the empirical evidence on which the assumptions about the structural status of extraposed relative clauses have been based. In support of the claim that relative clauses extraposed from objects (OX[21]) must be adjoined to VP, the prototypical test for VPhood, VP-preposing (VP-topicalization and *though*-preposing), has been applied. As the following examples (repeated from (35)–(37) above) demonstrate, an OX must be fronted along with the preposed VP (as in the (a)-sentences) and cannot be stranded (as in the (b)-sentences). This indicates that a relative clause extraposed from an object position must be part of the VP.

(54) a. John said that he would call people up who are from Boston, and [$_{VP}$ call **people** up *who are from Boston*]$_i$ he will $\__i$.

b. * John said that he would call people up who are from Boston, and [$_{VP}$ call **people** up]$_i$ he will $\__i$ *who are from Boston*. (Baltin, 1981, 269)

(55) a. John said he would meet a man at the party who was from Philadelphia, and [$_{VP}$ meet **a man** at the party *who was from Philadelphia*]$_i$ he did $\__i$.

b. * John said he would meet a man at the party who was from Philadelphia, and [$_{VP}$ meet **a man** at the party]$_i$ he did $\__i$ *who was from Philadelphia*.

(Culicover and Rochemont, 1990, 28)

(56) a. [$_{VP}$ Call **people** up *who are from Boston*]$_i$ though he may $\__i$, he's generally pretty cheap about long-distance calls.

b. * [$_{VP}$ Call **people**]$_i$ up though he may $\__i$ *who are from Boston*, he's generally pretty cheap about long-distance calls. (Baltin, 1981, 269)

Subject-related extraposed relative clauses (SX) behave differently. When an SX is preposed along with the VP, as in (57b) and (58), the sentences are sharply ungrammatical.[22] The relative clauses can be left behind, however, as demonstrated in (57a). Most researchers

[21] I borrow from Culicover and Rochemont the following convenient terminology: OX = relative clause extraposed from an object; SX = relative clause extraposed from a subject; WhX = relative clause extraposed from a preposed *wh*-phrase.

[22] See Rochemont (1986, 199–200, notes 125, 126) for some variation in acceptability of some examples displaying an interaction of PP extraposition and VP-preposing.

therefore assume that a relative clause extraposed from the subject may not be adjoined to VP, but is instead attached to S.

(57) a. They said that a man would come in, and [$_{VP}$ come in]$_i$ **a man** did $\__i$ *who had lived in Boston*.

b. * They said that a man would come in who had lived in Boston, and [$_{VP}$ come in *who had lived in Boston*]$_i$ **a man** did $\__i$. (Culicover and Rochemont, 1990, 36)

(58) a. * It was predicted that many people would resign who disagreed with the management's policy, and [$_{VP}$ resign *who disagreed with the management's policy*]$_i$ **many people** did $\__i$. (Reinhart 1976, 46, 1980, 623)

b. * John said that a man was seen last night who had green eyes and [$_{VP}$ seen last night *who had green eyes*]$_i$ **a man** was $\__i$. (Guéron, 1980, 641)

c. * It was predicted that many people would call who live in Boston, and [$_{VP}$ call *who live in Boston*]$_i$ **many people** did $\__i$. (Webelhuth, Sailer, and Walker, 2013a, 10)

It should be noted that Baltin (1981, 292–293n4) assumes that the ungrammaticality of the sentences in (57)–(58) might be due to some independent constraint that requires the subject of sentences with preposed VPs to be pronominal, in which case it cannot be the antecedent of a relative clause. However, Webelhuth, Sailer, and Walker (2013a, 10) argue against this: "Erich Groat tells us that in his idiolect there is no strict constraint against non-pronominal subjects in VP-preposing and that [58c] is much worse for him than whatever degradation would be caused by a non-pronominal subject of a preposed VP alone."

VP-deletion is another test for VPhood in English that has been invoked as evidence for the proposed structural positions of extraposed relative clauses. If a relative clause extraposed from the subject must be attached to S, it is predicted that it will be left behind when the VP is deleted. The examples in (59) from Baltin (1978/1985, 140) and in (60) from Asakawa (1979, 505–506) are claimed to support this assumption. While (59) and (60a) show that an SX can be stranded when the VP is elided, (60b) illustrates that it cannot be deleted along with the VP, i.e., we do not get an implicit relative clause reading on the subject of the second clause of the sentence.

(59) Although nobody would ride with Fred who knew just him, **people** would _ *who knew his brother*.

(60) a. The gardener appeared on TV who earned less money than a carpenter, and **the bricklayer** did _ *who earned more money than a college professor*.

b. * The gardener appeared on TV who earned more money than a college professor, and **the bricklayer** did _, too.

For relative clauses whose antecedent is an object, the predictions are exactly the opposite, under the assumption that they are adjoined to VP. The following sentences illustrate that an OX may be deleted along with the VP, as in (61a) and (62a), but it cannot be stranded, as in (61b) and (62b):

(61) a. I saw the bricklayer yesterday who earned more money than a college professor, and my wife did _, too.

b. * I saw the bricklayer yesterday who earned more money than a college professor, and my wife did _ *who earned less money than a carpenter*. (Asakawa, 1979, 506)

(62) a. John calls people up whom he has never met before, and Bill does _ , too.

b. * John calls people up whom he has never met before, and Bill does _ *whom he has met only briefly*. (Baltin, 1981, 291–292n3)

The validity of the data on VP-ellipsis as evidence for the structural assumptions concerning extraposed relative clauses has been subject to debate, however. Although Baltin (1981, 268, 291–292n3) agrees that sentences like (62) show that an OX cannot be stranded by VP-deletion, he argues that the ungrammaticality of (62b) cannot be taken as evidence that the OX must be part of the VP. He points out that Gapping also does not allow an OX to be stranded when the antecedent is deleted, as demonstrated in (63b), although it in principle does delete proper parts of the VP. Baltin thus concludes that "there seems to be an independent constraint that prohibits deletion rules from deleting the head of a phrase while retaining the modifiers of that phrase ... Therefore, the existence of some such constraint renders irrelevant the impossibility of stranding a relative launched from object position for VP constituency."

(63) a. John calls people up who want to be athletes, and Bill calls **people** up *who want to go into business*.

b. * John calls people up who want to be athletes, and Bill _ *who want to go into business*.

Culicover and Rochemont (1990, 29–32), Rochemont and Culicover (1990, 35), and Rochemont (1986, 121–125) use the evidence based on VP-ellipsis as shown in (64) to argue that SX may indeed adjoin to VP, contrary to prior claims.[23] Considering, for example, (64a), they claim that VP-deletion in the second conjunct includes the extraposed constituent, since *a woman* can be interpreted as a woman with blond hair. They conclude that the structure of the second conjunct is such that the extraposed PP is adjoined to the VP, which is then elided.[24]

[23]Rochemont (1986, 121–125), in fact, claims that SX *must* adjoin to VP.

[24]Example (64a) is from Culicover and Rochemont (1990, 30), (64b) from Rochemont and Culicover (1990, 35), and (64c) is cited in both works. As noted by the authors, upper case signals the required *sole* locations of sentence accents in these and the following examples. That the example in (64a) involves extraposition of a PP instead of a relative clause does not seem to be theoretically relevant.

(64) a. A MAN came in with blond hair, and a WOMAN did _ TOO.
b. A MAN came in who had lived in Boston, and a WOMAN did _, too.
c. Although none of the MEN did _, several of the WOMEN went to the concert who were visiting from Boston.

However, there are some conceptual problems with this analysis, as argued by Webelhuth, Sailer, and Walker (2013a, 12–14). Culicover and Rochemont themselves point out examples from Baltin (Culicover and Rochemont (1990, 31, ex. (20)), see Baltin (1981, 291n1)) and McCawley (Culicover and Rochemont, 1990, 32n21) which are problematic for the claim that subject-related relative clauses are deleted by VP-deletion. The examples show the same semantic effect as in (64), i.e., an implicit modifier interpretation although the modifier is missing, but these cases do not involve VP-ellipsis. This suggests that the phenomenon of implicit relatives has nothing to do with VP-deletion. For instance, in the sentences below originating with McCawley, *a woman* can be interpreted as a woman who has lived in Boston and a woman who is convicted of bank robbery, respectively, even though there is no VP-ellipsis involved. Culicover and Rochemont (1990, 32n21) admit that these cases "are a problem for [their] analysis and might be handled under an inferential approach."

(65) a. If you find a man who has lived in Boston, or a woman, please tell me.
b. A MAN who is convicted of bank robbery will get a ten-year sentence, but a WOMAN would get only five years.

Another example the authors provide is shown in (66). Although the PP in the first conjunct is not extraposed but remains within the subject NP, the second conjunct, where the VP is elided, allows a reading which implies that the woman has blond hair too.

(66) A MAN with blond hair came into the room, and a WOMAN did TOO.

In order to explain this effect and in defense of their analysis that SX is attached to VP, Culicover and Rochemont (1990, 32) claim that (66) is derived from (67), where in the second conjunct the PP is extraposed from the subject and adjoined to the VP. Deletion of the VP then includes the PP, thus allowing for the relevant reading in (66). However, being aware of the fact that the elided VP in the second conjunct is different from the VP in the first conjunct (the former but not the latter contains the PP), Culicover and Rochemont (1990, 32n22) note that "in order for [66] to be derived from [67], the principles licensing the interpretation of an ellipted VP must make reference to the interpretation of the entire sentence containing the antecedent VP." However, a formulation of such interpretive principles is not attempted.

(67) A MAN with blond hair came into the room, and a WOMAN came into the room with blond hair TOO.

As pointed out in Webelhuth, Sailer, and Walker (2013a, 13), this analysis is "questionable". Although VP-deletion does not require the two VPs involved to be morphologically

identical, it is striking that in Culicover and Rochemont's analysis of (66), the elided VP in the second conjunct contains a modifier of a VP-external element (the subject) that is not part of the antecedent VP in the first conjunct. Moreover, as Culicover and Rochemont themselves note, the entire sentence containing the antecedent VP, specifically the modifier of the subject NP, must be referenced by the interpretive principles in order to license the relevant interpretation of the elided VP. Thus, as suggested by Webelhuth, Sailer, and Walker, it might be possible to design the required "principles licensing the interpretation of an ellipted VP" in such a way that they account for the relevant interpretation not only in (66), but also in (64). This is supported by the fact that sentences such as in (65) require some "interpretive solution anyway, which might be designed to also cover [64] and [66]" (Webelhuth, Sailer, and Walker, 2013a, 14). But if such an analysis of (66) can be provided, Culicover and Rochemont's analysis that derives (66) from (67) becomes redundant, and hence their argument based on VP-ellipsis that SX can be adjoined to VP disappears.

As independent support of their analysis, Culicover and Rochemont (1990, 32–33) furthermore claim that in contrast to relative clauses or PPs, adjectival subject modifiers cannot be implied in the reading of the second conjunct when the VP is elided. In (68a), for example, *a woman* cannot be interpreted as having blond hair. The reason for this is, according to Culicover and Rochemont, that under the assumption that adjectives cannot be extraposed, there is no possible structure along the lines of (67) in which the adjective is adjoined to the VP before VP-ellipsis occurs.

(68) a. A blond-haired MAN came into the room, and a WOMAN did TOO.

b. A teenage BOY who sleeps around is admired by his peers, but a GIRL is not.

However, the example in (68b) constitutes counter-evidence to this claim. As argued by Webelhuth, Sailer, and Walker (2013a, 13n24), *girl* can be interpreted as teenage girl, "which strengthens the plausibility of a purely interpretive account."

I conclude the discussion about VP-ellipsis and about Culicover and Rochemont's claim that an SX must be allowed to adjoin to VP. Their main argument is based on the assumption that an SX can be implied in the interpretation of a sentence in which the VP has been elided (see (64)). However, the discussion above has shown that the evidence provided is not compelling. There are structures like (65) which, in the absence of an overt modifier, also give rise to an implicit modifier reading even though they do not involve VP-ellipsis. For these cases, some interpretive account is needed anyway, which might then also explain the facts in (64) and (66) (as well as (68)). Therefore, I do not consider Culicover and Rochemont's claim convincing that a relative clause extraposed from the subject can be adjoined to VP. Rather, in line with most proposals in the literature, I assume that an extraposed relative clause must be attached in a structural position that is higher than the surface position of its antecedent NP. Further evidence in support of this claim is presented in the following.

Wh-clefts constitute another construction that can be used as a test for VPhood and that has been applied to show that an OX, but not an SX, must be part of the VP. Based on prior work by Ross, Reinhart (1976, 61–62) claims that the predicate part of *wh*-clefts can contain only VP material, while the *what*-clause can contain only non-VP material. As shown by the following examples from Culicover and Rochemont (1990, 28), a PP extraposed from an object may be included in the VP-part of a *wh*-cleft (69a) but not in the *what*-clause (69b). The same observations can be made for relative clauses, as illustrated in (70) from Webelhuth, Sailer, and Walker (2013a, 11). These observations additionally support the assumption that phrases extraposed from an object are adjoined to VP.

(69) a. What John did was [$_{VP}$ draw **a picture** on the wall *of his brother*].

b. * [$_{CP}$ What John did *of his brother*] was [$_{VP}$ draw **a picture** on the wall].

(70) a. What we should do is [$_{VP}$ call **people** up *who live in Boston*].

b. * [$_{CP}$ What we should do *who live in Boston*] is [$_{VP}$ call **people** up].

Relative clauses extraposed from the subject, on the other hand, may not appear within the focus position of the pseudocleft construction, which suggests that an SX cannot be attached to VP:[25]

(71) a. ? [$_{CP}$ What **someone** did *who had lived in Boston*] was [$_{VP}$ come into the room].

b. * [$_{CP}$ What **someone** did] was [$_{VP}$ come into the room *who had lived in Boston*].

(Culicover and Rochemont, 1990, 37)

Observations on ordering restrictions of relative clauses extraposed from distinct antecedents have also been used to argue for the different attachment sites of SX and OX (assuming that relative linear order corresponds to relative height of attachment, as in traditional phrase structure terms). Under the assumption that an OX adjoins to VP while an SX is attached to S, it is predicted that an OX must precede an SX when both relative clauses appear in the same sentence. This nesting requirement is proposed, for example, by Rochemont and Culicover (1990, 53; 1997, 280), Baltin (2006, 241–242), and Fodor (1978, 452), who provide the following examples. Fodor attributes this contrast to a processing constraint against intersecting antecedent-anaphor paths (the Nested Dependency Constraint).

(72) a. **A man** came into **the room** last night [$_{OX}$ *that I had just finished painting*] [$_{SX}$ *who had blond hair*].

b. * **A man** came into **the room** last night [$_{SX}$ *who had blond hair*] [$_{OX}$ *that I had just finished painting*]. (Rochemont and Culicover, 1990, 53)

[25]This is in contrast to the claim made by Culicover and Rochemont (1990), Rochemont and Culicover (1990), and Rochemont (1986), as discussed above. In their theory, these cases are ruled out by the Complement Principle, which requires a government relation to hold between the extraposed relative clause and its antecedent.

(73) a. **Someone** picked **some books** up [$_{OX}$ *which were lying on the table*] [$_{SX}$ *who really didn't want to*].

b. * **Someone** picked **some books** up [$_{SX}$ *who really didn't want to*] [$_{OX}$ *which were lying on the table*]. (Baltin, 2006, 241–242)

(74) a. **No one** puts **things** in the sink [$_{OX}$ *that would block it*] [$_{SX}$ *who wants to go on being a friend of mine*].

b. * **No one** puts **things** in the sink [$_{SX}$ *who wants to go on being a friend of mine*] [$_{OX}$ *that would block it*]. (Fodor, 1978, 452)

However, the acceptability of these data has been subject to debate. Guéron and May (1984, 27) claim on the basis of the example in (75) that multiple extraposition in a single sentence is impossible.

(75) * **Many books** have been published by **many authors** recently [$_{OX}$ *who I know*] [$_{SX}$ *which I've enjoyed reading*].

Rochemont and Culicover (1990, 172n40), on the other hand, find this sentence to be "just clumsy" and argue that the slightly modified version in (76a) is better, but that both sentences contrast with the ungrammatical (76b), in which SX precedes OX:

(76) a. **Many books** have been published by **many authors** recently [$_{OX}$ *who I know personally*] [$_{SX}$ *that I've really enjoyed reading*].

b. * **Many books** have been published by **many authors** recently [$_{SX}$ *that I've really enjoyed reading*] [$_{OX}$ *who I know personally*].

Stucky (1987, 392–393) presents examples with different kinds of extraposed modifiers of two different argument NPs and shows that both orders of modifiers are acceptable, suggesting, however, that the interpretation of the intersecting cases seems to be facilitated by a pause before the final modifier. The following example with relative clauses thus contradicts the claim that an OX must precede the SX.

(77) Only **those students** were allowed to discuss **articles** in class last quarter [$_{SX}$ *whom the professor especially likes and encourages*], [$_{OX}$ *that had recently been published*].

Although she admits that the examples that display intersecting modifiers of the same category (e.g., both relative clauses) are "less satisfactory", Stucky (1987, 398) concludes with the generalization "that nonheads that do not ever linearly precede their heads can follow their respective heads, in any number and in any order." Possible limits on the number and order of extraposed modifiers are attributed to processing factors (p. 395). Thus, it is not clear whether the ordering restrictions of extraposed relative clauses are actually due to some structural constraint or whether they are determined by processing constraints.

When a relative clause is extraposed from a preposed *wh*-phrase (WhX), it must follow an extraposed relative clause related to an (in situ) subject (78) or object ((79)–(80)), as demonstrated by the following examples from Rochemont and Culicover (1997, 281):

(78) a. ?(?) **Which room** did **a man** enter last night [$_{SX}$ *who had blond hair*] [$_{WhX}$ *that you had just finished painting*]?

b. * **Which room** did **a man** enter last night [$_{WhX}$ *that you had just finished painting*] [$_{SX}$ *who had blond hair*]?

(79) a. ? **Which man** entered **which room** last night [$_{OX}$ *that you had just finished painting*] [$_{WhX}$ *who had blond hair*]?

b. * **Which man** entered **which room** last night [$_{WhX}$ *who had blond hair*] [$_{OX}$ *that you had just finished painting*]?

(80) a. **Which article** did you find on **a table** yesterday [$_{OX}$ *that was in the living room*] [$_{WhX}$ *that you claimed was written by your best friend*]?

b. * **Which article** did you find on **a table** yesterday [$_{WhX}$ *that you claimed was written by your best friend*] [$_{OX}$ *that was in the living room*]?

Comparing (78) with (72) above reveals that the order of an OX and an SX is changed when the object is *wh*-moved, i.e., moved to a position higher than the subject. Observations like these suggest that it is the surface position rather than the base position of the antecedent that determines the structural height of the attachment of an extraposed relative clause. Rochemont and Culicover (1997, 285) therefore conclude that the extraposed relative clause "must be at least as high as its antecedent."

Additional evidence in support of this claim is provided by Ross (1967/1986, sec. 5.1.1.3) with the sentences in (81) and by Andrews (1975/1985, 167–168) with the examples in (82). The contrasts show that the extraposed relative clause must be related to the preposed *wh*-phrase.

(81) a. ?? **Which packages** is it possible that Sam didn't pick up until it had stopped raining *which are to be mailed tomorrow*?[26]

b. * **Which packages** is it possible that Sam didn't pick up *which are to be mailed tomorrow* until it had stopped raining?

(82) a. Sam picked **somebody** up *who would sleep with him* before nine.

b. Sam picked **somebody** up before nine *who would sleep with him*.

[26] Ross (1967/1986, 172) notes that although (81a) is of low acceptability, it should not be treated as ungrammatical, since the acceptability can be improved when the length of the extraposed relative is increased:

(i) **Which packages** is it possible that Sam didn't pick up until it had stopped raining *which he had arranged with his agents in Calcutta to send to him here in Poplar Bluff because of his fear that someone in Saint Louis might recognize him*?

c. * **Who** did Sam pick up *who would sleep with him* before nine?

d. **Who** did Sam pick up before nine *who would sleep with him*?

A further argument is given by Rochemont (1982, 152). He claims that the adverb *last week* in (83) may be construed as modifying the higher verb *announce*, which indicates that the extraposed relative clause is adjoined outside the embedded clause and thus outside the clause that contains the base position of its antecedent.

(83) a. [**What secret documents**]$_i$ did the British government announce they were about to reveal $\__i$ last week, *that would change our view of history*?

Webelhuth, Sailer, and Walker (2013a, 7–8) set up the paradigm in (84) (see also (85) from Baltin (2006, 260)) to demonstrate that the licensing condition of an extraposed relative clause depends on the overt positions of the relative clause and its antecedent and that it must apply in overt syntax.

(84) a. [**What other issues** *that have not been mentioned yet*]$_i$ do you consider t$_i$ important?

b. [**What other issues**]$_i$ do you consider t$_i$ important *that have not been mentioned yet*?

c. * [**What other issues**]$_i$ do you consider [t$_i$ *that have not been mentioned yet*] important?

(85) * **How many girls** did he consider t$_i$ *who were from Boston* interesting?

(Baltin, 2006, 260)

When the NP is *wh*-moved to the front, the relative clause modifying the NP may be moved along with it (84a). The relative clause may also be extraposed to the end of the sentence (84b). Under the assumption that it must appear higher in the tree than its associate, this is possible if the relative clause is adjoined to CP. As the example in (84c) shows, however, the relative clause may not be stranded in the middle of the sentence, i.e., it may not be left behind in the position of the gap of the moved antecedent NP. Hence, the assumption that an extraposed relative clause must be licensed by the surface position of its antecedent also accounts for the impossibility of medial stranding of a relative clause when its antecedent is moved leftward.

The same claim can be made on the basis of A-movement. Guéron's (1980, 644–645) examples show that in a passive construction (86) as well as in a raising construction (87), an extraposed relative clause related to the passivized/raised NP must appear as high as its antecedent. When it is stranded inside the clause that contains the trace of the antecedent, as in (86b) and (87b), the sentences are ungrammatical.

(86) a. [**A book**]$_i$ was believed [$_S$ t$_i$ to be on the table] by all of us *which was written by William Shawcross*.

b. * [**A book**]$_i$ was believed [$_S$ t$_i$ to be on the table *which was written by William Shawcross*] by all of us.

(87) a. [**Many people**]$_i$ seemed [$_S$ to be hard to get along with t$_i$] to the other members of the department *who had at first made a good impression*.

b. * [**Many people**]$_i$ seemed [$_S$ to be hard to get along with t$_i$ *who had at first made a good impression*] to the other members of the department.

Further examples of A-movement are provided by Borsley (1997) and Baltin (2006):

(88) a. * [**One man**]$_i$ seemed [$_{NP}$ t$_i$ *who knew the truth*] to be late. (Borsley, 1997, 642)

b. * [**Someone**]$_i$ was given [$_{NP}$ t$_i$ *who liked Steinbeck*] an interesting book. (Baltin, 2006, 259)

Finally, the contrast shown below from Baltin (1978/1985, 42–45) further supports the structural assumptions that have been made all along. The relative clause is extraposed from the subject of the raising predicate *likely*, which is the underlying subject of *talk*. When the predicate including the infinitival complement is *wh*-preposed, the relative clause cannot be fronted along with it, as shown in (89b). This supports the claim that the extraposed relative clause cannot be licensed by the underlying–or base–position of the antecedent. The ungrammaticality of (89b) is straightforwardly explained, however, under the assumption that the extraposed relative clause must be higher in the tree structure than the surface position of its antecedent.

(89) a. **The people** were likely to talk *who knew Fred*.

b. * [Just how likely to talk *who knew Fred*] were **the people**?

This concludes the discussion on locality. Starting with the earliest investigations of relative clause extraposition, I have given a brief summary of the locality constraints on extraposition that have been proposed in the literature. The earliest accounts have tried to capture these in terms of subjacency, which established NP and S as bounding nodes (and in later proposals maximal projections of all major categories). However, it has been shown–and most recently confirmed by data from corpus studies and psycholinguistic experiments–that these subclausal locality constraints are too strict. Extraposition from antecedents embedded within PPs and NPs is possible. The clause-boundedness, i.e., the Right Roof Constraint, however, is manifested as a characteristic property of extraposition.

The question about the attachment site of extraposed relative clauses has also given rise to conflicting claims. Among them, the most intriguing one is the claim that a relative clause extraposed from the subject may be adjoined to the VP (Rochemont, 1986; Culicover and Rochemont, 1990; Rochemont and Culicover, 1990). However, following Webelhuth, Sailer, and Walker (2013a), I have argued that the evidence provided in favor of this claim, mainly based on assumptions concerning VP-ellipsis, is controversial and might as well be explained

in other ways. The further empirical evidence provided in the discussion about the structural status of extraposed phrases is based on observations about the behavior of extraposed relative clauses in connection to VP-preposing, VP-deletion, *wh*-clefts, ordering restrictions, *wh*-moved constituents, and A-movement (passive, raising, control). The majority of the evidence gives us reason to draw a conclusion that can be captured as the following generalization: an extraposed relative clause must be attached in a structural position at least as high as the surface position of its antecedent. We will see in the following section that these structural assumptions are supported as well by observations about the binding behavior of extraposed relative clauses.

2.3 Binding Effects

This section characterizes the behavior of extraposed and non-extraposed relative clauses with respect to the binding theory. I will first demonstrate the varying coreference options of relative clauses under Principle C of the binding theory. It will become clear that this evidence supports the structural assumptions about extraposed relative clauses. Moreover, and more importantly, it will be shown that extraposition may change the binding potential of relative clauses with respect to Principle C. The behavior with respect to variable binding, however, is not influenced by extraposition, as will be shown in Section 2.3.2. The final section presents a binding phenomenon of relative clauses with respect to leftward movement, the anti-reconstruction effects.

2.3.1 Principle C Effects of Relative Clause Extraposition

The claims about the attachment site of extraposed relative clauses have been supported by observations about the binding behavior of relative clauses, specifically the coreference options of names inside of the relative clauses, i.e., Principle C effects. According to Principle C of the binding theory, a pronoun must not c-command its antecedent. Hence, when a name appears within a relative clause, the relative clause must not be c-commanded by a pronoun that is coreferential with the name. This fact has been used as a test to determine the structural positions of extraposed relative clauses. That is, if a name within a relative clause can corefer with a pronoun in the matrix clause, this indicates that the relative clause must be in a structural position where it is outside the c-command domain of the pronoun. On the other hand, if the name within the relative clause cannot be the antecedent of the pronoun, this is an indicator that the relative clause must be attached in a position within the c-command domain of the pronoun.

Based on the comparison of the coreference options of extraposed and non-extraposed relative clauses, various authors have claimed that extraposition has an effect on the binding behavior of (elements within) relative clauses, which means that relative clause extraposition

may affect the semantic interpretation of a sentence. In the following, I present the relevant data that have been provided in the literature. The most detailed treatment of the binding facts is provided by Culicover and Rochemont. Therefore, unless indicated otherwise, the examples cited below are from Rochemont and Culicover (1997, 282–283), most of which are based on Culicover and Rochemont (1990).

The sentences in (90) show that a name contained in an OX must not be bound by a pronoun in the subject position of the sentence. This is taken as evidence that an OX must be adjoined to VP. In this position, the name inside the OX is c-commanded by the subject pronoun, in violation of Principle C of the binding theory. If the OX were attached higher (e.g., to IP), it would not be c-commanded by the subject, Principle C would not be violated, and the sentences should not be ungrammatical.

(90) a. * She$_i$ invited **many people** to the party *that Mary$_i$ didn't know*.

b. * She$_i$ told **many people** about the concert *who Mary$_i$ made nervous*.
(Guéron and May, 1984, 10)

c. * He$_i$ met **a woman** in Chicago *who went to school with Dan's$_i$ mother*.
(Reinhart (1976, 47), Reinhart (1981, 622), Reinhart (1983, 52))

In contrast, when the pronoun is in the position of an indirect object in a double object construction, it can bind a name contained within an extraposed relative clause that is related to the direct object, as in (91a). However, when the relative clause is not extraposed, Principle C is violated (91b). This contrast shows that relative clause extraposition can influence the binding potential of names inside the relative clauses and thus may have an effect on the semantic interpretation of a sentence.

(91) a. I sent her$_i$ **many gifts** last year *that Mary$_i$ didn't like*.

b. * I sent her$_i$ **many gifts** *that Mary$_i$ didn't like* last year.

The contrast can be explained on the basis of a number of assumptions. First, under the assumption that the OX in (91a) is adjoined to the VP and thus outside the phrase containing the verb and its arguments, it is not c-commanded by the pronoun in the indirect object position. In contrast, the in situ relative clause in (91b) is c-commanded by *her*. The latter assumption, however, presupposes that the relative clause is contained within the NP. As pointed out to Rochemont and Culicover by Bob Levine, there is another possible structure for the sentence in which the relative clause is string-vacuously extraposed out of the NP and adjoined to the VP, where it would be outside the c-command domain of the pronoun. In this case, (91b) should be as good as (91a). Baltin (1987, 585) indeed assumes that string-vacuous relative clause extraposition is possible. Fox (2002, 75) also addresses this issue. While he in principle allows for string-vacuous extraposition, he argues that it is disfavored because of a parsing preference according to which a structure with no extraposition is preferred over a structure with extraposition. Thus, most speakers assume a structure without

string-vacuous extraposition for (91b), but then Principle C is violated, which is why (91b) is judged worse than (91a). Fox assumes that the parsing preference is not very strong and might not even exist for some speakers, which might be the reason for conflicting and/or uncertain judgments.

Webelhuth, Sailer, and Walker (2013a, 15) discuss a further issue with the examples in (91), which is concerned with the question of whether Principle C perhaps only applies at LF. Given that the antecedent NPs are quantified, it might be possible that the two sentences have different structures at LF: (91b) would have to have a structure that is ruled out by Principle C, while the LF structure of (91a) should not violate Principle C. However, Webelhuth, Sailer, and Walker argue that "while conceivable, this avenue does not seem promising." Under standard assumptions, when *many gifts that Mary$_i$ didn't like* in (91b) is quantifier-raised, it is in a position where it is not c-commanded by *her$_i$*, and Principle C–applied to this output–is not violated. Hence, (91b) would be wrongly predicted to be good. Furthermore, Webelhuth, Sailer, and Walker point to a survey article in which Sportiche (2006, 69) shows on the basis of the sentences in (92) that operations mapping surface structures to LF representations (*wh*-in-situ interpretation, quantifier raising) "never bleed Condition C." In (92a), it is possible to quantifier-raise *every picture of Jane$_i$* to a position higher than the subject since it can outscope *a different person*. Yet, although *Jane$_i$* is then outside the c-command domain of *her$_i$*, the Principle C violation cannot be removed. In (92b), *which picture of Bill* is *wh*-preposed to [Spec,CP] at LF, where *Bill* is not c-commanded by *him$_i$*. But again, this does not remove the Principle C violation of the sentence.

(92) a. * A different person compared her$_i$ to every picture of Jane$_i$.

b. * Who told him$_i$ about which picture of Bill$_i$?

Thus, under the assumptions just mentioned, the contrast in (91) is accounted for and shows that relative clause extraposition may bleed Principle C.

The examples in (93) and (94) are consistent with the claim that a relative clause extraposed from a subject is attached to IP. Neither the in situ relative clause nor the extraposed relative clauses are c-commanded by the pronouns, so that the coreference as indicated is possible.

(93) a. **Nobody** *who knows anything about Rosa's$_i$ weird sleeping habits* would ever call her$_i$ before noon.

b. **Nobody** would ever call her$_i$ before noon *who knows anything about Rosa's$_i$ weird sleeping habits*. (Reinhart (1976, 43), Reinhart (1983, 49))

(94) **Many people** hate him$_i$ *who had the chance to work with Brando$_i$ on a film*.
(Reinhart, 1976, 135)

In support of the assumption that it is the surface and not the base position of the antecedent that determines the height of the attachment site of an extraposed relative clause,

Rochemont and Culicover (1997, 282) provide the contrast in (95). The absence of a Principle C violation in (95b) is correctly predicted if the relative clause is adjoined in a position higher than the surface position of its antecedent, i.e., to CP.[27]

(95) a. * She$_i$ invited [$_{VP}$ [$_{VP}$ **several people** to the party] [$_{OX}$ *that Mary$_i$ didn't like*]].

b. **How many people** did [$_{IP}$ she$_i$ invite to the party] [$_{WhX}$ *that Mary$_i$ didn't like*]?

The examples in (96) furthermore show that the extraposed relative clause may appear unboundedly far from the position of the *wh*-trace:

(96) a. * She$_i$ said she invited **several people** to the party [$_{OX}$ *that Mary$_i$ didn't like*].

b. [**How many people**]$_k$ did [$_{IP}$ she$_i$ say [$_{IP}$ she invited $\__k$ to the party]] [$_{WhX}$ *that Mary$_i$ didn't like*]? (adapted from Culicover and Rochemont (1990, 43))

However, comparison of (96b) with (97a) shows that the height of the extraposed relative clause is restricted by the height of the *wh*-phrase it takes as antecedent. The matrix subject in (97a) c-commands the WhX, causing a Principle C violation, which follows from the assumption that the WhX remains within the embedded CP. Note that this is consistent with the claim that a relative clause may not be extraposed out of the clause containing its overt antecedent, i.e., the Right Roof Constraint. This is confirmed by the other two examples in (97): the matrix subject pronoun c-commands the OX and the SX, respectively, which immediately follows if the extraposed relative clause cannot leave the minimal clause containing its associate.

(97) a. * She$_i$ wondered [$_{CP}$ **how many people** she$_i$ invited to the party [$_{WhX}$ *that Mary$_i$ didn't like*]].

b. * She$_i$ said [$_{CP}$ that I sent her$_i$ **many gifts** last year [$_{OX}$ *that Mary$_i$ didn't like*]].

c. * He$_i$ said [$_{CP}$ that **a man** came into the room [$_{SX}$ *that John$_i$ didn't like*]].

This argument was first given by Guéron and May (1984, 14–15), who provide the following examples in which an indirect object pronoun in the matrix clause c-commands an SX and an OX, respectively, embedded in a complement clause:

(98) a. * I told her$_i$ [$_{CP}$ that **many people** attended last year's concert [$_{SX}$ *who made Mary$_i$ nervous*]].

b. * I told her$_i$ [$_{CP}$ that the concert was attended by **many people** last year [$_{OX}$ *who made Mary$_i$ nervous*]].

[27] Taraldsen (1981, 480) does not accept a coreferential reading in an example that is structurally equivalent to (95b). Guéron and May's (1984) judgments are contradicting. They admit coreference in (i) (although they confess that "judgments are less than clear"), but not in (ii):

(i) Which agents do you think he will expose who Burgess has recruited? (Guéron and May, 1984, 16n18)

(ii) Which picture did she buy that Mary admires? (Guéron and May, 1984, 11n15)

See Culicover and Rochemont (1990, 42n36) for discussion.

When the embedded subject *a man* in (97c) is *wh*-moved to the front of the matrix clause, there is no Principle C violation, as illustrated in (99). The matrix subject pronoun does not c-command the relative clause extraposed from the *wh*-phrase, although it does c-command the trace of the *wh*-phrase. Again, this shows that the WhX must be adjoined in a position higher than the matrix subject, which is consistent with the claim that it is the surface and not the base position of the antecedent that determines the adjunction site of the extraposed relative clause.

(99) [**Which man**]$_k$ did he$_i$ say [$_{IP}$ _$_k$ came into the room] [$_{WhX}$ *that John$_i$ didn't like*]?

Finally, the examples in (100) show that it is the surface position and not the LF position of the antecedent that determines the position of the extraposed relative clause. Under the standard assumption that a *wh*-in-situ-element is moved at LF to the position of a c-commanding *wh*-phrase in the specifier position of CP ([Spec,CP]), *which student* in (100b) must be moved at LF to [Spec,CP] of the matrix clause. If it was this position that determined the attachment height of the extraposed relative clause (and if an extraposed clause has to be attached at least as high as its antecedent), the WhX would have to be adjoined to the matrix CP. But in that position it would be outside of the c-command domain of *her*, and the sentence should not be ruled out by Principle C.

Under the assumption that quantifier raising at LF is restricted to the minimal clause in which the quantified NP appears, the antecedent NP *a student* in (100a) is moved at LF to the specifier position of the embedded CP. The extraposed relative clause would now have to be adjoined to this CP (under the assumption of (i) the Right Roof Constraint, and (ii) that it must be attached higher than its antecedent), where it would still be within the c-command domain of the pronoun and thus subject to Principle C.

Hence, we would expect a contrast in grammaticality between (100a) and (100b) (which would parallel that in (95)). Since both sentences are equally ungrammatical, however, it cannot be the LF position of the antecedent that is relevant to the attachment site of the extraposed relative clause. Rather, the data can be straightforwardly explained if it is the surface structure position that determines the height of the extraposed relative.

(100) a. * Who told her$_i$ [$_{CP}$ that Sam was taking **a student** to the dance *that the teacher$_i$ liked*]?

b. * Who told her$_i$ [$_{CP}$ that Sam was taking **which student** to the dance *that the teacher$_i$ liked*]?

To sum up, this section has presented the evidence on the binding behavior of relative clauses, specifically with respect to Principle C, which has been provided in the literature in support of certain assumptions about relative clause extraposition. The data support the claims that an OX must be adjoined to VP, while an SX is attached to IP. More generally, an extraposed relative clause is attached at least as high as its antecedent. Moreover, it is the

surface position–and not the base or LF position–of the antecedent that determines the structural height of an extraposed relative clause. The binding data also confirm the Right Roof Constraint. Finally, it has been shown that extraposition may change the binding potential of relative clauses, i.e., extraposition has an effect on the interpretation of a sentence.

2.3.2 Variable Binding

The behavior of relative clauses with respect to variable binding, i.e., cases where a pronoun is bound by a c-commanding quantified noun phrase, differs from that with respect to Principle C. In contrast to the coreference options, which we have seen above may change when a relative clause is extraposed, variable binding is not influenced by extraposition.

As shown in (101a)–(101b), a pronoun contained in an OX may be bound by a quantifier in an object position (or in subject position as in (101c)), but a pronoun in an SX may not (102).[28] This contrast is surprising under the assumption that the OX and the SX are both adjoined in positions where they are outside of the c-command domain of the binder.[29] The variable should not be bound by the quantified NP in either case, i.e., the sentences in (101) should be ungrammatical as well.

(101) a. I told everyone$_i$ **the fact** yesterday [$_{OX}$ *that he$_i$ wanted to know*].

b. I would not tell everyone$_i$ **all the details** at once [$_{OX}$ *that he$_i$ might be interested in*].

c. Everybody$_i$ read **a book** yesterday [$_{OX}$ *that he$_i$ had bought at the supermarket*].

(102) a. * **A man** entered every room$_i$ yesterday [$_{SX}$ *who lived in it$_i$*].

b. * **A man** arrived at every station$_i$ [$_{SX}$ *who had built it$_i$*].

c. * **Many people** interviewed each of the candidates$_i$ [$_{SX}$ *who knew nothing whatsoever about his$_i$ background*].

d. * **Many people** interviewed nobody$_i$ [$_{SX}$ *who had nothing to offer him$_i$*].

(103) * The porter let **a man** into every room$_i$ yesterday *who lived in it$_i$*.

The binding options of these examples with extraposed relatives are parallel to those where the relative clauses are in situ, as demonstrated for the (a)-sentences in (104). Büring and Hartmann (1995, 1997) take this as evidence that variable binding in relative clause extraposition displays a reconstruction effect. The relative clause in (104a) is within the c-command domain of the quantified NP. Since this is the base position (or trace) of the OX in (101a), the binding behavior of the OX is correctly predicted if the OX is reconstructed. The

[28] All examples in (101)–(103) are from Büring and Hartmann (1997, 15, 17), with the exception of (101b), which is from Haider (1994, 6), and (102c) and (102d), which are cited from Reinhart (1983, 127) (originally from Reinhart (1976, 136)).

[29] This follows from the assumption that an OX is adjoined to VP and an SX to IP. Even if the latter was allowed to adjoin to VP, as claimed by Culicover and Rochemont (1990) and Rochemont and Culicover (1990), it would still be outside of the c-command domain of the quantified object NP.

relative clause in (104b), on the other hand, is not c-commanded by the quantified NP, hence the variable cannot be bound. The impossibility of variable binding in (102a) is therefore also correctly predicted under reconstruction. Thus, the behavior of relative clauses with respect to variable binding is not affected by extraposition.

(104) a. I told everyone$_i$ [$_{NP}$ **the fact** *that he$_i$ wanted to know*] yesterday.

b. * [$_{NP}$ **A man** *who lived in it$_i$*] entered every room$_i$ yesterday.

2.3.3 Anti-Reconstruction Effects

While the previous sections have mainly investigated the binding behavior of extraposed relative clauses, this section presents a well-known binding phenomenon of relative clauses that is not concerned with extraposition, but with leftward movement instead.

We have seen in Section 2.3.1 that the coreference options of relative clauses may change when a relative clause is extraposed, i.e., moved to the right. A similar effect can be found when a relative clause, or more precisely an NP containing a relative clause, is moved to the left. This is illustrated with the sentences in (105).[30] In (105a), the name within the relative clause cannot be coindexed with the pronoun that c-commands the relative clause since this induces a Principle C violation. When the NP including the relative clause is extracted, however, Principle C is bled, and *John* and *he* can corefer (105b). This phenomenon has come to be known as the anti-reconstruction effect, since the relative clause may not be reconstructed for interpretation since that would induce a Principle C violation (Lebeaux 1988/2000, 102–104, 1991, 212).

Interestingly, the coreference options are not changed when the name is contained in a complement clause, as shown in (106). This contrast was first noted by Van Riemsdijk and Williams (1981), who attributed it to the degree of embedding of the name within the preposed clause. Since Lebeaux (1988/2000, 1991) and Freidin (1986, 179), the contrast is typically taken to reflect a complement-adjunct asymmetry.

(105) a. * He$_i$ denied **the claim** [$_{RC}$ *that John$_i$ made*].

b. **Which claim** [$_{RC}$ *that John$_i$ made*] did he$_i$ later deny t?

(106) a. * He$_i$ denied the claim [$_{CP}$ that John$_i$ likes Mary].

b. * Whose claim [$_{CP}$ that John$_i$ likes Mary] did he$_i$ deny t?

This concludes the discussion of the binding phenomena of relative clauses. We have seen that the binding behavior of extraposed relative clauses is in line with the structural assumptions about relative clause extraposition that have been made in the literature. The varying potential for coreference under Principle C is compatible with the claim that the surface position, rather than the base or LF position, of the antecedent determines the height

[30] Both (105) and (106) are cited from Lebeaux (1991, 211).

of attachment of the extraposed relative clause. Specifically, the extraposed phrase is adjoined in a structural position higher than its antecedent. This is compatible with the claims that an OX is adjoined to VP, an SX to IP, and a WhX to CP. Furthermore, data have been provided whose coreference options support the claim that extraposition is clause-bounded (Right Roof Constraint). More importantly, it has been shown that relative clause extraposition may influence the coreference options of names within relative clauses. Variable binding, however, is not affected by extraposition. Finally, anti-reconstruction facts have shown that *wh*-movement of an NP together with its relative clause removes a Principle C violation that exists when a name within the in situ relative clause is bound by a pronominal subject.

Not only the binding potential is affected by the position of a relative clause, i.e., whether it is in situ, extraposed, or *wh*-moved with its antecedent. The following section shows that other aspects of sentence interpretation are influenced by relative clause extraposition as well.

2.4 Scope Effects of Relative Clause Extraposition

In addition to the variation in coreference possibilities, relative clause extraposition has been claimed to influence further areas of semantic interpretation, specifically the scope of logical operators.

Fox and Nissenbaum (1999, 2000) and Fox (2002) have argued in detail that relative clause extraposition affects the scope of the antecedent NP. In particular, drawing on Williams (1974), who focused on comparative and result clause extraposition, they show that the scope of the antecedent NP must be at least as high as the adjunction site of the extraposed relative clause. This was dubbed "Williams' Generalization" by Fox (2002, 71):

(107) **Williams' Generalization**

When an adjunct β is extraposed from a "source DP" α, the scope of α is at least as high as the attachment site of β (the extraposition site).

Fox and Nissenbaum (1999, 136) demonstrate this generalization with the examples shown in (108). They make use of the specific property of the 'free choice' element *any* that it must be licensed within the scope of some modal operator, for example *look for* or *would*. This is illustrated in (108a), where *look for* outscopes *any*. The sentence does not give rise to an interpretation such that there is a particular thing that the speaker was looking for.

(108) a. I [$_{VP}$ looked very intensely for **anything** *that would help me with my thesis*].

b. * I [$_{VP}$ looked for **anything** very intensely] *that will/would help me with my thesis*.

When the relative clause that modifies the NP containing the 'free choice' element is extraposed, the sentence is unacceptable (108b). This is correctly predicted by Williams' Generalization. The extraposed relative clause appears to the right of the adverbial *very intensely* that modifies *look for*, hence it is adjoined to the VP above the adverbial modifier. According to Williams' Generalization, the scope of the antecedent NP *anything* must be as high as this attachment site, which means that it is above the scope of *look for*. But then 'free choice' *any* is outside of the scope of its licensor. This conflict in scope requirements cannot be resolved, which is why the sentence is ungrammatical.

The sentences in (109) are control cases. Example (109a) shows that an extraposed relative clause is in principle allowed to adjoin to a position outside the scope of *look for*. Since *something* is not required to be within the scope of a modal operator, its scope may be as high as the extraposition site, without evoking a conflict. (109b) shows that a relative clause may even be extraposed from an NP headed by 'free choice' *any*, as long as it is not extraposed out of the scope domain of the modal operator that licenses the 'free choice' element. The relative clause in (109b) is extraposed across the adverbial modifier *without making a fuss* that modifies the main VP *buy anything*. A possible landing site is in adjunction to VP_3, as indicated, where it is still below the modal verb *would*. Hence, the antecedent NP *anything* can have scope as high as the extraposition site, as required by Williams' Generalization, while still being in the scope of the licensor of 'free choice' *any*, i.e., the modal verb *would*.

(109) a. I [$_{VP}$ looked for **something** very intensely] *that will (likely) help me with my thesis*.

b. I [$_{VP_1}$ would [$_{VP_2}$ [$_{VP_3}$ buy **anything** without making a fuss] *that will/would help me with my thesis*]].

Further examples demonstrating this scope effect of relative clause extraposition, cited from Fox and Nissenbaum (2000), are shown below:

(110) a. I looked in vain for **any book** *that would help me with my thesis*.

b. * I looked for **any book** in vain *that would help me with my thesis*.

c. I looked for **a certain book** in vain *that will (likely) help me with my thesis*.

(111) a. I looked very desperately for **any clue** *that the detective might have overlooked*.

b. * I looked for **any clue** very desperately *that the detective might have overlooked*.

From these observations Fox and Nissenbaum conclude that the generalization in (107) is correct: extraposition of a relative clause marks wide scope for its antecedent NP.

Guéron (1980, 650) shows that relative clause extraposition has an effect on the logical scope of negation and polarity items. As demonstrated in (112), the negative polarity item

(NPI) *the slightest effect*, which is unlicensed when the relative clause containing it is in situ (112a), becomes licensed when the relative clause is extraposed (112b).

(112) a. * M. thinks that [the extraposition transformation which has *the slightest effect* on LF] **hasn't** been found yet.

b. M. thinks that [the extraposition transformation _] **hasn't** been found yet [which has *the slightest effect* on LF].

The same effect is shown for PP extraposition with an example from Culicover (1981, 20):

(113) a. * Pictures [$_{PP}$ of *any* of the women] were hanging on **none** of the walls.

b. Pictures were hanging on **none** of the walls [$_{PP}$ of *any* of the women].

Interestingly, the licensing configuration is exactly the other way around when the negative polarity item (*any*) and the negation operator (*none*) are exchanged. The NPI is licensed when the PP containing its licensor is in situ. Extraposition destroys the licensing configuration:

(114) a. Pictures [$_{PP}$ of **none** of the women] were hanging on *any* of the walls.

b. * Pictures were hanging on *any* of the walls [$_{PP}$ of **none** of the women].

These examples seem to suggest that the surface order of the negation operator and the NPI seems to play a role in licensing the negative polarity items involved (see Webelhuth, Sailer, and Walker (2013a)).

That the semantic interpretation of a sentence is influenced by extraposition is also shown by the following examples from Guéron (1980, 650). When the antecedent NP contains a logical operator such as *only*, the acceptability of a sentence is degraded when the relative clause is extraposed:

(115) a. Only **those people** *who are interesting to talk to* will be invited.

b. Only **those people** will be invited *who are interesting to talk to*.

(116) a. **The only man** (there) *who was interesting to talk to* was invited.

b. * **The only man** (there) was invited *who was interesting to talk to*.

(Guéron, 1980, 650)

To conclude, the data presented in this section have shown that relative clause extraposition may affect the scope of logical operators and thus influences the interpretation of sentences.

2.5 Conclusion

In this chapter, I have systematically surveyed the theoretical literature and collected the data which have served for the formulation of empirical generalizations and theoretical analyses of relative clause extraposition in generative grammar. I have discussed the empirical claims within the domains of (i) construal, (ii) locality, (iii) binding, and (iv) scope, even though these domains are not independent of each other. I have shown that some of the data and claims have been controversial and less certain than others. Nevertheless, I have uncovered some central properties which I believe must be captured by any account. I conclude with the formulation of the following ten descriptive generalizations about relative clause extraposition (which are partially dependent on each other):

1. Extraposed relative clauses can have antecedent NPs which are embedded within PPs and NPs.

2. Extraposed relative clauses may have conjoined and split antecedents.

3. Determiners may require the presence of relative clauses.

4. The head noun of the antecedent NP of a relative clause may be elided.

5. In English, extraposed relative clauses can be related to *wh*-moved antecedents but not to topicalized antecedents or antecedents within topicalized phrases; in German, extraposed relative clauses can be related to *wh*-moved antecedents as well as topicalized antecedents and antecedents within topicalized phrases.

6. An extraposed relative clause is attached in a structural position higher than the surface position of its antecedent.

7. An extraposed relative clause must not be attached higher than the minimal VP containing its antecedent.

8. No clause boundary intervenes between an extraposed relative clause and its antecedent (Right Roof Constraint).

9. Relative clause extraposition may influence coreference options and the scope of logical operators, but it does not affect variable binding.

10. Relative clauses must not be stranded in medial position (follows from Generalization 6).

In Chapter 4, I will use these generalizations to assess the previous theories of relative clause extraposition and evaluate their strengths and weaknesses.

Chapter 3

A Psycholinguistic Experiment

In the previous chapter, we have seen that although there is a long research tradition on the topic of relative clause extraposition in English, there still exists a lot of controversy about the data in some areas of this topic. Two of the aspects that have been subject to debate in the literature concern the choice of the determiner of the antecedent NP as well as the choice of the matrix predicate in relative clause extraposition. In the theoretical literature, it has frequently been claimed that the acceptability of relative clause extraposition decreases when the antecedent NP is definite (the definiteness restriction) and when the main verb of the sentence is not a verb of appearance (the predicate restriction). However, the literature also contains conflicting judgments, suggesting the need to test the acceptability of relative clause extraposition experimentally. For this reason, I carried out a psycholinguistic experiment in order to cast light on these areas of uncertainty. This chapter reports on the experiment.[1]

After a brief introduction, I give an overview of the problems connected with the traditional methods of gathering linguistic judgment data, and I review recommendations on how to collect reliable judgment data by applying empirical methods (Section 3.2). Section 3.3 characterizes the constraints on relative clause extraposition, in particular the definiteness restriction (Section 3.3.1) and the predicate restriction (Section 3.3.2), and surveys the evidence for these constraints that has been presented in the literature. In Section 3.3.3, the question is raised whether the grammatical function (subject or direct object) of the antecedent of an extraposed relative clause has an influence on the acceptability of the sentence. Section 3.4 describes the experiment that was conducted to scrutinize the definiteness restriction, the predicate restriction, and the role of grammatical functions in relative clause extraposition. Empirical evidence is provided that corroborates the assumptions made in the literature. In Section 3.5, I discuss some further findings of the experiment and its implications for linguistic theory.

[1]This chapter appeared in an almost unmodified form in Webelhuth et al. (2013b) (some minor stylistic modifications have been made).

3.1 Introduction

I will investigate whether and in what ways the acceptability of relative clause extraposition in English is changed under certain conditions.[2] It has been widely observed that the acceptability of relative clause extraposition is influenced by factors such as the definiteness of the antecedent NP (the definiteness restriction) and the class of the main verb/predicate of the sentence, specifically the distinction between verbs of appearance and other verbs (the predicate restriction). The restrictions have been the subject of some debate for a long time, and various theories have been provided that have tried to explain the differences in acceptability between extraposition sentences.

These theories are based on intuitive judgments of the well-formedness of sentences, which are generally gathered informally, linguists consulting merely their own intuitions and those of some colleagues and friends and thus not satisfying the standards of empirical studies. However, judgment data elicited unsystematically have been frequently alleged to be unstable and unreliable, resulting in unclear and conflicting evidence (Schütze, 1996; Cowart, 1997; Bard, Robertson and Sorace, 1996). I will show that this includes the evidence on restrictions on extraposition. It is not my intention to dispute the existence of the definiteness effect and the predicate restriction. Rather, following Schütze (1996), Cowart (1997), Bard et al. (1996), Featherston (2005, 2007), Keller (2000), Riehl and Rothe (1960), and others, I suggest applying reliable empirical methods to provide objective evidence.

To this end, I conducted an experiment to scrutinize the restrictions on extraposition and to provide stable and reliable empirical data. Specifically, I applied the method of thermometer judgments (Featherston, 2007) to investigate whether and in what ways the acceptability judgments of a sentence containing an extraposed relative clause are influenced by the definiteness of the antecedent NP and the verb class. The additional factor of grammatical function was included to determine whether the grammatical function of the antecedent NP plays a role in the acceptability of extraposed relative clauses. Before I report on the investigation and present the results, I will give a short overview of the problems connected with the traditional methods of gathering linguistic judgment data.

3.2 Eliciting Judgment Data

Acceptability judgments by native speakers, i.e., native speakers' intuitive judgments of the well-formedness of utterances, are the main source of evidence that linguists rely on to formulate their theories. However, as Schütze (1996) argues, judgment data are often gathered in a very uncritical way. "In the vast majority of cases in linguistics, there is not the slightest attempt to impose any of the standard experimental control techniques, such as random

[2] I use the term "acceptability" in order to characterize the native speakers' intuitions about the linguistic data, whereas "grammaticality" is used as a theoretical notion to characterize whether sentences are formed according to the rules and principles of a grammar.

sampling of subjects and stimulus materials or counterbalancing for order effects" (Schütze, 1996, 4). Judgments are often collected in a naïve, intuitive way, and have therefore been alleged to be subject to severe instability of different kinds. Not only syntactic, semantic, and pragmatic factors, but also extralinguistic influences have been shown to affect an informant's response to an individual sentence. Among these are subject-related factors, e.g., literacy and linguistic expertise, and task-related factors, e.g., measurement scale, instructions, and order of presentation.[3]

Moreover, traditional judgment methods often use symbols like "?", "??", "?*", or "*" to categorize example sentences according to their perceived acceptability or grammaticality. However, their application has been shown to vary not only between informants, but also "within the work of a single author" (Bard et al., 1996, 34). This inconsistency makes it difficult to compare judgment data and to draw conclusions for linguistic theory, especially when acceptability differences are subtle.[4]

Thus, acceptability judgments are biased by a variety of factors, whose influence can, however, be minimized by employing proper control techniques. Schütze (1996) and Cowart (1997) urge the use of empirical methods, obeying the standards of psychological experiments, to obtain reliable judgments. They make a number of recommendations concerning the careful design and presentation of the experimental material (e.g., randomizing the order of stimuli, using multiple lexical forms and fillers for distraction), the procedure for gathering judgments (e.g., selecting a representative sample and an appropriate number of subjects, providing effective instructions and training sessions), and a careful analysis and interpretation of the data employing statistical tests (e.g., analysis of variance). As for the rating scale that should be used, it has been shown that an interval scale based on the magnitude estimation paradigm yields reliable and fine-grained judgment data (Bard et al., 1996; Cowart, 1997; Schütze, 1996). Featherston (2007) has developed the scale further and introduced the method of thermometer judgments, which uses an open-ended linear scale with two reference points. The use of such scales ensures consistency of the judgments of the sentences investigated in an experiment. Integrating a set of standard sentences into each experiment allows for comparability of judgments across experiments, which can, however, still be problematic in instances of very subtle differences.

Acceptability judgments that are gathered using standard experimental methods provide objective, reliable, and statistically significant data, which can be of great importance to linguistic theory. I therefore carried out an experiment to elicit more empirically adequate data on some constraints on relative clause extraposition. These are summarized in the next section.

[3]For a detailed survey of all the difficulties inherent to traditional methods of gaining introspective judgments of acceptability, the reader is referred to Cowart (1997), Schütze (1996), and Bard et al. (1996).

[4]A large collection of theoretically relevant German example sentences and their controversial grammaticality judgments can be found in the database SINBAD of Project A3 on "Suboptimal Syntactic Structures" of the SFB 441 in Tübingen/Germany (http://tusnelda.sfb.uni-tuebingen.de/sinbad/startseite.html).

3.3 Restrictions on Extraposition

This section characterizes the restrictions that were investigated in the experiment, namely the definiteness restriction, the predicate restriction, and a possible restriction on the grammatical function of the antecedent NP in relative clause extraposition. An overview is given of the evidence that is found in the literature and the assumptions that have been made.

3.3.1 The Definiteness Restriction

It has been widely observed that extraposition from definite NPs results in unacceptability, while a corresponding sentence with an indefinite antecedent NP is grammatical. This assumption has led to the formulation of the definiteness restriction: the determiner of the antecedent NP of the extraposition must be [- definite] (see Guéron (1976, 46, 1980, 665), Rochemont (1978/1985, 7)). The restriction was originally formulated for PP extraposition but has been extended to extraposition of relative clauses. A number of examples demonstrating the definiteness effect can be found in the literature. In most cases, linguists agree with the proposition that the acceptability of extraposition decreases when a definite instead of an indefinite determiner is used with the antecedent NP. But judgments on this issue are not always consistent. For example, Rochemont and Culicover (1990, 60) compare sentences with relative clauses in canonical position to sentences with relative clauses in extraposed position and claim that a sentence with extraposition becomes ungrammatical when a definite instead of an indefinite NP is used as antecedent, as illustrated in (117) and (118).[5]

(117) a. A man who is carrying a large package is here.
b. The man who is carrying a large package is here.

(118) a. A man is here who is carrying a large package.
b. *The man is here who is carrying a large package.

When the relative clause remains in its canonical position, as in (117), there is no clear difference in acceptability/grammaticality.

A similar contrast between extraposed and non-extraposed relative clauses is noted by Ziv and Cole (1974, 772), who provide the following examples for demonstration. However, they do not claim extraposition from a definite NP to be ungrammatical, but speak of "reduced acceptability" instead.

(119) a. A guy that I met at Treno's yesterday just came in.
b. The guy that I met at Treno's yesterday just came in.

(120) a. A guy just came in that I met at Treno's yesterday.

[5]For examples demonstrating the same effect on extraposition of PPs, see Guéron (1976, 1980) and Rochemont (1978/1985, 7).

b. ??The guy just came in that I met at Treno's yesterday.

Since Ziv and Cole give (120b) two questions marks (??), and Culicover and Rochemont give (118b) an asterisk (*), the former must be judged as better than the latter, and (118b) must be ungrammatical. At the same time, the judgment symbols suggest that the difference in acceptability between extraposition from an indefinite and a definite NP is bigger for the contrast in (118) than for the contrast in (120). Since the two constructions are structurally very similar, it is not clear how these differences come about, and the question is raised whether the distinctions prove to be stable and would also be detected if judgments were elicited with objective and reliable methods.

Maynell (2008) agrees with Ziv and Cole and assigns her example of extraposition from a definite NP two question marks:

(121) a. A cocktail waitress who was wearing a blond wig entered the dining room.

b. The cocktail waitress who was wearing a blond wig entered the dining room.

(122) a. A cocktail waitress entered the dining room who was wearing a blond wig.

b. ??The cocktail waitress entered the dining room who was wearing a blond wig.

Again, sentence (122b) is very similar to (118b), but Maynell does not perceive it as ungrammatical. According to the classification in terms of the symbols, (122b) would have to be of the same degree of acceptability as sentence (120b).

An example that shows the contrast in acceptability when using a demonstrative NP is given by Guéron and May (1984, 6):

(123) a. I read a book during the vacation which was written by Chomsky.

b. *I read that book during the vacation which was written by Chomsky.

According to the categorization symbol, sentence (123b) should be less acceptable than (120b) and (122b), and as ungrammatical as (118b).

All these pairs of sentences suggest that there is a definiteness effect in extraposition, and provide evidence in favor of the definiteness constraint. At the same time, the examples raise doubts about the consistency, reliability, and comparability of acceptability judgments based on the scale "ok-?-??-?*-*-**". It is not clear whether the acceptability differences noted above, and especially the different degrees of acceptability, are really perceived differences, or whether they are just results of an inconsistent use of the judgment scale.

It is, however, striking that Kroch and Joshi (1987, 126) use the following example sentences to demonstrate the extraposition process:

(124) a. The people who were angry at the movie have come.

b. The people have come who were angry at the movie.

They do not assume a difference in acceptability between these two sentences, but judge extraposition from a definite NP to be grammatical and fully acceptable, contrary to the other judgments above. Again, in its structure, sentence (124b) is very similar to the examples in (118b), (120b), and (122b), and it is not clear how the different judgments of acceptability are achieved.

Further evidence is provided by Rochemont and Culicover (1990, 60) in (125). A relative clause is extraposed from a definite NP, and thus the above-mentioned definiteness restriction is violated. Yet Rochemont and Culicover judge the sentence to be grammatical (see also Culicover and Rochemont (1990, 36n28)).

(125) That man came into the room that I was telling you about.

However, they note that this sentence is unacceptable if it has a contrastive meaning, i.e., if it is referring to 'that' man versus 'this' man; if there is only one man, in which case the sentence accent is assigned to *man*, the extraposition sentence is fully acceptable. Rochemont and Culicover propose that the felicity of extraposition from a definite antecedent NP depends on the discourse function of the NP, requiring a certain interpretation of the NP (Rochemont and Culicover, 1990, 60-63).

Similarly, Bolinger (1992) gives a range of examples which show that extraposition from definite NPs can be acceptable for various reasons, including information content with respect to the context and contrastivity.[6] Thus, the following sentences can be felicitously uttered if 'the few things' are contrasted with 'many other things' in (126a), and 'those species' are again in contrast to 'other species' in (126b) (Bolinger, 1992, 275).

(126) a. The few things are gone now that I most cherished.

b. Those species are most esteemed that have less fatty tissues.

These observations suggest that the constraint on extraposition as stated above in terms of the feature [- definite] on the determiner seems to be too strong. Nevertheless, we cannot deny the fact that, at least for sentences in isolation, a definiteness effect on extraposition has been noticed, as outlined in detail above. Replacing the indefinite with a definite determiner in relative clause extraposition affects the acceptability of the sentence in some way, even though in some cases the difference seems to be rather subtle. In order to find out whether the

[6]That these structures can be improved by contextual factors has been generally observed. For example, for the sentence in (i), Wittenburg (1987, 439-442) constructs a context (see (ii)) in which the sentence "with certain intonations, in particular, with little stress on the verb phrase and heavy stress on *never*" does not seem "nearly so bad as" in its isolated use in (i).

(i) ??The man gave Ralph a million dollars who he had never seen before.

(ii) Ralph knew that one of the two men in the photograph was his benefactor. He had seen the bearded one before, but, as it turned out, the man gave Ralph the fortune who he had never seen before.

It is not my intention to pursue the contextual behavior of extraposition further here. For different approaches to this issue, the reader is referred to Bolinger (1992), Guéron (1980), Huck and Na (1990, 1992), Maynell (2008), Rochemont (1978/1985), and Rochemont and Culicover (1990).

acceptability difference proves to be a generalizable and stable phenomenon, it is necessary to apply an objective and reliable method that yields statistically robust results. I therefore carried out a thermometer judgments study to clarify these issues. The results are reported in Section 3.4.3.

3.3.2 The Predicate Restriction

The second restriction on extraposition that is investigated in this study is the predicate restriction. It seems that extraposition from a subject NP is subject to the restriction that the main verb, or predicate, in the matrix sentence must be one of appearance (Guéron (1976, 47, 1980, 663), Rochemont (1978/1985, 7), Rochemont and Culicover (1990); for the constraint on PP-Extraposition, see Coopmans and Roovers (1986)). Consider the contrast in acceptability between the following sentences, taken from Rochemont and Culicover (1990, 65):

(127) a. A man arrived who wasn't wearing any clothes.
b. A man screamed who wasn't wearing any clothes.

While Rochemont and Culicover argue that (127a) is a felicitous instance of extraposition, they note that sentence (127b), in which the verb is not one of appearance, "sounds distinctly odd" (Rochemont and Culicover, 1990, 65). Interestingly, they do not mark (127b) with any sign for ungrammaticality or unacceptability, but when they allude to the same example in Culicover and Rochemont (1990, 29n14), they assign it two question marks (??). Again, this indicates that the traditional judgment scale is not used consistently.

Another contrast resulting from the different meanings of the predicates is noticed by Bolinger (1992, 280) between the sentences in (128), which are supposed to be answers to the question *So you had a surprise at the conference?*

(128) a. Yes, a guy came on the stage that I used to know back in Milwaukee.
b. *Yes, a guy gave a long speech that I used to know back in Milwaukee.

Both sentences have the same structure, and both predicates are similarly plausible in the given context, yet the sentences seem to have a different degree of acceptability, or even grammaticality.

Reviewing the general literature on extraposition, regardless of whether the predicate restriction is discussed, it becomes evident that, above all, verbs with an appearance meaning, e.g., *arrive, enter, come in, show up, appear,* are used to exemplify extraposition from subject (see also the examples in Section 3.3.1). However, evidence of extraposition in which the verb is not a verb of appearance can also be found, as in the following examples. The sentence in (129) is from Rochemont and Culicover (1990, 58), and the examples in (130) are from Bolinger (1992) (his examples (10), (25), (39), and (92), respectively).

(129) a. A man was painting the wall fully clothed (who was) from Philadelphia.
b. A man was painting the wall (who was) from Philadelphia fully clothed.

(130) a. A shield will work better that is mounted on both sides.
b. A dog bit him that they were afraid had rabies.
c. Those species are most esteemed that have less fatty tissues.
d. A lad is being punished who has done nothing wrong.

Even though all of these sentences contradict the predicate restriction, they are judged to be grammatical. Comparing these examples to sentence (128b), which is structurally similar, it seems unclear why the latter sentence should be ruled out while the others are fully acceptable. This conflicting evidence demonstrates that judgments on whether extraposition from subject requires a verb of appearance also vary, as was the case with extraposition from definite NPs (see Section 3.3.1).

Besides, it has been argued that the predicate restriction is not lexically defined, but that any verb can be used as a predicate of appearance if the sentence is embedded in an appropriate discourse context. So, it seems possible to improve the acceptability of extraposition with a verb like *scream* if the sentence is embedded in a context in which "the verb is pragmatically emptied of all semantic content beyond that of 'appearance in the world of the discourse' " (Guéron, 1980, 653-654). Compare the isolated sentence in (127b) to the following example, taken from Rochemont and Culicover (1990, 65):

(131) Suddenly there was the sound of lions growling. Several women screamed. Then a man screamed who was standing at the very edge of the crowd.

Some clarification of these issues is needed in order to provide a complete account of relative clause extraposition. Although it seems commonly accepted that extraposition is preferred with verbs of appearance, no systematic study of the acceptability differences in connection with the verb class has yet been conducted. The experiment I shall report below remedies this situation.

3.3.3 The Grammatical Function of the Antecedent NP

The antecedent of an extraposed relative clause, i.e., the element which the relative clause modifies, can occupy a variety of positions (see, for example, Baltin (2006, 239-242)). For instance, it is possible to extrapose a relative clause from a subject, as in (132a), and from a direct object, as in (132b). These are the grammatical functions that I will concentrate on in this study.

(132) a. A man came into the room who was smoking a pipe.
b. Mary saw a man yesterday who was smoking a pipe.

Different behavioral properties of these two constructions have been shown to exist, based on evidence from ellipsis, topicalization, and pseudoclefting of VP, and various analyses have been provided to account for these differences (cf. Baltin (2006); Guéron (1980); Culicover and Rochemont (1990); *inter alia*; see Chapter 2.2 for the evidence). However, to my knowledge, it has never been asked whether there is a subject/object asymmetry with respect to the acceptability of extraposition sentences which have not undergone any further processes such as ellipsis or topicalization, that is, sentences such as (132a) and (132b). There is no apparent acceptability difference between these two sentences or any similar constructions. However, I decided to include this factor in the experiment in order to investigate whether this assumption would be empirically verified and to provide reliable data. The following section describes the experiment and presents the results.

3.4 The Experiment

In this experiment, I elicited acceptability judgments to measure the effects of (a) the definiteness of the antecedent NP, (b) the verb class, and (c) the grammatical function of the antecedent NP in relative clause extraposition. The primary aim was to test the claims that these structures are judged more acceptable when the antecedent NP is indefinite and the verb is a verb of appearance. A secondary aim was to test whether the grammatical function of the antecedent NP has an effect. Data were collected from native speakers of British English.[7]

3.4.1 Predictions

I here repeat my predictions, which are based on the theoretical literature (see Section 3.3):

1. Relative clause extraposition is more acceptable with an indefinite antecedent NP (see (133a)) than with a definite antecedent NP (see (133b)).

2. Relative clause extraposition is more acceptable with verbs of appearance (see (134a)) than with other verbs (see (134b)).

3. There is no difference in acceptability between relative clause extraposition from subject (see (135a)) and relative clause extraposition from object (see (135b)).

(133) a. *A* man entered who was smoking a pipe.

b. *The* man entered who was smoking a pipe.

[7]I am grateful to Sam Featherston and Thomas Hoffmann for their help with the design of the experiment, Jonathan Ginzburg, Patrick Healey, and Gregory Mills for enabling me to carry out the experiment at King's College London and Queen Mary, University of London, and Andreas Cordes and Janina Radó for their help with the statistical analysis.

(134) a. A woman *appeared* who was wearing a hat.

b. A woman *fainted* who was wearing a hat.

(135) a. *A boy* arrived who was singing a song.

b. I saw *a boy* arrive who was singing a song.[8]

3.4.2 Method

3.4.2.1 Subjects

57 subjects, native speakers of British English, were recruited by postings to mailing lists, fliers, and personal invitation. All subjects were students from King's College London and Queen Mary, University of London. Participation was voluntary and paid.

The data of nine subjects were excluded for various reasons: Two of the informants were not born in England but in the U.S. and Wales, respectively, raising doubts about the interference of other varieties of English. One subject was bilingual. Three informants did not fill out the questionnaire completely. The data of another three were excluded because they did not apply the open-ended thermometer scale but set up their own scale with fixed maximum and minimum scores. This left 48 subjects for evaluation, 22 female and 26 male, aged between 18 and 30 years.

3.4.2.2 Materials and Design

In order to gain introspection data that can be considered valid and reliable, the experiment design was carefully constructed following the design of psycholinguistic experiments as described in Cowart (1997) and Schütze (1996) and exemplified in Hoffmann (2007). It is well-known that an informant's judgment of an individual sentence may be affected by many different syntactic, semantic, pragmatic, and even extralinguistic factors (see Section 3.2). In order to control for these influences and minimize their confounding effects, the extraneous systematic factors are distributed uniformly across the experimental conditions by using a counterbalanced factorial design. This ensures that any observed difference between any two sentence types can in fact be attributed to the intended factor.

Following these conditions, a factorial design was employed that crossed the factors definiteness of antecedent NP (DEFINITENESS), verb class (VERB CLASS), and grammatical function (GRAMMATICAL FUNCTION). The factor DEFINITENESS included two levels, [+ definite] (using the definite article *the*) and [- definite] (using the indefinite article *a*). The factor VERB CLASS had two levels, [+ appearance] (for verbs of appearance) and [- appearance] (for non-appearance verbs). For each level, three different verbs (*appear, enter, arrive* for [+ appearance], and *faint, stumble,* and *smile* for [- appearance]) were shown in order

[8]Obviously, the NP *the boy* is not unambiguously the direct object of *saw*, but could also be the subject of *arrive*. The reason why I used this particular construction is given in Section 3.4.2

to exclude the possibility that the results might be confounded by verb preference. The factor GRAMMATICAL FUNCTION comprised two levels, "subject" (i.e., the antecedent NP is the subject) and "non-typical direct object" (i.e., the antecedent NP is a non-typical direct object).

I use the term "non-typical direct object" to emphasize that the antecedent NP in the experimental sentences was indeed not a typical direct object. Sentences with a typical direct object, as, e.g., *I called a man yesterday who was wearing a hat*, were not used in this experiment since they could have incurred other confounding factors such as distance between the relative clause and its antecedent, and the length and meaning of the sentence. Moreover, it was decided not to use canonical transitive verbs since the factor VERB CLASS included the level "verb of appearance", and verbs of appearance are usually intransitive. For these reasons, the accusative and infinitive structure [*I* + *saw* + NP_{acc} + V_{inf} + RC], as in, e.g., *I saw a man arrive who was wearing a hat*, was used instead, even though this structure is controversial in that the status of the NP is ambiguous: it can either be analyzed as the direct object of *saw* in the main clause, or it may be the subject of the infinitival verb. However, for the above-mentioned reasons this structure was considered to exert fewer confounding influences on this kind of experiment than a structure with an ordinary transitive verb.

The experimental conditions are exemplified in (136). The conditions are shown for one verb of appearance (*arrive*) and one non-appearance verb (*faint*).

(136)
a. A girl arrived who was hugging a doll. [-def, SUBJ, +app]
b. The girl arrived who was hugging a doll. [+def, SUBJ, +app]
c. I saw a girl arrive who was hugging a doll. [-def, DO, +app]
d. I saw the girl arrive who was hugging a doll. [+def, DO, +app]
e. A girl fainted who was hugging a doll. [-def, SUBJ, -app]
f. The girl fainted who was hugging a doll. [+def, SUBJ, -app]
g. I saw a girl faint who was hugging a doll. [-def, DO, -app]
h. I saw the girl faint who was hugging a doll. [+def, DO, -app]

Thus, each token set contained a total of DEFINITENESS X GRAMMATICAL FUNCTION X VERB CLASS (each shown in three different lexicalizations) = 2 x 2 x (2 x 3) = 24 cells. Eight lexicalizations were constructed, which were adapted to the various syntactic conditions, yielding a total of 192 stimuli. The stimulus set was then divided into eight material sets of 24 stimuli by placing the items in a Latin square (see Keller (2000, 60n6)). Each subject thus saw a version of a material set that contained 24 experimental sentences in which each condition was represented once and each lexicalization appeared three times.

In order to minimize other confounding factors and balance the acceptability of relative clause extraposition more closely, in the experimental materials both subjects and non-typical direct objects were animate, the relative pronoun was always *who*, the structure of

the relative clause was kept constant (*who* + *was* + Xing + *a* + Y), and the length, meaning, plausibility, imagery content, and prosody of the words and sentences were matched.

Since the experiment was conducted employing questionnaires, eight different sets of questionnaires were constructed, each comprising one of the eight material sets. For each set of questionnaires, the experimental materials were arranged in two different random orders, so that there were 16 different versions of questionnaires all together, each of which was seen by three informants. In addition to the experimental items, 24 filler items were used that covered a wide range of acceptability and were randomly mixed among the experimental sentences in each of the 16 questionnaire versions. Each subject thus saw a total of 48 items: 24 experimental and 24 filler sentences.

3.4.2.3 Procedure

In this experiment, introspective judgments of naïve informants were gathered using the method of thermometer judgments (Featherston, 2007), which is a variant of magnitude estimation (Bard et al., 1996). It allows informants to use a linear scale to produce relative numerical judgments. The scale is open-ended, i.e., it has no maximum or minimum scores. Two reference items fix the location and the amplitude of the scale, one set at twenty and the other at thirty so that informants do not have to give judgments near zero, where distortion has been shown to occur (Featherston, 2007, 76).[9]

Each subject took part in an experimental session that lasted approximately 20 minutes. The experiment was conducted using printed questionnaires that were personally distributed to the informants by the experimenter. The questionnaire consisted of five parts: an instruction part, a short demographic questionnaire, a training session (to familiarize subjects with the concept of thermometer judgments), a practice session (to familiarize subjects with applying thermometer judgments to linguistic stimuli), and the main experimental phase.

The experiment proceeded as follows: The subjects first saw a set of instructions explaining the nature of the experiment and outlining the procedure. It was emphasized that the informants could not give any right or wrong answers, and that they were not being evaluated but were being used as a source of scientific information. The instructions familiarized the subjects with the concept of giving numerical judgments relative to two reference items. It was explained that in the first training session, the reference items consisted of two horizontal lines with the length of twenty and thirty "units".[10] Subjects were instructed to estimate the length of each further line relative to these two reference lines and assign it a number that would express how long the line was relative to the two reference lines. Three example lines and corresponding numerical values were provided to illustrate the concept of

[9]The similarity of this scale to the temperature scale, with the two reference items of freezing point and boiling point, has led to the name "thermometer judgments" (Featherston, 2007).

[10]The use of a "real" measuring unit of length, e.g., inches, was omitted in order not to mislead subjects into trying to estimate the real lengths of the lines. Instead, subjects were to be familiarized with the method of providing *relative* judgments.

relativity.

For the practice session and the main experiment, subjects were told to use numbers to assess some English sentences relative to two reference items. The criterion they were to use to judge the sentences was how "natural" they sound. The reference items were two sentences that were considered to be worth 20 and 30 units, respectively. As an illustration, three example sentences were provided together with numerical estimates that could possibly be assigned to them depending on how natural one feels each sentence sounds relative to the two reference sentences.

It was stressed that any numbers, including decimals, could be given and that there was no upper or lower limit to the numbers, i.e., numbers above thirty and below twenty could be used, too. It was pointed out that the sentences were not always right or wrong, but that the different "in-between" judgments were of interest. Since the experiment was self-paced, subjects were asked not to think too long about any one sentence (spending less than 10 seconds on each one) but to provide their spontaneous ("gut") feeling. They were to imagine somebody saying the sentences to them, since the object of interest was the spoken language rather than the written form. Subjects were instructed not to go back if they made mistakes, but to keep on with the experiment.

Following the instructions was a short demographic questionnaire including age, sex, nationality, place of birth (city, county, country), regional dialect, job or subject studied, and languages spoken. Subjects could optionally provide their names or remain anonymous.

The first training session consisted of judging line lengths. Since instructions were given in detail in the instruction part, the subjects were only reminded to judge the lengths of the lines on the following two pages relative to the two reference lines on top of each page. Four lines of different lengths were to be judged on each page, and the numerical estimation had to be written in a space below each line. All subjects saw the same lines in the same order, and the pair of reference lines was the same on each page and for all subjects.

For the practice session, subjects were reminded to judge the naturalness of the following sentences relative to two reference sentences. It was recalled that any whole numbers or decimals, also those above thirty and below twenty, could be used. The two reference sentences and their assigned units (twenty and thirty) were given at the top of the following page. The reference items were the same as those provided in the instructions because it was considered easier to deal with familiar sentences and in order to avoid confusion. Eight practice sentences were presented on the same page. Subjects' personal judgments had to be written as numerical values ("units") below each sentence. Each subject judged the whole set of practice items, which were presented in the same order on each questionnaire. The practice materials were carefully chosen to accustom the subjects on the one hand to the subsequent experimental sentences and the method to be used, but on the other hand to avoid confrontation with some of the less grammatical sentence types at this early stage of the experiment. The practice set contained sentences with relative clauses in canonical and ex-

traposed position as well as items with unrelated constructions. It aimed to cover the full range of acceptability.

Only after this practice phase did the main part of the experiment begin, in which the judgments for the relevant structures were elicited. The procedure in this phase was the same as in the practice session. As a reminder, subjects were given instructions to judge the naturalness of the sentences relative to the two reference items, and to use any whole numbers or decimals. The following six pages showed the same two reference sentences as before on the top of each page, and eight further sentences per page. Thus, subjects saw 48 test items, which consisted of 24 experimental items and 24 fillers.

3.4.3 Results

The data were normalized by transforming them to z-scores, i.e., each score was subtracted from the subject's mean and divided by the subject's standard deviation, so that all values had the same mean 0 and the same standard deviation 1. A repeated measures ANOVA (analysis of variance) revealed the following significant main effects: DEFINITENESS (F_1(1,47) = 44.18, $p < 0.001$, F_2(1,23) = 44.37, $p < 0.001$), VERB CLASS (F_1(1,47) = 51.1, $p < 0.001$, F_2(1,23) = 107.21, $p < 0.001$), and GRAMMATICAL FUNCTION (F_1(1,47) = 6.97, $p = 0.011$, F_2(1,23) = 5.54, p = 0.027). A significant interaction was obtained of DEFINITENESS/VERB CLASS (F_1(1,47) = 8.71, $p = 0.005$, F_2(1,23) = 7.92, $p = 0.010$) and GRAMMATICAL FUNCTION/VERB CLASS (F_1(1,47) = 5.1, $p = 0.029$, F_2(1,23) = 4.71, $p = 0.041$). The interactions of DEFINITENESS/GRAMMATICAL FUNCTION and DEFINITENESS/GRAMMATICAL FUNCTION/VERB CLASS failed to reach significance.

The results are summarized in Figures 3.1–3.3 below. In each graph, the vertical axis shows the mean normalized acceptability judgments, with higher scores indicating that the structures were judged to be more natural or acceptable. The horizontal axis and the different symbols for the mean values distinguish the conditions tested. The observed scores of the judgments of each condition are expressed with an error bar, in which the mean value is shown by the shape at the middle of the bar, and the length of the bar shows the 95% confidence interval. The bar is shorter if there was less variation in the scores given to the condition. Informally, one could say that if two error bars do not overlap, or overlap only to a certain extent, there is a clear difference between the scores. Error bars which overlap extensively indicate that the scores might not be reliably different.

In the following sections, I will outline the results for each factor in more detail before I discuss them in Section 3.5.

3.4.3.1 Definiteness

As predicted, the definiteness status of the antecedent NP has a significant effect on the acceptability of relative clause extraposition. Extraposition from an indefinite NP is generally

judged to be more natural (mean value: 0.1) than extraposition from a definite NP (mean value: −0.24). Moreover, the statistical analysis revealed a significant interaction of the factors of definiteness and verb class, as summarized in Figure 3.1. The graph shows the scores for the levels “definite NP” and “indefinite NP” on the horizontal axis. For the factor of verb class, the mean acceptability judgments for the level “verb of appearance” are indicated by circles, and the level “other verb” is illustrated by square markers.

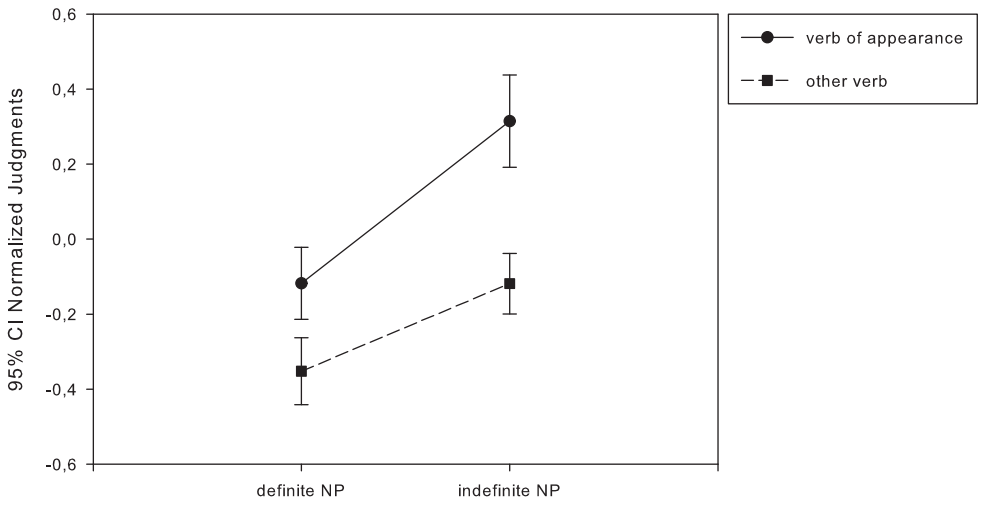


Figure 3.1: Mean acceptability scores for relative clause extraposition from definite and indefinite NPs for verbs of appearance and other verbs

The graph demonstrates that the preference for extraposition from indefinite antecedent NPs over definite antecedent NPs holds true for both verb classes. But the increase in acceptability from definite NPs to indefinite NPs is much bigger for verbs of appearance than for other verbs. Or, in other words, the acceptability difference resulting from the verb class is much bigger for indefinite NPs than for definite NPs. It is striking that extraposition from definite NPs and with verbs of appearance receives about the same scores as extraposition from indefinite NPs with other verbs. The best acceptability judgments are achieved when the verb is a verb of appearance and the antecedent NP has an indefinite determiner.

Hence, the assumptions that have been found in the literature concerning the definiteness restriction are empirically validated, at least for sentences in isolation, and any doubts resulting from conflicting evidence can be removed (see Section 3.3.1). Moreover, the experiment has revealed more detail, namely that the verb class has to be taken into account when comparing extraposition from definite and indefinite NPs. I will discuss these findings in Section 3.5 and now turn to the results for the factor of verb class.

3.4.3.2 Verb Class

Overall, the factor of verb class has a significant effect on relative clause extraposition. Sentences with verbs of appearance received significantly higher acceptability scores (mean value: 0.1) than sentences with other verbs (mean value: -0.24). The statistical analysis revealed significant interactions of the factor of verb class with the factors of definiteness and grammatical function; the results are summarized in Figures 3.1 and 3.2.

Figure 3.1 has been discussed in the preceding section. It shows the interaction between the factors of verb class and definiteness and reveals a preference for verbs of appearance over other verbs in relative clause extraposition from both definite and indefinite antecedent NPs. The contrast in acceptability is much bigger for indefinite NPs, however.

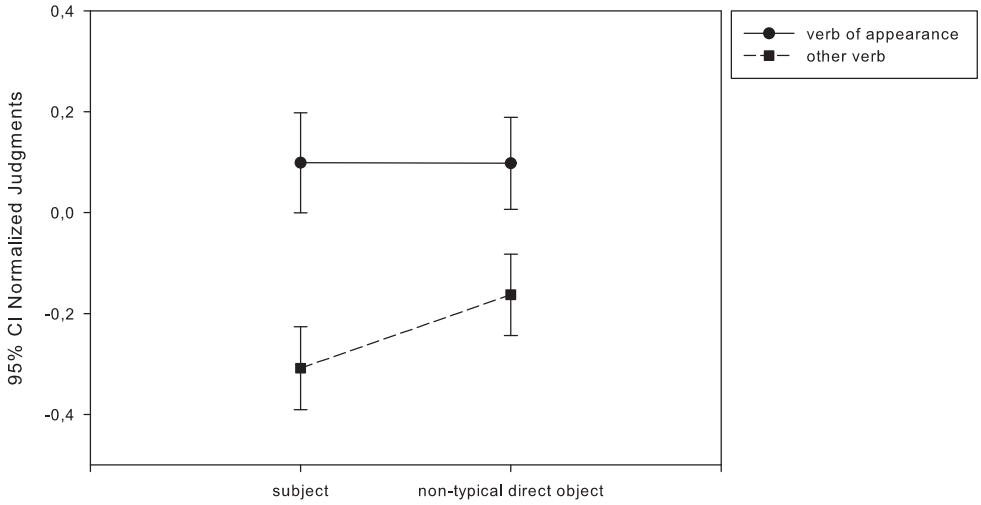


Figure 3.2: Mean acceptability scores for relative clause extraposition from subject and non-typical direct object for verbs of appearance and other verbs

Figure 3.2 indicates the results for the interaction of verb class and grammatical function. The graph shows the scores for the levels “subject” and “non-typical direct object” of the factor of grammatical function on the horizontal axis. The mean acceptability ratings for the level “verb of appearance” are indicated by a circle, and the mean scores for the level “other verb” are illustrated by a square marker. As can be seen, extraposition of relative clauses from both subject and non-typical direct object is judged significantly better with verbs of appearance than with other verbs. The acceptability differences are clear and stable. The experimental results thus verify the prediction and corroborate the claim about the contrast that has been made in the literature (see Section 3.3.2).

Above that, the results reveal that the difference in acceptability is bigger for extraposition from subject than from non-typical direct object. This is due to the fact that there is almost no acceptability difference between subject and object extraposition for verbs of

appearance, whereas for other verbs the scores are higher when the relative clause is extraposed from a non-typical direct object rather than from a subject. Hence, the acceptability of extraposition sentences with non-appearance verbs is affected by the factor of grammatical function, but this effect is not seen for verbs of appearance. An account for this will be given in Section 3.5.

3.4.3.3 Grammatical Function

Figure 3.2 also displays the results for the factor of grammatical function, distinguished by the factor of verb class because of the interaction that was found between these two factors. An acceptability difference in relative clause extraposition due to grammatical function is only found for sentences with non-appearance verbs, where extraposition from non-typical direct object receives higher ratings than extraposition from subject. Such a difference is not perceived for sentences with verbs of appearance, which receive about the same scores for subject and object extraposition. My prediction that the grammatical function would have no effect on the acceptability of relative clause extraposition is thus only partly verified, namely for sentences with verbs of appearance. For the other verbs, grammatical function is relevant. These findings reveal some interesting detail that has not been considered before, which I will turn to in the discussion in Section 3.5.

3.4.3.4 Comparison with Filler Sentences

The sentences that were assessed in this psycholinguistic study also included a set of filler sentences, which were constructed so as to cover a wide range of acceptability, including some fully acceptable sentences (Filler High), e.g., *I left the house early in the morning*, and some fully unacceptable sentences (Filler Low), e.g., *The couple through the woods walked*. The judgments on these sentences can be used as an absolute criterion to assess the judgments given for the sentences under investigation (cf. Featherston (2007, 84)). The findings for all conditions of the experiment including the filler sentences are summarized in Figure 3.3. As can be seen, none of the experimental sentences, i.e., sentences with extraposed relative clauses, were judged as bad as the fully unacceptable and hence ungrammatical sentences. On the other hand, none of the experimental sentences were judged as good as the fully acceptable sentences, and this difference was even stronger. All extraposition sentences lie somewhere in between the “good” and “bad” sentences and in line with the filler sentences of medium acceptability (Filler Medium).

3.5 Discussion

Overall, the results of the experiment clearly demonstrate that relative clause extraposition is sensitive to the definiteness status of the antecedent NP, the class of verbs/predicates, and

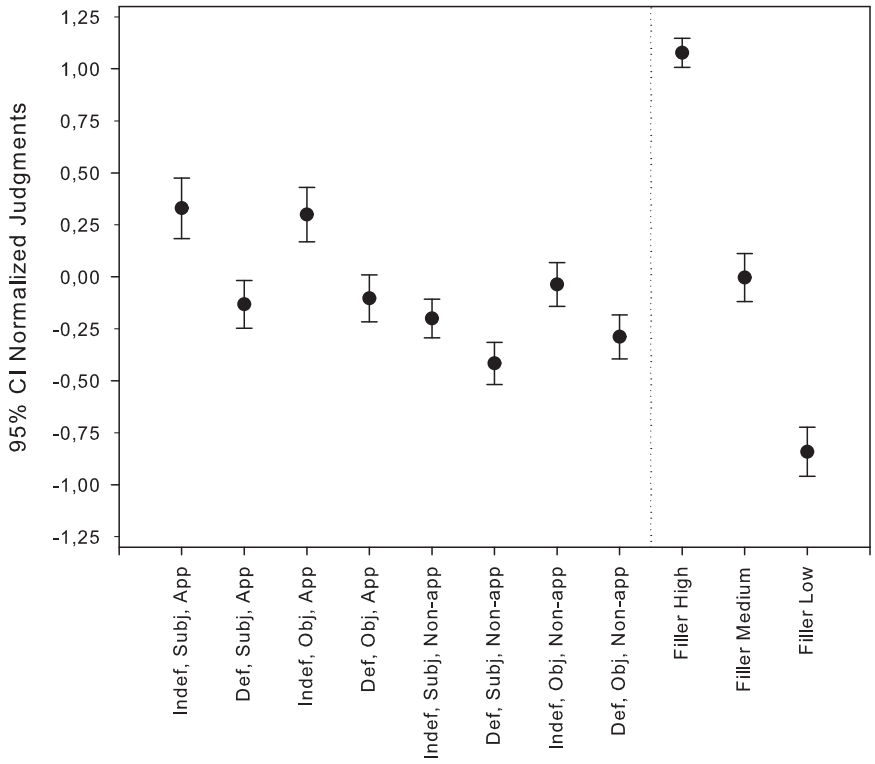


Figure 3.3: Mean acceptability scores for relative clause extraposition for all conditions, including judgments on filler sentences

the grammatical function of the antecedent NP. Clear differences in the acceptability of the sentences were revealed that can be attributed to these factors.

It is worth noting that the data from experimentally obtained relative judgments do not establish any binary division between “grammatical” and “ungrammatical”. Instead they establish the relative acceptability of sentences, i.e., whether one sentence is more or less acceptable than another sentence. Being less acceptable does not automatically mean that the structure is unacceptable or even ungrammatical (see Featherston (2007), Cowart (1997, 9)). However, the data set of the experiment included some fully acceptable and some fully unacceptable filler sentences in order to provide absolute standards to which the experimental sentences can be compared (cf. Featherston (2007)).

Regarding the definiteness status of the antecedent NP of relative clause extraposition, the experiment revealed that a definite NP is less accepted as an antecedent of the extraposed clause than an indefinite NP. In comparison to the filler sentences, however, extraposition from definite NPs is judged not as bad as the fully unacceptable sentences, such as *The couple through the woods walked* (see Figure 3.3). Following Keller (2000) and Sorace and Keller (2005), this can be taken as an indication that extraposition from NPs with definite determiners “only” violates a soft constraint. This term is introduced by Keller (2000) to refer to constraints whose violation causes mild unacceptability and which are subject to

contextual variation. Hard constraints, on the other hand, induce strong unacceptability when violated and fail to show context effects.[11]

Interestingly, it has been suggested in the literature that the acceptability of extraposition from definite NPs depends on semantic and/or pragmatic factors and might improve when an appropriate discourse context is given (see Section 3.3.1). This claim can neither be verified nor disproved by the results of this experiment since the experimental sentences were presented in isolation. Further research is needed to explore–both theoretically and experimentally–the contextual behavior of relative clause extraposition from definite antecedent NPs. Yet, the finding of this study that sentences with extraposition from definite NPs are not as bad as fully unacceptable sentences indicates that the definiteness constraint might not be a purely structural, i.e., syntactic constraint of the grammar. Together with the point about the context dependence of relative clause extraposition, this is compatible with the hypothesis that the definiteness constraint can be considered a soft constraint, which is assumed to apply at the syntax-pragmatics and/or syntax-semantics interface (cf. Sorace and Keller (2005)). Any theory of grammar that is to account for the phenomenon of extraposition should be able to explain the contrast in acceptability due to the definiteness status of the antecedent NP, but must also account for the fact that the definiteness constraint does not appear to be a hard constraint but is subject to contextual variation.

The results of the experiment also indicate that the predicate restriction could be considered a soft constraint. The experimental data clearly show a significant decrease in acceptability when verbs other than verbs of appearance are used in sentences with relative clause extraposition. Comparing these scores with the ratings of the fully unacceptable filler items, however, reveals that the former are not judged as bad as the latter. As with the effect of the definiteness of the antecedent NP, this suggests that the predicate restriction cannot be a hard constraint of the grammar. The feature [- appearance] on the verb does not inevitably rule out a sentence with an extraposed relative clause as ungrammatical. Following the assumptions made in the literature, it again seems to be the case that the context plays a role: in an appropriate context, any verb can apparently be "turned into" a verb of appearance, i.e., receive the function of merely introducing an element into the discourse (see Section 3.3.2). However, the evidence that is provided in the literature is unconvincing and insufficient to corroborate the claim. Whether this context effect can be empirically verified would have to be investigated in another objective and reliable study. Nevertheless, the empirically proven fact that the factor of verb class affects relative clause extraposition in some way cannot be ignored.

As mentioned in Section 3.4.3, the results of the experiment revealed a significant interaction of the factors of verb class and definiteness of the antecedent in relative clause

[11] In addition, soft constraints are subject to developmental optionality, whereas hard constraints do not show such effects. Both types of constraints are subject to constraint ranking and show cumulativity and "ganging up" effects. The distinction between them is crosslinguistically stable (Sorace and Keller, 2005).

extraposition. The best judgments of relative clause extraposition are achieved for sentences with verbs of appearance and with indefinite antecedent NPs, i.e., when neither the predicate constraint nor the definiteness constraint is violated (see Figure 3.1). In case of a violation of either of the two constraints, the acceptability scores clearly decrease. When both constraints are violated at the same time, the degree of unacceptability is even higher. These findings are in line with Keller (2000), who shows that both soft and hard constraints are cumulative, i.e., that a structure is less acceptable the more constraints it violates (see also Sorace and Keller (2005)). According to this claim, then, the low acceptability ratings for sentences with extraposition from definite NPs and with non-appearance verbs can be explained straightforwardly: Violations of both the definiteness constraint and the predicate constraint have been shown to trigger unacceptability. The combined violation of the two constraints results in an even lower acceptability; the constraints interact in a cumulative fashion.

By looking only at the acceptability scores given for relative clause extraposition with verbs of appearance, a very clear difference in the acceptability of definite and indefinite antecedent NPs becomes evident (see Figure 3.1). Sentences with indefinite NPs receive much higher ratings than sentences with definite NPs. I assume that this observation is not just idiosyncratic to extraposition, but that it is a background effect and that *any* structure with a verb of appearance will receive a higher degree of acceptability if the subject is expressed with an indefinite referent. According to Levin (1993, 258), the meaning and function of verbs of appearance is "to describe the appearance of an entity on the scene." In other words, a verb of appearance introduces an element into the discourse; hence, this element provides new information. It is widely assumed that there is a strong tendency for new and/or unfamiliar information in an utterance to be expressed with an indefinite description, whereas old and/or familiar information is expressed with a definite item (see, for example, Chafe (1970, 1976, 38-43); for the notion of "given" and "new" information, see Clark and Haviland (1977) and Prince (1981, 1992), *inter alia*). Verbs of appearance introduce new information into the discourse and are therefore assumed to be more naturally and more often used with indefinite than with definite NPs. Consequently, any structure which combines verbs of appearance with indefinite NPs should be perceived as more acceptable than combinations of verbs of appearance with definite NPs, independent of relative clause extraposition. However, since a similar yet not as big an effect is found for non-appearance verbs, i.e., extraposition from indefinite NPs is preferred over extraposition from definite NPs (see Figure 3.1), some of the acceptability difference must be attributed to the extraposition construction. Comparing extraposition sentences with other constructions in one and the same experiment might reveal how much of the acceptability difference in relative clause extraposition must actually be attributed to a general preference for verbs of appearance to appear with indefinite NPs, and how much of the difference can be attributed to some property of the extraposition process.

With regard to the factor of grammatical function, the experiment has revealed some interesting details. While it was predicted that there would be no acceptability difference between subject and object extraposition, this is only verified for extraposition sentences with verbs of appearance. When other verbs are used, the acceptability judgments are higher when the relative clause is extraposed from an object rather than a subject (see Figure 3.2). However, since for experimental reasons as described in Section 3.4.2.2 the accusative and infinitive (AcI) construction (see (137)) was used for relative clause extraposition from object, I cannot draw the conclusion at this point that "real" object extraposition, i.e., extraposition from a typical direct object, is more acceptable than subject extraposition. The status of the accusative NP in these sentences is unclear; it could be both, the direct object of *see* and the subject of the infinitival verb.

(137) a. *I* + *saw* + NP_{acc} + V_{inf} + RC

b. I saw [$_{NP}$ a man] [$_{V}$ faint] [$_{RC}$ who was smoking a pipe]

(138) A man fainted who was smoking a pipe.

What I can conclude is that for non-appearance verbs, extraposition from the accusative NP in this construction (see (137b)) is judged to be better than extraposition from a typical subject (see (138)). I believe that the reason for this can be found in considering the function of extraposition and the meaning of the AcI construction. According to Rochemont (1978/1985, 1986), Guéron (1980), Rochemont and Culicover (1990), and others, extraposition is a presentational focus construction, i.e., the extraposed phrase and/or the antecedent NP must find an interpretation as a presentational focus. Hence, the discourse function of extraposition is to introduce the presentationally focused element into the discourse. This function is compatible with the function or meaning of appearance verbs but not with the meaning of other verbs.

As explained above, verbs of appearance also have presentational meaning. They can therefore be very naturally used in extraposition sentences. The presentational meaning of the verb supports the presentational function of the extraposition construction, which leads to high acceptability judgments. Non-appearance verbs, on the other hand, do not have presentational meaning. When they are used in extraposition, a conflict arises between the function of the presentational focus construction and the non-presentational verb meaning. This leads to lower acceptability judgments, as can be seen in the scores given for the different verb classes in subject extraposition (see Figure 3.2).

However, when non-appearance verbs are used in object extraposition, which means that in the set of sentences assessed in this study they are used as the infinitival verb in the accusative and infinitive construction, the acceptability judgments get significantly better. I claim that this is because the meaning of the sentence changes when the particular construction "*I saw* NP V_{inf}" is used. In some sense the verb *see* describes the appearance of an entity, expressed by the object, on the scene. The sentence *I saw a man faint* describes what the

speaker (*I*) saw, namely a man who fainted; this can be introduced into the discourse using this structure. The whole sentence therefore obtains a presentational meaning, independent of the meaning of the verb *faint*. So, when a non-appearance verb is used in the AcI construction, the presentational meaning of the construction prevails over the non-appearance meaning of the infinitival verb. In consequence, the sentence can license extraposition of the relative clause and hence induces higher acceptability judgments.

In sum, while relative clause extraposition with non-appearance verbs is rather unacceptable in general, the acceptability is improved when the verb is embedded in the AcI construction that provides a presentational meaning and hence supports the presentational function of extraposition.

3.6 Conclusion

In this chapter, I presented an experimental study of relative clause extraposition. In the theoretical linguistics literature, relative clause extraposition has been claimed to be influenced in its acceptability by the definiteness restriction and the predicate restriction. A survey of the literature, however, revealed much conflicting evidence, suggesting the need to scrutinize the assumptions. It was shown in outline that the traditional methods of gathering acceptability judgments do not always prove to be objective and reliable, and do not bring about robust and consistent data. However, intuitive judgments on the well-formedness of sentences constitute the main source of evidence for linguistic theories. To ensure that judgment data remain available, it has been proposed by Schütze (1996), Cowart (1997), and others to employ empirical methods that make use of standard experimental control techniques in collecting data for linguistic theory. Following their suggestions and guidelines for the design and evaluation of psycholinguistic experiments, I conducted an experimental study to investigate the effect of the definiteness of the antecedent NP and the choice of verb class on the acceptability of relative clause extraposition. In addition, I tested whether the grammatical function (subject or direct object) of the antecedent NP affects the acceptability judgments.

The results support the assumptions in the syntactic literature. The experiment revealed that a definite NP in relative clause extraposition is distinctly less acceptable than an indefinite antecedent, and that verbs of appearance are clearly preferred over other verbs in relative clause extraposition. Above that, an interaction between these two factors was revealed. The acceptability differences result from a violation of the definiteness constraint and the predicate constraint. However, it was also shown that the degraded sentences should not be regarded as ungrammatical. I therefore suggested these constraints to be soft constraints on extraposition, which is supported by observations about the context dependence of the constructions.

As for the grammatical function of the antecedent NP, a preference for extraposition from a (non-typical) direct object was found only for non-appearance verbs. For verbs of

appearance, there is no acceptability difference between subject and object extraposition. Due to the controversial status of the direct object in the accusative and infinitive construction that was used in this experiment, I cannot draw firm conclusions about the effect of the grammatical functions "subject" and "typical direct object" yet. Further research is needed to explore their status in relative clause extraposition. However, the effect that the experiment revealed for non-appearance verbs was significant and must be accounted for. I claim that it is caused by the presentational meaning of the AcI construction, which was used for the object extraposition sentences. It supports the presentational function of extraposition and thus induces higher acceptability judgments.

One interesting thing about the findings of this experiment is that they show exactly the opposite of what has been criticized about the traditional methods of gathering acceptability judgments. The traditional linguists' judgments are shown to have been quite right; the experimental data confirm the theoretical assumptions. In addition, and more importantly, they provide more detail, for example in the interaction of the verb class with the definiteness of the antecedent NP, and the effect of the grammatical function, which is seen only for non-appearance verbs.

This concludes the empirical part of this dissertation. Drawing on data from the literature, I have identified some properties that a successful theory of relative clause extraposition should have. Furthermore, on the basis of an experimental investigation, I have provided reliable evidence that empirically validates the definiteness and the predicate restriction that have been noticed in the theoretical literature, but I have also argued that these constraints should not be regarded as purely structural constraints of the grammar.

In the second part of the dissertation, I turn to the theoretical approaches to relative clause extraposition. In the following chapter, I will review the major theories of relative clause extraposition in English that have been proposed in the literature of generative grammar. The subsequent chapter presents the main analyses of relative clauses and relative clause extraposition previously proposed within the framework of HPSG. I will systematically investigate the theories and test them against the empirical data and generalizations collected in the first part of this dissertation. It will become evident that none of the existing theories is able to capture all the generalizations and to cover all the data. In the remaining chapters, I will develop a theory of Generalized Modification and propose a new approach to the binding theory in HPSG which will account for a number of the phenomena that have been problematic for the previous theories.

Chapter 4

Previous Approaches

In this chapter, I provide a survey of the major theories of relative clause extraposition in English that can be found in the literature of formal grammar. There is a long and sophisticated research tradition on this topic, starting with Ross' (1967/1986) dissertation *Constraints on Variables in Syntax*. A large number of theories have been proposed, and it is impressive how different they are from each other. The diversity is aptly characterized by the following quote from Haider (1997, 115): "Current analyses of extraposition have exhausted all options compatible with the generative theory of grammar." The theories can be divided into two main groups, depending on whether or not they invoke core syntactic movement. In each group, at least the following different theoretical approaches can be found:

1. Core movement theories:
    (a) Rightward movement
    (b) Rightward movement + deletion
    (c) Leftward movement
    (d) Leftward movement + deletion
2. Theories without core movement:
    (a) Base generated adjunct
    (b) Base generated conjunct
    (c) Base generated conjunct + deletion
    (d) PF movement

In the following sections, I will present each of these theories in some detail and evaluate their relative strengths and weaknesses, taking the generalizations that I have motivated in Chapter 2 as a guideline.[1] I will start with a review of the movement theories, since the first treatments of relative clause extraposition tried to capture it in terms of rightward movement. The attempts to subsume extraposition under a general movement approach soon faced problems, however, as it became evident that movement to the right is quite distinct from movement to the left. As a reaction to these problems, research on relative clause extraposition took new directions. One line of research, the leftward movement approach, was inspired by Kayne's work *The Antisymmetry of Syntax* (1994). Its basic idea is that instead of moving the relative clause to the right, everything but the relative clause is moved to the left, thereby stranding the relative clause in its "extraposed" position. Another research direction dropped the claim that relative clause extraposition is the result of movement in core syntax. In essence, this brought up two classes of analyses: theories under which the relative clause is base-generated in extraposed position, and theories under which the relative clause is moved to the right in a grammar component following the core syntax.

4.1 Core Movement

The core movement theories of relative clause extraposition comprise the traditional rightward movement analysis and the leftward movement approach in terms of Kayne's (1994) antisymmetric theory of phrase structure. Variants of each of these theories have been proposed which make use of an additional deletion component.

4.1.1 Rightward Movement

The earliest approaches to relative clause extraposition, starting with Ross (1967/1986), considered it a syntactic rule of rightward movement: a relative clause is generated next to its antecedent and subsequently moved to the right. In the context of different theoretical assumptions, this rightward movement analysis is proposed by Chomsky (1973), Akmajian (1975), Reinhart (1976, 1980), Baltin (1978/1985, 50, 1983, 1984), Asakawa (1979), Guéron (1980, 639, 649), Chomsky (1981, 81), Culicover (1981, 20), Taraldsen (1981, 476), Guéron and May (1984, 3), Büring and Hartmann (1995, 1997), Müller (1995), Truckenbrodt (1995),

[1] In describing the benefits and problems of each theory, I will concentrate on the most important and relevant ones. The reader is also referred to the evaluation of the theories of relative clause extraposition presented in Webelhuth, Sailer, and Walker (2013a), which the present discussion draws on. Cf. also De Vries (2002, Ch. 7.4–7.5) for a systematic evaluation of the analyses of relative clause extraposition in Dutch.

Inaba (2007, 110)[2], Drummond (2009)[3], and others.[4]

It was soon recognized, however, that rightward movement has different properties than leftward movement. This already led Ross (1967/1986) to treat relative clause extraposition as a last-cyclic rule (see Section 4.2.4 below). Ross was the first to observe the clause-boundedness of extraposition, which later came to be known as the *Right Roof Constraint*. As demonstrated in (139a), a relative clause must not be extraposed out of the clause in which it originates. *Wh*-movement (movement to the left), on the other hand, may (successive cyclically) cross sentence boundaries (139b). Thus, rightward movement is *more* locally constrained than leftward movement.

(139) a. * [$_S$ That **a gun** went off] surprised noone *which I had cleaned*.

(Ross, 1967/1986, 4)

b. What$_k$ did Mary say [$_S$ that Peter bought $\__k$]?

Various attempts have been made to subsume the clause-boundedness of extraposition under a general theory of bounding, starting with Chomsky's (1973) *Subjacency*. Cases of unbounded (leftward) movement, like (139b), do not violate subjacency since they can be analyzed as involving successive cyclic movement, i.e., the *wh*-constituent is moved successive cyclically into complementizer (COMP) positions (Chomsky, 1973, 243–244). The problem with extraposition is that if it is an instance of movement, there is no obvious reason why it should not apply in a similar, successive cyclic fashion. The Subjacency account is thus insufficient, in and of itself, to fully explain the relevant phenomena, and is in need of some adaptive stipulations in order to account for the bounded nature of rightward movement.[5]

Akmajian (1975) claimed that the locality restriction on rightward movement is even stricter than the clause-boundedness in that it must hold at a subclausal level. In particular, he established NP as a bounding node for relative clause and PP extraposition. Furthermore, Baltin (1978, 1978/1985, 82) and Van Riemsdijk (1978) proposed that PP had to be included

[2]Inaba claims that relative clause extraposition must be treated differently in English and German (p. 113): while he considers English relative clause extraposition to be a syntactic movement rule (pp. 108–110), he argues that the process in German must be a postsyntactic movement operation (pp. 126, 130).

[3]Drummond investigates PP extraposition and suggests that this analysis might extend to relative clause extraposition.

[4]Throughout this chapter, citations are often ordered chronologically rather than alphabetically, in order to emphasize the historical trail of the analyses.

[5]Chomsky (1973, 271—272) postulates that complementizer substitution is only leftward, so that rightward movement cannot move an item out of its clause. Baltin (1981, 261) notes that the Right Roof Constraint could be explained in a similar way to how Chomsky (1973, 248) captures the Complex NP Constraint (Ross, 1967/1986): Since NPs lack complementizers, there is no escape hatch for the relative clause. Hence, it cannot be moved successive cyclically out of the clause in which it originates, since it would cross two bounding nodes, S of the clause and the NP of which it is originally a part (cf. Chomsky (1973, 244, 247–248)). For further discussion of the non-cyclic behavior of relative clause extraposition and the difficulties it causes for movement approaches in general and Subjacency in particular, see, among others, Akmajian (1975, 120n4), Koster (1978a, 560–561, 1978b, 49, 51–54), Guéron (1980, 645), Baltin (1981, 283), Baltin (1983, 161n8), Guéron and May (1984, 15), Culicover and Rochemont (1990, 24, 27), Rochemont and Culicover (1990, 164n4), Larson and May (1990, 112n7), Kayne (1994, 118–119), and Müller (1995).

in the set of bounding nodes relevant to subjacency (for both, leftward movement and relative clause extraposition).

Baltin (1981) argued for a fundamental difference between leftward and rightward movement in claiming that there is an asymmetry between the set of bounding nodes for leftward and rightward movements. While all major categories, including VP and AP, must be bounding nodes for rightward movement, only a proper subset of these are bounding nodes for leftward movement (i.e., PP, NP, S or S'). He termed this restriction *Generalized Subjacency*.[6] Note that in his article of 1981, Baltin assumes relative clause extraposition to be stylistic (see Section 4.2.4 below), but in his response in 1983 to an article by Guéron (1980), he recants: "Extraposition must be a syntactic movement rule, rather than a stylistic movement rule" (p. 161).

Although Guéron (1980) also considers extraposition (of prepositional phrases as well as relative clauses) a movement rule, she rejects Baltin's (1981) conclusion that it must be subject to Generalized Subjacency. To account for the locality restriction on extraposition, in particular the subject-object asymmetry with respect to the landing sites of extraposed constituents (see Chapter 2.2), she instead proposes the following principle (p. 642), which holds at the level of Logical Form:

(140) The *complement* of X is a constituent governed by X.

Assuming that the governor X must be phonologically realized, it follows from this principle that an extraposed constituent which is moved in overt syntax may be adjoined in any position, as long as it is governed by the element it is associated with. It is then interpreted as a complement of the element it has moved away from. Guéron shows that relative clause extraposition may influence the behavior of negative polarity items and thus must be part of Core Grammar (syntax plus Logical Form) rather than a stylistic rule. Furthermore, she argues that the syntactic constraints on extraposition must be complemented by principles of semantic interpretation (pragmatic and discourse constraints) (see also Guéron (1976), where this idea was developed).

The analysis in Guéron and May (1984) is a further development and refinement of Guéron's (1980) analysis. Comparing extraposition from NP with result clause extraposition, the authors argue that in addition to the head-complement relation that must hold at LF, the different properties of these two extraposition types can be attributed to the differences in the thematic status of their heads and the interaction with independently motivated principles and properties of the grammar, such as "c-command, the θ-Criterion, the nonvacuity of operators, the Empty Category Principle, and the nature of indexing" (p. 30).

Relative clause extraposition is not only *more* restricted than leftward movement (being subject to the Right Roof Constraint, as explained above), but at the same time it is also *less*

[6] For a more detailed illustration and discussion of the locality constraints, see Chapter 2.2.1.

restricted. For instance, although relative clauses and other adnominal adjuncts cannot be moved to the left (141), they can be moved to the right (142):

(141) a. * [*Which was written by Chomsky*]$_k$ I bought **a book** _$_k$ yesterday.

b. * [*With what colour cover*]$_k$ did you buy **a book** _$_k$ yesterday?[7]

(142) a. I bought **a book** yesterday *which was written by Chomsky*.

b. I bought **a book** yesterday *with a bright blue cover*.

Furthermore, relative clause extraposition does not obey island constraints.[8] While leftward movement may not extract elements out of complex noun phrases (143a),[9] relative clauses and other NP adjuncts may be extraposed from deeply embedded constituents, as we have seen in Chapter 2.1.1, of which I have repeated an example here in (143b):

(143) a. * [Who]$_k$ did you hear stories about a picture of _$_k$? (Chomsky, 1973, 248)

b. [$_{NP_1}$ The construction of [$_{NP_2}$ **a bridge**]] was proposed *which would span the Delaware River*. (Guéron, 1980, 647n11)

Finally, subjects are usually islands for leftward movement, but not for extraposition, as shown by the following examples from Rochemont and Culicover (1990, 33) (see also Culicover and Rochemont (1990, 24)). Relative clause extraposition thus appears immune to Huang's (1982) Condition on Extraction Domains (CED).[10]

(144) a. * [Which actors]$_k$ would beautiful pictures of _$_k$ cost too much?

b. **A man** came into the room *that no one knew.*

Culicover and Rochemont (1990) and Rochemont and Culicover (1990) were the first to severely criticize the movement theory. They thoroughly investigated the empirical and

[7] Examples (141b) and (142b) are taken from Sheehan (2010, 203).

[8] That relative clauses can be extraposed from embedded NPs was first noted by Guéron (1980, 647n11) and Stucky (1987, 391). Stucky suggests that posthead non-arguments may appear anywhere after their heads within the local domain of a clause and have no further local restrictions. Any limits on extraposition are attributed to human limitations on processing (p. 381). She also notes that interpretation plays an important role in determining well-formed cases of extraposition, but she does not provide a formal analysis (p. 401–402). Culicover and Rochemont (1990) and Rochemont and Culicover (1990) have shown that relative clause extraposition also violates other island constraints and have taken this as evidence against a movement account of extraposition.

[9] This restriction and Ross' (1967/1986) Complex NP Constraint were incorporated into Subjacency; cf. Footnote 5 of this chapter.

[10] According to Baltin (1987, 591–593), the possibility for rightward but not leftward movement from syntactic islands can be attributed to the adjunct character of the extraposed relative clause (see also Culicover and Rochemont (1990, 24–25)). Adapting a proposal of Lasnik and Saito (1984), he argues that extraposed relative clauses, being adjuncts, do not have to leave traces at S-structure since these are not required by any independently motivated principle of grammar (e.g., the Projection Principle). Hence the Empty Category Principle (ECP), which is assumed to rule out leftward movement in these cases, fails to apply in derivations involving relative clause extraposition. For problems concerning this account, see Culicover and Rochemont (1990, 24–26).

Müller (1995, 226) derives the apparent island violations by permitting intermediate adjunction to NP exclusively on the right, followed by a further step of successive cyclic movement again exclusively to the right.

theoretical differences between leftward and rightward movement and discussed the different assumptions required for the two processes, thereby pointing out a number of difficulties that arise if extraposition is analyzed as movement. They concluded that extraposed relative clauses should not be derived by movement at all, but should be base-generated in their surface position (the details of their analysis will be presented in Section 4.2.1 below).

Although it is true that the movement approach requires different sets of principles to account for the differences between leftward and rightward movement, this is not a particularly strong argument against this analysis (Webelhuth, Sailer, and Walker, 2013a, 20). Even if relative clause extraposition is not analyzed as movement, two separate sets of principles are needed: one for the analysis of (leftward) movement, and another one for the analysis of relative clause extraposition. "Unless the latter principles are independently motivated, there is no conceptual gain, as one is still left with two different sets of principles" (Webelhuth, Sailer, and Walker, 2013a, 20).

However, there are further problems with the movement account. As has become evident in Chapters 2.1.1 and 2.2.1, in which I have discussed the cases where relative clauses are extraposed from deeply embedded NPs, counterexamples can be found to all versions of the rightward movement constraints that have been proposed in the literature (see also Strunk and Snider (2013)). Yet, these counterexamples do not refute the movement theory as such, since they might be overcome by modifying the bounding principles and perhaps supplementing them with processing principles, as suggested by Strunk and Snider (2013).

The most serious problem for a movement approach to relative clause extraposition is posed by relative clauses with conjoined and in particular split antecedents (see Chapter 2.1.2). It is imaginable that a movement account can be found for the former, perhaps if one adopts the NP-S analysis for relative clauses and employs the semantic mechanisms proposed by Bach and Cooper (1978) for these structures (Webelhuth, Sailer, and Walker 2013a, 20-21). But the split antecedent cases remain a "paradox" for the movement theory, as already stated by Perlmutter and Ross (1970). Together with Webelhuth, Sailer, and Walker (2013a), I therefore consider this construal phenomenon a knock-down argument against the movement theory.

4.1.2 Rightward Movement + Deletion

Fox and Nissenbaum (1999) and Fox (2002) provide a variant of the rightward movement analysis in which the relative clause itself is not moved. Rather, the associate NP is moved covertly (quantifier-raised), followed by late merger of the extraposed relative clause into the moved NP.[11] To allow for this analysis, Fox and Nissenbaum argue for a single component

[11] See Reeve and Hicks (in press) for an interesting alternative of this analysis, which allows for a dual derivation of relative clause extraposition: if the antecedent is an indefinite or quantified NP which undergoes quantifier raising followed by 'restrictor minimization', the relative clause can be base-generated in its extraposed position; otherwise, the relative clause undergoes rightward movement.

grammar which allows overt operations to take the output of covert operations (like quantifier raising (QR)) as their input. They adopt Chomsky's (1993) copy theory of movement and the phonological theory of QR proposed by Bobaljik (1995), Groat and O'Neil (1994), and Pesetsky (1998). Under these assumptions, movement produces a chain of copies, and phonology targets one copy of the chain for pronunciation. The distinction between overt and covert movement is as follows: overt movement results from the phonology targeting (i.e., pronouncing) the highest copy of the chain, while covert movement is the result when only the lowest copy is spelled out phonologically. The difference between overt and covert movement is thus determined by principles of the syntax-phonology interface.

The derivation of relative clause extraposition under this account is illustrated in (145):

(145) I gave him$_i$ an argument yesterday that supports John's$_i$ theory.

Step 1: I gave him$_i$ [an argument] yesterday.

Step 2: I [[gave him$_i$ [an argument]$_k$ yesterday] ~~[an argument]~~$_k$]. (QR to the right)

Step 3: I [[gave him$_i$ [an argument]$_k$ yesterday] [~~an argument~~ that supports John's$_i$ theory]$_k$]. (Late merger)

In Step 1, the associate NP of the relative clause is merged into the tree in its argument position, crucially without the relative clause. In Step 2, the NP undergoes covert movement (quantifier raising) to the right to a position in which it can be interpreted. In Step 3, the "extraposed" relative clause is adjoined to the higher copy of the associate NP in the manner of "late merger" of an adjunct proposed by Lebeaux (1988/2000) for *wh*-movement to the left.

Fox and Nissenbaum cite some favorable outcomes of their analysis, of which I will present the most relevant here. First, it provides an explanation for the following phenomenon, which is a "puzzle" for a literal movement account: There is a general restriction on movement that adjuncts cannot be extracted from NP ((146a)+(146b)) (in contrast to complements (146c)). Extraposition from NP, however, violates this constraint; adjuncts can clearly be extraposed. Under Fox and Nissenbaum's account, adjunct extraposition does not involve movement of the adjunct and hence does not violate this general movement constraint.

(146) a. *?? [$_{RC}$ That supports John's theory]$_k$ I gave him [$_{NP}$ an argument _$_k$] yesterday.

b. *?? [From where]$_k$ did you see [$_{NP}$ a painting _$_k$]?

c. [Of whom]$_k$ did you see [$_{NP}$ a painting _$_k$]?

Note, however, that even though Fox and Nissenbaum can preserve the general constraint that disallows movement of adjuncts from NPs, they will still have to postulate different sets of principles for leftward movement and rightward movement, since some version of the

Right Roof Constraint is needed to constrain movement to the right but not movement to the left.

Secondly, the analysis accounts for the Principle C effects of relative clause extraposition, specifically that it bleeds Principle C in cases like (145). Since the extraposed relative clause is merged in its overt position, it never appears within the position of the overt NP, which means that it cannot reconstruct into this position. It follows that the name within the relative clause is never c-commanded by the coindexed pronoun, and Principle C is not violated.

For complement extraposition, Fox and Nissenbaum crucially assume a different analysis, namely literal movement to the right, which they claim must always be reconstructed. They thus predict an argument-adjunct asymmetry with respect to Principle C, which is also displayed in movement to the left (the (anti-)reconstruction effects noticed by Van Riemsdijk and Williams (1981), Freidin (1986), and Lebeaux (1988/2000); see Chapter 2.3.3). As shown in (147), complement extraposition does not obviate a Principle C violation. When the extraposed complement clause is reconstructed, the name inside of it is within the c-command domain of the coindexed object pronoun.

(147) ??/* I gave him$_i$ [an argument $\__k$] yesterday [that this sentence supports John's$_i$ theory]$_k$.

Thirdly, the scope phenomena discussed in Chapter 2.4 and illustrated again in (148) provide further powerful evidence for Fox and Nissenbaum's analysis. Since the derivation of adjunct extraposition involves quantifier-raising of the associate NP and post-QR merger of the adjunct, it is predicted that the scope of the associate NP is at least as high as the attachment site of the extraposed adjunct (Williams' Generalization). The examples below bear out this prediction:

(148) a. I [$_{VP}$ looked very intensely for **anything** *that would help me with my thesis*].
b. * I [$_{VP}$ looked for **anything** very intensely] *that will/would help me with my thesis*.

The deviance of (148b) results from two conflicting scope requirements of 'free choice' *any*. On the one hand it must be within the scope of its licensor, the modal verb *look for*, but on the other hand its scope must be as high as the attachment site of the extraposed relative clause.

Since Fox and Nissenbaum analyze complement extraposition as rightward movement, they also predict a complement-adjunct asymmetry for the scope phenomena. Specifically, it is predicted that adjunct extraposition–but not complement extraposition–marks wide scope for the antecedent NP. This is verified by the following examples:

(149) a. * I [$_{VP}$ looked for **any clue** very desperately] *that the detective might have overlooked*.
b. I [$_{VP}$ looked for [any clue $\__k$] very desperately] [that the detective might have overlooked important evidence]$_k$.

(149a) is equivalent to (148b). The fact that (149b), in contrast, is perfectly acceptable shows that complement extraposition does not set a lower bound for the scope of the antecedent NP. 'Free choice' *any* can stay within the scope of *look for* and there is no scope conflict.

Although Fox and Nissenbaum's theory can handle some phenomena which seem to be difficult to deal with in most of the other theories proposed, it also faces a number of problems. I will present the most important ones in the following. First of all, it is unclear how the theory would handle the cases of the determiners with obligatory relative clauses. It is a crucial assumption of the theory that relative causes are adjuncts, which–in contrast to complements–can be merged late. This is how Fox and Nissenbaum explain the contrast between (145) and (147), as explained above. Moreoever, the possibility of late merger is essential to account for the coreference contrasts shown in Culicover and Rochemont's (1990) examples repeated here in (150). Since the in situ relative clause in (150b) is merged into the second object, which also appears in situ, it is c-commanded by the pronoun in the first object position, hence the Principle C violation. In (150a), in contrast, the relative clause is merged late into the post-QR position of the second object–which is possible *because it is an optional adjunct*–where it is outside the c-command domain of the pronoun.

(150) a. I sent her$_i$ **many gifts** last year *that Mary$_i$ didn't like*.

b. * I sent her$_i$ **many gifts** *that Mary$_i$ didn't like* last year.

Note, now, that extraposed obligatory relative clauses may also bleed Principle C, as shown by the example in (151) from Webelhuth, Sailer, and Walker (2013a, 22). If this judgment is correct, it violates Fox and Nissenbaum's logic of explaining the contrasts in (150) and between (145) and (147), since the relative clause in (151) is obligatory.[12]

(151) Ich habe ihm$_i$ damals diejenige Frau $\__k$ vorgestellt, [die einmal Peters$_i$ Gattin
I have him back then the woman introduced who later Peter's wife
werden sollte]$_k$.
become would

'Back then I introduced him to the woman who later would become Peter's wife.'

Another case to which Fox and Nissenbaum's analysis does not extend straightforwardly is extraposition from *wh*-moved elements, as shown with the example below from Webelhuth, Sailer, and Walker (2013a, 25):[13]

(152) **Who** can you recommend to me *who speaks good French*?

Along the lines of the derivation shown in (145), the derivation of (152) should start with the following steps:

[12]This reasoning relies on the assumption that obligatory relative clauses are complements. The problem disappears if obligatory relative clauses could be treated as obligatory adjuncts, along the lines of Goldberg and Ackerman (2001).

[13]This problem has also been pointed out by Fox (2002, 71n16) himself and by Baltin (2006, 266–267).

(153) Derivation of (152):

Step 1: can you recommend who to me. (merger of *who* in argument position)

Step 2: can you recommend who$_k$ to me ~~[who]~~$_k$. (QR of *who* to the right)

Step 3: can you recommend who$_k$ to me [~~[who]~~$_k$ [$_{RC}$ who speaks good French]].
(Late merger of the relative clause)

The *wh*-element *who* is merged into the object position of *recommend* and quantifier-raised to the right to the position in which the relative clause is adjoined by late merger. The question now is where the sentence-intial spelled-out *who* in (152) comes from. One assumption would be that the original *who* that is merged into the argument position of *recommend* in the first step undergoes two movement operations: one covert rightward movement as shown in Step 2, and one additional overt leftward movement. Such a double syntactic movement, however, seems to be unprecedented. Another possibility would be that the initially merged *who* first moves to the right by quantifier-raising, and then into the position at the beginning of the sentence by overt *wh*-movement. Again, this kind of movement seems to be unattested (see also Baltin (2006, 267)). Furthermore, since the *who* is covertly moved to the right, the original *who* in the object position of *recommend* should not be deleted by the phonological deletion rule. But then the *who* should be pronounced twice in the sentence (Webelhuth, Sailer, and Walker, 2013a, 25-26).

Finally, Fox and Nissenbaum's theory cannot capture the relative clauses with split antecedents. Recall the example shown in (154):

(154) **A man** entered the room and **a woman** went out [$_{RC}$ *who were quite similar*].

The plural agreement on the verb (*were*) and the semantics of the predicate (*similar*) in the relative clause require its subject to be plural. Hence, the antecedent NP to which the "extraposed" relative clause is merged must be plural. According to the phonological theory of QR underlying the late merger theory, this plural antecedent NP must have undergone covert quantifier raising, and the lowest copy of this NP must be spelled out. However, there is no overt plural NP in this sentence. I do not see how the theory might get out of this dilemma.

In sum, the rightward movement + deletion theory has some advantages over a pure rightward movement account since it is not the relative clause that is moved, but rather the associate NP, to which the relative clause is merged late. However, it does not provide a solution for all the problems of relative clause extraposition. I conclude that the rightward movement theories cannot be considered successful theories of relative clause extraposition since they cannot account for all the phenomena that must be explained. In the following two sections, I will turn to the leftward movement theories and investigate how well they capture the relevant generalizations.

4.1.3 Leftward Movement

Kayne's (1994) theory of the antisymmetry of syntax does not allow adjunction or attachment to the right, be it base-generated or derived. This is an immediate consequence of the Linear Correspondence Axiom (LCA), which maps asymmetric c-command to linear precedence. The principle informally states that if a non-terminal category A asymmetrically c-commands a non-terminal category B, all the terminals dominated by A must precede all the terminals dominated by B.

In consequence, in situ relative clauses cannot be right-adjoined to N or any projection of N (or D). Instead, they are analyzed as CP complements of determiners: [$_{DP}$ D^0 CP] (Kayne, 1994, 87). The nominal "head" of the relative is raised from within the relative clause to [Spec,CP], as shown in (155). This analysis corresponds to the raising/promotion analysis of restrictive relative clauses developed by Schachter (1973) and Vergnaud (1974) and first proposed by Smith (1964) (see also Andrews (1975/1985, 189) and Brame (1976, 125)). Note that the cases of determiners with obligatory relative clauses and the obligatory presence of relative clauses with names preceded by definite articles follow naturally from this account, as well as the fact that relative clauses contribute to the restriction of the determiner of the associate DP.

(155) [$_{DP}$ the [$_{CP}$ [$_{NP}$ picture] [that [Bill saw [e]]]]]

Since right-adjunction structures are excluded in Kayne's theory, he rejects any proposals for the analysis of relative clause extraposition in which the extraposed relative clause is moved to or base-generated in right-adjoined positions. Instead of the relative clause moving rightward, Kayne therefore proposes an alternative analysis in which the associate is moved leftward, and the "extraposed" relative clause is stranded in its base position. This is demonstrated with Kayne's (1994, 118) examples in (156):

(156) a. **Something**$_i$ just happened [[e]$_i$ *that you should know about*].

b. **Someone**$_i$ just walked into the room [[e]$_i$ *who we don't know*].

Compared to the extraposition approaches (i.e., rightward movement or base-generation to the right), Kayne claims his theory of relative clause stranding to have, among others, the advantages that it provides a better account of the Right Roof Constraint and of the fact that the "extraposed" relative clause appears to the right of its associate rather than to its left. However, his antisymmetric theory of relative clauses in general and the theory of relative clause stranding in particular have been criticized heavily from the beginning, for example, by Borsley (1997, 2001), Büring and Hartmann (1997), De Vries (2002), Koster (2000), Rochemont and Culicover (1997, Section 4.1), and Wilder (1995).[14] Here, I will briefly summarize some of the most important and relevant objections that have been raised

[14] A defense of parts of the theory or variants of it can be found in the literature as well, however, for instance in Bianchi (1999, 2000), Bhatt (2002), De Vries (2002), and Sauerland (2003).

with respect to the analysis of relative clause extraposition. For more details, the reader is referred to the works cited.

One dubious fact is that instead of a single rightward movement, Kayne's account of leftward movement must assume several steps even for a relatively simple sentence like (157a), as noted by Borsley (1997, 641). Since extraposed relative clauses normally appear in sentence-final position, but the underlying word order in Kayne's theory is SVO, all other sentence constituents must be moved leftwards around the relative clause. A sentence like (157a) has to start out with a structure like (157b), where the relative clause is within the non-final subject. To derive the surface order with a final relative clause, at least three leftward movements are required: the verb and the prepositional object must move leftwards around the DP containing the relative clause, and then the associate of the relative clause has to move to the left, stranding the relative clause in sentence-final position (157c).

(157) a. **A man** came into the bar *who we knew in school*.

b. . . . [$_{VP}$ [$_{DP}$ [**A man**] *who we knew in school*] [came] [into the bar]]

c. [**A man**]$_i$ [came]$_j$ [into the bar]$_k$ [$_{VP}$ [t$_i$ *who we knew in school*] t$_j$ t$_k$].

Borsley (1997, 641–642) raises and discusses the question of where the various constituents move to and concludes that a clause structure would be required that is "significantly more complex . . . than that assumed by Chomsky (1993), which is already quite complex." Moreover, the leftward movements lack independent motivation. They only seem to be necessary to make Kayne's antisymmetric theory of phrase structure compatible with relative clause extraposition. This reduces the explanatory value of the account.

A similar difficulty pointed out by Wilder (1995, 279) is given with sentences like (158a), where a relative clause is extraposed from a PP. In Kayne's leftward movement theory, the example should be derived from a structure like (158b) by moving the string *to someone* to the left. As Kayne (1994, 125–126) himself notes, the problem is that *to someone* does not obviously form a constituent.

(158) a. John is going to talk [$_{PP}$ to [$_{DP}$ **someone**]] tomorrow [$_{RC}$ *who he has a lot of faith in*].

b. . . . to talk tomorrow [$_{PP}$ to [$_{DP}$ **someone** *who* . . .]]

In order to get out of this dilemma, he proposes the following analysis. Starting with the structure shown in (159a), *someone* is first moved to Spec of PP, yielding (159b). The preposition *to* is then left-adjoined to *someone*, as shown in (159c). The string *to someone* now forms a constituent which can feed another leftward movement to yield (158a).

(159) a. [$_{PP}$ to [$_{DP}$ D [$_{CP}$ someone who . . .]]]

b. [$_{PP}$ someone$_i$ [to [$_{DP}$ D [$_{CP}$ t$_i$ who . . .]]]]

c. [$_{PP}$ [to$_k$ [someone$_i$]] [t$_k$ [$_{DP}$ D [$_{CP}$ t$_i$ who . . .]]]]

Wilder (1995, 279) criticizes this analysis: "It is difficult to see how to overcome the implausibility caused by such multiplication of L[eftward]-movements, which serve only to recreate a base order higher up in the tree." Moreover, as noted by Rochemont and Culicover (1997, 287), if the preposition and the antecedent of the relative clause are analyzed as a constituent that excludes the relative clause, examples like (160) would be incorrectly predicted:

(160) * In which magazine did you see it which was on the table? (Baltin, 1978/1985, 82)

The cases where relative clauses are extraposed from DPs[15] embedded within larger DPs (see Chapter 2.1.1) require an even greater number of implausible leftward movements. Furthermore, as pointed out by Koster (2000, 8–9), such examples contradict the stranding analysis since the associate DPs are moved to positions (inside of the PPs/DPs) in which they fail to c-command their traces, thus "violat[ing] the principle of c-commanding landing sites." Hence, the leftward movement theory does not provide a satisfying solution for the construal problem.

Another objection, raised by Borsley (1997, 642), is that the leftward movement theory fails to rule out at least some cases of medial stranding. In the derivation of a typical raising sentence like (161a), the subject is assumed to be moved through the intermediate positions as indicated by the traces. A relative clause modifying the subject, however, cannot be stranded in the intermediate positions, as shown in (161b). Kayne's (1994, 121) ad hoc constraint that "a relative clause can be stranded by A-movement only in a non-Case position" does not account for these cases.

(161) a. $[\text{One man}]_k$ seemed $[t_k$ to $[t_k$ know the truth]].

b. * **One man** seemed *who knew the truth* to be late.

Recall from Chapter 2 that there is strong and converging evidence that extraposed relative clauses appear in positions that are structurally higher than their associate DPs. The evidence comes from the application of grammatical operations testing for VP-constituency (VP-preposing, VP-deletion, *wh*-clefts) as well as from investigations of the behavior of extraposed relative clauses with respect to binding and scope. It was shown, *inter alia*, (i) that extraposed relative clauses related to the subject cannot be part of the VP (Chapter 2.2.2, ex. (57)–(60) and (71), (ii) that extraposed relative clauses related to a *wh*-moved element are not c-commanded by the subject (Chapter 2.3.1, ex. (95b)), (iii) that extraposed relative clauses related to a direct object are not c-commanded by an indirect object in a double object construction (Chapter 2.3.1, ex. (91a)), and (iv) that an extraposed relative clause marks wide scope for its antecedent DP (Chapter 2.4, ex. (108b)). The leftward movement theory, however, does not capture these structural properties. In fact, the structural relationships in this

[15]For the sake of consistency with Kayne's analysis, I speak of "DP" instead of "NP" here, even though I used the category label "NP" in earlier chapters. I will adopt an NP-analysis of noun phrases in my own approach to relative clauses presented in Chapter 7.

theory are even the other way around. Since a leftward moved constituent must c-command its trace, a leftward moved associate DP also c-commands the "extraposed" relative clause attached to this trace. That is, the stranded relative clause is in a structurally lower position than its antecedent. This is in contradiction to the empirical facts mentioned above. For example, requirement (ii) is failed since under the assumption that an extraposed relative is stranded in an A-position, it will be c-commanded by the subject. Similarly, requirement (iii) is not fulfilled since in the leftward movement analysis an indirect object c-commands the direct object and also a relative clause related to the direct object, whether it is stranded or not. Finally, requirement (iv) is problematic for the stranding analysis since the "extraposed" relative clause occurs in the lowest position in the structure (see Rochemont and Culicover (1997, Section 4.1), Sheehan (2010, 211–212), and Webelhuth, Sailer, and Walker (2013a)).

Finally, as an instance of movement, Kayne's leftward movement theory fails to capture the existence of relative clauses with split antecedents. It is not clear how the antecedents could originate inside the relative clause and then be split and moved to positions within two different, conjoined clauses (see also Alexiadou et al. (2000, 14)).

Rochemont and Culicover (1997) are aware of the problems with Kayne's theory and propose a variant of the leftward movement analysis which makes use of several additional specifier positions on the left as landing sites. The relative clause moves to a specifier position higher than the landing site of its antecedent, and the constituents stranded by the movement of the relative clause (and containing the antecedent) are subsequently raised to a still higher specifier position. This results in a structure in which the extraposed relative clause is stranded in sentence-final position, but it is not c-commanded by its antecedent or any other relevant sentence constituents. As noted in Webelhuth, Sailer, and Walker (2013a), Rochemont and Culicover's analysis is not worked out in sufficient detail. For example, it remains unclear what the category labels of the mother nodes are that dominate the specifier positions needed as landing sites. Moreover, some version of the Complement Principle is still required for a proper interpretation of the relative clause, and an appropriate level of clausal embedding of the structures must be ensured (Rochemont and Culicover, 1997, 289). Finally, the authors themselves are aware of the fact that their theory completely lacks independent motivation: "This analysis remains incomplete, of course, without (i) some account of why the boxed phrase must move, (ii) independent motivation for the structures assumed, and (iii) an explanation of what licenses the required movements, e.g., movement of IP across RX [the "extraposed" relative clause; H.W.] into a higher Spec" (Rochemont and Culicover, 1997, 290).[16]

[16]Webelhuth, Sailer, and Walker (2013a, 29n37) note that in later work, Culicover and Jackendoff have surveyed the history of generative syntax up to the theory of Antisymmetry and have come to the conclusion: "We now note how little of the theoretical development is motivated on the basis of the facts" (2005, 84). They reject a movement rule for relative clause extraposition and adopt a base generation approach again (2005, 167) of the kind that Culicover had already developed together with Rochemont in earlier work (see Section 4.2.1 below).

4.1.4 Leftward Movement + Deletion

Wilder (1995) also recognizes serious problems of Kayne's leftward movement theory and proposes an interesting alternative that combines leftward movement with deletion. Instead of the antecedent moving leftward by itself, the whole constituent including the relative clause is moved to the left, leaving behind a syntactic copy in accordance with Chomsky's (1993) copy theory of traces. This is shown in (162) in Step 2 of the derivation of the sentence *A girl kissed him yesterday who really likes John*. The relative clause is then subdeleted inside the moved copy of the DP (leftward/backward deletion, Step 3), and everything but the relative clause is subdeleted in the trace copy (forward deletion, Step 4).

(162) **A girl** kissed him yesterday *who really likes John*.

Step 1: kissed him yesterday [$_{DP}$ **a girl** *who really likes John*]. (Basic)

Step 2: [$_{DP}$ **a girl** *who really likes John*]$_i$ kissed him yesterday [$_{DP}$ **a girl** *who really likes John*]$_i$. (Leftward movement of the DP, leaving behind a copy)

Step 3: [$_{DP}$ **a girl** ~~*who really likes John*~~]$_i$ kissed him yesterday [$_{DP}$ **a girl** *who really likes John*]$_i$.
(Backward deletion of the relative clause in the initial copy of the DP)

Step 4: [$_{DP}$ **a girl** ~~*who really likes John*~~]$_i$ kissed him yesterday [$_{DP}$ ~~**a girl**~~ *who really likes John*]$_i$.
(Forward deletion of everything but the relative clause in the final copy of the DP)

The analysis is motivated by the fact that it captures generalizations between extraposition and backward deletion in coordination (such as Right Node Raising constructions). For example, both processes only target constituents in right-peripheral positions.

Wilder's approach dispenses with the implausible and unmotivated leftward movements as in (159) that are needed in Kayne's leftward movement theory to derive sentences like (158a), where a relative clause is extraposed from a PP. In the leftward movement + deletion theory, such sentences have the following structure:

(163) John is going to talk [$_{PP}$ to [$_{DP}$ **someone** ~~*who he has a lot of faith in*~~]]$_i$ tomorrow
[$_{PP}$ ~~**to**~~ [$_{DP}$ ~~**someone**~~ *who he has a lot of faith in*]]$_i$.

What is moved leftward is the whole PP including the relative clause. Unlike in Kayne's theory, where the PP without the relative clause is moved, the moved element here forms a natural constituent. However, now the deletion process must apply to the non-constituent *to someone* in the trace copy. But this is only an apparent problem, since deletion in coordination can generally apply to non-constituents, as shown by the following example from Webelhuth, Sailer, and Walker (2013a, 31):[17]

[17]The underlined expression licenses the deletion.

(164) [$_S$ Mary sent a book to Jill] and [$_S$ ~~Mary sent~~ a CD to Cindy].

Another improvement over the pure leftward movement theory is that the constraints on deletion in coordination can account for the ban on medial stranding. As shown by the contrast in (165), backward deletion in coordination can only be triggered by an overt antecedent in the final conjunct and must apply uniformly to all non-final conjuncts (165a). In (165b), the overt antecedent that triggers the backward deletion is not in the final but in the medial conjunct, which leads to ungrammaticality.

(165) a. Peter will buy ~~the newspaper~~, read ~~the newspaper~~, and throw out the newspaper.
b. * Peter will buy ~~the newspaper~~, read the newspaper, and throw it out.

A sentence in which a relative clause is illicitly stranded in medial position (cf. (161b) above and (84)–(88) in Chapter 2.2.2) is ruled out by the same reasoning. According to Wilder, the stranded relative clause in such cases occupies a non-final position in a movement chain. But in this position, analogous to the non-final conjunct in (165b), it cannot trigger a backward deletion.

Note, however, that this account requires the medial stranding cases to have a structure in which the base position of the DP including the relative clause is further to the right of the stranding position. Wilder (1995, 278) is aware of this problematic issue: "In English, it must be assumed that subjects and objects, as well as PP/CP complements and adjuncts, may be generated in a position following a VP-final adverbial. . . . Such unorthodox assumptions, which are necessary in any variant of Kayne's proposal, call for clarification. I do not explore this issue here, but shall assume that a reasonable account can be constructed."

Wilder's theory is problematic in some further respects, as pointed out in Webelhuth, Sailer, and Walker (2013a). Although it eliminates some movements such as in (159), it still requires a lot of other unmotivated leftward movements. Borsley's criticism of Kayne's derivation of (157) thus also applies to Wilder's variant of the leftward movement theory.

Like all the other movement approaches to relative clause extraposition, Wilder's theory fails to capture the existence of relative clauses with split antecedents.

Furthermore, the structural assumptions of Wilder's theory do not allow him to capture the behavior of relative clause extraposition with respect to binding theory, scope, VP-ellipsis etc. As in Kayne's theory, the leftward movements produce a movement chain, which is only well-formed if the moved element c-commands the lowest member of the chain. Thus, the antecedent, which is part of the moved DP whose relative clause is subdeleted, asymmetrically c-commands the "extraposed"–or stranded–relative clause, which is part of the trace copy in which the antecedent is subdeleted. This contradicts the evidence, as was shown above.

Webelhuth, Sailer, and Walker (2013a, 32-33) exemplify the difficulties with the following example from Baltin (1981), which will be incorrectly ruled out according to the leftward movement + deletion theory:

(166) Although nobody was introduced to Sue who rode with Fred, **some** were _ *who rode with his brother*.

Since the verb in (166) is passive, the base position of the DP that contains the relative clause (***some*** *who rode with his brother*) must be a complement position of *introduce*, i.e., it is within the VP. This is the lowest position of the movement chain formed by moving the DP leftwards, and thus, according to Wilder's assumptions, it is the only position that can trigger the backward deletion of the relative clause in the highest position of the movement chain, i.e., within the subject of the main clause. However, given that *introduced... to Sue* is unpronounced in the main clause, it can be assumed that VP-ellipsis has applied in this clause. But then the relative clause *who rode with his brother* should not be pronounced, either, under the plausible assumption that Wilder adopts the widely accepted Uniform Thematic Alignment Hypothesis of Baker (1988). The only way out of this dilemma would be for the DP that contains the relative clause to move out of the VP. But this copy of the DP would then be in a medial position of the movement chain and thus should not be able to trigger the backward deletion within the subject. Again, this reasoning is analogous to the reasoning given for (165b), where a non-final conjunct is not allowed as a trigger for backward deletion in coordination. But backward deletion of the relative clause must apply to the subject, or else the surface order of (166) cannot be derived. As far as I can see, Wilder's leftward movement + deletion theory cannot provide a solution to this dilemma.

To conclude, Wilder's theory provides a clever alternative to the simple leftward movement theory by adding a deletion component. It avoids some of the latter's problems and makes it possible to capture generalizations between relative clause extraposition and leftward deletion in coordination. However, it does not solve all of the problems and even creates some new ones.

This ends the discussion of the (core) movement theories, which we have seen do not succeed in capturing all the generalizations relevant to relative clause extraposition. I will next present the analyses that do not invoke movement in core syntax, i.e., the base generation theories and the PF movement theories.

4.2 Theories without Core Movement

In view of the problems that the movement theories have encountered, research took a new direction. It was suggested to analyze relative clause extraposition without invoking movement in core syntax. This gave rise to basically two kinds of approaches: (i) base-generation theories that base-generate the relative clause in extraposed position, and (ii) theories that analyze relative clause extraposition as movement not in core syntax, but rather in a post-syntactic component. I will present each of these approaches and some variants thereof in turn.

4.2.1 Base Generated Adjunct

Although Guéron (1980) and Guéron and May (1984) take relative clause extraposition to be a movement rule of core syntax (Guéron explicitly argues against it being a stylistic rule), they do not agree with Baltin (1981) that it should be restricted by Bounding Theory. Instead, they propose to account for the locality of extraposition with a constraint in terms of government that holds at the level of Logical Form. That is, in overt syntax, the relative clause is moved to the right, and at LF, it is interpreted as a *complement* of the NP it has moved away from, under the presupposition that it is governed by this NP. Thus, as stated in Webelhuth, Sailer, and Walker (2013a, 34), their approach "represents a paradigm change from prior work in at least two respects." The structural distance between the relative clause and its antecedent NP is not restricted by the relationship between the moved relative clause and its trace, but by the relationship between the relative clause and the associate NP. "Consequently, as there exists no movement relationship between the associate and the relative clause, the locality condition of government is motivated by the need to interpret the relative clause, rather than by conditions on movement."

Culicover and Rochemont (1990), Rochemont and Culicover (1990), and Rochemont (1992) discuss a number of problems faced by a movement account of relative clause extraposition (see Section 4.1.1 above) and take Guéron and May's approach as a starting point of their own analysis. They point out that Guéron and May's interpretive principle, which they refer to as the "Complement Principle", not only accounts for the correct interpretation of an extraposed relative clause without requiring the presence of a trace within the associate NP, but that a proper formulation of the principle also accounts for the bounding effects of extraposition. Thus, if the tools of movement theory are not needed to capture the locality restrictions and the appropriate interpretation of relative clause extraposition, and even pose more problems than they solve, Culicover and Rochemont conclude that extraposed relative clauses should not be derived by movement at all. Instead, they propose that an extraposed relative clause is base-generated in its surface structure position (i.e., there is no gap within the antecedent NP) and licensed interpretively under government.[18]

Culicover and Rochemont argue extensively that relative clauses extraposed from the subject must be allowed to be adjoined to the VP, which further undermines the movement approach, since the extraposed relative clause in the VP does not c-command and hence does

[18]That extraposed relative clauses should be base-generated in their surface structure position had been proposed before. For example, Andrews (1975/1985, 2) explicitly argued that relative clauses with split antecedents exclude a movement analysis. Koster (1978a, 560–563, 1978b, 48–57, 76) argued that a movement rule "Extraposition from NP" is redundant since a rule of discourse grammar (which he called "Linking to Focus") is needed anyway to interpretively link the extraposed PP/relative clause to its associate (he adopted this proposal from Guéron (1976)), and since the "extraposed" positions are possible deep structure positions. He additionally motivated his proposal by pointing out that the non-cyclic behavior of extraposed PPs/relative clauses causes problems for a movement account and Subjacency in particular. Lasnik and Saito (1992, 104–105) also suggested that extraposed relative clauses should be base-generated and the relationship to their antecedents established by "some sort of predication," which they did not specify any further, however. See also Larson (1983).

not properly bind its trace within the subject position. In order to allow for a subject-related extraposed relative clause to be attached either to IP or to VP, Culicover and Rochemont adjust Guéron and May's licensing requirement according to which the complement must be governed by the antecedent, such that the government relation between the antecedent NP and the relative clause is allowed to hold in either direction. Their Complement Principle (Culicover and Rochemont, 1990, 41) is shown in (167), which they claim must apply at Surface Structure and not at LF:

(167) β is a *potential complement* of α (α, β = X^{max}), only if α and β are in a government relation.

Culicover and Rochemont have systematically established the Principle C effects of extraposition and investigated the behavior of extraposed relative clauses with respect to VP-preposing, VP-deletion, and *wh*-clefts. They have based the proper formulation of their Complement Principle on these empirical observations. Hence, their theory makes the correct predictions in these domains, with the exception that they argue that a subject-related extraposed relative clause (SX) may be included in the ellipsis of VP, which causes them to allow an SX to be a adjoined to VP (see the discussion around example (64) in Chapter 2.2.2).

However, the base generation theory also faces a number of problems. In a reply to Guéron's (1980) proposal, and in defending his Generalized Subjacency approach, Baltin (1983) criticizes Guéron's Complement Principle by drawing attention to the fact that the notion of *government* it requires "is incompatible with the notion of government needed by Chomsky and other government-binding theorists" (p. 156). Contrary to the standard concept of government, Guéron–as well as Guéron and May (1984) and Culicover and Rochemont–must assume that the governor in their head-complement relation is a maximal projection rather than a lexical category. This necessitates an extension of the theory of government, so that the analysis fails to reduce the licensing conditions of extraposed relative clauses to independently motivated concepts of the Government and Binding Theory of that time. Culicover and Rochemont's claim that the government relation between the relative clause and its antecedent NP can hold in either direction furthermore contradicts the standard view that in canonical complementation, the predicate governs its complement and not the other way around (Webelhuth, Sailer, and Walker, 2013a). Büring and Hartmann (1997, 22) call the "required licensing mechanisms" of the base generation theories "stipulative and empirically inadequate."

In addition to the conceptual problems, an empirical problem is given by the cases where relative clauses are extraposed from embedded NPs (cf. Culicover and Rochemont (1990, 41n34), Rochemont and Culicover (1990, 166n13), Guéron (1980, 647n11), as well as Büring and Hartmann (1997, 22)).

Furthermore, it is not clear how the base generation theory would account for the scope effects of relative clause extraposition noted by Guéron (1980), Culicover (1981), and Fox and Nissenbaum (1999). Culicover and Rochemont do not provide a successful theory of the semantic interpretation of extraposed relative clauses.[19]

Finally, the split antecedent cases are problematic for this version of the base generation theory. Although Culicover and Rochemont argue that their theory can correctly analyze extraposed relative clauses with split antecedents in the subject position of two conjoined sentences (Culicover and Rochemont (1990, 45n40) and Rochemont and Culicover (1990, 38)), it is not obvious how the plural morphology in the relative clause and the correct truth conditions of the sentence will be accounted for. Moreover, as they point out themselves (Rochemont and Culicover, 1990, 38–39), their analysis fails to account for sentences with split antecedents within object positions. Yet, there are speakers who accept such structures, as demonstrated by the following example from Andrews (1975/1985, 78), where the relative clause is supposed to modify *woman* and *girl*:

(168) A man saw **a woman** and a boy saw **a girl** [$_{RC}$ *who were similar*].

4.2.2 Base Generated Conjunct

Koster (2000) proposes an alternative version of the base generation theory, in which the extraposed relative clause is not adjoined directly to a verbal projection (VP, IP, etc.). Instead, relative clause extraposition is analyzed as a form of parallel construal, which also encompasses constructions like coordination and equatives.[20] To account for these structures, Koster introduces a new kind of phrase, the Colon Phrase (= ":P", named after the colon punctuation mark):

(169) Colon Phrase:
[$_{:P}$ XP [: XP]]

The head of this phrase is the ":" (the colon), which "functions as [a] Boolean operator, leading to the addition of properties," and may be paraphrased as 'namely' (Koster, 2000, 21). To illustrate the general idea, consider the following example with an equative:

(170) John built *something beautiful: a golden igloo*.

The primary phrase structure element, the NP *something beautiful*, is in the Spec of the colon phrase, and *a golden igloo* is the specifying addition which is in the complement position of the colon head. The NP to be specified can also be embedded within a larger

[19] A recent account by Hunter and Frank (2014) largely agrees with Culicover and Rochemont's base generation theory, but it improves on it by providing an explicit formulation of the semantic composition operations that link (extraposed) adjuncts with their modifiees. However, it is not clear to me how this theory would account for the scope effects and the split antecedent cases (see below).

[20] Koster calls his analysis *parallel construal*. De Vries (2002, 240) refers to it as *specifying coordination*.

phrase (this is called pied piping). For instance, the specifier of the colon phrase can be a PP, as shown in (171). The equative *a golden igloo* is added to the PP, but it specifies the NP *something beautiful* contained within the PP.

(171) John has talked [$_{:P}$ [$_{PP}$ about [$_{NP}$ *something beautiful*]] [: [$_{NP}$ *a golden igloo*]]].

As long as the NP to be specified is contained within the Spec of :P, this specifier may be an NP, a PP, an AgrOP, up to a whole CP. The minimal CP is the limit to account for the Right Roof Constraint.

This approach is extended to relative clause extraposition. As shown in (172), a relative clause serves as the complement of the colon head and provides a further specification of the head of the relative clause, which is contained in the specifier position of the colon phrase. In the case of restrictive relative clauses, the colon indicates set intersection.

(172) Ik heb [$_{:P}$ [$_{AgrOP}$ [$_{NP}$ *een vrouw*] gezien] [: [$_{CP}$ *die alles wist*]]].
I have a woman seen who everything knew
'I saw a woman who knew everything.'

Koster's analysis of relative clause extraposition is not without problems. The pied piping that is invoked for the licensing of the extraposed relative clause is not constrained by anything other than the Right Roof Constraint. This means that a relative clause can be attached to (or rather coordinated with) any phrase dominating the antecedent NP, up to the clause level. However, we have seen evidence from binding theory that the surface position of an extraposed relative clause is restricted. In (173), a Principle C violation is predicted under the assumption that the relative clause extraposed from the object is adjoined in a position within the c-command domain of the subject pronoun:

(173) * She$_i$ invited **many people** to the party *that Mary$_i$ didn't know*.

According to Koster's theory, however, the object-related relative clause would be allowed to attach to IP, since this would not violate the Right Roof Constraint. But in this position, it would be outside the c-command domain of the subject pronoun, thus incorrectly predicting the absence of a Principle C effect (see Sheehan (2010, 214) and Webelhuth, Sailer, and Walker (2013a)).

Since extraposed relative clauses are coordinated with larger phrases than their in-situ equivalents, the theory can explain, however, why relative clause extraposition bleeds Principle C in the following cases:

(174) a. * I sent her$_i$ **many gifts** *that Mary$_i$ didn't like* last year.
b. I [$_{:P}$ [$_{VP}$ sent her$_i$ **many gifts** last year] [: [*that Mary$_i$ didn't like*]]].

The relative clause in (174b) follows the VP-adverbial and therefore must be coordinated with a phrase at least as large as the VP. Since the VP also contains the indirect object pro-

noun, there is no c-command relation between her_i and $Mary_i$, and the sentence is correctly predicted to be grammatical.

Since Colon Phrases should always be optional, it is not obvious how Koster's analysis would account for the determiners that obligatorily require the presence of a relative clause. Moreover, a relative clause is licensed in a Colon Phrase via linking to NP and not to D^0 (Webelhuth, Sailer, and Walker, 2013a, 36).

The scope effects of relative clause extraposition noticed by Guéron (1980), Culicover (1981), and Fox and Nissenbaum (1999) are not correctly predicted, either, since Koster (2000, 25) postulates a principle that ensures that sentences with extraposed and non-extraposed relative clauses are "interpretively equivalent."

4.2.3 Base Generated Conjunct + Deletion

De Vries (2002, 213–214, 240–241, Ch. 7.5–7.6) presents further problems of Koster's theory, which he refers to as *specifying coordination*. Among others, he criticizes that in structures like (172), the two conjuncts are neither "functionally, nor syntactically" (p. 270) equivalent and are of different semantic types. He therefore proposes to make the specifying conjunct containing the relative clause "both semantically and syntactically" (p. 240) similar to the conjunct in Spec of :P and to add a deletion component to the analysis to yield the surface form of the expression (hence, he calls his analysis *specifying coordination plus ellipsis*). This creates structures as shown in (175) from De Vries (2002, 241):[21]

(175) Ik heb [$_{\&:P}$ [$_{AgrOP_1}$ *de man* gezien] [&: [$_{AgrOP_2}$ [$_{DP}$ ~~de~~ ~~man~~ *die zijn tas*
I have the man seen the man who his bag
verloor] ~~gezien~~]]].
lost seen
'I saw the man who lost his bag.'

De Vries uses the symbol "&:" instead of ":" for the Boolean head in order to distinguish his theory from Koster's. The two coordinated constituents are now of the same category–here AgrOP. The second conjunct contains the relative clause and is thus more specific than the first. Repeated material is phonologically deleted.

As noted in Webelhuth, Sailer, and Walker (2013a), the specifying coordination + ellipsis theory is similar to the rightward movement + deletion analysis of Fox and Nissenbaum (1999) as well as Wilder's (1995) leftward movement + deletion analysis: In none of these analyses is the extraposed relative clause moved out of or generated outside its associate NP. Rather, in each case, a copy of the associate including the relative clause is created, and everything but the relative clause is phonologically deleted. "This assumption makes it all but impossible for these theories to handle relative clauses with split antecedents, since the

[21] The glosses and translation are added by H.W.

extraposed relative clause can only occur in one associate at a time" (Webelhuth, Sailer, and Walker, 2013a, 38).

The specifying coordination + ellipsis analysis also fails to account for Culicover and Rochemont's interpretive effects shown in (174) above, since the relative clause is always structurally associated with the antecedent. In (174a), a Principle C violation is correctly predicted since the in-situ relative clause is contained in the direct object which is c-commanded by the indirect object. In the analysis of (174b), where the extraposed relative clause follows the VP-adverbial, the second conjunct of &: is the VP with the exact same structural relationships as in (174a). The only difference is that everything but the relative clause is phonologically deleted. But phonological deletion should not have any influence on binding theory. Hence, (174b) is incorrectly predicted to be ruled out by Principle C.[22]

Similarly, the specifying coordination + ellipsis theory cannot capture the scope effects of relative clause extraposition noticed by Guéron (1980) and Fox and Nissenbaum (1999) (see Chapter 2.4). For instance, consider again Fox and Nissenbaum's examples repeated here in (176):

(176) a. I [$_{VP}$ looked very intensely for **anything** *that would help me with my thesis*].

b. * I [$_{VP}$ looked for **anything** very intensely] *that will/would help me with my thesis*.

Recall the reason for the difference in grammaticality: In (176a), the relative clause occurs in situ, and its antecedent, the 'free choice' element *anything*, can be correctly licensed within the scope of the modal verb *look for*. (176b) is ungrammatical because the extraposed relative clause marks wide scope for its antecedent (Williams' Generalization), which leads to a scope conflict for 'free choice' *any*. This difference cannot be predicted by the specifying coordination + ellipsis analysis. It assigns (176b) a structure in which in the second conjunct the relative clause is structurally associated with its antecedent NP *anything*. Again, the only difference to the in-situ case is that the antecedent NP of the "extraposed" relative clause (and everything else but the relative clause) is unpronounced. This phonological process should have no effect on the interpretation of scope.

Finally, the existence of determiners with obligatory relative clauses cannot be accounted for by this theory. Since the relative clause only occurs in the second conjunct, the occurrence of the determiner in the first conjunct lacks an obligatory argument. As shown in Webelhuth, Sailer, and Walker (2013a), other coordinations in which an obligatory argument is missing are clearly ungrammatical (see (177)). Although all the required arguments of *put*$_2$ appear in the second conjunct, this does not license *put*$_1$ in the first conjunct to occur without its direct object.

(177) * Mary put$_1$ _ on the desk and Jill put$_2$ books on the shelf.

[22]It should be noted that De Vries (2002, 261–262, 299) claims that the binding effect shown in (174) for English does not exist in Dutch, but that the structural equivalent of (174b) in Dutch is as bad as that of (174a). The same has been argued by Inaba (2007, 112) for German. See the works cited as well as Kluck and De Vries (2013) for further discussion.

In sum, I consider all these problems to render the base generated conjunct + deletion theory suspect.

There is one final version of the base generation analysis that I am aware of, the theory of *Generalized Modification* developed by Kiss (2003, 2005) and adopted in essentially unmodified form by Crysmann (2013). Both theories are formulated within the framework of Head-Driven Phrase Structure Grammar (HPSG). Since the analysis of relative clause extraposition that I propose in Chapter 7 largely builds on these theories, I will postpone their discussion and present them in more detail in Chapter 5, after I have given an introduction to the framework of HPSG.

4.2.4 PF Movement

The previous discussion in this chapter has shown that relative clause extraposition shows properties that are quite different from standard leftward movement. It is both more and less restricted than movement to the left. For example, on the one hand, it is more locally constrained in being subject to the Right Roof Constraint. On the other hand, it may violate constraints such as the Complex NP Constraint and Huang's (1982) Condition on Extraction Domain. These observations have been a challenge to the attempts to analyze relative clause extraposition in terms of movement and to provide a unified account of leftward and rightward movement. One response to these difficulties was the development of the various base generation and deletion analyses, as presented in the preceding sections.

Another reaction was to treat relative clause extraposition as a "late", post/last-cyclic, or stylistic/PF rule, which thus behaves differently from the (cyclic) rules of the core syntax. This idea started with Ross (1967/1986), who argued that "extraposition from NP", as he called the rule, is a last-cyclic rule. This was motivated by his observation that extraposition from NP must follow the last-cyclic rule called Particle Movement (p. 166) and, moreover, that postulating extraposition from NP as last-cyclic would make it possible to dispense with the Frozen Structure Constraint[23] (p. 173).

Baltin (1978/1985, 45–47) reports that Chomsky proposed in class lectures at the Massachusetts Institute of Technology in Spring 1978 that extraposition rules should be stylistic in the sense of Chomsky and Lasnik (1977). This would make it possible to simplify the formulation of a filter proposed by the latter, since stylistic rules apply after the filter, and thus extraposition rules would be able to escape the filter's effects. A similar line of reasoning is followed by Koster (1978b, 48–57), who additionally argues that relative clause extraposition is not constrained by Subjacency and concludes that "extraposition phenomena are outside the scope of core grammar" (p. 56). Baltin (1981, 263–266) draws the same conclusion by

[23]Ross (1967/1986, 173) formulates the *Frozen Structure Constraint* as follows: "If a clause has been extraposed from a noun phrase whose head noun is lexical, this noun phrase may not be moved, nor may any element of the clause be moved out of that clause."

showing that a binding-theoretic constraint proposed by Reinhart (1976), which holds at the level of logical form, is not affected by his rule called Detachment. Although his evidence is based on complement clause extraposition, he also subsumes relative clause extraposition under the Detachment rule and generally posits this rule as a stylistic rule. Rochemont (1978/1985, 20) develops a theory of stylistic rules in English and proposes that PP extraposition "is a stylistic rule, and not a syntactic operation which is subject to subsequent interpretation."

Although McCawley (1982) doubts the existence of a separate "stylistic component" of the grammar, he proposes a variant according to which relative clause extraposition is analyzed as a movement transformation that changes the linear order of constituents without changing the constituent structure, thus giving rise to discontinuous constituent structures (with crossing branches). That is, a relative clause remains a constituent of its antecedent NP even if it is moved to the right. This assumption, he argues, explains why extraction out of an extraposed relative clause is impossible, as shown in (178). The relative clause and its antecedent still form a complex NP, so that Ross' Complex NP Constraint is violated.[24]

(178) *[What kind of clothing]$_k$ did **a man** enter *who was wearing* $\__k$?

Chomsky (1986, 40–41) notes that some cases of relative clause extraposition pose problems for his Barriers approach and suggests: "A possibility that might be explored is that extraposition is indeed a PF rule and that θ-government does not play the role in determining barriers in the PF component that it does in the syntactic and LF components" (p. 41). Similar tentative statements ("These speculations") can be found in Chomsky (1995, 325) and ("likely", "Quite possibly") in Chomsky (2008, 136, 154).

Finally, Göbbel (2007, 2013b,a, 2014) argues that extraposition is phonologically conditioned and occurs at PF. As motivation of his theory, he presents several reasons why extraposition should not be considered a syntactic movement operation. One theory-internal argument is that extraposition is optional and lacks a syntactic trigger[25] and thus does not conform with all the theoretical properties of movement required within the Minimalist Program. Furthermore, he emphasizes that extraposition behaves differently from leftward movement (e.g., it is clause-bound but not sensitive to syntactic islands) and claims that reconstruction

[24]Baltin (1984) argues against McCawley's analysis by showing that PP extraposition changes the island status of a PP.

[25]This argument is also stated by Kayne (1994, 120–121), Koster (2000, 4), De Vries (2002, 242), Baltin (2006, 254), and Sheehan (2010, 203). It has often been claimed in the literature that extraposition is a focus construction (cf. Rochemont (1978/1985, 1986), Huck and Na (1990, 68), Rochemont and Culicover (1990, 25–27, 163n30), and Möck (1994), among others). However, examples like the following from Bolinger (1992, 294–295) show that this claim cannot be upheld for extraposed relative clauses:

(i) A: Aren't you going to invite the Hatfields and the McCoys?
B: No, I don't WANT people in my church who are so quarrelsome…

See also Rochemont and Culicover (1990, 64–65) and Göbbel (2007, 2013b,a, 2014) for similar counterexamples.

effects (e.g., variable binding) can be straightforwardly explained if extraposition occurs postsyntactically.

Analyzing relative clause extraposition as a stylistic/PF-movement rule implies that this word order change does not have an effect on semantic interpretation, as stated in the literature: "The operation of stylistic rules will not affect interpretation" (Rochemont, 1978/1985, 20). "As soon as the a-rules…[i.e., Deletion rules, Filters, Phonological rules, Stylistic rules] apply, the b-rules…[i.e., Construal rules, Interpretive rules, Conditions on binding] are inaccessible" (Koster, 1978b, 57). "Detachment is a stylistic rule.… Stylistic rules apply independently of logical form" (Baltin, 1981, 271). "An operation that occurs at PF remains invisible for the semantic component" (Göbbel, 2013a, 402).

However, as I have shown in Chapter 2, Sections 2.3.1 and 2.4, there is considerable evidence that relative clause extraposition is not semantically neutral. Culicover and Rochemont (1990) and Rochemont and Culicover (1990, 1997) have argued that relative clause extraposition affects Principle C. Fox and Nissenbaum (1999, 2000) and Fox (2002), drawing on Williams (1974), have demonstrated that extraposed relative clauses mark the scope of the antecedent NP. And Guéron (1980) and Culicover (1981) have given evidence that relative clause extraposition has an effect on the logical scope of negation and polarity items.

In view of these data, some authors who earlier argued for a stylistic/PF-movement theory have changed their point of view. For example, Baltin admits in his reply from 1983 to Guéron (1980): "Guéron shows quite convincingly, however, that Extraposition must be a syntactic movement rule, rather than a stylistic movement rule" (p. 161n8). Obviously, Rochemont has also abandoned the stylistic hypothesis in his joint work with Culicover (Culicover and Rochemont (1990), Rochemont and Culicover (1990, 1997); see also Rochemont (1986, 197n110)), where they have elaborated on the binding effects of relative clause extraposition and concluded: "We do not think it feasible that EX [i.e., extraposition] may be analyzed as a PF rule" (Culicover and Rochemont, 1990, 37).

Besides the convincing evidence that relative clause extraposition has an effect on the semantic interpretation of a sentence, there is a further problem with the general postsyntactic movement approach. Since it analyzes extraposition as a movement process, it also has difficulties in accounting for relative clauses with split antecedents, like all the other movement theories. I therefore conclude that relative clause extraposition should not be considered a movement rule in the PF component of the grammar.[26] At the same time, however, I do not deny the arguments that relative clause extraposition may be affected and even motivated by prosodic properties, as argued convincingly by Truckenbrodt (1995) and Göbbel (2007, 2013b, 2014).

[26]This conclusion is also explicitly formulated in Guéron (1980, 649), Taraldsen (1981, 476) ("Our conclusion will be that extraposition belongs in the transformational component."), Culicover and Rochemont (1990, 37) (see the citation in the previous paragraph), Möck (1994, 59) ("Man kann von keiner stilistischen Regel Extraposition ausgehen."), and Sheehan (2010, 242n7).

4.3 Summary and Conclusion

In this chapter, I have given a systematic overview over the major analyses of relative clause extraposition in English. The large number and the diversity of the theories that have been proposed in the literature is impressive and reflects the inventiveness with which linguists have tried to capture the properties of this grammatical phenomenon. As formulated in Haider's (1997, 115) words, "all options compatible with the generative theory of grammar" have been "exhausted": movement, both to the right and to the left, in the core syntax and postsyntactic, with and without deletion, as well as base generation, as adjunct and conjunct, with and without deletion.

I have sketched the analyses in some detail and assessed their relative success with regard to how well they capture the empirical generalizations that I have deduced from the evidence in the literature and presented in Chapter 2. It has become evident that none of the theories is able to account for all of the data and capture all the generalizations, although some fare better than others.

The biggest problem for all the movement theories is that they cannot account for relative clauses with split antecedents. Although this phenomenon has been commented on in almost every work that has dealt with relative clause extraposition since Ross (1967/1986), no solution has been found yet. In view of the intensity with which linguists have tried to develop a proper movement approach, I doubt that the problem of split antecedents can be solved at all within this theory. I therefore conclude that a movement analysis of relative clause extraposition is not able to cover the whole range of data, and a successful theory of this phenomenon should not invoke movement of either the relative clause or the antecedent in core syntax or PF.

Furthermore, we have seen that the binding and scope data and the data with negative polarity items are problematic for many of the theories. These data provide evidence that extraposition may affect the semantic interpretation of a sentence, and that the extraposed relative clause must be in a position in core syntax that is structurally higher than its non-extraposed counterpart. This rules out all the theories in which the extraposed relative clause occurs adjacent to its antecedent throughout the core syntax, and the final "extraposed" structure is derived by some postsyntactic operation, either through movement of the relative clause to the right (as in the PF movement approaches) or through a deletion process that strands the relative clause in extraposed position (as in the base generated conjunct + deletion theory).

The (pure) base generation theories are more promising in these respects. Even though the problem of the split antecedents has not been solved yet, there is reason to believe that a proper analysis can be found if some assumptions or mechanisms are added to these theories. A possible approach to a solution is suggested in Webelhuth, Sailer, and Walker (2013a, 47), considering the following example as a point of departure:

(179) **A man**$_i$ entered the room and **a woman**$_k$ went out. **They**$_{i+k}$ were quite similar.

The discourse antecedent of the pronoun *they* in the second sentence in (179) must be plural. It has to be accommodated from the two singular referents expressed in the two distinct conjuncts of the preceding sentence. "If the licensing procedure for base-generated extraposed relative clauses can draw on this mechanism of accommodation, extraposed relative clauses with split antecedents would be brought into the fold for the first time since the phenomenon was noticed in 1970" (Webelhuth, Sailer, and Walker, 2013a, 47). In Chapter 5.3.3, I will show that the theory of Generalized Modification (Kiss, 2003, 2005) holds out the prospect of being able to capture this phenomenon.[27]

The theory of Generalized Modification is in general an improvement over the other base generation theories as it makes progress on the semantic and licensing side of extraposed relative clauses (see Chapter 5.3.3 for the details). That a grammar of relative clause extraposition must be enriched by interpretive rules was first suggested by Guéron (1976, 1980). We have seen further ample evidence that relative clause extraposition displays interpretive effects, e.g., with regard to negative polarity items (Guéron (1980), Culicover (1981)), binding (Culicover and Rochemont (1990), Rochemont and Culicover (1990)), and quantifier scope (Fox and Nissenbaum, 1999). Hence, any successful theory of relative clause extraposition requires a precise semantic component in order to be able to account for these facts. The theory proposed by Kiss is promising in this respect. It is the first theory that provides a formally and conceptually precise account of the semantic interpretation of relative clauses that are base-generated in extraposed position. However, as I will show in Chapter 5.3.3.2, it also has problems and in its present form cannot capture all the empirical generalizations.

In Chapter 7, I will propose an analysis that remedies these deficiencies. I will take Kiss' theory of Generalized Modification as a point of departure and develop it further. Employing the fairly recently developed framework of Lexical Resource Semantics (Richter and Sailer, 2004), I will introduce tools and mechanisms that will make it possible to solve many of the problems mentioned above and capture many of the empirical generalizations of relative clause extraposition, for example the scope effects and the cases of determiners with obligatory relative clauses. It is thus an improvement over the existing base generation theories of relative clause extraposition.

[27] Chaves (2007, Ch. 5.3 + Ch. 6.6) provides the semantic foundation of an approach to relative clauses with conjoined antecedents. Chaves (2009, Sections 3.1 + 3.2) anticipates that this theory can also be extended to relative clauses with split antecedents.

Chapter 5

Relative Clauses in HPSG

This chapter is devoted to the analysis of English relative clauses in Head-Driven Phrase Structure Grammar (HPSG). I will first give a brief introduction to the framework of HPSG and the basic fragment that I will later use for my own analysis of relative clauses. In Section 5.2, I present the two main analyses of relative clauses that exist in the HPSG literature, one proposed by Pollard and Sag (1994), which makes use of a phonologically empty complementizer, and the other developed by Sag (1997), which is construction-based. These analyses concentrate on the internal structure of relative clauses and account for their attachment in canonical position.

In Section 5.3, I will present the previous HPSG analyses of extraposed relative clauses. These comprise an analysis in terms of Complex Domain Formation (Section 5.3.1), an analysis in terms of a Nonlocal Dependency (Section 5.3.2), and a theory of Generalized Modification (Section 5.3.3). The latter captures both extraposed and non-extraposed relative clauses using the same tools and mechanisms. A final analysis is presented that integrates ideas from both the Nonlocal Dependency theory and the theory of Generalized Modification (Section 5.3.4). It is these latter two approaches that my own theory of relative clause attachment, presented in Chapter 7, is based upon.

5.1 HPSG: Background

In this section, I give a brief introduction to the grammatical framework of Head-Driven Phrase Structure Grammar (HPSG). I point out some properties of HPSG and give an overview of its basic concepts and mechanisms. Rather than defining a complete syntactic fragment, I will focus on aspects that are relevant for the later analysis of relative clauses and relative clause extraposition. The HPSG fragment presented here is a compilation of various proposals made in the HPSG literature. I draw heavily from Sailer (2009) and Levine, Richter, and Sailer (in prep.), which are mostly based on Pollard and Sag (1994), but adopt assumptions from Sag (1997), Ginzburg and Sag (2001), and others.

The theoretical aspects of HPSG have been developed mainly in the three works Pollard and Sag (1987), Pollard and Sag (1994), and Ginzburg and Sag (2001). HPSG was heavily influenced by Generalized Phrase Structure Grammar (GPSG, Gazdar, Klein, Pullum, and Sag (1985)) and integrated ideas from Government and Binding Theory (Chomsky, 1981), Categorial Grammar, Lexical Functional Grammar, and others. It is a constraint-based, surface-oriented, monostratal, and lexical theory of grammatical signs. This precludes, for instance, transformational derivations. Instead, lexical entries and phrasal schemata ("constructions") are seen as constraints on well-formed signs of types word and phrase.

The set of descriptive constraints expressing the theory of an HPSG grammar consists of (a) a lexicon that licenses basic words, (b) lexical rules that license derived words, (c) immediate dominance (ID) schemata that license the constituent structure, (d) linear precedence (LP) statements that constrain the word order,[1] and (e) a set of grammatical principles that express generalizations about linguistic objects (Levine and Meurers, 2006, 238).

Formally, an HPSG grammar consists of two components: the signature and the theory. In the *signature*, the basic ontological assumptions about the language are expressed. It states which kind of objects exist and which properties of which objects are modeled. It consists of a type hierarchy (or sort hierarchy) and appropriateness conditions, defining which features (or attributes) are appropriate for each type as well as what type of value is appropriate for each feature. The *theory* is a set of constraints (the descriptions which make up the theory) that singles out a subset of grammatical objects from all the objects that are compatible with the signature. A linguistic object is admissible with respect to the theory if and only if it satisfies each of the descriptions in the theory (Levine and Meurers, 2006, 243–244).

The HPSG architecture uses typed feature structures to model linguistic objects. Since these models represent objects in the world, they are total (as opposed to partial) with respect to the ontology declared in the signature. In formal terms, the feature structures are *totally well-typed* and *sort-resolved*. Totally well-typed means that all the attributes that are defined for the types in the feature structure are present, and the values of these attributes are of the appropriate types. Sort-resolved means that every type that is used in the feature structure is maximally specific (Pollard and Sag, 1994, 17–18). It should be noted that *type* and *sort* are often used synonymously, as well as *attribute* and *feature*.

To talk about sets of objects, a specific description language and its abbreviating AVM (attribute value matrix) notation is used in an HPSG theory. Descriptions consist of three parts: (i) type descriptions, which single out all objects of a particular type (e.g., *word*), (ii) attribute-value pairs, which describe objects that have a particular property (e.g., [CASE *accusative*]), and (iii) tags (structure sharing), which specify token identity (e.g., $\boxed{1}$). Complex descriptions are obtained through conjunction ($\wedge$), disjunction ($\vee$), negation ($\neg$), and implication ($\Rightarrow$).[2]

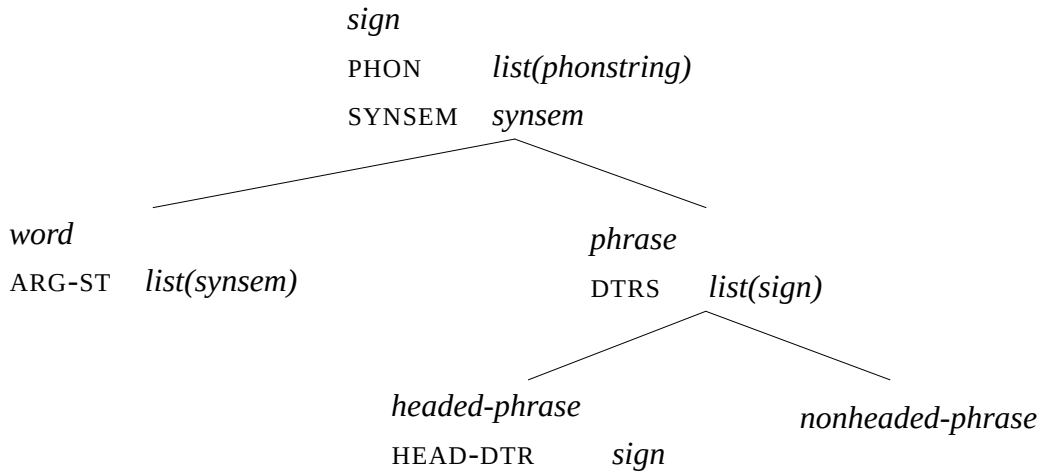
[1] In the fragment that I use, the linear order is implemented within the schemata.

[2] De facto, complex formulae might involve quantification and relations as well; see Richter (2000).

Having specified some basic concepts and formal properties of an HPSG grammar, I will now outline the basics of a particular version of HPSG. HPSG follows the Saussurean tradition in conceiving of linguistic expressions (i.e words and phrases) – or signs – as structured complexes of phonological, syntactic, semantic, discourse, and phrase-structural information. Most current syntactic theories posit two or more levels of representation. In HPSG, all signs at a minimum possess the two attributes PHONOLOGY (PHON), SYNTAX-SEMANTICS (SYNSEM, or SS), and–in the case of phrases–DAUGHTERS (DTRS). PHON and DTRS can be regarded as the rough analogs of the GB levels PF (phonetic form) and S-structure.

All expressions in HPSG are modeled as feature structures of type *sign*, which is divided into the types *word* and *phrase*. Lexical entries are descriptions of (or constraints on) feature structures that belong to the type *word*; immediate dominance schemata (or phrase structure rules, or construction rules) are partial descriptions of feature structures of type *phrase*. These assumptions are collected in the signature. The tree shown in (180) expresses the sort hierarchy (or type hierarchy) and the appropriateness conditions below the sort *sign*.

(180) Sort hierarchy and appropriateness conditions of the sort *sign*:



The value of PHON is a list of phonological representations corresponding to the words that the sign comprises. Since I am not concerned with phonology in this work, I will simply assume an orthographic representation, e.g., for a word like *read*, I consider the PHON value to be a list that contains the string *read*. The value of the attribute SYNSEM are objects of type *synsem* specifying syntactic and semantic information.[3] These objects encapsulate the information that heads select for.

The subtype *word* has the additional feature ARGUMENT-STRUCTURE (ARG-ST), whose value is a list of *synsem* objects.[4] It represents the syntactic arguments selected by a head. They are ordered according to their relative obliqueness, with the subject (the least oblique element) appearing first (leftmost), followed by the primary object, the secondary object, and

[3]Chapter 6 is devoted to the encoding of semantics.

[4]The ARG-ST list replaces the SUBCAT list of Pollard and Sag (1994). See, for example, Manning and Sag (1998, 1999).

other, more oblique complements (in that order, if such exist). Thus, the ARG-ST list plays an important role for the binding theory, which I will come back to in Chapter 8. A principle called Argument Realization Principle (see, e.g., Ginzburg and Sag (2001, 23)) relates the elements of the ARG-ST list to the valence features SUBJECT (SUBJ), SPECIFIER (SPR), and COMPLEMENTS (COMPS). More precisely, the value of ARG-ST is the concatenation of the SUBJ/SPR lists and the COMPS lists.

The second subtype of *sign* is the type *phrase*. Like the type *word*, it inherits the features PHON and SYNSEM from the supertype *sign*. In addition, it has the attribute DAUGHTERS (DTRS), whose value is a list of elements of type *sign*. The type *phrase* is further subdivided into the types *headed-phrase (hd-ph)* and *nonheaded-phrase (non-hd-ph)*. Each of these types will have further subtypes, which I will introduce in due course.

These remarks should suffice to characterize the feature structures, i.e., the objects that exist in the model of an HPSG grammar. I will add further details about types, features, and type constraints as they occur.

Let me illustrate a linguistic object of type *word*. An example of a (partial) lexical description of the verb *read* is shown in (181). The PHON value is given as a list representing the orthographic form of the word. The value of the attribute SYNSEM is an object of type *synsem*, for which two features are defined: LOCAL (LOC) and NONLOCAL (NLOC). The feature NONLOCAL (not shown in (181)) will be explained further down below. The feature LOCAL contains information about the syntactic category and some part of the semantic information. It is the information that is shared between a gap and its filler in unbounded dependency constructions (see below). I will ignore the semantic information for now and turn to it in detail in Chapter 6. The syntactic information is contained in the value of the attribute CATEGORY (CAT). It consists of the features HEAD (HD) and VALENCE (VAL). The HEAD value specifies the part of speech of a sign, which is *verb* here, and any further attributes associated with that part of speech. The type *verb*, for example, has additional attributes to encode the particular inflected form, or whether a verb is an auxiliary. Here, only the latter is shown. Since the verb *read* is not an auxiliary, the value of the feature AUX(ILIARY) is "$-$". Auxiliary verbs will have the value "$+$". The value of HEAD contains the information that is shared between a head daughter and its mother.

The VALENCE feature specifies the combinatory potential of a sign as a list of *synsem* objects (as opposed to *signs*) of the features SUBJ and COMPS. Thus, neither phonological information nor information on the constituent structure of a sign (which we will see is encoded for phrases in the feature DAUGHTERS) can be selected for. The VAL values are identified (structure-shared) with the elements on the ARG-ST list, as indicated by the tags (1, 2). The abbreviation "NP" is short for a syntactically saturated sign that is headed by a noun. For the analysis of NPs, I follow Pollard and Sag (1994) and most of the subsequent HPSG literature in treating the noun as the lexical head of an NP.

(181) Description of the lexical entry of *read*:

$$\begin{bmatrix} \textit{word} \\ \text{PHON} \quad \langle \textit{read} \rangle \\ \text{SYNSEM} \begin{bmatrix} \textit{synsem} \\ \text{LOCAL} \begin{bmatrix} \textit{local} \\ \text{CATEGORY} \begin{bmatrix} \textit{category} \\ \text{HEAD} \begin{bmatrix} \textit{verb} \\ \text{AUX} \ - \end{bmatrix} \\ \text{VALENCE} \begin{bmatrix} \text{SUBJ} \ \langle \boxed{1} \rangle \\ \text{COMPS} \ \langle \boxed{2} \rangle \end{bmatrix} \end{bmatrix} \\ \text{CONTENT} \quad \text{(see Chapter 6)} \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} \quad \langle \boxed{1}\ \text{NP}, \boxed{2}\ \text{NP} \rangle \end{bmatrix}$$

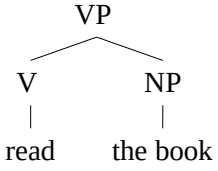
A phrase can be modeled as a typed feature structure just like a word. As indicated in the type hierarchy in (180), each phrase has a DTRS attribute, and each headed phrase additionally has the attribute HEAD-DAUGHTER (HD-DTR), whose value is a sign, and which is used to identify one of the daughters as the head daughter. Although this information can be encoded in terms of feature structures, the DTRS value is often represented in the traditional form of a tree diagram. An example description for the verb phrase *read the book* is given in both AVM notation and tree notation in (182).

(182) Description of the VP *read the book*

a. AVM notation:

$$\begin{bmatrix} \textit{phrase} \\ \text{PHON} \quad \langle \textit{read, the, book} \rangle \\ \text{SYNSEM} \quad \ldots \\ \text{DTRS} \quad \langle \boxed{1}\ \text{V} \left[\text{PHON} \ \langle \textit{read} \rangle \right], \text{NP} \left[\text{PHON} \ \langle \textit{the, book} \rangle \right] \rangle \\ \text{HEAD-DTR} \ \boxed{1} \end{bmatrix}$$

b. Tree diagram:



The verb phrase *read the book* consists of two daughters, the V *read* and the NP *the book*. In the AVM notation in (182), these two elements appear on the DTRS list. The order is identical to the surface order of the constituents of the VP. The first element on the

DTRS list is identified with the HD-DTR value, as indicated by the tag, thereby encoding this daughter as the head in the local tree.[5]

All grammatical principles and generalizations over phrasal structures are expressed as constraints. The most prominent principle is the Head Feature Principle, which ensures that a phrase and its head daughter have the same value for the feature HEAD. It is stated as a constraint on the phrase type *headed-phrase*:

(183) The Head Feature Principle:

$$\textit{headed-phrase} \Rightarrow \begin{bmatrix} \text{SYNSEM|LOCAL|CAT|HEAD } \boxed{1} \\ \text{HEAD-DTR} \left[\text{SYNSEM|LOCAL|CAT|HEAD } \boxed{1}\right] \end{bmatrix}$$

A second general principle ensures that the head daughter is among the overall daughters. Following Sailer (2009, 159), I will call this principle the Head Daughter Principle:

(184) The Head Daughter Principle:

$$\textit{headed-phrase} \Rightarrow \begin{bmatrix} \text{DTRS} & \left\langle \ldots, \boxed{1}, \ldots \right\rangle \\ \text{HEAD-DTR } \boxed{1} & \end{bmatrix}$$

The basic schemata used to combine words into phrases are listed in (185). Following recent developments in HPSG, there is a different subtype of *headed-phrase* for each type of phrasal structure. The basic ones are *head-subject-phrase (hd-subj-ph)*, *head-specifier-phrase (hd-spr-ph)*, *head-complement-phrase (hd-comp-ph)*, and *head-adjunct-phrase (hd-adj-ph)*. I will introduce further types once they become relevant.[6]

(185) a. The Head-Subject Schema:

$$\textit{head-subject-phrase} \Rightarrow \begin{bmatrix} \text{SS|LOC|CAT|VAL} \begin{bmatrix} \text{SUBJ} & \langle\rangle \\ \text{SPR} & \boxed{A} \\ \text{COMPS} & \boxed{B} \end{bmatrix} \\ \text{DTRS} \left\langle \left[\text{SS } \boxed{1}\right], \boxed{2} \right\rangle \\ \text{HD-DTR } \boxed{2} \left[\text{SS|LOC|CAT|VAL} \begin{bmatrix} \text{SUBJ} & \left\langle \boxed{1} \right\rangle \\ \text{SPR} & \boxed{A}\langle\rangle \\ \text{COMPS} & \boxed{B}\langle\rangle \end{bmatrix}\right] \end{bmatrix}$$

[5]This encoding of the daughters is adopted from Ginzburg and Sag (2001).

[6]In my analysis of relative clauses developed in Chapter 7, I will treat a determiner as a functor that selects the noun. NPs will then be analyzed as phrases of type *head-functor-phrase* (Van Eynde, 1998, 2003a,b, 2006) rather than *head-specifier-phrase*.

b. The Head-Specifier Schema:

$$\textit{head-specifier-phrase} \Rightarrow \begin{bmatrix} \text{SS|LOC|CAT|VAL} \begin{bmatrix} \text{SUBJ} & \boxed{A} \\ \text{SPR} & \langle\rangle \\ \text{COMPS} & \boxed{B} \end{bmatrix} \\ \text{DTRS} \left\langle \left[\text{SS } \boxed{1}\right], \boxed{2} \right\rangle \\ \text{HD-DTR } \boxed{2} \begin{bmatrix} \text{SS|LOC|CAT|VAL} \begin{bmatrix} \text{SUBJ} & \boxed{A} \\ \text{SPR} & \left\langle \boxed{1} \right\rangle \\ \text{COMPS} & \boxed{B}\langle\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

c. The Head-Complement Schema:

$$\textit{head-complement-phrase} \Rightarrow \begin{bmatrix} \text{SS|LOC|CAT|VAL} \begin{bmatrix} \text{SUBJ} & \boxed{A} \\ \text{SPR} & \boxed{B} \\ \text{COMPS} & \langle\rangle \end{bmatrix} \\ \text{DTRS} \left\langle \boxed{1}, \left[\text{SS } \boxed{2}\right], \ldots, \left[\text{SS } \boxed{n}\right] \right\rangle \\ \text{HD-DTR } \boxed{1} \begin{bmatrix} \text{SS|LOC|CAT|VAL} \begin{bmatrix} \text{SUBJ} & \boxed{A} \\ \text{SPR} & \boxed{B} \\ \text{COMPS} & \left\langle \boxed{2}, \ldots, \boxed{n} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

d. The Head-Adjunct Schema:

$$\textit{head-adjunct-phrase} \Rightarrow \left(\begin{bmatrix} \text{SS|LOC|CAT|VAL } \boxed{4} \\ \text{DTRS} \left\langle \boxed{1}, \boxed{2}\left[\text{SS|LOC|CAT|HEAD|MOD } \boxed{3}\right] \right\rangle \\ \text{HD-DTR } \boxed{1}\left[\text{SS } \boxed{3}\left[\text{LOC|CAT|VAL } \boxed{4}\right]\right] \end{bmatrix} \right)$$
$$\text{or}$$
$$\left(\begin{bmatrix} \text{SS|LOC|CAT|VAL } \boxed{4} \\ \text{DTRS} \left\langle \boxed{2}\left[\text{SS|LOC|CAT|HEAD|MOD } \boxed{3}\right], \boxed{1} \right\rangle \\ \text{HD-DTR } \boxed{1}\left[\text{SS } \boxed{3}\left[\text{LOC|CAT|VAL } \boxed{4}\right]\right] \end{bmatrix} \right)$$

I refrain from providing examples for these basic phrasal structures, but I have listed the phrasal schemata for the sake of completeness.

I will now briefly explain the treatment of nonlocal dependencies in HPSG, since these play a role in the analysis of relative clauses and relative clause extraposition. Nonlocal (or unbounded) dependencies are grammatical dependencies that may hold over large syntactic distances, for example when valence requirements are fulfilled by elements that appear arbitrarily distant from the selecting head. In transformational grammar, these phenomena are standardly analyzed in terms of *wh*-movement or A-bar movement, i.e., movement to the nonargument position Spec of CP. For English, phenomena such as topicalization, *wh*-questions, and relative clauses, as demonstrated in (186) from Pollard and Sag (1994, 157), fall into the class of unbounded dependency constructions.

(186) a. Kim$_i$, Sandy loves $\__i$. (topicalization)

b. I wonder [who$_i$ Sandy loves $\__i$]. (*wh*-question)

c. This is the politician [who$_i$ Sandy loves $\__i$]. (*wh*-relative clause)

In HPSG, these dependencies are described in terms of a linking relation between the dislocated element, the "filler", and the extraction site, the "gap", which is achieved through structure sharing. The relevant information needed to establish the relation between the gap and the filler is percolated throughout the tree and locally picked up by the filler. To this end, the *synsem* attribute NONLOCAL is used to represent the nonlocal information. Its value is a feature structure of type *nonlocal* with the following internal structure:

(187) Internal structure of NONLOCAL value:

$$\begin{bmatrix} \textit{nonlocal} & & \\ \text{INHERITED} & \begin{bmatrix} \text{SLASH} & \text{(set of } \textit{local} \text{ structures)} \\ \text{REL} & \text{(set of } \textit{ref} \text{ indices)} \\ \text{QUE} & \text{(set of } \textit{npros)} \end{bmatrix} \\ \text{TO-BIND} & \begin{bmatrix} \text{SLASH} & \text{(set of } \textit{local} \text{ structures)} \\ \text{REL} & \text{(set of } \textit{ref} \text{ indices)} \\ \text{QUE} & \text{(set of } \textit{npros)} \end{bmatrix} \end{bmatrix}$$

The attribute INHERITED (INHER) is employed to specify information as nonlocal information and pass it up the tree, and the TO-BIND feature is used to bind off (or cancel) the nonlocal dependency and thus preventing it from percolating further. Each of these features contains the attributes SLASH, REL, and QUE. The latter is used for interrogatives, which I will ignore here. REL is employed to percolate information about relative pronouns. I will say more about this in Section 5.2 below, when I present the structure of relative clauses. The attribute SLASH is used to model long distance dependencies as mentioned above. Its value is a set of elements of type *local*, since all the local information, including category and content, is needed to relate a filler to its gap.

There are several possibilities to introduce the nonlocal information into the SLASH set. Since the choice is not relevant to my analysis of relative clause attachment, I will here simply present the standard treatment in terms of traces, as given in Pollard and Sag (1994, Ch. 4).[7] A trace is a phonologically empty category that is realized in the position of the gap. Its lexical entry is shown in (188):

[7]For a traceless analysis in terms of lexical rules, see Pollard and Sag (1994, Ch. 9.5). Müller (1999) provides a unary dominance schema for the introduction of SLASH values (pp. 106–108) and discusses all three possibilities (Ch. 9.4). See also Bouma, Malouf, and Sag (2001) and Ginzburg and Sag (2001).

(188) Trace as it appears in the lexicon:

$$\begin{bmatrix}\text{PHONOLOGY}\ \langle\rangle \\ \text{SYNSEM}\begin{bmatrix}\text{LOCAL}\ \boxed{1} \\ \text{NONLOCAL}\begin{bmatrix}\text{INHERITED}\begin{bmatrix}\text{SLASH}\ \{\boxed{1}\} \\ \text{REL}\ \{\} \\ \text{QUE}\ \{\}\end{bmatrix} \\ \text{TO-BIND}\begin{bmatrix}\text{SLASH}\ \{\} \\ \text{REL}\ \{\} \\ \text{QUE}\ \{\}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

A trace structure-shares its LOCAL value with the SLASH value. Once it occurs, for example, as a complement of some head, its LOCAL value is also structure-shared with whatever local values are specified for that complement by the head, and hence, these values will appear in the SLASH value set of the trace. Traces can also be subjects and adjuncts.

To account for the percolation of this information up the tree, a principle called the Nonlocal Feature Principle is formulated:

(189) Nonlocal Feature Principle (Pollard and Sag, 1994, 164):

For each nonlocal feature, the INHERITED value on the mother is the union of the INHERITED values on the daughters minus the TO-BIND value on the head daughter.

The local tree realizing the filler is licensed by the head-filler schema. The constraint on the type *head-filler-phrase (hd-fill-ph)*, which is a subtype of *headed-phrase*, is shown in (190):

(190) Constraint on the sort *head-filler-phrase*:

$$\textit{head-filler-phrase} \Rightarrow \begin{bmatrix}\text{SS}\ \left[\text{LOC}|\text{CAT}|\text{VAL}\ \boxed{3}\right] \\ \text{DTRS}\ \left\langle\left[\text{SS}|\text{LOC}\ \boxed{2}\right], \boxed{1}\right\rangle \\ \text{HD-DTR}\ \boxed{1}\begin{bmatrix}\text{SS}\begin{bmatrix}\text{LOC}|\text{CAT}\begin{bmatrix}\text{HEAD}\begin{bmatrix}\textit{verb} \\ \text{VFORM}\ \textit{fin}\end{bmatrix} \\ \text{VAL}\ \boxed{3}\begin{bmatrix}\text{SUBJ}\ \langle\rangle \\ \text{SPR}\ \langle\rangle \\ \text{COMPS}\ \langle\rangle\end{bmatrix}\end{bmatrix} \\ \text{NLOC}\begin{bmatrix}\text{INHER}|\text{SLASH}\ \{\ldots, \boxed{2}, \ldots\} \\ \text{TO-BIND}|\text{SLASH}\ \{\boxed{2}\}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

In effect, a head-filler phrase consists of a finite sentence containing a trace that is unbound within that sentence (this is the head daughter) and a filler whose LOCAL value is also the LOCAL value of the trace (this is the non-head daughter). Moreover, the TO-BIND|SLASH value of the head daughter is identified with the filler's LOCAL value in order to bind off the

nonlocal dependency. Thus, in virtue of the Nonlocal Feature Principle, this SLASH value is not passed up any further.

This concludes the short introduction to HPSG and the basics of the fragment that I assume. I will introduce and present various extensions once they are necessary for the further discussion. In the following section, I will turn to the analysis of relative clauses in HPSG and present two main proposals from the literature.

5.2 Relative Clauses

In HPSG, there exist two main approaches to an analysis of relative clauses. One is based on Pollard and Sag (1994), and the other one is a construction-based analysis developed by Sag (1997). It should be noted that for my analysis of relative clause extraposition that I propose in Chapter 7 below, the internal structure of relative clauses is much less relevant than the external relationship between a relative clause and its antecedent. For this reason, I will only give a brief description of the two analyses here.[8]

5.2.1 Pollard and Sag (1994)

Pollard and Sag (1994, Ch. 5) propose an analysis of the following types of relative clauses:

(191) a. the person who I talked to _ . (nonsubject *wh*-relative)
b. the person who left. (subject *wh*-relative)
c. the person that I talked to _ . (*that* relative)
d. the person that left. (*that* relative)
e. the person I talked to _ . (*that*-less relative)

They introduce a new syntactic category *relative clause* (RP), which is headed by a phonologically empty relative complementizer (= relativizer, which is assigned to the part of speech called *relativizer*). *Wh*-relative clauses in essence consist of two parts, which are connected by the relativizer: a *wh*-phrase containing a relative *wh*-word, and either a sentence that is missing an element (in nonsubject *wh*-relatives) or a finite VP (in subject *wh*-relatives). So, in nonsubject *wh*-relative clauses as in (191a), the relativizer selects these two elements via its SUBCAT list: the first argument corresponds to the *wh*-phrase, and the second argument corresponds to the (finite, unmarked) sentence containing a gap. The INHER|SLASH value of this sentence is identified with the LOCAL value of the first argument, which means that the gap of the sentence is filled by the *wh*-phrase. The relativizer binds off the SLASH dependency of its sentential complement in order to prevent the SLASH value from percolating further. The structure of a relative clause is shown in (192). The empty

[8] In this section and in Section 5.3 below, unless indicated otherwise, all descriptions, principles, and constraints are shown as in the works cited.

relativizer "e" first combines with the sentence containing a gap, *Kim gave a book _*, to form an R′. This R′ then combines with the *wh*-phrase to form the maximal projection RP.

(192) $[_{RP}\ [_{PP}$ to whom$]_i\ [_{R'}$ e $[_S$ Kim gave a book $\__i]]]$

The empty relativizer not only links the *wh*-phrase to the rest of the relative clause, it also establishes the relation of the relative clause to the nominal it modifies, i.e., its antecedent, by selecting it via its MOD feature. In order to account for the agreement between the nominal antecedent and the relative pronoun as well as the semantic composition of the antecedent and the relative clause, the INDEX values of the nominal and the relative pronoun are identified. To this end, a new nonlocal feature REL is employed. The relative word in the *wh*-phrase structure-shares its INDEX value with its INHER|REL value, which is percolated to the maximal projection of the *wh*-phrase (and even further to the maximal projection of the relative clause) in virtue of the Nonlocal Feature Principle.[9] The empty relativizer identifies this REL value with the INDEX value of the nominal antecedent (via its MOD value), thus ensuring that the antecedent and the relative pronoun have the same agreement specifications.[10]

To ensure that the semantic contribution of the antecedent is integrated with the semantic contribution of the relative clause, the relativizer unifies the restriction set of its second argument (the sentence with the gap) with the restriction set of the modified nominal. Furthermore, the INDEX value of the relativizer is identified with the REL value of the relativizer's first argument (i.e., with the index of the relative pronoun). Since the relativizer is the head of the relative clause, it follows that the relative clause has a restricted referential index which is identical to the referential index of the relative pronoun.[11] When the relative clause combines with the nominal it modifies, the resulting phrase is a head-adjunct structure whose semantics is specified by identifying the CONTENT value with the CONTENT value of the relative clause (due to the Semantics Principle). That is, a relative clause functions as a regular adjunct in a head-adjunct structure.

Finally, the relativizer requires the modified nominal to identify its TO-BIND|REL value with the INHER|REL value of the *wh*-phrase in order to prevent the relative dependency from being projected across the N′ resulting from the adjunction of the relative clause to the nominal antecedent.

Subject *wh*-relative clauses as in (191b) are analyzed in a similar fashion. However, rather than filling a gap in the second part of the relative clause, Pollard and Sag assume that

[9]Pollard and Sag (1994, 211–212) postulate language-specific principles which ensure that the INHER|REL value is a singleton set (Singleton REL Constraint) and that a headed constituent may inherit a non-empty INHER|REL value from at most one daughter (Relative Uniqueness Principle). It follows from these principles that English relative clauses cannot contain more than one relative pronoun. This distinguishes English relative clauses from relative clauses in languages like Marathi, but also from English interrogative clauses, which may contain mutliple *wh*-words.

[10]Pollard and Sag (1994, 25) assume that the INDEX value consists of the agreement (ϕ-) features PERSON, NUMBER, and GENDER.

[11]It should be noted that this is important for the analysis of relative clause extraposition proposed by Kiss (2005), which will be discussed in Section 5.3.3 below.

the *wh*-phrase in these cases functions as a subject that is raised from a VP in the second part of the clause. This analysis is achieved by the empty relativizer described above undergoing the Subject Extraction Lexical Rule. In essence, this lexical rule turns the relativizer's sentential complement into a finite VP complement and identifies the (single) SUBCAT value of this VP complement with the relativizer's first argument.[12]

For the sentences in (191c)–(191e), Pollard and Sag assume that only (191c) and (191e) are true non-*wh*-relatives. Relative clauses like (191d) are analyzed analogously to subject *wh*-relatives like (191b). It is assumed that the *that* in these cases is a relative pronoun like a *wh*-relative word, whose CASE value is *nominative*. From the case specification it follows that relative *that* (in contrast to *wh*-relative words like *whom* and *whose*) cannot give rise to illicit pied piping, and that it cannot appear in infinitival relative clauses.

The *that* in (191c) is not a relative pronoun but a complementizer, which is in principle optional, so that (191e) is regarded as the *that*-less variant of (191c). Since these relative clauses do not contain a relative pronoun, Pollard and Sag have to postulate a second phonologically empty relativizer. In contrast to the relativizer described above, this second one takes only one argument, namely the finite sentence containing a gap, which is bound off by the relativizer itself.

Some aspects of the relative clause analysis of Pollard and Sag (1994) are problematic. First, the authors themselves note (p. 216n3) that the lexical entry of the phonologically empty *wh*-relativizer violates the Raising Principle postulated in the same work (p. 140).

Secondly, the analysis does not account for infinitival relative clauses as in (193a), which is not simply a non-finite variant of the finite *wh*-relative clause in (193b). One reason for this is that the *wh*-phrase in the infinitival cases must be a PP, while finite *wh*-relative clauses also allow it to be an NP, as shown in (194). In order to allow for structures like (193a), Pollard and Sag (1994) would have to assume yet a third phonologically empty relativizer. The generalizations holding across the different relative clause types in English would thus have to result from random specifications within three different lexical entries.

(193) a. the baker [in whom to place your trust]
b. the baker [in whom you should place your trust]

(194) a. * the baker [who(m) to place your trust in]
b. the baker [who(m) you should place your trust in]

The fact that the relativizers are phonologically empty categories leads to a third problem. As for example Sag (1997, 433–434, 443) points out, there is no independent linguistic or psychological evidence for the existence of invisible elements. Sag (1997) approaches these problems and shows that within a constraint-based lexicalist framework like HPSG,

[12] I omit further details here. See Pollard and Sag (1994, 218–219) for a precise analysis.

the empty relativizers can be replaced by surface constructions which are organized in a multiple inheritance hierarchy. His analysis is presented in the following section.

5.2.2 Sag (1997)

Sag (1997) develops a construction-based analysis of English relative clauses. In a construction-based grammar, grammatical properties may be directly associated with constructions rather than being projected from lexical or grammatical formatives. Constructions are organized in a multiple inheritance hierarchy, in which individual phrase types inherit constraints from higher types.

Sag classifies phrases simultaneously according to the two dimensions of *clausality* and *headedness*. The latter dimension distinguishes between phrases of type *headed-phrase* and *nonheaded-phrase*, each type exhibiting a variety of subtypes (e.g., *head-subject-phrase (hd-subj-ph), head-complement-phrase (hd-comp-ph), head-filler-phrase (hd-fill-ph), head-adjunct-phrase (hd-adj-ph)*, etc.). The dimension *clausality* distinguishes clauses from non-clauses, with at least the following subtypes of *clause*: *decl(arative)-cl(ause), inter(rogative)-cl(ause), imp(erative)-cl(ause),* and *rel(ative)-cl(ause)*. Each type of phrase is cross-classified and inherits constraints both from a type of clausality and a type of headedness. This makes it possible to capture generalizations among different kinds of phrases and to eliminate phonologically empty complementizers. The functions of the latter are taken over by type constraints formulated for the various clausal subtypes.

In addition to the relative clause types analyzed by Pollard and Sag (1994) and shown above in (191), Sag's (1997) analysis covers the following types:

(195) a. the house [in which] to live _ (infinitival *wh*-relative)

b. [the person (for us) to visit _]; the person to do the job (simple infinitival relative)

c. standing in the doorway; hassled by the police; in the room (reduced relative)

The basic idea of his approach is that relative clauses are assigned a simple structure, headed by the highest verb in the clause rather than an empty relativizer.[13] The verb bears the specification for the feature MOD that relates the relative clause to the nominal it modifies. It thus takes over some of the functions of the null relativizer.

Furthermore, the different types of restrictive relative clauses are treated as individual constructions. For each of these individual constructions Sag introduces a distinct type. Each type is associated with specific constraints that account for the correct syntactic and semantic properties of each construction, thus replacing the empty relativizer.

All of these construction-specific types are subtypes of the type *rel-cl*. It is subject to the (partially language-specific) constraints, shown in (196), that (i) English relative clauses

[13] Sag (1997, 434–435) argues that this assumption is empirically motivated by languages like Korean, where verbs show special morphological forms when they appear as the highest verb in a relative clause.

are not main clauses (expressed as [M(AIN) C(CLAUSE) –]), that (ii) they block auxiliary inversion ([INV –]), that (iii) they modify a nominal constituent, and that (iv) they denote a proposition.[14]

(196) *rel-cl* ⇒
$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{MC} & - \\ \text{INV} & - \\ \text{MOD} & \left[\text{HEAD} \ \textit{noun}\right] \end{bmatrix} \\ \text{CONTENT} & \textit{proposition} \end{bmatrix}$$

These constraints are inherited by eight different specific phrasal types for relative clauses. Sag distinguishes between *wh*-relative clauses and non-*wh*-relative clauses, for which he introduces the types *wh-rel-cl* and *non-wh-rel-cl*, respectively, as immediate subtypes of *rel-cl*. In contrast to Pollard and Sag (1994), he does not make a distinction between *that* as a complementizer (as in (191c)) and *that* as a relative pronoun (as in (191d)), but rather treats all these occurrences of *that* as relative pronouns, similar to *wh*-relative words. This view is based on Hudson (1990, 396) and supported by the fact that *that*-relatives, in contrast to bare relatives, may be coordinated with *wh*-relatives, and that in some dialects relative *that* allows a possessive form (Sag, 1997, 463). Consequently, *that*-relatives are classified as *wh*-relative clauses.

The constraint for the type *wh-rel-cl* is shown in (197). It requires that the non-head daughter of the *wh*-relative clause must have a REL value containing an index that is identical to the index of the relative clause's MOD value. Note that the REL value is introduced by a relative word through structure-sharing the relative word's INDEX value with its REL value, and it may percolate up the tree to the non-head daughter of the relative clause.[15] Since the MOD value will be further identified with the NP that the relative clause modifies, it follows that the latter is coindexed with the *wh*-word inside the non-head daughter.

(197) *wh-rel-cl* ⇒
$$\begin{bmatrix} \text{HEAD} & \left[\text{MOD} \ \text{NP}\boxed{1}\right] \\ \text{NON-HD-DTRS} & \left\langle\left[\text{REL} \ \left\{\boxed{1}\right\}\right]\right\rangle \end{bmatrix}$$

Like Pollard and Sag (1994), Sag (1997) distinguishes between subject *wh*-relative clauses and non-subject *wh*-relative clauses. The former are analyzed as head-subject structures; they are instances of the type *wh-subj-rel-cl*, which is a subtype of both *wh-rel-cl* and *hd-subj-ph*.[16] The latter are analyzed as head-filler structures, which are divided into the

[14] As in Sag (1997), the attribute value matrices shown in this section are simplified in systematically omitting features like SYNSEM, LOCAL etc.

[15] It should be noted that nonlocal feature inheritance is treated differently than in Pollard and Sag (1994). The features INHERIT and TO-BIND are eliminated, and the Nonlocal Feature Principle is replaced by the following mechanisms: words amalgamate the SLASH, REL, and QUE values of their arguments, and the inheritance of these features is governed by two distinct constraints on the phrasal type *hd-nexus-ph*, the SLASH Inheritance Principle and the *Wh*-Inheritance Principle.

[16] More precisely, Sag (1997) introduces a subtype *fin-hd-subj-ph* of *hd-subj-ph*, which is the immediate supertype of *wh-subj-rel-cl*. The constraint associated with this new type requires that the phrase be headed by a finite verb.

two subvarieties finite and infinitival. These are treated in terms of two distinct subtypes of the type *hd-fill-ph*, namely *fin-hd-fill-ph* and *inf-hd-fill-ph*. Finite non-subject *wh*-relative clauses are then treated as instances of the type *fin-wh-fill-rel-cl*, which inherits from the supertypes *wh-rel-cl* and *fin-hd-fill-ph*, while infinitival *wh*-relatives are instances of the type *inf-wh-fill-rel-cl*, which is a subtype of *wh-rel-cl* and *inf-hd-fill-ph*. The multiple inheritance type hierarchy of phrases describing English *wh*-relative constructions is shown in Figure 5.1.[17]

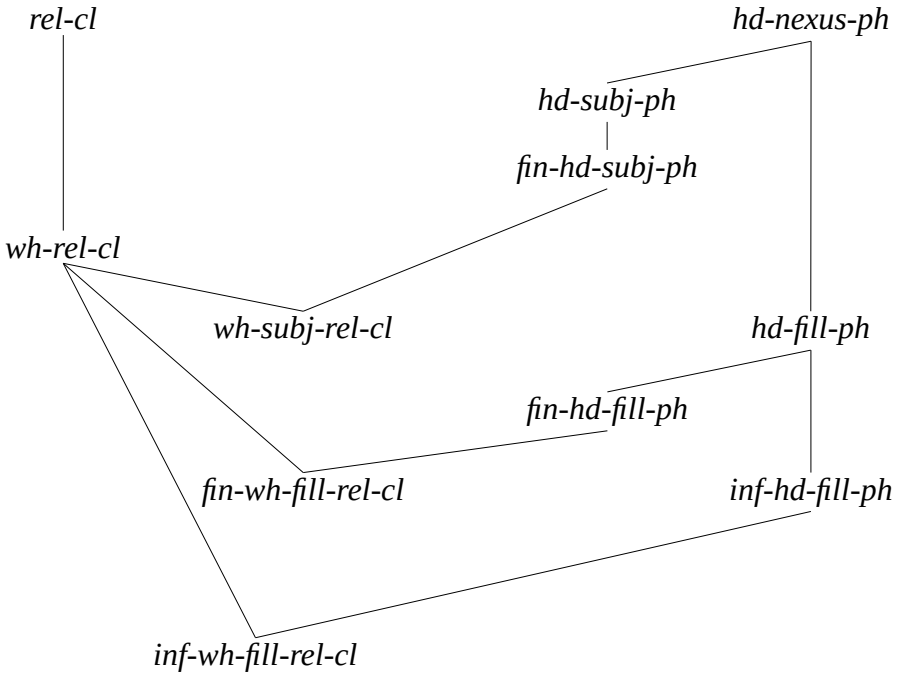


Figure 5.1: Phrasal type hierarchy for *wh*-relative constructions (Sag, 1997, 464)

For non-*wh*-relative clauses, Sag introduces the type *non-wh-rel-cl*, which is restricted by the following constraint:

(198) *non-wh-rel-cl* $\Rightarrow$
$$\begin{bmatrix} \textsc{head} & \left[\textsc{mod}\ \mathrm{N}'\boxed{1}\right] \\ \textsc{slash} & \{\} \\ \textsc{hd-dtr} & \left[\textsc{slash}\ \left\{\mathrm{NP}\boxed{1}\right\}\right] \end{bmatrix}$$

Note that this constraint requires non-*wh*-relative clauses to modify N′ constituents, i.e., nominal projections with a non-empty SPR value, rather than specifier-saturated NP constituents as required for *wh*-relatives.[18] Sag (1997, 465–468) motivates this analysis by pointing out that bare relatives, which are a subtype of non-*wh*-relatives, must precede *wh*-relative clauses when they both appear in the same sentence:

[17]Note that among the headed phrases, Sag draws a distinction between the types *head-adjunct-phrase (hd-adj-ph)* and *head-nexus-phrase (hd-nexus-ph)*, the latter being broken down into the four subtypes *hd-fill-ph*, *hd-comp-ph*, *hd-subj-ph*, and *hd-spr-ph*, in order to account for the different semantic combinatorics in these phrases. The constraint on the type *hd-nexus-ph* identifies the CONTENT value of the phrase with the CONTENT value the head daughter. The constraints on the type *hd-adj-ph* are shown further down below.

[18]Sag (1997, 467) adopts this idea from Weisler (1980).

(199) a. The only person [I like _] [whose kids Dana is willing to put up with _] is Pat.
b. * The only person [whose kids Dana is willing to put up with _] [I like _] is Pat.

This constituent order follows automatically from the assumption that non-*wh*-relatives are adjoined to N′, while *wh*-relatives must adjoin to NP. Further independent support is given by the fact that *wh*-relatives, but not bare relatives, may modify nominal phrases that do not have an obvious internal structure consisting of a specifier and an N′:

(200) a. [Who [who/that you like _]] does Sandy also like?
b. * [Who [you like _]] does Sandy also like?

However, since bare relatives may modify expressions like *someone, everything,* and *nothing,* Sag (1997, 468n39) is forced to treat such expressions as NPs with an internal structure (e.g., *some one*). While this is conceivable for the cases mentioned, it is difficult to see how an expression like *none*, which may also be modified by a bare relative, would be analyzed with an internal structure. In Chapter 7.3.2 (page 181), I will discuss this problem and provide further evidence that challenges Sag's claim that the different relative clause constructions have distinct adjunction sites.

The other constraints in (198) require that the SLASH value of the head daughter be bound off in phrases of type *non-wh-rel-cl*. Since the NP in this SLASH value is coindexed with the MOD value, it follows that the gap inside a non-*wh*-relative clause is referentially linked to the head noun of the modified nominal.

The type *non-wh-rel-cl* has the two subtypes *bare-rel-cl* and *simp-inf-rel-cl*. Bare (or *that*-less) relatives are treated in terms of the former, which also inherits from the type *fin-hd-subj-ph*. Simple infinitival relatives belong to the latter type, which is also a subtype of the type *hd-comp-ph*.

Finally, Sag proposes an analysis of reduced relatives, for which he posits the type *red-rel-cl*, which is a subtype of both *rel-cl* and *hd-comp-ph*. Reduced relatives may adjoin to either NP or N′. The type hierarchy of phrases describing English non-*wh*-relative constructions is shown in Figure 5.2.

For the combination of relative clauses with their antecedents, Sag (1997) has to introduce a distinct type of construction. Relative clauses cannot simply be treated like regular adjuncts in a head-adjunct structure, as in Pollard and Sag's (1994) analysis. The reason for this is that in Sag's analysis, relative clauses are headed by a verb, which has verbal semantics (i.e., propositional content). But to combine a relative clause with a nominal projection, it must have nominal semantics (i.e., a restricted index).[19] To solve this problem, Sag introduces a new type *hd-rel-ph*, which is a subtype of *hd-adj-ph*, and whose constraints account

[19]Recall that in Pollard and Sag's (1994) analysis, the characteristic semantic properties of relative clauses, in particular that they are clauses syntactically but show nominal semantics, follow from the lexical specifications of the empty relativizer.

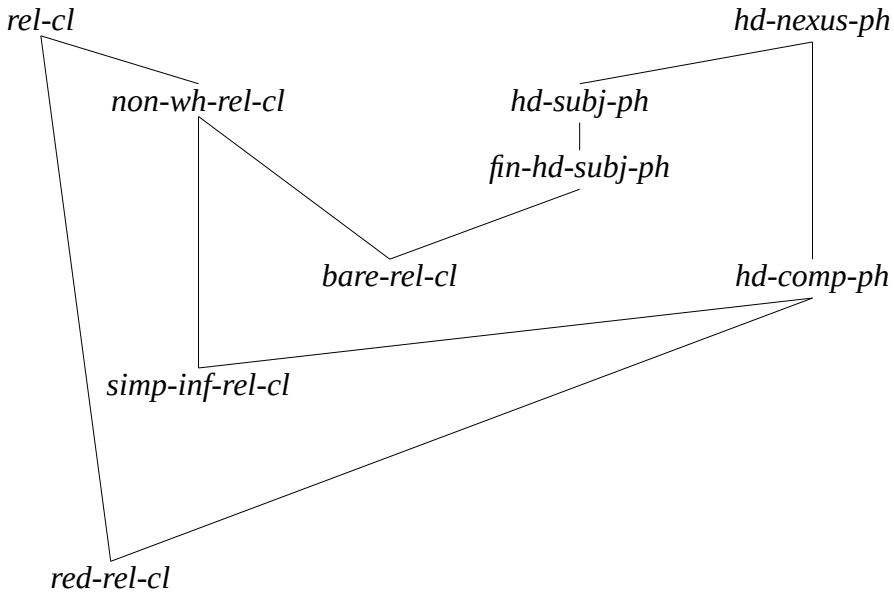


Figure 5.2: Phrasal type hierarchy for non-*wh*-relative constructions (Sag, 1997, 473)

for the correct semantic composition in head-relative phrases. As shown in (201), the constraints of the type *hd-adj-ph* ensure that in all head-adjunct phrases, the MOD value of the non-head daughter is identified with the SYNSEM value of the head daughter. The constraints on *hd-rel-ph*, shown in (202), require that the CONTENT value of a head-relative phrase be a restricted index whose restriction set is constructed by adding the propositional content of the relative clause into the restriction set of the head daughter.[20]

(201) *hd-adj-ph* $\Rightarrow$
$$\begin{bmatrix} \text{HD-DTR} & \left[\text{SYNSEM } \boxed{1}\right] \\ \text{NON-HD-DTRS} & \left\langle \left[\text{HEAD } \left[\text{MOD } \boxed{1}\right]\right] \right\rangle \end{bmatrix}$$

(202) *hd-rel-ph* $\Rightarrow$
$$\begin{bmatrix} \text{HEAD} & \textit{noun} \\ \text{CONT} & \begin{bmatrix} \text{INDEX } \boxed{2} \\ \text{RESTR } \boxed{3} \uplus \left\{\boxed{4}\right\} \end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix} \text{INDEX } \boxed{2} \\ \text{RESTR } \boxed{3} \end{bmatrix} \\ \text{NON-HD-DTRS} & \left\langle \left[\text{CONT } \boxed{4} \textit{proposition}\right] \right\rangle \end{bmatrix}$$

Sag's (1997) approach is criticized by Müller (2007, 196–197) for being in conflict with the basic assumption of HPSG, based on De Saussure (1916), that signs should be pairs of form and meaning. Thus, a relative clause has a specific syntactic structure that corresponds to the specific meaning of a relative clause. In Sag's analysis, however, the meaning of the relative clause corresponds to the meaning of the verb, and the specific meaning of the relative clause is only arrived at when the relative clause combines with the nominal. The same issue is raised by Kiss (2005, 290n13).

[20]The symbol "$\uplus$" is used to designate set union, which is like familiar set union, except that its result is undefined if its set arguments are not disjoint.

A further point of criticism is that by itself, Sag's (1997) analysis does not account for extraposed relative clauses. The constraints on the various relative clause constructions require the relative clauses to adjoin to NP or N′, respectively, and the constraints on *hd-rel-ph* that account for the semantic composition of the meaning of the relative clause and the meaning of the modified nominal require the two to be realized as syntactic sisters. However, an extraposed relative clause is adjoined in a position non-adjacent to its antecedent.

This problem is solved by Kiss (2005). He develops an interesting alternative analysis, the theory of *Generalized Modification*, which allows a relative clause to adjoin to any kind of constituent, not just a nominal projection, as long as the phrase *contains* a noun that can be modified by the relative clause. The head noun itself thus constitutes the minimal domain of adjunction. In contrast to the theories proposed by Pollard and Sag (1994) and Sag (1997), this theory requires only one licensing schema for the adjunction of relative clauses in both canonical and extraposed position. While Kiss makes use of Pollard and Sag's (1994) syntactic analysis of relative clauses, I will show in Chapter 7, where I introduce a further development of Kiss' approach, that the theory of Generalized Modification is also compatible with a construction-based analysis of the internal structure of relative clauses as proposed by Sag (1997).

I will present the theory of Generalized Modification developed by Kiss (2005) in the following section. The section starts with a summary of two further approaches to relative clause extraposition that have been proposed in HPSG, a linearization-based approach and an analysis of extraposition in terms of a nonlocal dependency.

5.3 Relative Clause Extraposition

There are basically three approaches to relative clause extraposition in HPSG.[21] The first one that I will present is the linearization-based approach proposed by Kathol and Pollard (1995), which uses a complex operation to form word order domains. The second approach was developed in parallel by Keller (1994, 1995) and Müller (1999).[22] It treats extraposition as a nonlocal dependency and is based on the analysis of unbounded dependency constructions

[21]The first analysis of relative clause extraposition in HPSG was proposed by Pollard and Sag (1987, 166–168). Within this theory, it was assumed that a head selects the adjuncts by which it is modified via a head feature ADJUNCTS. The elements that appear in the ADJUNCTS set of a verb or of a verb's NP complement (including the subject complement) are realized as syntactic sisters of the complements of the verb. As a consequence, a relative clause associated with an object complement appears within the VP, while a relative clause associated with the subject is outside the VP. The linear order of the sister constituents is determined by linear precedence constraints. However, this analysis of adjuncts was discarded and revised in Pollard and Sag (1994), since it did not make it possible to integrate the semantic contribution of adjuncts in a satisfactory manner. Further counter-evidence is given by the fact that an extraposed relative clause may modify a nominal that is not a direct complement of the verb, but rather embedded within another NP, which is incompatible with Pollard and Sag's (1987) analysis (Müller, 1999, 211). For these reasons, I will not discuss this analysis any further here.

[22]This is stated in Müller (1999, 205).

for movement to the left, e.g., topicalization and *wh*-movement. As will be shown, this approach does not succeed in explaining all the empirical generalizations of the phenomenon. A third, anaphoric approach to relative clause extraposition was developed by Kiss (2003, 2005). His theory of *Generalized Modification* does not rely on movement, or a simulation of movement, of the extraposed relative clause, but rather base-generates the relative clause in its extraposed position, where it is licensed by the principles that establish its semantic interpretation. I will also briefly present an extension of Kiss' theory developed by Crysmann (2013). This analysis synthesizes Kiss' anaphoric approach with the movement approach to account for relative clause extraposition as well as complement clause extraposition. It is able to capture the common properties of the two types of extraposition and can at the same time account for their differences.

5.3.1 Extraposition via Complex Domain Formation

Kathol and Pollard (1995) propose an analysis of extraposition in German adopting the linearization-based theory of word order domains developed by Reape (1993, 1994). Their account is based upon a proposal by Nerbonne (1994).

Word order domains, given as a list value for the feature DOM, determine phrasal word order. They are ordered sequences of constituents, called *domain objects*, whose ordering is achieved via linear precedence constraints. The word order domain of a constituent is defined in terms of its lexical daughters or the word order domains of its phrasal daughters. There are basically two ways to integrate the word order domain of a sign into that of its mother: (i) The domain objects of the sign can give rise to a *single* domain object, which is defined by a relation called *(total) compaction*. The result is an "opaque" domain object, which means that the adjacency relations holding between the elements within the domain object cannot be broken up; the elements must remain adjacent. (ii) The other option is called *domain union*, which in effect allows the domain objects of a sign to appear discontinuously or non-adjacently in the mother's word order domain, as long as the relative order of the daughter's domain objects is preserved. The operation of domain union is defined in terms of the *sequence union* or *shuffle* relation. Stated informally, three lists A, B, and C stand in a shuffle relation iff C contains all and only the elements of the lists A and B, and the relative order of the elements of each of the lists A and B is preserved in C. Consequently, any precedence (but not adjacency) relations between domain elements in one domain will also hold between these elements in all other order domains they are members of.

For their analysis of extraposition, Kathol and Pollard extend the possibilities for domain formation and propose a new relation called *partial compaction*.[23] In effect, this relation allows a designated domain element of the word order domain of a sign to be "liberated"

[23]To be more precise, total compaction and partial compaction are not distinct: the former is a subcase of the latter.

when the domain of the mother is formed, while all the other elements of the sign's domain are compacted into a single domain object. Thus, this designated domain object may appear relatively freely in the mother's domain, subject to the shuffle relation and linear precedence constraints.

Kathol and Pollard tie the extraposibility of an element to its linear properties: an element can only be extraposed if it occurs in final position within the constituent it is dislocated from. The binary-valued feature EXTRA is employed to indicate whether an element is extraposable or not. Thus, a relative clause has the EXTRA value +. A linear precedence statement requires that non-extraposed constituents precede extraposed constituents ([EXTRA –] $\prec$ [EXTRA +]).

The head-complement schema invokes the relation *partial compaction* and an additional constraint that ensures that only elements that are specified as [EXTRA +] are liberated into the higher domain. So, for example, when the verb *füttern* ('feed') in example (203) is combined with the NP *einen Hund der Hunger hat* ('a dog who is hungry'), the relative clause, which is specified as [EXTRA +], may be liberated from the other elements of the word order domain of the NP and is treated as an individual domain object in the domain of the VP. It will be ordered last according to the linear precedence constraint mentioned above. In addition, a further constraint will ensure that extraposition is clause-bounded. The analysis of the example in (203) is shown in Figure 5.3.

(203) einen Hund füttern, der Hunger hat
a dog feed who hunger has
'feed a dog who is hungry'

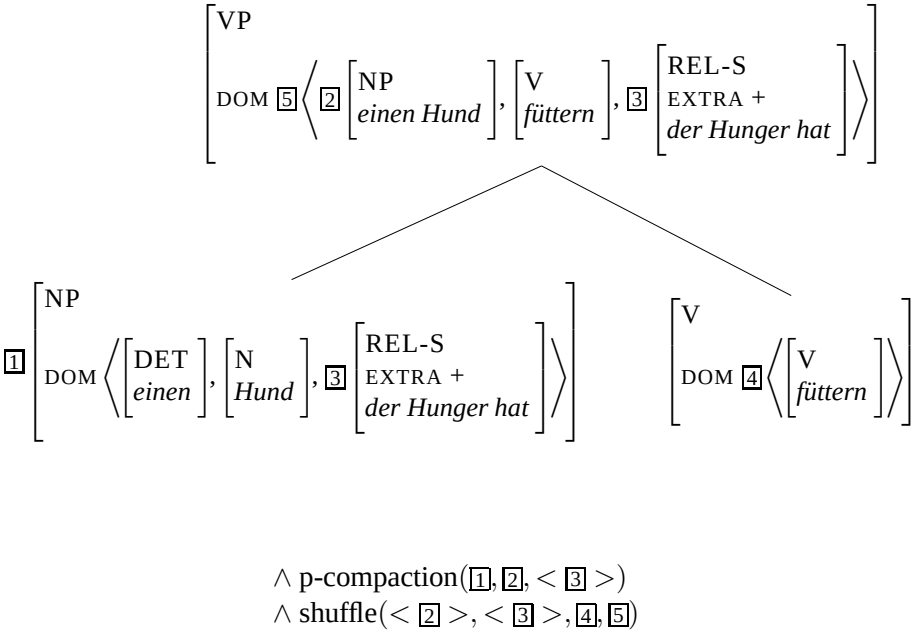


Figure 5.3: Relative clause extraposition via partial compaction, adapted from Kathol and Pollard (1995, 178)

While the theory proposed by Kathol and Pollard can account for the construal of relative clauses extraposed from PPs as well as from NPs embedded within NPs, and may also capture the interaction of extraposition with topicalization and *wh*-movement, it faces problems with respect to some of the other empirical generalizations that I have formulated in Chapter 2. The various interpretive effects noted by Culicover (1981), Culicover and Rochemont (1990), Fox and Nissenbaum (1999), and Guéron (1980), e.g., the scope of logical operators and the Principle C effects, do not follow from a pure linearization-based theory as proposed in Kathol and Pollard (1995).[24] Moreover, we have seen evidence from grammatical operations testing for VP constituency as well as binding and scope that an extraposed relative clause must be in a structurally higher position than its associate NP. However, in the syntactic structure, a relative clause is always locally connected to the nominal it modifies, and extraposition is achieved by altering the linear order of expressions without altering the syntactic structure involved. Therefore, the linearization-based approach cannot syntactically distinguish between extraposed and non-extraposed relative clauses. Finally, it is not clear how the theory would account for the cases with obligatory relative clauses and for relative clauses with split antecedents.

5.3.2 Relative Clause Extraposition as a Nonlocal Dependency

The most prevalent approach to relative clause extraposition is the analysis in terms of a nonlocal dependency developed by Keller (1994) and Müller (1999) for German, with an extension to English in Keller (1995). An adaptation to Dutch is given by Bouma (1996), and a variant for German is proposed by Penka (2000). Rather than summarizing every single analysis proposed and discussing the differences between them, I will present the basic concepts that all of these analyses treating extraposition as a nonlocal dependency have (more or less) in common.

It should be noted that the theories do not provide separate analyses for relative clause extraposition, but subsume both adjunct (including relative clauses and PP adjuncts) and complement extraposition under a general analysis of extraposition, implementing relevant differences where necessary (for example for the introduction of the nonlocal dependencies). In the discussion to follow, I will only present the details relevant to relative clause extraposition and ignore the fact that some (but not all) of the mechanisms introduced also apply to extraposition of the other types of adjuncts and complements.

Since extraposition is different from movement to the left (e.g., it is clause-bounded and may violate island constraints), a new nonlocal feature EXTRA analogous to SLASH is introduced to establish the connection between the extraposed relative clause and its antecedent.[25]

[24] But see Yatabe (2001, 340–341), who proposes a variant of Kathol and Pollard's linearization-based theory incorporating a theory of semantic composition that is claimed to provide an explanation of Guéron's (1980) observation that extraposition may affect semantic scope relations.

[25] Gazdar (1981) develops a GPSG analysis for relative clause extraposition that uses the same SLASH-

The value of EXTRA is a set of elements of type *local*.[26] The EXTRA set of a *sign* contains local information about all extraposed relative clauses whose antecedents are contained within the sign and which have not been bound off yet. The values are percolated in the same way as the other nonlocal values, i.e., by means of the Nonlocal Feature Principle (Pollard and Sag, 1994, 400), which must now comprise the EXTRA feature as well (see Keller (1994, 21) for the new formulation of the principle).

The nonlocal dependency of an extraposed relative clause can be introduced into the EXTRA set by means of a trace, a unary schema, or a lexical rule (Müller, 1999, 228–232, Keller, 1994, 22–31).[27] The trace, which is equivalent to the trace assumed in Pollard and Sag (1994, 164) for movement to the left (see (188) above), is a phonologically empty element that specifies its LOCAL value in its EXTRA set (see Müller (1999, 229) for a lexical specification). However, the use of traces has been criticized in recent work in HPSG, and attempts are made to avoid invisible elements (see Pollard and Sag (1994, Ch. 9), Sag and Fodor (1994), Sag (1997), among others). For further problems concerning the use of traces to introduce nonlocal information in adjunct extraposition, see Keller (1994, 30–31).

Alternatively, one can use a unary schema that introduces the required information into the EXTRA set. Müller (1999, 229–230) provides an example of such a schema for complement extraposition. A second schema would be required for relative clause (adjunct) extraposition.

Finally, a lexical rule can be used that introduces the nonlocal dependency of an extraposed relative clause into the NONLOCAL|INHERITED|EXTRA set of a noun. Such a rule is shown in (204) from Keller (1994, 23).[28] The extraposed relative clause selects the modified noun by identifying its MOD|LOC value with the SYNSEM|LOC value of the noun. Note how the semantic contribution of the extraposed relative clause is incorporated into this lexical rule. The CONTENT value of the output of the lexical rule is structure-shared with the CONTENT value of the extraposed element (3). An (extraposed) relative clause forms its CONTENT as described in Pollard and Sag (1994, Ch. 5): via its MOD value, it has access to the LOCAL|CONTENT value of the modified nominal; it identifies its INDEX value with that of the modified noun and unifies its set of restrictions with the set of restrictions of the modified nominal. Thus, the semantics of the output of the lexical rule corresponds to the semantics of the extraposed relative clause. This CONTENT value is then passed up to the mother in accordance with the Semantics Principle (Pollard and Sag, 1994, 56). Note that

mechanism as employed for movement to the left.

[26] Müller (1999, 225n82) uses lists instead of sets as values of the EXTRA feature. Bouma (1996) assumes that elements of the EXTRA set are of type *synsem* to account for the interaction of extraposition and fronting in Dutch; see Müller (1999, 237) for discussion.

[27] An alternative, which dispenses with traces and lexical rules, is proposed by Penka (2000) for extraposition in German. This constraint-based, head-driven analysis is based on and analogous to the traceless unified analysis of complement and adjunct extraction developed by Bouma et al. (2001). I will not provide the details here but refer the reader to the work cited.

[28] Keller (1995) provides a generalized version of this rule that also introduces PP adjuncts as nonlocal dependencies.

in order to allow for multiple extraposed relative clauses, the Relative Clause Extraposition Lexical Rule is a recursive lexical rule, which is rather unusual in standard HPSG.[29]

(204) Relative Clause Extraposition Lexical Rule (Keller, 1994, 23):[30]

$$\left[\text{SYNSEM}\left[\begin{array}{l}\text{LOC}\,\boxed{2}\,|\,\text{CAT}\,|\,\text{HEAD}\quad \textit{noun}\\ \text{NLOC}\,|\,\text{INHER}\,|\,\text{EXTRA}\;\boxed{1}\end{array}\right]\right] \;\Rightarrow$$

$$\left[\text{SYNSEM}\left[\begin{array}{l}\text{LOC}\,|\,\text{CONT}\;\boxed{3}\\ \text{NLOC}\,|\,\text{INHER}\,|\,\text{EXTRA}\;\boxed{1}\cup\left\{\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HEAD}\quad \textit{relativizer}\left[\text{MOD}\,|\,\text{LOC}\;\boxed{2}\right]\\ \text{SUBCAT}\;\langle\rangle\end{array}\right]\\ \text{CONT}\;\boxed{3}\end{array}\right]\right\}\end{array}\right]\right]$$

The attachment of a relative clause in extraposed position is licensed by a new schema, which is similar to the head-filler schema and binds off the nonlocal dependency in the EXTRA set. The schemata formulated in the different analyses mentioned above differ in some relevant details. Since most of the analyses are developed to capture generalizations of relative clause extraposition in German, which differ from the generalizations in English in relevant aspects, I will not provide the details here. For exemplification, I present the head-extra schema proposed by Keller (1995), whose analysis accounts for English as well as for German:[31]

(205) Head-Extra Schema (Keller, 1995, 4):

$$\left[\begin{array}{l}\text{SYNSEM}\left[\begin{array}{l}\text{LOC}\,|\,\text{PER}\;\textit{extra}\\ \text{NLOC}\,|\,\text{INHER}\,|\,\text{EXTRA}\;\{\}\end{array}\right]\\ \text{DTRS}\left[\begin{array}{l}\text{H-DTR}\,|\,\text{SYNSEM}\left[\begin{array}{l}\text{LOC}\,|\,\text{PER}\;\textit{right}\\ \text{NLOC}\left[\begin{array}{l}\text{INHER}\,|\,\text{EXTRA}\;\text{loc}(\boxed{1})\\ \text{TO-BIND}\,|\,\text{EXTRA}\;\text{loc}(\boxed{1})\end{array}\right]\end{array}\right]\\ \text{EXTRA-DTRS}\;\boxed{1}\end{array}\right]\end{array}\right]$$

Keller introduces this new immediate dominance schema to build *head-extra-structures*, which bear the feature EXTRA-DTRS. The INHER|EXTRA value of the head daughter is

[29] It should be pointed out that Keller (1994) tries to subsume both complement and adjunct extraposition under a general analysis of extraposition. While the lexical rule in (204) can be easily amended to account for extraposition of PP adjuncts as well, as shown in Keller (1995), a separate lexical rule would be needed for complement extraposition. To avoid the postulation of several lexical rules, Keller (1994, 24–28) also proposes an alternative that makes it possible to introduce the nonlocal dependencies for both adjunct and complement extraposition in terms of a single lexical rule. This analysis presupposes that adjuncts appear in COMPS lists, to which they are added by a lexical rule as proposed by Van Noord and Bouma (1994). Keller then formulates a lexical rule that removes an element from the COMPS list and introduces it into the EXTRA set. Cf. Bouma (1996) for a variant and discussion of this proposal.

[30] The lexical rule in (204) is taken directly from Keller (1994). In my own proposal, I use the symbol "$\mapsto$" between the input and the output description of a lexical rule. I use the symbol "$\Rightarrow$" for implicational constraints, following, for example, Ginzburg and Sag (2001).

[31] Recall that Keller's analysis accounts for both adjunct extraposition, including PP adjuncts, and complement extraposition. The head-extra schema applies to all of these cases.

bound off by identification with the local features of the extraposed relative clause(s) and by introducing it as TO-BIND|EXTRA of the head daughter.[32] In accordance with the Nonlocal Feature Principle, this prevents the EXTRA feature from continuing to be passed up the tree and hence being bound again higher in the tree. Note that the value of EXTRA-DTRS is a non-empty list of *sign*. Since the mother is specified as [INHER|EXTRA { }], all elements of EXTRA have to be bound at the same level; hence, extraposed relative clauses originating from the same nominal are realized as syntactic sisters.

Instead of assuming a fixed landing site for extraposed constituents, Keller proposes that an extraposed relative clause is attached to a phrase that introduces material that intervenes between the extraposed element and its antecedent.[33] This is to explain the interaction between extraposition and fronting and to prevent spurious ambiguities. In order to account for this, Keller employs the notion of periphery, for which he introduces the feature PERIPHERY (PER), located under LOCAL. A phrase with a non-empty INHER|EXTRA set is marked [PER *left*] if there is no material that could intervene between the extraposed element and its antecedent. Additionally, for English, all lexical entries are assumed to be marked [PER *left*]. Extraposed relative clauses can only be attached to phrases that are marked [PER *right*]. For that reason, the head daughter in the head-extra schema is specified as [PER *right*].[34]

To account for the upward-boundedness of relative clause extraposition, Keller (1995, 6) proposes that a sentence be specified as [INHER|EXTRA { }].

Analyzing relative clause extraposition as a nonlocal dependency is not without problems. Although a relative clause is not actually moved to its extraposed position, it is related to its antecedent (or its canonical position) through structure sharing which, in effect, is a simulation of movement. For this reason, this analysis has the same difficulties as the rightward movement theories formulated within Government and Binding Theory that I have reviewed in Chapter 4.1.

First of all, it cannot account for relative clauses with split antecedents. No matter whether the nonlocal dependency is introduced by a trace, a unary schema, or a lexical rule, it is always introduced by the modified noun (in the case of a trace, the trace must be combined with the modified noun) whose LOCAL value is identified by the element introduced into

[32] In (205), loc(x) is "a function which takes as x a list of *sign* and returns a set of *loc* containing the LOC values of the elements of x" (Keller, 1995, 4n8).

[33] This is reminiscent of the locality constraints formulated as generalizations by Akmajian (1975, 119), Asakawa (1979, 505), Baltin (2006, 241), and others, which state that an extraposed element is adjoined to the first maximal projection that dominates its antecedent. See the discussion of locality constraints on extraposition in Section 2.2.1. Keller's analysis was inspired by a similar locality constraint proposed by Wiltschko (1994).

[34] The mother of the head-extra schema is specified as [PER *extra*] in order to prevent adjuncts from being adjoined higher than extraposed relative clauses, as in (i):

(i) *An entirely new band rings today, [$_{RC}$ several of whom are members of the congregation] at Great Torrington.

Adjuncts are specified as [MOD|LOC|PER *non-extra*], so that they cannot be adjoined on top of a head-extra structure.

the EXTRA set (via the MOD feature). The LOCAL value of this element is structure-shared with the LOCAL value of the extraposed relative clause. In the case of a relative clause with two (split) antecedents, it is not clear how the nonlocal dependency would be introduced, since neither of the two singular nominals can introduce a nonlocal dependency that can be structure-shared with a relative clause that requires a plural antecedent.

Furthermore, since the semantic contribution of the relative clause is incorporated into the lexical rule (or the unary schema or the trace) that introduces the nonlocal dependency, an extraposed relative clause receives the same "low" interpretation as its in-situ equivalent. But we have seen evidence from binding and scope that extraposed relative clauses must be interpreted differently from in-situ relative clauses. These interpretive effects cannot be captured by this analysis.

Since the noun introduces the nonlocal dependency, it is not clear how to account for determiners with obligatory relative clauses.

Finally, Kiss (2005, 318) criticizes the theory for neglecting the fact that modifier extraposition is completely different from complement extraposition, for example with respect to island constraints. Since the same feature EXTRA is employed to account for both of these processes, it is unclear how to capture their different behavior.[35]

Kiss proposes an alternative theory of relative clause extraposition which does not rely on movement. I will present his theory in the following section.

5.3.3 Generalized Modification

Kiss (2003, 2005) develops an analysis that base-generates the relative clause in its extraposed position. In extraposed position, the relative clause is licensed by an interaction of the same syntactic and semantic constraints which, most notably, also license a non-extraposed relative clause. Central to the analysis is the question of how an (extraposed) relative clause is semantically interpreted. Since my own theory of relative clause extraposition, which I will present in Chapter 7 below, is based on the theory proposed by Kiss, I will illustrate this approach in some detail.

In Section 5.3.3.1, I will first explain how the semantic interpretation of relative clauses is generally achieved within the framework of *Minimal Recursion Semantics* (MRS) (Copestake, Flickinger, Pollard, and Sag, 2005), which is employed by Kiss. Then, I will explain the tools and mechanisms developed by Kiss in order to license relative clauses in extraposed position. I will summarize the main proposal, which is given in his 2005 article for German, and also present the extensions to English and to topicalization and *wh*-constructions provided in his 2003 article. I conclude the section by pointing out some of the advantages of this theory. In Section 5.3.3.2, I will point out some problems.

[35] Crysmann (2013) provides a clever solution to this problem. See section 5.3.4 below.

5.3.3.1 The Theory

As a starting point, Kiss takes the observation that relative clause extraposition–in contrast to complement clause extraposition–may violate various constraints for movement to the left (island constraints), i.e., relative clauses may be extraposed out of syntactic configurations that are standardly assumed to be islands for movement to the left.[36] He claims that while the link between an extraposed complement clause and its antecedent is syntactic in nature, guided by subcategorization requirements of the antecedent, the link between an extraposed relative clause and its antecedent is semantic. The extraposed relative clause must be linked to its antecedent because it receives an interpretation as if it were adjacent to its antecedent. In consequence of these observations, Kiss proposes a semantic analysis of relative clause extraposition, suggesting that modifier extraposition is governed by principles of interpretation. Following a proposal by Wittenburg (1987), he regards the relation between an extraposed relative clause and its antecedent as anaphoric.[37]

When a noun is modified by a restrictive relative clause, whether in situ or extraposed, the resulting logical form can be described as follows: Since restrictive relative clauses are intersective modifiers, the meaning of the relative clause is conjoined with the meaning of the modified noun. The resulting predicate lies within the restrictor of the quantifier expressed by the determiner that combines with the modified nominal.

Kiss employs the framework of *Minimal Recursion Semantics* for the semantic analysis. In MRS, intersective modification is brought about by identifying both the *index* and the *local top handle* of the modifier and the modified phrase. Kiss assumes that the index of a relative clause is identical to the index of the relative pronoun, which is an immediate consequence of the internal analysis of relative clauses that Kiss essentially adopts from Pollard and Sag (1994) (see below).

An *index* corresponds to a distinguished normal variable (Copestake et al., 2005, 305). Kiss adopts the analysis of indices of Pollard and Sag (1994, 24–26), who consider indices to play a role analogous to that of NP indices in GB theory. An index of a referential noun is anchored to an entity in a given context. It is constrained by relations (conditions) that are imposed on it and which the entity has to satisfy in order for the expression to be applicable to it. Thus, when the index of a relative pronoun is identified with the index of a nominal, the conditions imposed on the index of the relative pronoun are added to the conditions already imposed on the antecedent's index. That is, the content of the relative clause is combined

[36] Kiss primarily investigates data from German, where relative clauses seem to be able to be extraposed more freely than in English. For instance, relative clauses can be extraposed fairly easily from NPs embedded within larger NPs; see Chapter 2.1.1 as well as Müller (1999, 211, 2004, 10) and Strunk and Snider (2013) for some examples. The same seems to be true for Dutch as well; see the discussion in Koster (2000) and Koster (1978b, 48–57). Moreover, we have seen evidence in Chapter 2.1.1 that relative clause extraposition from NPs within NPs in English is accepted by some speakers, too.

[37] Wittenburg (1987) proposes a DRT (Discourse Representation Theory) analysis of base-generated extraposed relative clauses. However, the analysis does not seem to account for quantified antecedent NPs and for antecedents which are embedded within PPs or NPs. For further criticism, see Kiss (2005, 319–321).

with the content of the nominal, which results in an intersective interpretation.

Furthermore, Kiss follows Pollard and Sag (1994, 25) in assuming that indices are composed of the agreement features PERSON, NUMBER, and GENDER (the ϕ-features). Hence, when the indices of the relative pronoun and its antecedent are identified, the necessary requirement that they have the same agreement specifications is satisfied.

In MRS, the basic units of a semantic representation consist of elementary predications (EPs), which are single relations with their associated arguments. For instance, an elementary predication corresponding to a common noun consists of the noun's relation name and a single variable for the noun's referent. An elementary predication corresponding to a generalized quantifier has three argument slots: one argument slot that is filled by the variable bound the quantifier and two scopal argument slots corresponding to the quantifier's restriction and scope.

Each EP has a *handle*, or label. Handles are used to reify scopal relationships/semantic subordination, i.e., to relate scope-taking functors to their arguments. If the handle of some elementary predication EP_1 is connected to an argument slot of another elementary predication EP_2, this indicates that EP_1 is a semantic argument of EP_2. For example, when a noun is combined with a determiner, the handle of the EP provided by the noun is identified with the quantifier's argument slot corresponding to the quantifier's restriction. This ensures that the noun falls in the restriction of the quantifier. An additional attribute called *local top* (*ltop*) is introduced, which is the handle or label of the relation that has the widest scope within a constituent. In other words, the local top handle is that handle that has not been connected to a scopal argument slot at the current stage of syntactic combination.

In the case of intersective modification, the local top handles of the conjoined elementary predications are identified. This means that they are on the same level of semantic subordination. For illustration, the semantic representation of the phrase *every old man* is shown below:[38]

(206) { h0: every(BV: x, RESTR: h1, SCOPE: h2), h1: old(x), h1: man(x) }

The elementary predications of the expressions are grouped in a bag, which is similar to a set except that it allows for repeated elements. The order of the elements within the bag is not semantically significant. The EPs of *man* and *old* have the same handle, h1, indicating intersective modification. This handle is identified with the handle in the restriction slot of the quantifier. This ensures that the meanings of both *man* and *old* lie within the quantifier's restrictor. Restrictive relative clauses are intersective modifiers and thus behave like *old* above.

To sum up, when the index and the local top handle of a relative clause are identified with the index and the ltop of the antecedent nominal, (i) the semantic contribution of the

[38]The representation of the quantifier is sometimes given in a simplified version, where the names of the argument slots are omitted: h0:every(x, h1, h2).

relative clause is added to the semantic contribution of the nominal, (ii) the pronoun and its antecedent have the same morphosyntactic agreement specifications, and (iii) the relative clause is correctly embedded in the semantic subordination structure of the sentence, in particular, it contributes a restriction to the quantifier expressed by the determiner of the modified nominal. Hence, the relative clause is correctly interpreted within the overall structure of the sentence as an intersective modifier of the modified nominal.

The question now is: how is the logical form as described above correctly arrived at in cases where the relative clause appears in extraposed position, i.e., not adjacent to the nominal it modifies? We have just seen that all we need in MRS-terms to establish the correct semantic interpretation and subordination of a relative clause is the index and the local top handle of the nominal it modifies. There is a problem, however, since it is a general assumption in HPSG that constraints can only be imposed on local structures. That is, when a relative clause is attached in extraposed position, it can only impose conditions on its syntactic sister, but it does not as such have access to the index and handle of its antecedent when the latter is embedded inside the syntactic sister.

Kiss proposes an elegant solution to this problem: he develops tools and mechanisms that allow the required information (i.e., the noun's index and local top handle) to climb up the tree and thus become accessible to the relative clause even in positions higher up in the syntactic structure. For this purpose, he makes use of HPSG's mechanisms of nonlocal feature inheritance. He introduces a new nonlocal feature ANCHORS that contains the needed information and formulates principles that make sure that this information is passed up the tree to the place where it is needed. More specifically, the value of the feature ANCHORS is a set of index/handle pairs. Such pairs of index and handle, which Kiss refers to as *anchors*, take the form of a tuple, $< \boxed{\text{i}}, hn >$, where $\boxed{\text{i}}$ is an index and hn is the handle corresponding to that index.[39] Every noun that is modifiable by a restrictive relative clause contains as its ANCHORS value a singleton set with such an anchor consisting of the noun's index and handle. These anchors are projected up the tree in the standard way of nonlocal feature inheritance employed in HPSG (Pollard and Sag, 1994). Kiss (2005, 310) formulates the *Anchors Projection Principle* as shown in (207), which requires that the ANCHORS value of a phrase be the collection of the ANCHORS values of all its immediate daughters. Hence, anchors are projected almost freely through the syntactic tree structure.[40]

(207) Anchors Projection Principle (preliminary):

The *anchors set* of a headed phrase consists of the union of the anchors sets of the daughters.

[39] In the style of Kiss (2005), I represent indices here as letters in square boxes. To indicate certain readings in example sentences, I stick to the more familiar notation of using subscripts *i, j* etc.

[40] However, to account for the clause-boundedness of relative clause extraposition, the Anchors Projection Principle will be revised and further constraints will be introduced to the effect that anchors are canceled at clause boundaries. See further down below.

With this machinery, the index and the handle of a noun are now available at every phrasal node that dominates the noun. That means that a relative clause can attach to any such constituent and has local access to its antecedent's index and handle–all the information required for the semantic licensing of the relative clause–even if the antecedent is deeply embedded within the constituent.[41]

The next question is how the attachment of the extraposed relative clause to such a constituent is licensed. Syntactically, Kiss proposes to treat relative clause (modifier) extraposition as ordinary adjunction, but it must be subject to the following (informal) semantic condition:

(208) Generalized Modification (Kiss, 2005, 288):
The index of a modifying phrase has to be identified with a suitable index contained in the phrase to which the modifier is adjoined.

Or in other words, the realization of an extraposed relative clause is subject to the following principle:

(209) Generalized Modification (Kiss, 2005, 301):
A relative clause can be realized in a syntactic position which allows access to a suitable antecedent of the relative pronoun.

Ordinary adjunction in HPSG is licensed by the head-modifier schema (cf. Pollard and Sag, 1994, 56). The head-modifier schema licenses phrases that consist of a head daughter and an adjunct daughter. The adjunct daughter selects the head daughter, i.e., the element it modifies, and imposes restrictions on it via its MOD attribute. In the analysis of relative clauses of Pollard and Sag (1994, Ch. 5) (see Section 5.2.1 above), the MOD value of the relative clause is specified to select a nominal projection (more precisely an N′) whose index must be identified with the relative pronoun's index. Obviously, given these specifications, the head-modifier rule can only license the in-situ adjunction of the relative clause to the nominal it modifies. The relative clause cannot be adjoined in extraposed position, for example to VP. Kiss fixes this "problem" as follows.

In essence, he adopts the internal structure of relative clauses proposed by Pollard and Sag (1994). But in order to be able to use the same head-modifier schema to license the adjunction of relative clauses in situ as well as in extraposed position, Kiss proposes that the syntactic requirement of the relative clause's MOD value should be relaxed so that the relative clause is allowed to adjoin to a constituent of any type of syntactic category, whether nominal

[41] Note that a similar idea had been proposed earlier by Egg and Lebeth (1995), also using the techniques of MRS, to represent underspecification of the attachment site of intersective modifiers like temporal localizers as in: *Sollen wir im März noch einen Termin ausmachen?* ('Should we schedule a meeting in March?').

or non-nominal.[42] In addition, the constraint on index identification must be amended.[43]

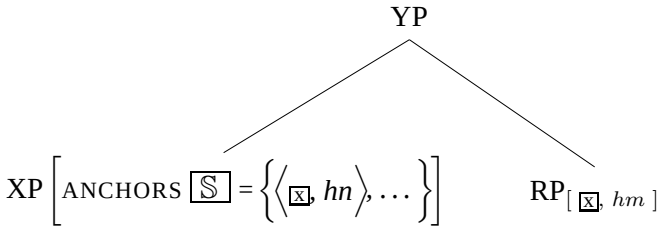
Thus, he eliminates the syntactic (categorial) restriction on relative clause adjunction and instead proposes that a relative clause–extraposed or in situ–is licensed by semantic conditions: A relative clause may be adjoined to any constituent that allows access to the antecedent of the relative pronoun. This "access" is provided via the anchor. More specifically, the relative clause may be adjoined to any constituent that contains an anchor whose index can be identified with the index of the relative pronoun. This incorporates the requirement that the index of the relative pronoun has the same ϕ-features as the anchor's index. Moreover, the handles of the anchor and the relative clause must be identified. Since the anchor's index and handle are identical to the index and handle of the nominal that introduced the anchor, it is thus ensured that the meaning of the relative clause can be correctly combined with the meaning of its nominal antecedent, in the way described above. Formally, the semantic identification requirement for relative clauses is stated as follows (Kiss, 2005, 310):

(210) $\text{RP}_{[\boxed{x},hn]}$ [MOD|ANCHORS $\boxed{\mathbb{S}}$ & $< \boxed{x}, hn > \in \boxed{\mathbb{S}}$]

This constraint is part of the lexical entry of the empty relativizer R^0 functioning as the head of the relative clause according to the analysis of Pollard and Sag (1994). It says that a relative clause which has the index $\boxed{x}$ and the handle hn modifies a phrase whose ANCHORS value is the set $\boxed{\mathbb{S}}$. This set must contain at least one anchor (index/handle pair) that can be identified with the index and the handle of the relative clause $([\boxed{x}, hn])$.

Kiss calls this kind of modification *Generalized Modification*, since the modifier (i.e., the relative clause) selects the modified phrase without having to be adjacent to it. Schematically, this is described as follows (Kiss, 2005, 312; slightly adapted):

(211) *Generalized Modification*



An illustration of Kiss' analysis of relative clause extraposition is shown in Figure 5.4 for the sentence *Pat saw some man yesterday who was dancing*.[44] The noun *man* introduces the anchor $< \boxed{i}, h1 >$, which is percolated up the tree due to the Anchors Projection Principle.

[42] See Kiss (2005, Section 2.2) for an empirical motivation of an adjunction of relative clauses to phrases other than NPs.

[43] For further minor differences between the analyses of Pollard and Sag (1994) and Kiss (2005), see Kiss (2005, 290n14).

[44] For simplicity, I have ignored irrelevant details, among others, the semantic contribution of the adverb *yesterday*, the semantic representation of the name *Pat*, the event variable introduced by the verbs, tense and aspect, etc.

The relative clause may be adjoined to the VP since the ANCHORS set of the VP contains the noun's anchor, and the INDEX and LTOP values of the relative clause can be locally identified with the corresponding elements of the anchor. I have also indicated the bag of elementary predications for each node. We can see that via the anchor, the index and the local top handle of the relative clause are locally identified with those of *man*. Consequently, the relative clause is correctly interpreted within the sentence as an intersective modifier of the noun *man*: (i) the semantic conditions imposed on the index of the relative pronoun are added to the conditions already imposed on the index of *man*; (ii) due to the handle identification, the meaning of the relative clause is correctly embedded in the semantic subordination structure, i.e., it falls in the restrictor of the quantifier expressed by *some*; (iii) through the index identification, it is furthermore ensured that the relative pronoun and its antecedent *man* have the same ϕ-features.

The condition in (210) requires that a relative clause can only be adjoined to a phrase that contains a suitable anchor in its ANCHORS set. Thus, given the way the anchor percolation is designed, this phrase must contain (i.e., dominate) the element that introduces the anchor, i.e., the relative clause's antecedent. In effect, this predicts that an extraposed relative clause occurs in a position that is syntactically superior to the position of its antecedent. Kiss (2005) provides convincing evidence that confirms this prediction for German, see in particular Section 3.2 of his article. For English, we have already seen in Chapter 2 that there is strong and converging evidence from grammatical operations applying to the VP (VP-preposing, *wh*-clefts, VP-deletion) as well as from binding and scope that extraposed relative clauses occur in positions that are structurally higher than their antecedent NP. Thus, Kiss' theory elegantly captures this structural empirical generalization.[45]

To account for the upward boundedness of relative clause extraposition (the Right Roof Constraint (Ross, 1967/1986)), Kiss postulates that the percolation of anchors is canceled at sentence boundaries so that the anchors are not passed up any further in the tree structure. This way, they do not become available and cannot be picked up by a relative clause outside the clause in which the anchors originate. Kiss uses the same mechanism as employed in Pollard and Sag (1994) to bind off nonlocal dependencies, as for example in head-filler constructions. Thus, he incorporates TO-BIND specifications into the schemata that license clauses, and the ANCHORS values of the daughters are identified with the TO-BIND|ANCHORS value of the head daughter. In combination with the reformulation of the Anchors Projection Principle shown in (212) (which is similar to the Nonlocal Feature Principle of Pollard and Sag (1994, 164)), this guarantees that anchors are not projected across a clause boundary.

[45]I have to point out here that in the extension of his analysis to English and to topicalization and *wh*-movement constructions (Kiss, 2003), Kiss assumes that in certain cases an extraposed relative clause may be attached to a phrase that crucially does not contain the antecedent, but only the lexical head that selects the antecedent as its specifier. In these cases, the extraposed relative clause is not in a structurally higher position than its antecedent. I will explicate this proposal below. It faces some problems, however, as I will show in Section 5.3.3.2.

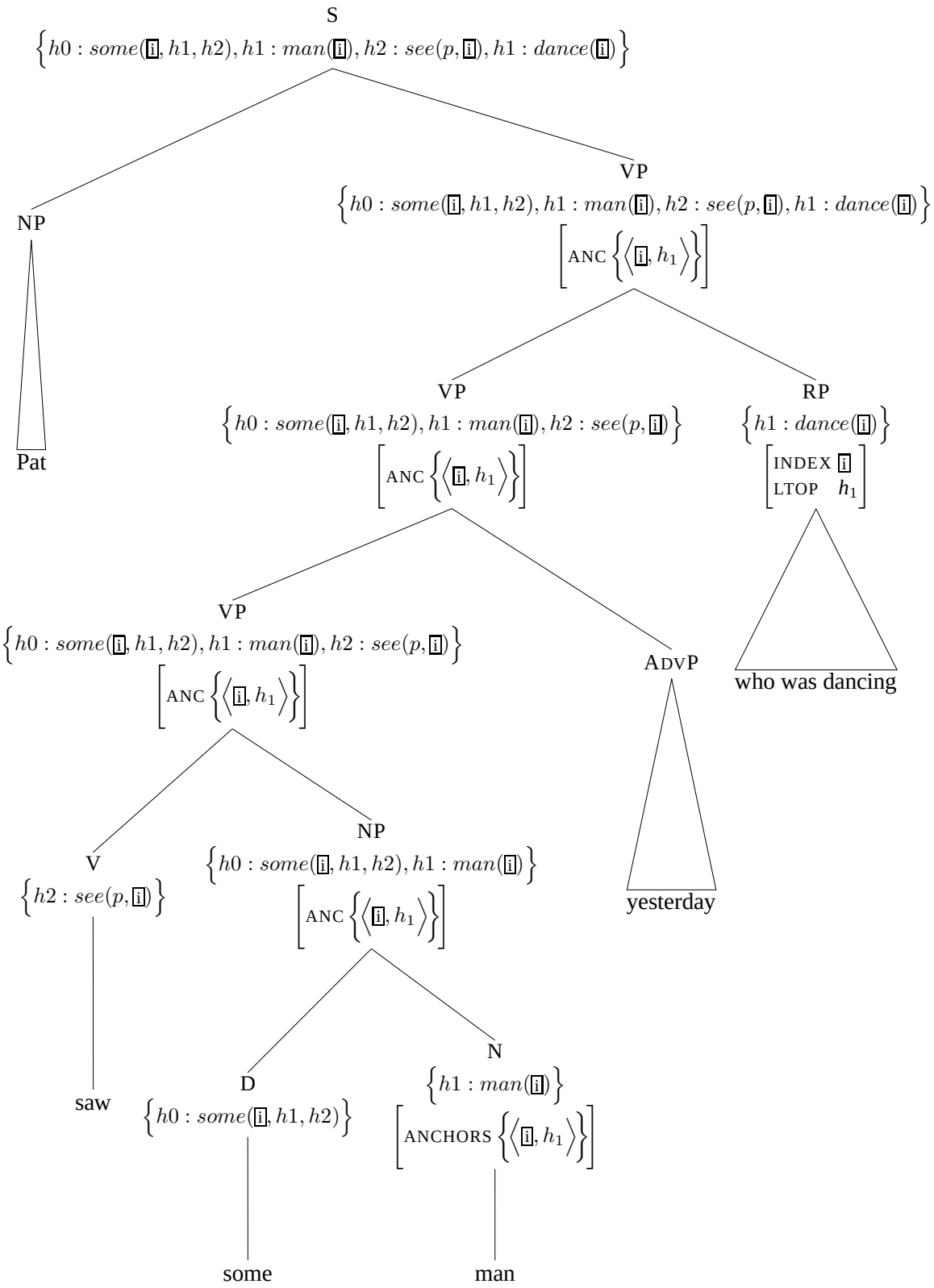


Figure 5.4: Analysis of relative clause extraposition according to Kiss (2005)

(212) Anchors Projection Principle (final version) (Kiss, 2005, 315):

The *anchors set* of a headed phrase consists of the union of the anchors sets of the daughters less those anchors that are specified as TO-BIND|ANCHORS on the head daughter.

For the analysis of German clause types, Kiss (2005) follows Kiss (2001) in suggesting that clauses are licensed by the head-specifier schema or the head-complement schema, the latter of which is employed to combine subordinate conjunctions and complementizers with their sentential arguments. I will not discuss the encoding of upward boundedness in German any further here, but refer the reader to the references cited.

In Kiss (2003), the analysis of relative clause extraposition is extended to English. Kiss assumes that English clauses are licensed by either the head-specifier schema (as stated in Pollard and Sag (1994, 362)) or the head-filler schema (as stated in Pollard and Sag (1994, 164)). He modifies both schemata so that the ANCHORS values of both daughters are specified as the TO-BIND|ANCHORS value of the head daughter. This is shown for the head-specifier schema in (213). Thus, all anchors become bound if the resulting phrase is an instance of the head-specifier schema or the head-filler schema.

(213) Head-Specifier Schema (Kiss, 2005, 314):

$$\mathrm{XP}\left[\textsc{spr}\ \langle\rangle\right] \rightarrow \boxed{1}\,\mathrm{YP}\left[\textsc{anchors}\ \boxed{2}\right],\ \mathrm{X}'\begin{bmatrix}\textsc{spr} & \left\langle\boxed{1}\right\rangle\\ \textsc{anchors} & \boxed{3}\\ \textsc{to-bind}|\textsc{anchors} & \boxed{2}\cup\boxed{3}\end{bmatrix}$$

Kiss (2003) assumes that subjects in English are realized as specifier daughters, and not as subject daughters as in the revised theory of Pollard and Sag (1994, 391). That is, a subject is introduced as a SPR value and not as a SUBJ value of the verb. Note that under these assumptions, the analysis presented so far does not allow an extraposed relative clause to be related to a subject, since the anchors of the subject are canceled once the subject is realized and combined with the VP via the head-specifier schema. Obviously, this is contrary to the facts.

However, Kiss makes a further assumption, which remedies this deficiency. He follows Culicover and Rochemont (1990) in assuming that a subject-related extraposed relative clause may appear within the VP. Culicover and Rochemont have based this observation, among others, on evidence that an elided VP may be interpreted as containing a subject-related modifier (see the discussion around (64)–(68) in Chapter 2.2.2). In order for a relative clause to be licensed within the VP, Kiss' theory of Generalized Modification requires the VP to contain the anchor of the relative clause's antecedent NP. Since the VP does not dominate the subject and therefore does not inherit its anchors via the Anchors Projection Principle, Kiss employs another technique to make the subject's anchors available within the VP: He invokes the concept of lexical amalgamation of nonlocal features developed by Bouma et al. (2001). Accordingly, the anchors of the subject, which appears in the SPR value

of the verb, are collected ("amalgamated") by the verb that selects the subject. More precisely, the ANCHORS value of a lexical head is set-unioned with the ANCHORS value of its specifier. Hence, the anchors of the specifier (i.e., the subject) are available once the lexical head (i.e., the verb) has been introduced. Consequently, when the VP inherits the anchors from its daughters, it can license a subject-related relative clause, crucially even though the subject is not contained within the VP. In fact, the subject-related relative clause is forced to appear inside the VP, because the subject's anchors are canceled once the subject is realized as a specifier daughter (according to (213)). Besides, object-related relative clauses must also appear within the VP since the anchors introduced by objects are also bound off when the VP combines with the subject.

The theory developed in Kiss (2003) is designed to also cover the behavior of extraposed relative clauses with respect to topicalization and *wh*-question formation. In English, an extraposed relative clause may take an antecedent that has been *wh*-moved, but it must not take an antecedent contained in a topicalized phrase, as shown in (214) from Kiss (2003, 110) (see Chapter 2.1.5 for further examples). For this reason, Kiss considers topicalization and *wh*-question formation as structurally different: while he analyzes *wh*-moved subjects and objects, like ordinary subjects, as specifier daughters licensed by the head-specifier schema, topicalized phrases are analyzed as filler daughters licensed by the head-filler schema. Note that this is in contrast to the typology assumed in Pollard and Sag (1994), where both *wh*-moved and topicalized constituents are analyzed as fillers.

(214) a. **Which argument** do you know *that Sandy thought was unconvincing*?

b. * The governor said he would meet a man at the party who was from Philadelphia, and meet **a man** at the party he did *who was from Philadelphia*.

However, this proposal as such raises a problem. Recall that in phrases licensed by the head-specifier schema, all anchors of the daughters are canceled. That is, when the *wh*-moved object *which argument* in (214a) is combined with the constituent *do you know* by application of the head-specifier schema, the anchor introduced by *argument* is not passed up to the resulting phrase, and consequently, the relative clause cannot be adjoined to this S node.

A further assumption of Kiss' theory that is problematic for the analysis of (214a) is that traces do not contain anchors. This is empirically justified by examples like (215), which show that an extraposed relative clause may not occur in a position where it modifies the trace of the *wh*-moved antecedent.[46] Further support is given by the fact that traces and their antecedents only share their LOCAL features, but anchors belong to the NONLOCAL features. It follows that the relative clause in (214a) cannot be adjoined to the VP or the lower S, either.

[46]Kiss mentions that these cases would alternatively be excluded in an analysis that does not employ traces, as in Sag (1997).

(215) * [**Which man**]$_i$ did you meet [t$_i$ *who was from Philadelphia*] at the party?

The question, then, is how and in which position the extraposed relative clause in the grammatical example (214a) can be licensed. Kiss' solution is to analyze English *wh*-constructions (as well as German V2-constructions) like *tough*-constructions in Pollard and Sag (1994, 166-171). That is, an inverted English verb (like *do* in (214a)) cancels the SLASH value of its VP complement (by identifying it with its own TO-BIND|SLASH value) and at the same time identifies it as its own SPR value. This is how a *wh*-moved constituent is analyzed as a specifier. In addition, as I have already explained above, the ANCHORS value of the specifier is set-unioned with the ANCHORS value of the inverted verb itself. As a consequence, the anchors of the *wh*-moved element become available once the inverted verb is introduced into the syntactic structure. Hence, the relative clause in (214a) can be adjoined to the constituent *do you know*, since that constituent contains the anchor of the relative clause's antecedent. The lexical specifications of an English inverted verb are shown in (216), and the analysis of example (214a) is sketched in Figure 5.5.

(216) Lexical specification of English inverted verbs (Kiss, 2003, 120):[47]

$$\left[\begin{array}{l} \text{LOC|CAT}\left[\begin{array}{ll} \text{HEAD} & \textit{verb}\left[\text{INV} +\right] \\ \text{SPR} & \left\langle\left[\begin{array}{ll}\text{LOC} & \boxed{1} \\ \text{NLOC|INHER|ANC} & \boxed{2}\end{array}\right]\right\rangle \\ \text{COMPS} & \left\langle \boxed{3}\,\text{NP},\ \text{VP}\left[\begin{array}{ll}\text{SPR} & \langle\boxed{3}\rangle \\ \text{SLASH} & \{\boxed{1}\}\end{array}\right]\right\rangle \end{array}\right] \\ \text{NLOC}\left[\begin{array}{ll}\text{INHER|ANC} & \boxed{2}\cup\boxed{4} \\ \text{TO-BIND|SLASH} & \{\boxed{1}\}\end{array}\right] \end{array}\right]$$

The analysis just presented for relative clause extraposition from *wh*-moved constituents does not carry over to topicalization structures as in (214b). Since topicalized phrases are not analyzed as specifiers, but rather as filler daughters, their anchors do not become available inside the head daughter of the head-filler phrase. Moreover, the projection of all anchors is blocked once the filler is combined with the head daughter by the head-filler schema. For these reasons, the relative clause in (214b) can neither be attached to the VP or lower S headed by *did* nor to the highest S node that is an instance of the head-filler schema.

To conclude, I would like to point out some benefits of Kiss' theory of Generalized Modification. It is a clever alternative to the base generation theories that I have presented in Chapter 4.2, and it has some considerable advantages. Extraposed relative clauses are licensed by those principles that establish their semantic interpretation, an idea which was

[47] Since I use the formalization of HPSG as proposed in Richter (2000), tags are variables of the HPSG description language. Whenever such a variable has a free (unbound) occurrence in a constraint, it is interpreted as being bound by an existential quantifier that takes wide scope over the entire constraint.

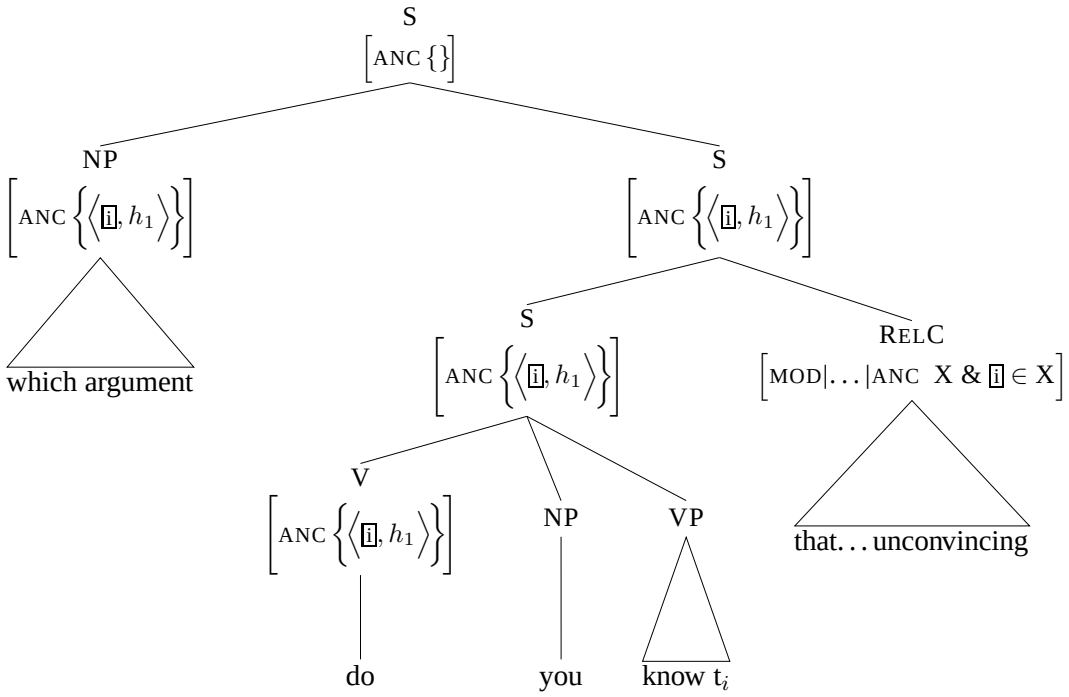


Figure 5.5: Relative clause extraposition from a *wh*-moved element, slightly adapted from Kiss (2003, 118)

already proposed by Guéron (1980) and adopted by Culicover and Rochemont (1990). The theory provides standard logical forms for sentences with restrictive relative clauses, extraposed or in situ.

A particularly elegant aspect of the theory is the fact that only one licensing mechanism is needed to license a relative clause in extraposed as well as in non-extraposed position. A relative clause merely requires that it can adjoin to some constituent that contains an anchor that allows its index and handle values to be identified with those of the relative clause. Since this anchor is introduced by the noun itself, the very same schema, the head-modifier schema, that licenses the relative clause in extraposed position will also license it when it occurs in situ.

This mechanism allows a relative clause to be attached very flexibly. In particular, a relative clause may be adjoined to some constituent while semantically modifying a nominal that is deeply embedded within that constituent. Thus island constraints, which are considered to be constraints on movement, may be violated, an assumption for which we have seen ample evidence.

The theory of Generalized Modification is also successful with respect to the phenomenon of relative clauses with conjoined antecedents, demonstrated in (217). The DP resulting from the conjunction of the two DPs *a man* and *a woman* will have a plural anchor, which can thus license the interpretation of a relative clause–in situ or extraposed–with a plural relative pronoun.[48]

[48] A semantic foundation of such an approach is given in Chaves (2007, Ch. 5.3 + 6.6).

(217) [$_{DP}$ [$_{DP}$ **A man** and **a woman**] [$_{RC}$ *who were quite similar*]] entered the room.

Since sentences with split antecedents, as shown in (218), do not contain a DP with a plural anchor, the present version of the theory does not account for this phenomenon. However, I believe that the theory might be extended in such a way that it can capture these cases as well. A tentative proposal is that in such coordination structures and some other syntactic configurations, an (implicit) plural anchor can be built from the anchors that have been explicitly introduced in the syntax. This could be integrated with techniques for the formation of groups as described semantically by Link (1983, 1984).[49] Hence, in contrast to the other theories of relative clause extraposition, which we have seen are helpless with respect to this phenomenon, the theory of Generalized Modification even holds out the prospect of accounting for relative clauses with split antecedents.

(218) **A man** entered the room and **a woman** went out [$_{RC}$ *who were quite similar*].

5.3.3.2 Problems

As promising as the theory of Generalized Modification presented above is, it also faces a number of problems.

First, the theory in its present form cannot capture the phenomenon of determiners with obligatory relative clauses (e.g., *derjenige/diejenige/dasjenige*). The reason for this is that the anchors are introduced into the tree structure by nouns, and additionally, that the anchors may be left unused. Hence, there is no way that the presence of a relative clause can be enforced, and much less that it is enforced by a determiner.

Secondly, the theory's claim that subject-related extraposed relative clauses (SX) must appear within the VP raises problems. Note that the theory makes the same predictions about VP-ellipsis as Culicover and Rochemont's theory, namely that an elided VP may be interpreted as comprising not only an object-related but also a subject-related extraposed relative clause (Culicover and Rochemont (1990); Rochemont and Culicover (1990); Rochemont (1986); see the discussion in Chapter 2.2.2 around examples (64)–(68)). However, I have argued in Chapter 2.2.2 that the arguments Culicover and Rochemont provide are questionable, and the examples they adduce are not unambiguous and might as well be explained by some interpretive account.

A further problem of analyzing SX as part of VP is given by examples like (219), in which a VP containing an SX is preposed. The sentence is sharply ungrammatical, and we have seen in Chapter 2.2.2 that none of the constituency tests like VP movement or *wh*-clefts validate such a structure. Yet, as far as I can see, Kiss' (2003) theory licenses such sentences, and there is no obvious solution to the problem without giving up fundamental assumptions of HPSG.

[49] Such a possibility is also envisaged by Chaves (2009, Section 3.1 + 3.2) in his theories of coordination and adjunct extraction in terms of cumulation.

To explicate this, consider the relevant second conjunct of the sentence in (219). According to Kiss' (2003) theory, as explained above, the subject *many people* is analyzed as the specifier of *did* (i.e., it is identified with its SPR value). Auxiliaries like *did* are subject-to-subject raising verbs according to all the usual criteria (idioms, expletives, selectional restrictions). In HPSG, such verbs identify their own subject valent with the subject valent of their VP complement. Kiss (2003) treats the constituent raised from the VP complement as a specifier (SPR) of the VP complement as well, as can be seen in the lexical specification of such an auxiliary in (216). Hence, *many people* in (219) is not only the specifier of *did*, but also the specifier of *call*. Since Kiss assumes that lexical heads amalgamate the anchors of their specifier, the verb *call*–and by inheritance the VP it heads–contains the anchor of *many people*. But this means that the relative clause in (219) can be licensed within the preposed VP. Obviously, this is contrary to the facts, since the sentence is completely ungrammatical.

(219) * It was predicted that many people would call who live in Boston, and [$_{VP}$ call *who live in Boston*]$_k$ [**many people**] did $\__k$.

Thirdly, indirect questions as in (220) pose a problem for Kiss' assumption of analyzing *wh*-moved elements as specifiers. The indirect question lacks a lexical head in the form of an auxiliary that could license the *wh*-moved object as a specifier. Moreover, the specifier position is already occupied by the subject *she*.

(220) I wonder whom she saw.

To offer a solution, Kiss makes the "tentative proposal" that indirect questions should be headed by a phonologically empty element which would behave like an auxiliary verb in English (cf. (216)) and take the *wh*-phrase as specifier:

(221) I wonder [[who] [e she saw]].

However, such an analysis lacks independent motivation, and moreover, the postulation of empty heads has been called into question in the recent development of HPSG (e.g., Sag (1997), Ginzburg and Sag (2001)).

Finally, the present form of the theory of Generalized Modification cannot account for the scope effects of relative clause extraposition noted by Culicover (1981), Fox and Nissenbaum (1999), and Guéron (1980) (see Chapter 2.4). Both extraposed and non-extraposed relative clauses are licensed by the same schema subject to the principle of Generalized Modification. The mechanisms are designed in such a way that relative clauses are interpreted "low", that is inside the restrictor of the quantifier of the antecedent, no matter whether they occur in situ or in extraposed position. However, Culicover (1981) and Guéron (1980) have shown that the licensing of negative polarity items inside of relative clauses is influenced by the word order of the relative clauses. Moreover, the examples of Fox and Nissenbaum (1999) provide evidence that the attachment site of an extraposed relative clause determines the scope of the

antecedent's quantifier, but Kiss' theory does not create a connection between these two and therefore cannot account for these cases.

In Chapter 7, I will propose an analysis that fixes these problems. My new analysis is based on the theory developed by Kiss, but it modifies some of the techniques and introduces some new ones. These innovations make it possible to account for obligatory relative clauses and the scope effects. The proposed analysis dispenses with the mechanism of lexical amalgamation of anchors and introduces alternative constraints to capture the behavior of relative clause extraposition with respect to topicalized and *wh*-moved constituents, thus avoiding the problems related to the examples (219)–(221). Before I present this new analysis, I will briefly introduce an interesting extension of Kiss' theory developed by Crysmann (2013), since I will incorporate some of his ideas into my own analysis.

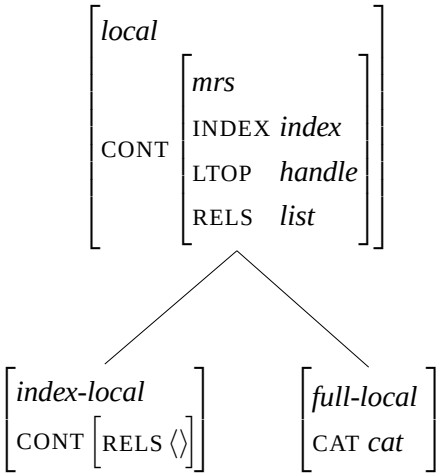
5.3.4 An Integration of Generalized Modification with the Nonlocal Dependency Analysis

Crysmann (2013) extends the ideas developed by Kiss (2003, 2005) for relative clause extraposition and integrates them with an analysis of complement clause extraposition. He investigates the differing locality conditions of complement clause and relative clause extraposition in German. As we have already seen above, relative clause extraposition is insensitive to adjunct islands, the complex NP constraint, and it permits semantic attachment to split antecedents. Crysmann shows that complement clause extraposition from deeply embedded complex NPs is also possible in general, but it is subject to semantic and prosodic licensing requirements. Moreover, complement clause extraposition differs from relative clause extraposition with respect to split antecedents and the sensitivity to adjunct islands. From these observations he concludes that complement clause extraposition is similar to leftward movement from NP, while relative clause extraposition should be regarded as an anaphoric process, as proposed by Kiss.

Crysmann presents a formal analysis for these two types of extraposition that combines Kiss' (2003, 2005) anaphoric approach to relative clause extraposition with the movement approach proposed by Keller (1995). As in Kiss' theory, the analysis is couched in the framework of HPSG, enriched with the semantic formalism of MRS. For the percolation mechanism, Crysmann employs a single nonlocal feature EX to model both extraposition processes, thus making it possible to account for the properties shared by the two constructions (most notably clause-boundedness and rightward orientation). The value of this feature is a set of elements of type *local*. The differences of the two extraposition processes, i.e., their different behavior with respect to island constraints, are accounted for by imposing different restrictions on the type and amount of material being percolated. While full syntactic and semantic information is needed to license an extraposed complement clause (which is syntactically and semantically selected by its head), only semantic information, in particular the index

and handle of the antecedent, is needed to license a relative clause (as explained in Section 5.3.3.1 above). To model this, Crysmann splits local values into two types, *index-local*, which contains only index and handle information, and *full-local*, which contains syntactic as well as full semantic information:

(222) Sort hierarchy and appropriateness conditions of the sort *local* (Crysmann, 2013):



The two extraposition processes differ in what type of element is percolated in order to license the respective extraposed clause in a position higher up in the tree. What is needed in relative clause extraposition are elements of type *index-local*. These are introduced by nouns into their NLOC|INHER|EX sets. Since they consist of the noun's index and handle, these elements are similar to the anchors employed by Kiss; they are only represented in a slightly different way. The remaining machinery is as proposed by Kiss: the *index-local* elements are passed up the tree in accordance with the Nonlocal Feature Principle, and they may–but need not–be picked up by a relative clause. To block the percolation of these elements across clause boundaries and thus account for the Right Roof Constraint, Crysmann follows Kiss in requiring the elements to be bound off. However, instead of integrating this binding constraint into the clausal schemata, he postulates the constraint shown in (223). It states that for each sentential sign that is embedded as a non-head daughter, its set of *index-local* elements is specified as the TO-BIND|EX value of the head daughter.

(223) Constraint to capture the clause-boundedness of relative clause extraposition (Crysmann (2013, 390), slightly adapted[50]):

$$\left[\text{NHD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}\left[\begin{array}{ll}\text{HEAD} & \left[\begin{array}{ll}\textit{verb} & \\ \text{VFORM} & \textit{fin}\end{array}\right] \\ \text{VAL} & \left[\begin{array}{ll}\text{SUBJ} & \langle\rangle \\ \text{COMPS} & \langle\rangle\end{array}\right]\end{array}\right]\right] \Rightarrow$$

$$\left[\begin{array}{l}\text{HEAD-DTR}|\text{SYNSEM}|\text{NLOC}|\text{TO-BIND}|\text{EX}\ \boxed{1}\ \textit{set(index-local)} \\ \text{NHD-DTR}|\text{SYNSEM}|\text{NLOC}|\text{INHER}|\text{EX}\ \boxed{1}\end{array}\right]$$

In complement clause extraposition, it is elements of type *full-local* that are percolated, again in accordance with the Nonlocal Feature Principle. The elements are introduced into the NLOC|INHER|EX set of the noun by means of a Complement Extraposition Lexical Rule, based on Keller (1995) and modeled after the Complement Extraction Lexical Rule proposed by Pollard and Sag (1994). The attachment of an extraposed complement clause is licensed by a special phrase structure schema that identifies the percolated local value in the INHER|EX set with the local value of the complement clause. Moreover, since the subcategorization requirements of the head that selects the complement clause are fulfilled, the retrieved local value is bound off in order to block further percolation. It is beyond the scope of this work to provide further details of the analysis of complement clause extraposition. For a full account, the reader is referred to Crysmann (2013).

To conclude, Crysmann shows that while complement clause and relative clause extraposition behave differently in some respects, for example with regard to island constraints, they also have some properties in common, for example clause-boundedness. While he concludes that these two extraposition types should be regarded as different processes, i.e., complement clause extraposition as a "movement" process and relative clause extraposition as an anaphoric process, he proposes an analysis that accounts for both the differences as well as the similarities. Specifically, his analysis makes it possible to capture the common properties of the two different extraposition processes by using a single feature percolation mechanism, while at the same time making it possible to differentiate between the two processes by distinguishing the amount of information being percolated. Crysmann's approach thus shows that a feature percolation mechanism can combine insights of core-movement and base-generation accounts.

[50] I follow Ginzburg and Sag (2001) in using the symbol "⇒" to designate an implicational constraint. Therefore, I have adjusted Crysmann's notation, who uses the symbol "→".

5.4 Conclusion

In this chapter, I first introduced the basic concepts and formal properties of HPSG and provided some basic information about the framework that I will employ for my analysis of relative clauses that I will present in Chapter 7. I then summarized the two main HPSG analyses of relative clauses in English, those of Pollard and Sag (1994) and Sag (1997).

Finally, I presented the previous approaches to relative clause extraposition within this framework: the linearization-based theory of Kathol and Pollard (1995), an analysis as a nonlocal dependency construction (e.g., Keller (1994, 1995), Müller (1999)), the theory of Generalized Modification developed by Kiss (2003, 2005), and a combination of the nonlocal approach and the theory of Generalized Modification proposed by Crysmann (2013). We have seen that none of these theories is able to cover all the empirical data of relative clause extraposition. The biggest problem for the nonlocal dependency account is the phenomenon of relative clauses with split antecedents, which is why I believe that this analysis of relative clause extraposition should be rejected. The cases of obligatory relative clauses and the interpretive effects concerning the scope of logical operators and NPIs as well as the Principle C effects do not follow from any of these theories in their present form. The theory of Generalized Modification is the most promising in this respect. In Chapter 7, I will introduce some new mechanisms to it and modify the theory in such a way that it will be able to capture the empirical facts mentioned above.

Chapter 6

Lexical Resource Semantics

In this chapter, I give an introduction to the framework of Lexical Resource Semantics (LRS) (Richter and Sailer, 2004), which I will adopt for my analysis of relative clause attachment. The first section presents the main ideas, the architecture, and the basic principles. In the second section, I give an example analysis of relative clause modification in this framework.

6.1 The Theory

Lexical Resource Semantics was developed by Frank Richter and Manfred Sailer. The following summary is based on Richter and Sailer (2004), which gives a detailed presentation of the framework, as well as on Sailer (2004a), Penn and Richter (2004), Richter and Kallmeyer (2009), and Levine, Richter, and Sailer (in prep.). LRS combines techniques of underspecified semantics (Reyle (1993), Pinkal (1999), Egg (2010, 2011), Copestake et al. (2005), among others) with the properties of an HPSG grammar. The logical form of a sentence is formulated in a standard semantic representation language, Ty2 (Gallin 1975), whose expressions are encoded as objects of sort *meaningful-expression* (*me*, see Sailer 2003). The semantic contribution of a sign is conceived of as a list of subexpressions of the final logical form, rather than being considered a single *content* object. This use of *discontinuous representations* is an important property of LRS.

LRS distinguishes between local (lexical) and non-local (clausal, combinatorial, truth-conditional) semantics, which is parallel to the distinction in syntax between syntactic category (encoded in the CAT value of a sign) and constituent structure (encoded in the DTRS value of a sign). Aspects relevant for local semantic phenomena (e.g., linking, selection, and binding theory) are encoded as the value of the attribute CONTENT inside the LOCAL value of a sign. The clausal, or combinatorial semantics (i.e., the logical form of a clause) appears as the value of LOGICAL-FORM (LF), which is introduced as a new feature of the type *sign*. Since it does not belong to the *synsem* values of a sign, it is invisible to syntactic and semantic selection. The new architecture of a sign is shown in (224).

(224) The architecture of semantics (Sailer, 2004a, 203)

$$\begin{bmatrix} \textit{phrase} & \\ \text{PHON} & \text{phonological structure} \\ \text{SYNSEM} & \begin{bmatrix} \textit{synsem} & \\ \text{LOCAL} & \begin{bmatrix} \text{CATEGORY} & \text{local syntactic structure} \\ \text{CONTENT} & \boxed{\textbf{local semantic structure}} \end{bmatrix} \\ \text{NONLOCAL} & \text{pied-piping} \end{bmatrix} \\ \text{LOGICAL-FORM} & \boxed{\textbf{logical expressions associated with the sign}} \\ \text{DTRS} & \text{constituent structure} \end{bmatrix}$$

Certain parts of the local content and the compositional semantics are interconnected by an interface theory, thus allowing for some interaction as, for example, syntactic heads lexically selecting for the semantic variables of their arguments. In the following, I will first present the assumptions about local semantics and then explain the way nonlocal semantics is dealt with in LRS and illustrate the interplay between the two components.

The values of the attribute CONTENT are objects of the sort *content*. The appropriateness conditions of the sort *content* are specified in (225):

(225) Appropriateness conditions of the sort *content*:

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

All *content*-objects have the features INDEX and MAIN. The value of the attribute MAIN of a word is the main semantic predicate contributed by this word. It is some expression of the semantic representation language, typically a constant, encoded as an object of the sort *meaningful-expression*. The value of the attribute INDEX is the referential index of the word. In the theory of Pollard and Sag (1994), the index encodes only morphosyntactic agreement information, i.e., the ϕ-features (person, number, and gender), and is used for the purposes of binding theory and argument linking and for agreement. Sailer (2004a) and Levine, Richter, and Sailer (in prep.) argue that the morphosyntactic function and the semantic function should be separated out into a set of ϕ-features and a semantic expression. For this reason, the original HPSG index is extended to contain these two parts, and a new sort, *extended-index*, is introduced for the value of INDEX. Its appropriate attributes and attribute values are shown in (226).[1] While in Pollard and Sag's (1994) theory only nouns, adjectives, and determiners have an INDEX value, the attribute is now, following Soehn (2003), defined for all parts of speech, including verbs.

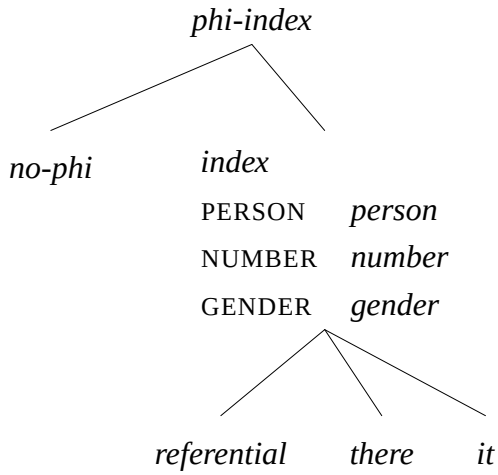
[1] It was Soehn (2003) and Soehn and Sailer (2003) who originally argued for a more structured INDEX value and introduced the PHI feature.

(226) Appropriateness conditions of the sort *extended-index*:

extended-index
PHI *phi-index*
VAR *meaningful-expression*

This new kind of index has two attributes, PHI and (REFERENTIAL-)VAR(IABLE). The feature PHI contains the traditional index features, i.e., the ϕ-features. Its value is an object of sort *phi-index*, defined in (227). Since it is not clear what the ϕ-features of a verb should be, a new subsort of *phi-index*, called *no-phi*, is introduced which has no such features.[2] For nouns, adjectives, and determiners, the PHI value is of sort *index*, which expresses the ϕ-features and is structured as prescribed by the sort *index* in Pollard and Sag (1994).

(227) Sort hierarchy and appropriateness conditions of the sort *phi-index*:



The value of the attribute VAR is an expression of the semantic representation language which corresponds to the index in the logical form. It is interpreted as the referent of a sign. Typically, this is an individual variable. It corresponds to the referential semantic argument of the object in the MAIN value. For nouns the VAR value will usually be a variable or a constant of type *e*. For verbs the index will typically be an event variable.

The Content Principle given in (228) ensures that the CONTENT values of a mother and its head daughter are identical.

(228) The Content Principle:
In any headed phrase, the SYNSEM|LOCAL|CONTENT value of the mother and the head daughter is identical.

To illustrate the local semantics, I have provided the descriptions of the lexical entries of a noun (*dog*), a determiner (*every*), and a verb (*chase*) in (229). Note that these descriptions also already contain the combinatorial semantics in the LF values, which I will get to

[2]The idea of introducing the subsort *no-phi* was originally mentioned in Sailer (2004a, 206). The sort hierarchy in (227) is taken from Levine, Richter, and Sailer (in prep.).

below. The specifications of the local semantics can be seen in the CONTENT (CONT) values. The MAIN value of the noun *dog* is the constant dog′, which expresses the core semantic contribution of the noun. Its ϕ-features are those of a third person singular expression. The referential index, i.e., the VAR value, is the variable x.

The MAIN value, i.e., the core local semantics, of the determiner *every* is the universal quantifier $\forall$, a functor that combines with a variable and the scope. The VAR value is the variable (x) that is bound by this quantifier. The PHI features require it to be third person singular since *every* can only be combined with third person singular nouns.

The core lexical semantics of the verb *chase* is the predicate chase′, expressed as the MAIN value. The verb has the PHI value *no-phi*, and its referential index is the event variable e.

(229) a. Description of the lexical entry of *dog*:

$$\begin{bmatrix} \textit{word} & \\ \text{PHON} & \langle \textit{dog} \rangle \\ \text{SS|LOC|CONT} & \begin{bmatrix} \textit{content} & \\ \text{INDEX} & \begin{bmatrix} \text{PHI} & \begin{bmatrix} \text{PER} & \textit{3rd} \\ \text{NUM} & \textit{sg} \end{bmatrix} \\ \text{VAR} & x \end{bmatrix} \\ \text{MAIN} & \boxed{3a}\ \text{dog}' \end{bmatrix} \\ \text{LF} & \begin{bmatrix} \textit{lrs} & \\ \text{EXCONT} & \textit{me} \\ \text{INCONT} & \boxed{3}\ \text{dog}'x \\ \text{PARTS} & \langle x, \boxed{3}, \boxed{3a} \rangle \end{bmatrix} \end{bmatrix}$$

b. Description of the lexical entry of *every*:

$$\begin{bmatrix} \textit{word} & \\ \text{PHON} & \langle \textit{every} \rangle \\ \text{SS|LOC|CONT} & \begin{bmatrix} \textit{content} & \\ \text{INDEX} & \begin{bmatrix} \text{PHI} & \begin{bmatrix} \text{PER} & \textit{3rd} \\ \text{NUM} & \textit{sg} \end{bmatrix} \\ \text{VAR} & x \end{bmatrix} \\ \text{MAIN} & \boxed{4b}\ \forall \end{bmatrix} \\ \text{LF} & \begin{bmatrix} \textit{lrs} & \\ \text{EXCONT} & \textit{me} \\ \text{INCONT} & \boxed{4}\ \forall x[\alpha \rightarrow \beta] \\ \text{PARTS} & \langle x, \boxed{4}, [\alpha \rightarrow \beta], \boxed{4b} \rangle \end{bmatrix} \end{bmatrix}$$

c. Description of the lexical entry of *chase*:

$$\left[\begin{array}{ll} \textit{word} & \\ \textsc{phon} & \left\langle \textit{chase} \right\rangle \\ \textsc{ss|loc} & \left[\begin{array}{ll} \textsc{cat} & \left[\textsc{head}\ \textit{verb}\right] \\ \textsc{cont} & \left[\begin{array}{ll} \textit{content} & \\ \textsc{index} & \left[\begin{array}{ll} \textsc{phi} & \textit{no-phi} \\ \textsc{var} & e \end{array}\right] \\ \textsc{main} & \boxed{1c}\ \mathsf{chase}' \end{array}\right] \end{array}\right] \\ \textsc{arg-st} & \left\langle \textsc{np}\left[\textsc{index|var}\ x\right], \textsc{np}\left[\textsc{index|var}\ y\right] \right\rangle \\ \textsc{lf} & \left[\begin{array}{ll} \textit{lrs} & \\ \textsc{excont} & \textit{me} \\ \textsc{incont} & \boxed{1}\ ((\mathsf{chase}'e)y)x \\ \textsc{parts} & \left\langle e, \boxed{1}, (\mathsf{chase}'e)y, \boxed{1b}\ \mathsf{chase}'e, \boxed{1c}, \exists e.\phi, \exists \right\rangle \end{array}\right] \end{array}\right]$$

& $\boxed{1b} \lhd \phi$

I now turn to the nonlocal, or clausal semantics, which is captured within the attribute LOGICAL FORM (LF), a newly introduced feature of the type *sign*:

(230) Appropriateness conditions of the sort *sign*:

sign	
PHONOLOGY	*list(phonstring)*
SYNSEM	*synsem*
LOGICAL-FORM	*lrs*

The value of LF are objects of the sort *lrs*, which contain three attributes needed for the LRS combinatorics. The approriateness conditions are given in (231):

(231) Appropriateness conditions of the sort *lrs*:

lrs	
EXTERNAL-CONTENT	*meaningful-expression*
INTERNAL-CONTENT	*meaningful-expression*
PARTS	*list(meaningful-expression)*

The value of the attribute PARTS is a list which contains all the subexpressions contributed by a sign. To find out what the subexpressions are, the logical form of the sign can be considered in the form of an expression tree, i.e., a tree that displays how the semantic expressions are combined according to the syntax of the semantic representation language. Then what the sign contributes is the nodes that constitute the expression tree. These are the elements that appear on the PARTS list of the sign. It is a core assumption of LRS that all the nodes that form the expression tree of an utterance are contributed by the lexical items.

Hence, in a sentence, the PARTS list contains all and only the meaning contributions of the lexical units in the sentence. The subexpressions together constitute the overall logical form of a sign, which appears as the value of the feature EXTERNAL-CONTENT (EXCONT) in the form of an expression of the semantic representation language. The INTERNAL-CONTENT (INCONT) value of a sign specifies the scopally lowest semantic contribution of the semantic head of the sign. For example, the internal content of a noun is what is in the restrictor of its quantifier, and the internal content of a verb must be in the scope of all the quantifiers introduced by the arguments of the verb.

To account for the connection between the local and the nonlocal semantics, the Content-LF Principle in (232) is introduced. It ensures that the MAIN and VAR values of a sign appear on the PARTS list and thus belong to the subexpressions that are contributed by the sign.

(232) The Content-LF Principle:
In any sign, the expressions in the SYNSEM|LOCAL|CONTENT|MAIN value and the SYNSEM|LOCAL|CONTENT|INDEX|VAR value must be elements of the sign's LF|PARTS list.

The specifications of the LF values assumed for the example words *dog*, *every*, and *chase* can also be seen in the lexical descriptions in (229). The EXCONT values of these lexical entries are left unspecified. It is required that they be of type *meaningful-expression*, i.e., expressions of the semantic representation language Ty2. They will be further specified once the words are combined in a phrase.

The INCONT value of the noun is the semantic constant dog' applied to its referential index, i.e., $\mathsf{dog}'x$. The PARTS list shows the semantic contribution of the noun to the combinatorial semantics. It consists of the referential index (x), the semantic constant (dog'), and the application of the constant to the referential index ($\mathsf{dog}'x$).

For the quantifier *every*, the INCONT value does not uniquely identify an expression of the semantic representation language, but it only specifies parts of the expression that is being described. It is an expression starting with the universal quantifier which binds the variable x and has scope over an implication. The restrictor and the nuclear scope are not further specified. Lower case Greek letters are used for subexpressions that are not further described.

Formally, the Greek letters are tags, but their occurrence is restricted to the use as meta-variables in the semantic representation language. In fact, the variables of the semantic representation language (i.e., x in this example) are also tags. This reflects the fact that the name of a particular variable is not important, but what is crucial is whether the same or a different variable is used inside an expression. To avoid confusion with the font for sort names, boxes are sometimes put around the variables ($\boxed{x}$) when their tag character should be emphasized. This can be seen in (233), which shows a pure AVM notation of the LF specification of *every*. When comparing the notations for the INCONT values in (229b) and

(233), it becomes clear that the notation $\forall x[\alpha \rightarrow \beta]$ is shorthand for the AVM description of the INCONT value shown in (233).

The PARTS list of *every* contains the variable (x), the quantified formula ($\forall x[\alpha \rightarrow \beta]$), the implication ($\alpha \rightarrow \beta$), and the quantifier ($\forall$). Note the interplay between the CONT value and the LF value: In the CONT value, we have the variable x as the VAR value and the quantifier $\forall$ as the MAIN value. In the LF|INCONT value we see that this variable is actually bound by this quantifier.

(233) AVM notation of the LF specification of *every*:

$$\left[\begin{array}{l} \textit{lrs} \\ \text{EXCONT}\ \textit{me} \\ \text{INCONT}\ \boxed{4}\left[\begin{array}{ll} \textit{quantifier} & \\ \text{DET} & \boxed{4b}\ \textit{universal} \\ \text{VAR} & \boxed{x}\ \textit{var} \\ \text{SCOPE}\ \boxed{4a} & \left[\begin{array}{l} \textit{implication} \\ \text{ARG1}\ \alpha \\ \text{ARG2}\ \beta \end{array}\right] \end{array}\right] \\ \text{PARTS}\ \left\langle \boxed{x}, \boxed{4}, \boxed{4a}, \boxed{4b} \right\rangle \end{array}\right]$$

The INCONT value of the verb *chase* is the predicate chase' together with the argument linking. This includes the eventuality argument *e*, which is assumed for verbs. I have used the curried notation $((\mathsf{chase}'e)y)x$ here instead of the un-curried version $\mathsf{chase}'(e, x, y)$ in order to explicitly illustrate the structure of the expression. The subexpressions contributed by the verb, which appear on the PARTS list, are the semantic constant chase', the referential index of the verb, i.e., the event variable e, and the application expressions $\mathsf{chase}'e$, $(\mathsf{chase}'e)y$, and $((\mathsf{chase}'e)y)x$. The latter expressions indicate that the constant chase' is first applied to the referential index ($\mathsf{chase}'e$). The function $\mathsf{chase}'e$ is then applied to the direct object, and the resulting complex $(\mathsf{chase}'e)y$ is finally applied to the subject ($((\mathsf{chase}'e)y)x$). Note that the variables of the semantic argument slots are identified with the respective variables of the VAR values of the syntactic arguments in the ARG-ST list of the verb. This is possible since the VAR values are included in the arguments' SYNSEM values that appear on the ARG-ST list. Thus, the lexical entry provides the linking properties of the verb, i.e., which semantic role is filled by the referent of which of its syntactic arguments.[3] The referents themselves, however, are not contributed by the verb (rather, they are contributed by the arguments, e.g., the nouns) and therefore do not appear on its PARTS list. The verb only contributes its own referent, the event e. For the other semantic arguments, it

[3]In addition to argument linking, the LRS architecture of a sign allows for semantic selectional and sortal restrictions since the basic semantic constant (the MAIN value) of a selected element as well as its index are visible to a selector. At the same time, the information about the clausal semantics, including quantifiers and other semantic operators, is invisible for selection since it is contained in the LF values, which are not part of the *synsem* objects. Sailer (2004a) has provided empirical motivation for this distinction between local and combinatorial semantics, thus arguing against the HPSG architecture of linguistic signs as given in Pollard and Sag (1994), which gathers all of the semantic information within the LOCAL value.

merely specifies how they are related to the grammatical functions by using the same variables. Finally, the verb contributes the existential quantification over the event variable, i.e., $\exists e.\phi$, and the existential quantifier ($\exists$), which also appear on the PARTS list. Note that, for reasons of simplicity, it is assumed that the event variable is bound with the narrowest possible scope, and potential scopal interactions with other quantifiers are ignored (Sailer, 2004a, 205n7). In order to ensure that the predicate of the verb itself is in the scope of the quantifier that binds the event variable, the constraint $\boxed{1b} \lhd \phi$ is added to the lexical entry of the verb. The symbol "$\lhd$" encodes the relation "*is a component/subexpression of*".

For the combinatorial system, i.e., the semantic composition mechanism of LRS, two well-formedness conditions are imposed on *lrs*, the Incont Principle in (234) and the Excont Principle in (235).

(234) The Incont Principle:
In each *lrs*, the INCONT value is an element of the PARTS list and a component of the EXCONT value.

(235) The Excont Principle:

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

b. 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.

The Incont Principle ensures that the INCONT value of a word appears in the PARTS list of the word, thus characterizing it as a necessary meaning contribution to each syntactic head. Furthermore, the INCONT value must also be a subexpression (component) of the EXCONT value. Since the EXCONT value, which is interpreted as the logical form of a sign, is identical throughout a head projection line (see (236a) below), this latter requirement guarantees that the scopally lowest meaning contribution of a lexical syntactic head is included in the logical form of the projection of this head.

The external content of a sign is what its maximal projection contributes to the meaning of the overall expression. It is constrained by the Excont Principle, which consists of two clauses, one for phrases and one for utterances. The first clause refers indirectly to the EXCONT value of a completed head projection. A sign is a completed head projection either if it is an utterance (this case is covered by the second clause), or if it is a non-head daughter in a phrase, i.e., if it combines with another sign and the resulting phrase is not the head projection of the sign under consideration. The EXCONT value of such a completed head projection must appear in the PARTS list of this sign. This means that it must have been part of the semantic contribution of some sign dominated by this head projection, since the PARTS list of a sign consists of all and only the elements of the PARTS lists of its daughters

(see (236c) below). From the Incont Principle it moreover follows that the EXCONT value of a completed head projection contains the scopally lowest semantic contribution (the INCONT value) of the lexical head as a subexpression.

In an utterance, the external content value is the logical form of the utterance in the traditional sense. According to the second clause of the Excont Principle, it comprises only those subexpressions which have been contributed by some lexical element dominated by that utterance, and all the semantic contributions of these lexical elements must occur in the EXCONT value of this utterance. Thus, the logical form of an utterance consists of all and only the meaning contributions of the lexical elements in the utterance.

In a phrase, the LF values of its daughters and the way they are syntactically combined fully determine the LF value of the phrase. This is specified in the LRS Projection Principle in (236) and the Semantics Principle in (237).[4] The LRS Projection Principle states that the EXCONT and the INCONT value of a phrase are identical throughout a head projection. The PARTS list of a phrase consists of all and only the elements of the PARTS lists of the daughters, thus guaranteeing that all the semantic contributions of all the signs dominated by that phrase are collected.

(236) LRS Projection Principle:
In each *headed-phrase*,
a. the EXCONT values of the head and the mother are identical,
b. the INCONT values of the head and the mother are identical,
c. the PARTS value contains all and only the elements of the PARTS values of the daughters.

The Semantics Principle specifies requirements on the combination of the meaning contributions of different types of syntactic and semantic daughters. For each kind of meaning composition which introduces subterm restrictions, a constraint is introduced. These constraints state how the terms of each syntactic daughter must be mutually embedded. If the relative embedding of the meaning contributions is not determined, a descriptive underspecification of readings is achieved.

(237) The Semantics Principle:
In each *headed-phrase*,
a. if the non-head is a quantifier, then its INCONT value is of the form $Qx[\rho \circ \nu]$[5],

[4] Richter and Sailer (2004) and Sailer (2004a) present both these principles as one principle, which they call the Semantics Principle. The separation into the LRS Projection Principle and the Semantics Principle is taken from Penn and Richter (2004).

[5] The notation $Qx[\rho \circ \nu]$ is shorthand for the AVM description $\begin{bmatrix} \textit{quantifier} & \\ \text{VAR} & \textit{var} \\ \text{SCOPE} & \begin{bmatrix} \textit{logical-connector} & \\ \text{ARG1} & \rho \\ \text{ARG2} & \nu \end{bmatrix} \end{bmatrix}$. See also the AVM notation of the LF specification of *every* in (233), which shows the AVM description of the universal quantifier. The sort *implication* is a subsort of the sort *logical-connector*.

the INCONT value of the head is a component of ρ, and the INCONT value of the non-head daughter is identical with the EXCONT value of the head daughter,

b. if the non-head 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,

c. in a *head-adjunct-phrase*, the EXCONT value of the non-head is a component of the EXCONT value of the head, and

   i. if the non-head is an intersective modifier, then its EXCONT value is of the form $\alpha \wedge \beta$ and the INCONT value of the head is a component of β.

   ii. if the non-head is a non-intersective modifier, then its EXCONT value is of the form $\alpha(\beta)$ and the INCONT value of the head is a component of β.[6]

The constraint in (237a) treats the combination of a quantifier with a head noun. It ensures that the internal content of the noun occurs in the restrictor of the quantifier and that the EXCONT value of the noun is identical to the INCONT value of the quantifier.

The clause in (237b) specifies requirements on how to combine a quantified NP argument with its syntactic head. Specifically, it requires that the internal content of the head be part of the scope of the quantifier. Thus, if a verb combines with a quantified NP, it contributes to the nuclear scope of the quantified NP.

Clause (237c) imposes constraints on the combination of a head and an adjunct. While the second clause (ii) does not play a role here and will not be further discussed, I will explain the first clause (i) in Section 6.2 below, where I will exemplify the constraint by providing an analysis of a relative clause modifying a nominal.

Before that, I will illustrate how LRS works with the scopally ambiguous sentence in (238a), which has the two readings given in (238b) and (238c). Recall that it is assumed that the event variable is bound with the lowest possible scope.

(238) a. Every dog chased some cat.

b. $\forall\exists$-reading: $\forall x[\mathsf{dog}'x \rightarrow \exists y[\mathsf{cat}'y \wedge \exists e[((\mathsf{chase}'e)y)x]]]$

c. $\exists\forall$-reading: $\exists y[\mathsf{cat}'y \wedge \forall x[\mathsf{dog}'x \rightarrow \exists e[((\mathsf{chase}'e)y)x]]]$

The LRS analysis of the sentence is shown in Figure 6.1. At each node, the LF values are given in AVM notation. Additionally, the scope constraints imposed by the Semantics Principle (237) are specified at each branching node by using the symbol "$\lhd$" for the relation "*is a component/subexpression of*". Below these constraints, for the VP and the S node, I have indicated the sketch of the logical form that follows from the Semantics Principle. The LF values of the lexical nodes are identical to those of the corresponding lexical entries provided in (229) above. The LF values of *some* and *cat* are analogous to those of *every* and

[6]The clause on *head-adjunct-phrases* is adapted from Sailer (2001).

dog. Note that the INCONT value of *some* consists of the existential (instead of the universal) quantifier with a variable that has scope over a logical conjunction.

As an effect of the Incont Principle, the Excont Principle, and the Semantics Principle, it is now possible to specify the EXCONT value for each lexical head. For both nouns, it must be identical to the INCONT value of its quantifier according to the Semantics Principle (237a).[7]

The EXCONT values of the determiners are identical to their INCONT values. This follows from an interaction of the Incont Principle (234) and the Excont Principle (235a). Consider, for example, the LF value of *every*. Its INCONT value, the expression $\forall x[\alpha \rightarrow \beta]$, is an element of the PARTS list, according to (234). As can be seen, this is the "biggest" expression of the PARTS list. The EXCONT value of *every* has to fulfill two requirements: First, according to (234), it must contain the INCONT value, i.e., the expression $\forall x[\alpha \rightarrow \beta]$, as a subexpression. Second, according to (235a), it must be an element of the PARTS list ((235a) applies since *every* is the non-head daughter of the noun phrase *every dog*). But the only element on the PARTS list of *every* that contains the expression $\forall x[\alpha \rightarrow \beta]$ is this expression itself. It follows that the EXCONT value and the INCONT value of *every* are identical.

Since the verb is the ultimate head daughter of the overall utterance, its EXCONT value is identical to that of the VP node and the S node. This follows from the LRS Projection Principle (236a). I will further specify it once I have explained the other combinatorial mechanisms of the sentence.

For each phrasal node, the EXCONT and INCONT values are identical to those of its head daughter, and the PARTS list is the concatenation of the PARTS lists of its daughters, according to the LRS Projection Principle (236).

In addition to the lexical requirements and the effects of the Incont Principle, the Excont Principle, and the LRS Projection Principle that determine the respective LF values, further subordination constraints as formulated in the Semantics Principle are added at each phrasal node. So, at each NP node, the Semantics Principle (237a) requires the INCONT value of the noun to be a component of the restrictor of its quantifier. For the NP *every dog*, $\mathsf{dog}'x$ must be within the restrictor of the universal quantifier ($\boxed{3} \lhd \alpha$), so that the logical form, i.e., the EXCONT value, of this NP can be specified to be $\forall x[(...\mathsf{dog}'x...) \rightarrow \beta]$. For the NP *some cat*, $\mathsf{cat}'y$ must be within the restrictor of the existential quantifier ($\boxed{2} \lhd \gamma$), and we get the logical form $\exists y[(...\mathsf{cat}'y...) \wedge \delta]$. Note that the Semantics Principle only requires the INCONT value of a noun to be a *subexpression* of the restrictor of its quantifier. We do not know yet whether there will be other expressions in the sentence falling into this restrictor. This is indicated by the dots (...).

[7] For purposes of illustration, where appropriate in the tree structure, I have indicated in parentheses which principle(s) constrain(s) each piece of information.

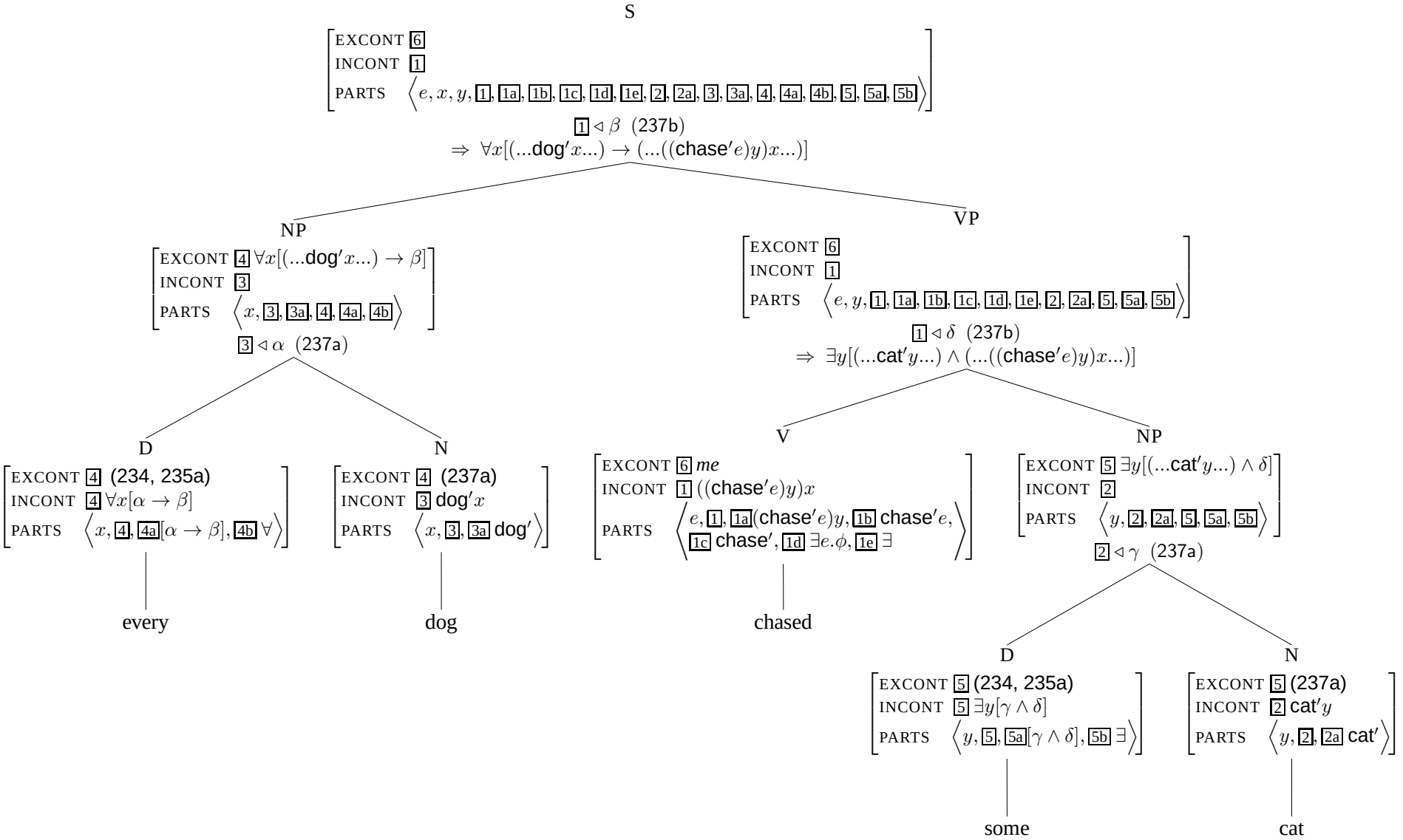


Figure 6.1: LRS analysis of the sentence *Every dog chased some cat*.

The Semantics Principle (237b) ensures that the INCONT value of the verbal head ($((\mathsf{chase}'e)y)x$) falls within the scope of both quantifiers in the sentence. At the VP node, it requires the INCONT value to be a component of the scope of the existential quantifier of the object NP *some cat* ($\boxed{1} \lhd \delta$). Together with the requirements that were imposed on the NP, the logical form is now constrained to be $\exists y[(...\mathsf{cat}'y...) \wedge (...((\mathsf{chase}'e)y)x...)]$. At the S node, $((\mathsf{chase}'e)y)x$ must be a subexpression of the scope of the universal quantifier of the subject NP *every dog* ($\boxed{1} \lhd \beta$). Including the constraints imposed on the subject NP, the logical form is hence required to be $\forall x[(...\mathsf{dog}'x...) \rightarrow (...((\mathsf{chase}'e)y)x...)]$. Thus, it follows that the expression $((\mathsf{chase}'e)y)x$ is within the scope of both quantifiers within the sentence. The relative scope of these two quantifiers, however, is not constrained by the grammar. This is exactly what is desired in order to derive the two readings shown in (238b) and (238c) for the sentence *Every dog chases some cat*.

Finally, we can specify the overall logical form of the sentence. The EXCONT value of the S node must consist of all and only the elements that appear on the PARTS list of the S node (according to the Excont Principle (235b)). These are all the subexpressions contributed by the lexical elements in the sentence. In addition, all the constraints imposed on any of the subexpressions in the utterance must be fulfilled. As explained above, the constraints on the subexpressions lead to the following two requirements for the logical form: (i) $\forall x[(...\mathsf{dog}'x...) \rightarrow (...((\mathsf{chase}'e)y)x...)]$ and (ii) $\exists y[(...\mathsf{cat}'y...) \wedge (...((\mathsf{chase}'e)y)x...)]$. Adding all and only the other subexpressions from the PARTS list of the S node, we get two options for the overall logical form (the EXCONT value) of the sentence, which are exactly the desired readings already shown in (238b) and (238c) above:

(239) a. $\forall\exists$-reading: $\forall x[\mathsf{dog}'x \rightarrow \exists y[\mathsf{cat}'y \wedge \exists e[((\mathsf{chase}'e)y)x]]]$
b. $\exists\forall$-reading: $\exists y[\mathsf{cat}'y \wedge \forall x[\mathsf{dog}'x \rightarrow \exists e[((\mathsf{chase}'e)y)x]]]$

In sum, in this section I have given an introduction to the semantic framework of Lexical Resource Semantics and presented its main ideas and basic concepts, which have led to a new architecture of the sign in HPSG. LRS distinguishes between local (lexical) semantics, whose properties are captured within the local feature CONTENT, and nonlocal (clausal) semantics, for which a new feature L(OGICAL-)F(ORM) is introduced on the sort *sign*. I have given an overview of the newly introduced sorts with their sort hierarchies and appropriateness conditions and provided example lexical entries for illustration. Moreover, I have introduced some of the basic principles of LRS, i.e., the Content Principle and the Content-LF Principle, which regulate the interaction of the local semantics with the rest of the grammar, the Incont Principle, the Excont Principle, and the LRS Projection Principle for the semantic composition system of LRS, and finally the Semantics Principle, which restricts for each type of phrase the combinatoric possibilities of its daughters. Finally, I have provided an example analysis of a scopally ambiguous sentence that has illustrated the interplay of all the principles and constraints and that has shown how the techniques of underspecification

employed in LRS account for the scope ambiguities.

Since I employ the framework of LRS for the analysis of extraposed relative clauses developed in Chapter 7, I will first illustrate the "standard" analysis of canonical relative clauses in LRS. This is presented in the next section.[8]

6.2 Relative Clauses in LRS

Before I provide an analysis of relative clauses in terms of LRS, I would like to say a few words about the properties and the interpretation of restrictive relative clauses in general. A restrictive relative clause has the following morphosyntactic and semantic properties:

(240) Morphosyntactic and semantic properties of a restrictive relative clause:

a. The relative pronoun agrees with the head noun (antecedent), i.e., they have identical ϕ-features (person, number, and gender).

b. The restrictive relative clause falls in the restrictor of the quantifier of the head noun.

c. Restrictive relatives are interpreted as intersective modifiers of the head, not as non-intersective modifiers (as, for example, *alleged*).

d. The relative pronoun and the head noun are translated into the same variable (have the same index), which is bound by the same quantifier.

Restrictive relative clauses are intersective modifiers. They serve to restrict the denotation of the noun they modify and pick out a subset of the set denoted by the noun. The denotation of the combination of a relative clause and the modified noun is the set of things that are both in the set denoted by the relative clause and the set denoted by the noun, that is, its denotation is the *intersection* of these two sets (the observation about the semantics of relative clauses seems to go back to Quine (1960)). For illustration, consider the following example:

(241) A dog which is brown barks.

While *dog* denotes the set of dogs and *which is brown* denotes the set of brown entities, *dog which is brown* denotes the intersection of these two sets, i.e., the set of all entities which are dogs and which are brown. Thus, the sentence can be said to be true just in case there is at least one individual which is both a member of the set of brown things and of the set of dogs, and that individual is also in the set denoted by *barks*.

I will now show how a relative clause and its head noun are combined using the techniques of LRS. Syntactically, modifiers are commonly analyzed as adjunct daughters in phrases of type *head-adjunct phrase* in HPSG (see Pollard and Sag (1994), Sag (1997),

[8] See Sailer (2004b) for an example analysis of intersective modification involving an adjective.

and Ginzburg and Sag (2001)).[9] However, I have to point out that in Section 7.3.1 below, I will argue that relative clauses should not be treated as adjuncts in "regular" head-adjunct phrases. In contrast to other modifiers, relative clauses (as well as some other kinds of modifiers) can be extraposed. I will therefore argue that a distinction be made between what I will call *canonical* modifiers, which can only appear in canonical position where they both syntactically and semantically modify the element they adjoin to, and *generalized* modifiers (which I will later call *anchor modifiers*), which may appear in canonical or extraposed position. While canonical modifiers are licensed in the familiar way by the regular head-adjunct schema, a different *Schema of Generalized Modification* will be introduced that licenses generalized modifiers. It will be shown that this very same schema licenses relative clauses both in extraposed position and when they appear in situ. As a consequence, in order to avoid spurious ambiguities, the regular head-adjunct schema will be restricted so as to license only canonical modifiers, but not generalized modifiers.

Before I introduce the new Schema of Generalized Modification, I would like to show how a relative clause would be licensed in the traditional way, i.e., as an adjunct in a regular head-adjunct phrase, within the framework of LRS. This is meant to further explicate the semantic composition mechanism of LRS with respect to modification.

The semantic constraints on phrases of type *head-adjunct-phrase* are given in the Semantics Principle in (237c) above. They require that the EXCONT value of the non-head be a subexpression of the EXCONT value of the head and thus ensure that the semantic contribution of the adjunct is included in the logical form of the head. How exactly the meaning contributions of the adjunct and the head are mutually embedded is specified by two separate constraints: one for intersective modifiers (237c-i) and one for non-intersective modifiers (237c-ii). Since the latter does not play a role for relative clauses, it is ignored here.

Clause (237c-i) treats the combination of an intersective modifier with a head and accounts for two things: First, it specifies that the EXCONT value of the intersective modifier consists of a conjunction of two expressions ($\alpha \wedge \beta$), which is as desired for describing the intersection of two predicates. Second, the clause requires that the INCONT value of the head be a component of the second conjunct of the EXCONT value of the modifier (β).[10] This ensures that the scopally lowest meaning contribution of the head is actually a part of the intersective modification, i.e., one of the two things that are subject to the intersection.

For illustration, consider the following example of relative clause modification, where the noun *dog* is modified by the restrictive relative clause *which is brown*:

(242) a. Pat bought **a dog** *which is brown*.

[9] Sag (1997) actually introduces a subtype of *head-adjunct-phrase*, called *hd-rel-ph*, to account for the correct semantic construal of relative clauses in his theory of relative clause constructions, which dispenses with an empty relativizer. Syntactically, however, he also considers relative clauses to function as adjuncts (see Section 5.2.2).

[10] Since logical conjunction is commutative, the order of the two conjuncts could also be changed. That is, the INCONT value of the head could also be a component of the first conjunct.

b. Pat bought [$_{NP_2}$ [$_{NP_1}$ a dog] [$_{RC}$ which is brown]].

A few words are in order about the syntactic structure I assume here, as indicated in (242b), namely that the relative clause is adjoined to the noun phrase consisting of the head noun and its determiner, i.e., NP_1 *a dog*. This might seem unusual in view of the fact that the prevailing assumption seems to be that a restrictive relative clause must be adjoined below the determiner, a position that is argued for mainly for semantic reasons (the "Partee-structure", see Partee (1973, 511–513)). However, it will directly become clear that the way LRS is designed does not require the relative clause to form a constituent with the noun in order to receive the correct semantic interpretation within the restriction of the quantifier. Furthermore, the mechanisms and the Schema of Generalized Modification that I will introduce in Chapter 7, which will replace the regular head-adjunct schema for licensing relative clauses, will only allow the attachment of the relative clause to NP, but not to N′/NOM or N. Applying the equivalent syntactic structure for a regular head-adjunct phrase here will allow for a better comparison, especially with respect to the technical details concerning the semantic composition.

Figure 6.2 illustrates the syntactic structure and the semantic analysis of the modified NP *a dog which is brown* of the sentence in (242). The semantic specifications of the lexical heads of the determiner *a* and the noun *dog* are analogous to those shown for *some* and *cat* in Figure 6.1 above. Simultaneously, the LF value of NP_1 *a dog* is equivalent to the LF value of the NP *some cat* in Figure 6.1. Thus, by satisfying the lexical restrictions as well as all principles and constraints, the logical form (i.e., the EXCONT value) of NP_1 *a dog* must be $\exists y[(...\mathsf{dog}'y...) \wedge \beta]$.

I ignore the internal structure of the relative clause here since it is not relevant for the semantic analysis of relative clause modification. The EXCONT value of the relative clause is $[\gamma \wedge \delta]$, with γ being the propositional content of the relative clause. The semantic contribution of the adjective *brown* is a component of γ. Hence, the logical form (i.e., the EXCONT value) of the relative clause can be specified to be $[\mathsf{brown}'y \wedge \delta]$.

When the relative clause is adjoined to NP_1, the result is a noun phrase (NP_2) of type *head-adjunct-phrase*, and the Semantics Principle in (237c) has to be applied, specifically (237c-i) since relative clauses are intersective modifiers. The first clause of (237c-i) is satisfied since the EXCONT value of the relative clause is of the form $[\gamma \wedge \delta]$. The second requirement is that the INCONT value of the head, i.e., $\mathsf{dog}'y$, be a component of δ ($\boxed{3} \lhd \delta$). The result is an expression of the form $[\mathsf{brown}'y \wedge (...\mathsf{dog}'y...)]$. The last requirement, stated in the first clause of (237c), specifies that the EXCONT value of the relative clause be a subexpression of the EXCONT value of NP_1 ($\boxed{13} \lhd \boxed{4}$), i.e., of the expression $\exists y[(...\mathsf{dog}'y...) \wedge \beta]$. Together with the constraint of (237c-i) just explained, which requires that $\mathsf{brown}'y$ and $\mathsf{dog}'y$ form a conjunction, it follows that the expression for the logical form (i.e., the EXCONT value) of NP_2 now has the form $\exists y[[\mathsf{brown}'y \wedge (...\mathsf{dog}'y...)] \wedge \beta]$.

Thus, as illustrated, all of the conditions together correctly ensure for the sentence in (242) that (i) *dog* is in the restrictor of the existential quantifier (of the determiner *a*) (Semantics Principle (237a)), (ii) *dog* and *which is brown* are intersectively combined (237c), and from the combination of these two it follows that (iii) *which is brown* is also in the restrictor of the quantifier. This can be seen in the logical form that was derived for NP_2 in the tree structure in Figure 6.2.

As mentioned above, the syntactic structure assumed here is such that the relative clause is adjoined to the NP node. However, it can now be seen that the relative clause could also be adjoined to N, according to the way LRS is designed. The semantic representation for the modified NP (*a dog which is brown*) would be exactly the same. What is needed for the semantic combination of a head and its modifier is the EXCONT and the INCONT values of the head. Since these are identical for NP and N, as shown in Figure 6.2 (according to the LRS Projection Principle), it does not semantically matter whether the modifier is adjoined to N or NP. The resulting logical form will be the same, namely the one shown in the EXCONT value of NP_2.

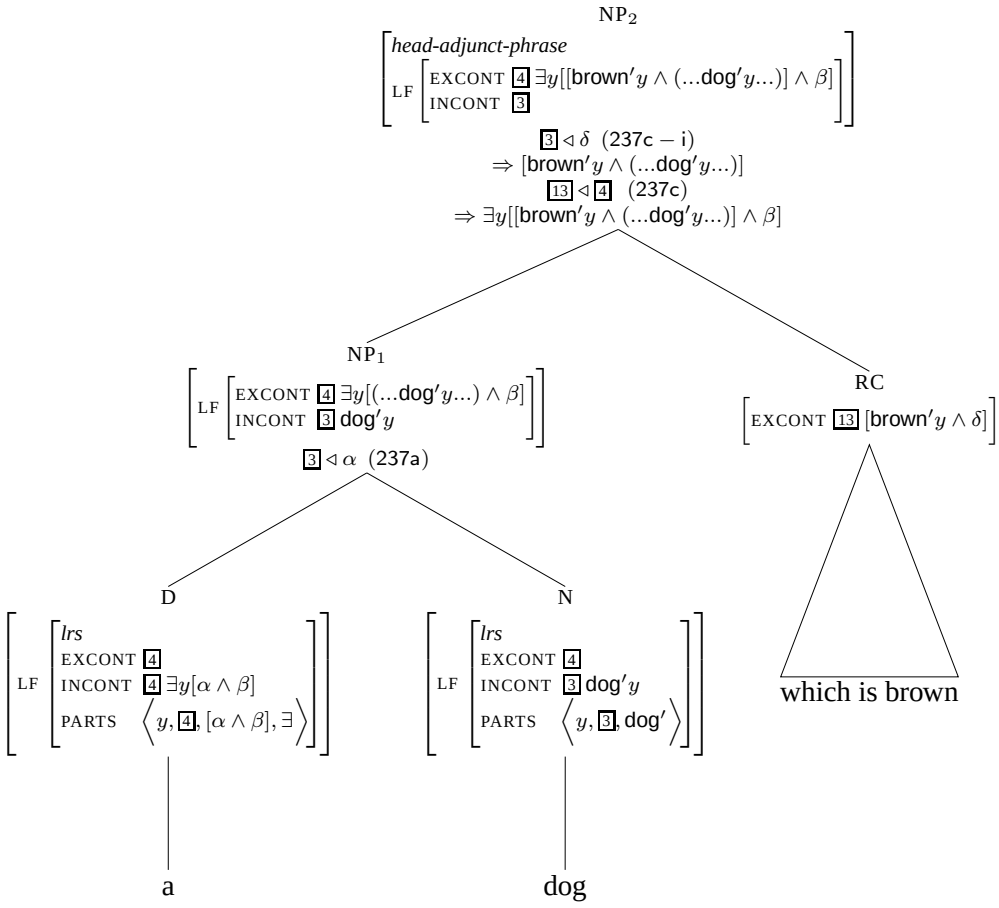


Figure 6.2: LRS analysis of the NP *a dog which is brown*.

To conclude, the principles and constraints of LRS introduced in this chapter provide correct semantic interpretations for restrictive relative clauses that adjoin within the NP of the semantically modified noun (or N′/NOM). An extraposed relative clause, however, cannot

be analyzed as a regular adjunct of a regular head-adjunct phrase, since it does not semantically modify the element it adjoins to in extraposed position. In the following chapter, I will present a new analysis of relative clauses and introduce a new Schema of Generalized Modification that licenses relative clauses in both extraposed position and in situ and accounts for their correct semantic construal. The analysis is implemented in the framework of HPSG and employs the techniques of LRS for the semantics.

Chapter 7

A New Theory of Generalized Modification

In this chapter, I present a new analysis of relative clauses and relative clause extraposition within the framework of HPSG, enhanced with an underspecified LRS semantics (Richter and Sailer, 2004). It builds upon the theory of Generalized Modification proposed by Kiss (2005) and adopts his main ideas. The extraposed relative clause is base-generated in extraposed position, and both the extraposed and the non-extraposed relative clause are licensed by the same syntactic and semantic constraints. The correct semantic interpretation of the relative clause is achieved by means of an *anchor*, which basically consists of the index of the antecedent nominal and is percolated throughout the tree so that it can establish the relationship between the modified nominal and the relative clause even when the latter appears in a nonlocal position.

As was shown in Section 5.3.3.2, Kiss' theory still has some significant problems in capturing the generalizations about relative clause extraposition collected in Chapter 2. The present theory develops his analysis further and remedies the deficiencies.

Section 7.1 gives some preliminary remarks. To remind the reader of the empirical facts that a comprehensive theory of relative clause extraposition must be able to account for, the section begins with a brief summary of the relevant data (Section 7.1.1). I will then briefly recapitulate the main ideas and proposals of Kiss' (2005) theory of Generalized Modification (Section 7.1.2). The introductory section is closed with a short overview of the main innovations of the new proposal (Section 7.1.3).

In Sections 7.2 and 7.3, I will develop the new analysis step by step. The former section is concerned with the introduction and the form of the anchor. At first, I present the analysis of the noun phrase assumed here in order to account for relative clauses with elliptical antecedents (Section 7.2.1). In Sections 7.2.2 and 7.2.3, I introduce the anchor employed in the present analysis and show how it is constructed, introduced, and percolated up the tree.

In Section 7.3, I develop a theory of the attachment of relative clauses. In Section 7.3.1, I present the *Schema of Generalized Modification*, a revised version of Kiss' proposal which

is adapted to LRS. In Section 7.3.2, I will argue that the Schema of Generalized Modification not only accounts for relative clauses, but for all modifiers that may extrapose, and I will motivate a distinction between extraposable and non-extraposable modifiers. I propose that the former are subject to the Schema of Generalized Modification, while the latter are licensed by the regular head-adjunct schema. In Section 7.3.3, I introduce the Anchors Saturation Principle, which ensures that all anchors must be bound off at the sentence boundary and thus, in combination with the other mechanisms introduced, guarantees the occurrence of a relative clause when it is required, for example by determiners like *derjenige/diejenige/dasjenige* ('the+that') in German. It will be shown that the Right Roof Constraint noted by Ross (1967/1986) falls out from this principle. In Section 7.3.4, I illustrate the new analysis with an example of relative clause extraposition. Section 7.3.5 provides an account of relative clauses with elliptical antecedents. In Section 7.3.6, I introduce a further constraint that will make it possible to account for the scope effects of relative clause extraposition observed by Fox and Nissenbaum (1999). This will be integrated with the other constraints of Generalized Modification developed before. Section 7.3.7 summarizes the final version of the Schema of Generalized Modification. In Section 7.3.8, I address the interaction of relative clause extraposition with topicalization and *wh*-movement and provide a constraint that accounts for the contrast found in English. Finally, in Section 7.3.9, I propose a constraint that captures the fact that relative clauses extraposed from objects must be adjoined within the VP. Section 7.4 summarizes the analysis developed in this chapter.

7.1 Preliminaries

7.1.1 Facts to be Accounted for

In Chapter 2, I gave an overview of the empirical facts which any successful theory of relative clauses and relative clause extraposition has to account for. For convenience, I will repeat the most important phenomena here. The most basic criterion that has to be fulfilled is the correct semantic construal of the relative clause, especially when it appears in extraposed position. I have illustrated this with an example repeated here in (243). The meaning of the relative clause *which I had read* must be integrated with the meaning of the NP *every book* in such a way that it contributes to determining the restriction of the quantifier expressed by the determiner.

(243) a. I gave **every book** *which I had read* to my sister.

b. I gave **every book** to my sister *which I had read*.

There are more challenging cases where the antecedent of the relative clause is embedded within a prepositional phrase (244a) or within a larger NP (244b):

(244) a. I saw it [$_{PP}$ in **a magazine**] yesterday *which was lying on the table*.
(Baltin, 1978/1985, 115)

b. [$_{NP1}$ The construction of [$_{NP2}$ **a bridge**]] was proposed *which would span the Delaware River*. (Guéron, 1980, 647)

Furthermore, a theory of relative clauses that not only strives to capture the English data but lays claim to generality should also be able to account for the phenomenon in German where a certain determiner class obligatorily requires the presence of a restrictive relative clause. This relative clause can also appear either in situ or in extraposed position:

(245) a. **diejenige (Frau)** *(*die dort steht*)
the+that woman who there stands
'the very woman who is standing there'

b. Ich habe **diejenige (Frau)** bewundert, *(*die dort steht*).
I have the+that woman admired who there stands.
'I have admired the very woman who is standing there.'

As these examples moreover show, the head noun of the relative clause's antecedent NP can even be elided. Phenomena like this can also be found in English:

(246) a. **Many/Some/Those (guests)** *that arrived early*

b. **Many/Some/Those (guests)** are drunk already *that arrived early*.

Finally, it has been shown that relative clause extraposition influences the scope of the antecedent NP, which is illustrated with the sentences in (247). An element like 'free choice' *any* must be licensed within the scope of some modal operator, which is *look for* in this case. A relative clause that is associated with such an element cannot be extraposed to a position higher than the modal verb, as demonstrated in (247b). Fox and Nissenbaum (1999) ascribe this to an observation already made by Williams (1974), namely that an extraposed relative clause requires its antecedent NP to have scope as high as the extraposition site. It follows that *anything* in (247b) must be subject to two conflicting scope requirements–below *look for* on the one hand, and above the VP on the other hand–which it cannot fulfill at the same time.

(247) a. I [$_{VP}$ looked very intensely for **anything** *that would help me with my thesis*].

b. * I [$_{VP}$ looked for **anything** very intensely] *that will/would help me with my thesis*.

c. I [$_{VP}$ looked for **something** very intensely] *that will (likely) help me with my thesis*.

An adequate theory of relative clauses and relative clause extraposition must be able to account for all these phenomena. While it was shown that some theories proposed in the literature are able to capture at least some of the generalizations mentioned above, none of the approaches succeeds in solving all the problems. In the remainder of this chapter, I will

propose an analysis of relative clauses that does account for all the phenomena mentioned above. Since it takes the theory developed by Kiss (2005) as a starting point, the following section provides a brief recapitulation of the main ideas of Kiss' Generalized Modification.

7.1.2 Recapitulation of Kiss' (2005) Theory of Generalized Modification

The theory of *Generalized Modification* developed by Kiss (2003, 2005) was presented in Chapter 5.3.3. It is an HPSG account of relative clauses which base-generates the extraposed relative clause in extraposed position. Recall that in order to license the extraposed relative clause and achieve its correct semantic interpretation, Kiss makes use of a nonlocal feature, called ANCHORS, which contains the index and the local top handle (a handle or label of the relation that has the widest scope within the constituent) of the modified nominal. Every noun that is modifiable by a restrictive relative clause introduces such an anchor, which is percolated up the tree using the standard machinery of HPSG for nonlocal feature inheritance. A relative clause may then be adjoined to any phrase that contains an anchor such that the index of the relative clause, which is the index of the relative pronoun, can be identified with the index of the anchor and the local top handle of the relative clause can be identified with the anchor's local top handle. As a consequence, the content of the relative clause is added to the content of the nominal, resulting in an intersective interpretation and a correct semantic subordination within the whole phrase. By employing this mechanism of anchor percolation, both canonical relative clause adjunction and relative clause extraposition are treated in the same way–as ordinary adjunction subject to the condition of Generalized Modification. While an anchor is not canceled after an identification process, constraints are introduced in order to account for the upward boundedness of relative clause extraposition (Ross' Right Roof Constraint).

As was shown, this theory still has significant problems in that it cannot handle all the generalizations about relative clauses and relative clause extraposition collected in Chapter 2. For example, it cannot account for the scope effects of extraposition, nor can it capture the cases where the determiner requires the presence of a relative clause, even if the noun is covert. There are two reasons why the latter phenomenon is problematic for Kiss' approach. First, the theory of Generalized Modification predicts that relative clauses are only optionally adjoined to phrases containing a suitable antecedent. Since anchors may be left unused, the presence of a relative clause is not enforced, and the theory thus cannot account for the fact that NPs with determiners like *derjenige/diejenige/dasjenige* ('the+that') obligatorily need a relative clause. Secondly, since it is the noun that introduces the anchor through which the relative clause is semantically connected to its antecedent, sentences in which a relative clause modifies an NP with an elided noun are problematic for Kiss' theory. Kiss does not

offer a solution for these cases.[1]

As for the scope effects of extraposition noted by Fox and Nissenbaum (1999) and shown in (247) above, these cannot be captured by Kiss' present analysis of Generalized Modification, either. The mechanisms of the theory are designed in such a way that both in situ and extraposed relative clauses are interpreted "low", that is inside the restrictor of the quantifier of the antecedent. Since there is no connection between the extraposition site and the scope of the antecedent's quantifier, the theory cannot account for the fact that an extraposed relative clause marks wide scope for its antecedent NP.

In the following, taking the principles of Kiss' Generalized Modification as a point of departure, I will develop some modifications that remedy these deficiencies. The next section gives an informal overview of the theory I propose, before I will present the new development in detail.

7.1.3 Outline of the New Proposal

The analysis of relative clauses and relative clause extraposition proposed in this chapter develops Kiss' (2005) theory of Generalized Modification further. It preserves the spirit of Kiss' Generalized Modification and adopts his main ideas and proposals. That is, an extraposed relative clause is base-generated, and its semantic interpretation is licensed through some kind of anaphoric process. Specifically, an anchor that percolates throughout the tree is used to establish the relationship between the relative pronoun and its antecedent and to account for the correct semantic subordination of the relative clause in the logical form of the overall sentence. Since I employ the framework of LRS instead of MRS, the technical details of what an anchor consists of will be different. However, in effect, the anchor also contains the nominal's index and a feature to ensure that the meaning of the relative clause will be part of the restrictor term of the quantifier that binds that index.

A relative clause is then licensed by a Schema of Generalized Modification, which allows the relative clause to be adjoined to any phrase that contains a suitable antecedent for the relative clause. The phrase attached to does not have to be the antecedent itself. It only needs to contain an anchor capable of incorporating the meaning of the relative clause into the meaning of the whole sentence.

In order to remedy the deficiencies of Kiss' theory mentioned in the previous section, I propose the following modifications. First of all, to account for the cases where a relative clause modifies an NP whose head noun is covert, I propose that the determiner rather than the noun introduces the anchor and passes it up the tree. This reflects the fact that there is a

[1] In Section 7.3.5, I will propose an analysis for such structures, employing a unary-branching schema rather than a phonologically empty noun. Since in the theory developed below the anchor is introduced by the determiner instead of the noun, it has to be demonstrated that cases of NPs without a determiner (e.g., plural NPs and mass nouns) can be handled. This problem is independent of relative clause extraposition, and solutions have been proposed that we can build on, e.g., Beavers (2003), as will be argued at the end of Section 7.2.3.

close relationship between the determiner and the relative clause.

Secondly, to account for the cases with obligatory relative clauses, I will introduce three mechanisms which in combination will enforce the presence of a relative clause: (i) The determiners that obligatorily require a relative clause (e.g., *derjenige/diejenige/dasjenige* ('the+that')) will obligatorily introduce an anchor, while the other determiners that do not require a relative clause only optionally introduce one, i.e., they introduce an anchor only if the nominal they combine with will actually be modified by a relative clause. (ii) The Schema of Generalized Modification is modified in such a way that an anchor that is "used", or "picked up", by a relative clause is bound off. That is, once a compatible relative clause is adjoined, the respective anchor will be canceled from the set of anchors and hence will not be projected any further. (iii) An additional constraint on a complete clause ensures that no anchors may be left at the sentence level (the *Anchors Saturation Principle*). That means that a sentence can only be well-formed if either every anchor that is introduced in a sentence is also picked up (bound off) by a relative clause within the sentence, or if no anchor is introduced in the first place.

So, all three mechanisms together ensure that a relative clause must appear whenever an anchor is introduced within a sentence. Hence, for determiners like *derjenige/diejenige/dasjenige* ('the+that') which obligatorily introduce anchors, the presence of a relative clause is guaranteed. When no anchor is introduced, no relative clause can be present in the sentence. In short, a relative clause appears within a sentence if and only if an anchor is introduced within that sentence.

Finally, in order to account for the scope effects of relative clause extraposition, I will add a further constraint to the Schema of Generalized Modification which ensures that the scope of the relative clause's antecedent NP will be as high as the attachment site of the extraposed relative clause. This is made possible by using the framework of Lexical Resource Semantics, which employs techniques of underspecified semantics and which considers the semantic contributions of words to be collections of expressions that are (potentially) distributed over the overall logical form of the sentence in which the words appear.

I will next provide the step-by-step development of the new analysis of Generalized Modification.

7.2 The Anchor

This section is concerned with the introduction and percolation of the anchor. I will first present an analysis of the noun phrase which will allow the determiner to introduce the anchor of the noun.

7.2.1 The Structure of the NP: The Head-Functor-Phrase

Since at least in German there are cases where a determiner requires the presence of a relative clause (see (245)) and, moreover, there are cases where a relative clause can even modify an antecedent NP whose head noun is not (overtly) expressed (see (245) and (246) above), I assume that it is the determiner that introduces the anchor that establishes the semantic relation between the relative clause and its antecedent. As will be shown in the following sections, the anchor must consist of the index of the noun as well as its main semantic predicate, both of which are contained in the CONTENT value of the noun. In order for the determiner to introduce this information as an anchor, it needs access to these values.

In the grammar of Pollard and Sag (1994) and Ginzburg and Sag (2001), nouns are identified as the heads of the noun phrase which select for their specifiers via the SPR attribute and then project into an NP. At the same time, determiners reciprocally select (the SYNSEM values of) their head sisters via the feature SPEC. Since the SPEC value also contains the CONTENT value of the selected nominal, the determiner has access to the information that is required to "build" the anchor. Hence, this selection mechanism via the feature SPEC of Pollard and Sag (1994) would be sufficient to introduce the anchor.

However, Pollard and Sag and Ginzburg and Sag do not provide an analysis of noun phrases with elided nouns, and since they assume the noun to be the head of the NP, it is not obvious how they would deal with an NP in which the head is missing. A solution to this problem is provided by Branco and Costa (2006), who propose a unary schema for noun-elliptical NPs. It licenses a noun phrase that consists of only one daughter, which is the determiner in cases like (245) and (246), and in which the (covert) noun is considered to be the head. To ensure that the noun phrase inherits the HEAD features of the noun, Branco and Costa follow a proposal by Allegranza (1998a,b) and Van Eynde (1998, 2003a,b, 2006), who treat determiners as functors that select the nominal. Through this selection mechanism, a determiner has access to the SYNSEM value–and thus the HEAD value–of the noun, which it then passes up to the mother node of the noun-elliptical NP. The details of Branco and Costa's analysis will be presented in Section 7.3.5 below, where I will also show how it can be expanded to license relative clauses that modify noun-elliptical NPs. Since Branco and Costa's analysis builds upon the work of Van Eynde, some details of which I will also adopt for my analysis of relative clauses and relative clause extraposition, I will briefly present the relevant aspects of Van Eynde's *functor treatment*.

Based mainly on inflectional morphology and morpho-syntactic agreement data from Dutch,[2] Van Eynde (1998, 2003a,b, 2006) argues that "determiners" are categorially heterogeneous and must be treated as members of independently motivated substantive parts of speech, especially adjectives and nouns. As a consequence, he rejects the DP treatment

[2]The analysis also extends to agreement types that are more semantic in nature, such as NP-internal index agreement and hybrid agreement, as shown in Van Eynde (2006).

of the noun phrase[3] and instead proposes an analysis in which the noun is identified as the head of the NP. At the same time, he assumes that specifiers are not selected by their head and thus abolishes the distinction between specifiers and modifiers. Instead, all prenominal dependents (specifiers and adjuncts) are uniformly treated as functors which select their head. This is modeled by employing a single feature SELECT, which replaces the features MOD(IFIED) and SPEC(IFIED) of Pollard and Sag (1994) and Ginzburg and Sag (2001).[4] It is a HEAD feature, and its value will be *synsem* or *none*:[5]

(248) *part-of-speech*

SELECT *synsem* ∨ *none*

Via the SELECT feature, a non-head daughter (i.e., the functor) imposes constraints on its head sister. To model the combination of the functor with its head, Van Eynde introduces the type *head-functor-phrase*, which is a subtype of *headed-phrase* and as such constrained by the Head Feature Principle and the Valence Principle. The constraint specified for the type *head-functor-phrase* is shown in (249). It describes all phrases in which the non-head daughter selects the head daughter and as such emcompasses the *head-adjunct*, *head-specifier*, and *head-marker* phrase types of Pollard and Sag (1994) and Ginzburg and Sag (2001).

(249) *head-functor-ph* ⇒

$$\begin{bmatrix} \text{SS|LOC|CAT|MARKING } \boxed{3}\ \textit{marking} \\ \text{DAUGHTERS} \left\langle \left[\text{SYNSEM|LOC|CAT} \begin{bmatrix} \text{HEAD|SELECT } \boxed{1} \\ \text{MARKING } \boxed{3} \end{bmatrix} \right], \boxed{2} \right\rangle \\ \text{HEAD-DTR } \boxed{2} \left[\text{SYNSEM } \boxed{1}\ \textit{synsem} \right] \end{bmatrix}$$

Head-functor phrases have a non-head daughter (the functor daughter) whose SELECT value is identified with the SYNSEM value of the head daughter (1). This constraint is called the Selector Principle, which is a generalization of the SPEC PRINCIPLE of Pollard and Sag (1994, 51) since it extends to all types of selection by non-heads. Since the SELECT value is of type *synsem*, a functor can impose syntactic and semantic requirements on the head. For instance, the determiner *every* can require its head to be a singular count noun.

The MARKING feature is the counterpart to the HEAD feature: while the HEAD value of the mother is identified with that of its head daughter, the MARKING feature contains information which is shared between the mother and the non-head daughter (3). This is

[3]According to the DP hypothesis, originally proposed by Abney (1987), the determiner is the lexical head which takes a nominal projection as its complement and yields a DP. See Van Eynde (2006) for arguments against the DP analysis in different variants (e.g., Netter (1994, 1996)).

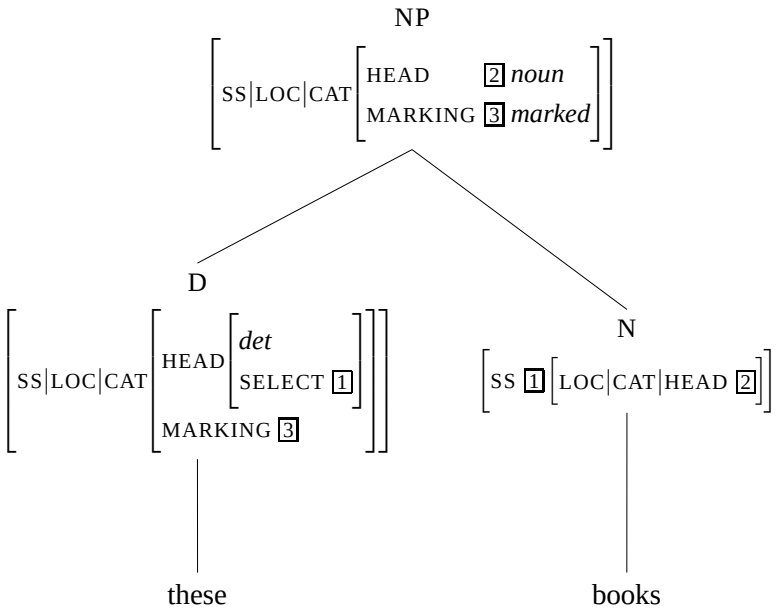
[4]In Pollard and Sag (1994) and Ginzburg and Sag (2001), MOD is a feature of the substantive parts of speech (A, N, V, P), while SPEC is assigned to the functional parts of speech (Det, Marker, ...). Van Eynde, however, dispenses with the dichotomy between the substantive and the functional parts of speech. This is another reason why he does not distinguish between MOD and SPEC.

[5]The SELECT feature is assigned to all parts of speech. However, not every word or phrase is always used as a functor. For example, adjectives in predicative position are complements rather than functors, since they are selected by a copular verb. The value of their SELECT feature will thus be *none* (Van Eynde, 2006, 165).

called the Generalized Marking Principle. The MARKING value basically describes the degree of saturation of a phrase and is used to model, for example, the stacking properties of the prenominals as well as the definiteness status of the NP.[6]

So, an NP like *these books* is a phrase of type *head-functor-phrase*. The functor daughter is the determiner, which selects the noun and determines the degree of saturation of the phrase (the MARKING value), and the head daughter is the noun, which determines the HEAD value (and the valence values) of the phrase:

(250)



Crucial for my analysis is the fact that determiners select nominals via the SELECT feature and thus have access to the *synsem* values, i.e., the syntactico-semantic information, of the nominals. This will be important for the introduction of the anchor of the nominal, especially in cases where the noun is elided. As will be shown in the next section, the anchor consists of the CONTENT value of the nominal. The determiner introduces this value as an anchor, which it then passes up the tree so that it can be picked up by a relative clause. The details of these mechanisms are explained in the following sections.

7.2.2 The Introduction of the Anchor

In this section, it is shown how the anchor is introduced that establishes the relation between a relative clause (canonical or extraposed) and its antecedent. The anchor will consist of the index and the semantic predicate of the nominal, and it is introduced by the determiner in order to be passed up the tree.

I employ a feature called ANCHORS (ANC), which belongs to the nonlocal attributes.[7] As in Pollard and Sag (1994), objects of sort *nonlocal*, which are the values of the feature NON-

[6] See Van Eynde (2003b, 2006) for a development of a complex sort hierarchy of the sort *marking*.

[7] I adopt this idea from Kiss (2005), who also employs a feature called ANCHORS. However, the value of his ANCHORS feature is different. Kiss takes it to be a set of index-handle pairs. The latter take the form of a tuple consisting of a nominal's index and the corresponding handle.

LOCAL, have the two attributes INHERITED (INH) and TO-BIND. In the SLASH mechanism, the INHERITED feature is employed to introduce nonlocal dependencies at the gap site and pass them up the tree, while the TO-BIND feature is used to bind the nonlocal dependency at the filler. Both of these features take objects of type *nonlocal1* as their value. In Pollard and Sag (1994), this type has the attributes SLASH, REL, and QUE, and I now add the attribute ANCHORS. The sort hierarchy and appropriateness conditions of the types *nonlocal* and *nonlocal1* are shown in (251).[8]

(251) a. Appropriateness conditions of the sort *nonlocal*:

nonlocal	
INHERITED	*nonlocal1*
TO-BIND	*nonlocal1*

b. Appropriateness conditions of the sort *nonlocal1*:

nonlocal1	
SLASH	*set(local)*
REL	*set(ref)*
QUE	*set(npro)*
ANCHORS	*set(local)*

I assume that the ANCHORS attribute takes a set of elements of type *local* as its value.[9] According to the feature architecture of Pollard and Sag (1994), elements of type *local* contain the features CATEGORY and CONTENT. However, I adopt a proposal by Crysmann (2013), whose analysis of relative clause and complement clause extraposition, based on Kiss (2005), also employs an anchor mechanism. Crysmann splits the type *local* into two types, *index-local* and *full-local*. As shown in (252), CONTENT is the feature appropriate for the common supertype *local*, while CATEGORY is a feature only for the subtype *full-local*. On the one hand, this partitioning allows Crysmann to model both relative clause and complement clause extraposition by employing one and the same feature, whose value is a set of *local* elements.[10] On the other hand, he can account for the differences between the two mechanisms in that in the case of relative clause extraposition, the anchor consists of an element of type *index-local*, i.e., only semantic content information, while in the case of complement clause extraposition, it is of type *full-local*, i.e., it contains full syntactico-

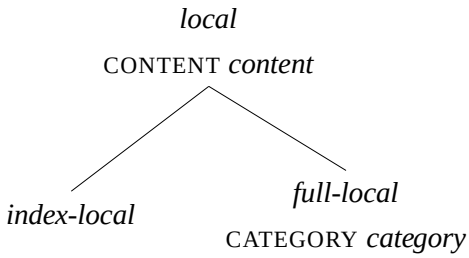
[8]The assumption of this architecture for extraposition constructions is also based on Crysmann (2013), who draws on Keller (1995). The latter introduced the nonlocal feature EXTRA to model extraposition processes as a nonlocal dependency. See Chapter 5.3 for a review of all major analyses of relative clause extraposition proposed in HPSG.

[9]This idea stems from Crysmann (2013).

[10]Hence, all rightward-oriented displacement processes are modeled by means of one and the same feature, which Crysmann calls EX instead of ANCHORS, while all leftward extraction processes are modeled using the standard HPSG nonlocal feature SLASH.

semantic information (see Chapter 5.3.4 for a full review of Crysmann's analysis).[11]

(252) Sort hierarchy and appropriateness conditions of the sort *local*:



Recall that the relationship between an extraposed relative clause and its head is regarded to be quasi-anaphoric (see Chapter 5.3.3 and Kiss (2005)). The relative clause mainly needs access to the referential index introduced by its antecedent. More precisely, the index of the relative pronoun must be identified with the index of the head noun. Furthermore, as will be shown in Sections 7.3.1 and 7.3.4 below, the semantic predicate of the nominal is additionally needed in order to ensure that the semantic contribution of the relative clause and the semantic contribution of its antecedent are intersectively conjoined. For that reason, Crysmann's proposal is adopted in the present analysis of relative clause extraposition, and the value of the ANCHORS attribute is a set of elements of type *index-local*. Its feature CONTENT contains both, the INDEX and the MAIN value (i.e., the semantic predicate) of the nominal.

The next question is: how is the anchor introduced? In contrast to Kiss (2005), in whose theory the anchor is introduced by the noun, I assume that it is the noun's determiner that introduces the anchor. One important argument for this analysis is that relative clauses can even modify elements that lack an overt noun, as in the German example *diejenige, die dort steht* ('the+that who there stands'), or in the English example *some/many that were drunk* (see Section 7.3.5 below for an account of these cases). Furthermore, certain determiners in German enforce the presence of a relative clause (**diejenige Frau* ('the+that woman') vs. *diejenige Frau die dort steht* ('the+that woman who there stands')). Finally, although proper names can neither be modified by a restrictive relative clause (in English **Paris that I love*, or in German **Berlin, das ich liebe* ('Berlin that I love')), nor can they be specified by a determiner (**the Paris*, **das Berlin* ('the Berlin')), a restrictive relative clause can be adjoined when a determiner is present, as in *the Paris that I love* and *das Berlin, das ich liebe* ('the Berlin that I love'). These cases suggest that there is a close dependency between the determiner and the relative clause.[12] It is therefore natural to assume that the determiner is

[11] Since Crysmann (2013) uses the semantic framework of MRS (Minimal Recursion Semantics), the features appropriate for his sort *content* differ from the ones employed in LRS. See Chapter 5.3.4 for the details. However, the effects of both theories are the same.

[12] This observation goes back to Smith (1964), Vergnaud (1974), Kayne (1994), Schmitt (2000), and Sauerland (2003), among others, who take the relative clause to be selected by the determiner.

the element responsible for introducing the anchor and hence for licensing a relative clause.[13]

Since a determiner selects the nominal via its SELECT feature, it is straightforward to specify a lexical constraint on the determiner which introduces the anchor of the nominal, whether the nominal is overt or elided. The constraint is formulated for all words whose HEAD value is of type *determiner (det)*, as shown in (253).

(253) Anchor Introduction Constraint:

$$\begin{bmatrix} \textit{word} \\ \text{SS|LOC|CAT|HEAD } \textit{det} \end{bmatrix} \Rightarrow \begin{bmatrix} \text{SS} \begin{bmatrix} \text{LOC|CAT|HEAD|SELECT|LOC|CONT } \boxed{1} \\ \text{NLOC|INH|ANCHORS} \left\{ \left(\begin{bmatrix} \textit{index-local} \\ \text{CONT } \boxed{1} \end{bmatrix} \right) \right\} \end{bmatrix} \end{bmatrix}$$

Every determiner thus introduces into its ANCHORS set an element of type *index-local* whose CONTENT value is structure-shared with the CONTENT value of the nominal it selects. Note, however, that the element in the ANCHORS set is only optionally introduced, which is indicated by the parentheses. This is in order to account for the difference between determiners that enforce the presence of a relative clause (e.g., *derjenige/diejenige/dasjenige* ('the+that')) and determiners that do not require one (e.g., *the, a, some* in English, and *der/die/das* ('the'), *ein/eine/ein* ('a') in German). The introduction of the anchor is obligatory for the former, in which case the lexical entry of the determiner is specified to have a nonempty set as its ANCHORS value, as illustrated in (254a). In the latter case, the introduction of the anchor is optional, and nothing further needs to be specified in the lexical entry of such a determiner (254b). As will be shown below, if an anchor is introduced, it must be picked up by a relative clause. That means that a determiner like *the* or *a* only introduces an anchor if the nominal it selects is also modified by a relative clause. If the nominal is not modified by a relative clause, the determiner has an empty ANCHORS set.

(254) a. Sketch of a lexical entry of a determiner (*diejenige* ('the+that')) with an obligatory relative clause:

$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{diejenige} \right\rangle \\ \text{SS} \begin{bmatrix} \text{LOC|CAT|HEAD } \textit{det} \\ \text{NLOC|INH|ANCHORS } \textit{non-empty-set} \end{bmatrix} \end{bmatrix}$$

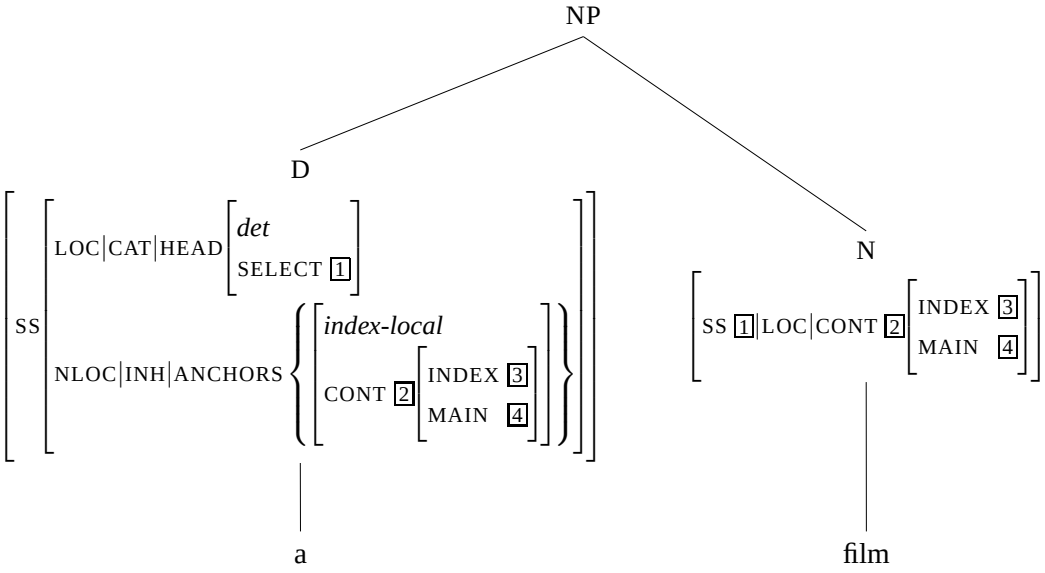
b. Sketch of a lexical entry of a determiner (*der* ('the')) that optionally licenses a relative clause:

$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{der} \right\rangle \\ \text{SS|LOC|CAT|HEAD } \textit{det} \end{bmatrix}$$

[13]The reader might wonder at this point how an anchor will be introduced, i.e., how a relative clause will be licensed, in cases where there are no determiners, for example in plural NPs and mass nouns. This issue will be addressed in the section to follow.

The tree structure in (255) illustrates the mechanism of the introduction of the anchor for the NP *a film*. The determiner selects the SYNSEM value of the nominal it combines with and introduces the nominal's CONTENT value (i.e., the INDEX and MAIN values) as an anchor into its ANCHORS set.

(255) Sketch of the introduction of the anchor:



What needs to be achieved next is that the anchor is passed up the tree so that it can eventually be picked up by a relative clause. This is taken care of in the following section.

7.2.3 The Percolation of the Anchor

Since the ANCHORS feature is employed as a nonlocal feature, the standard HPSG mechanism for nonlocal feature inheritance can be used to percolate the anchor up the tree, as suggested by Kiss (2005). The Nonlocal Feature Principle of Pollard and Sag (1994) is modified so that it comprises the ANCHORS feature in addition to the other nonlocal features SLASH, QUE, and REL (see also Crysmann (2013)):

(256) The Nonlocal Feature Principle

In a headed phrase, for each nonlocal feature F = SLASH, QUE, REL, or ANCHORS, the value of SYNSEM|NONLOCAL|INHERITED|F is the set difference of the union of the values on all the daughters and the value of SYNSEM|NONLOCAL|TO-BIND|F on the HEAD-DAUGHTER.

Accordingly, the anchor of every noun is included in the ANCHORS set of every phrase dominating the determiner that introduces the noun's anchor, as long as it is not specified as the TO-BIND value of the head daughter. The percolation mechanism is illustrated in Figure 7.1. It shows the tree structure of the sentence in (257) from Guéron (1980, 647), in which the noun *bridge*, which is embedded within a larger NP, is modified by an extraposed relative clause.

(257) The construction of **a bridge** was proposed *which would span the Delaware River*.

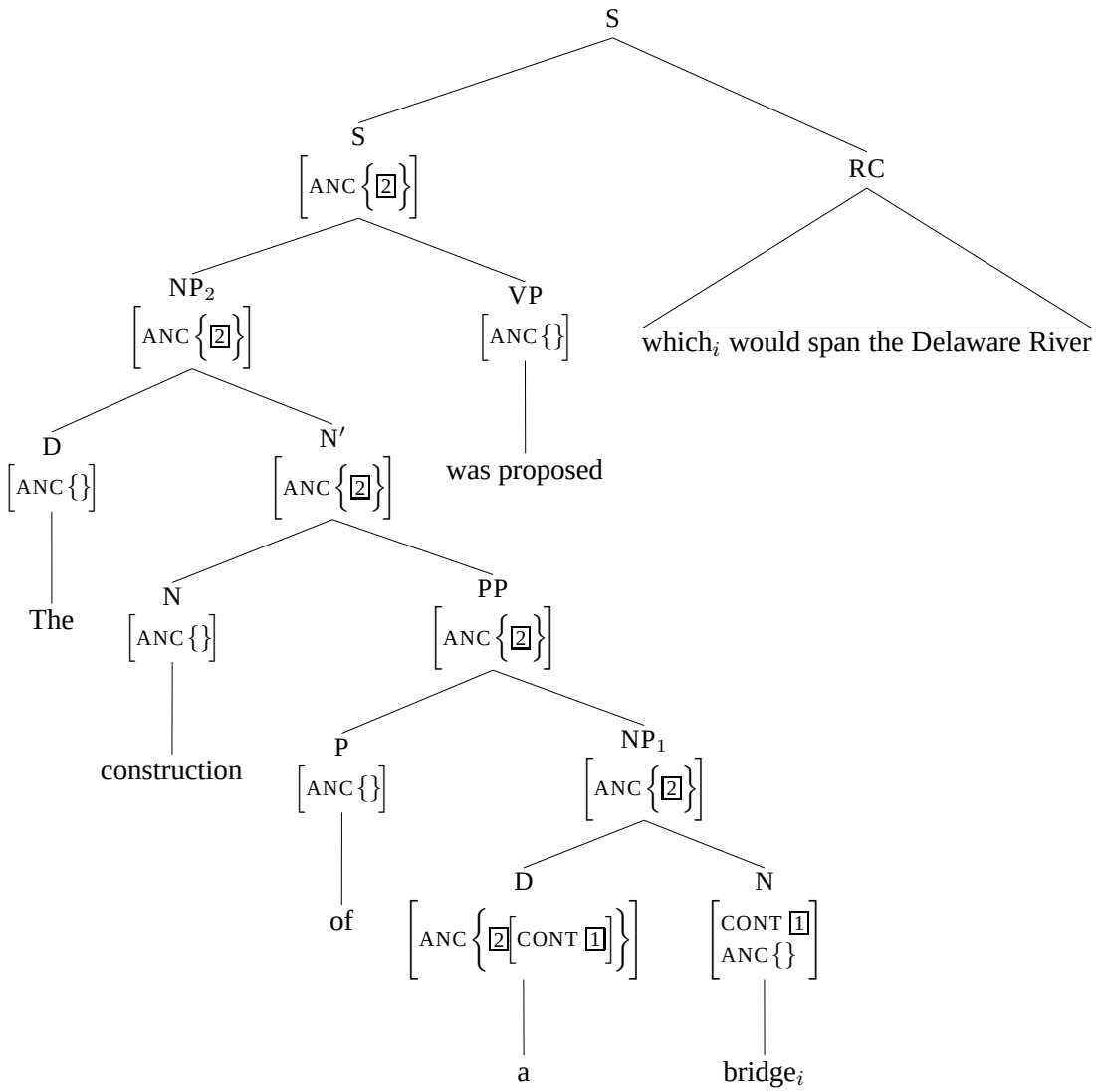


Figure 7.1: Illustration of the percolation of the anchor

The CONTENT value of *bridge* is introduced as an anchor by its determiner, and this anchor is passed up the tree in accordance with the Nonlocal Feature Principle. Every phrase that dominates the determiner of the noun *bridge* contains the anchor of *bridge*. Note that no anchor is introduced for the noun *construction*, since this noun is not modified by a relative clause in this sentence.

Through this anchor percolation mechanism, the CONTENT value of a noun becomes nonlocally available at any phrasal node that dominates the determiner of the noun. It follows that a relative clause can adjoin to any of these nodes, since all it requires is that it can locally identify the relative pronoun's index with the index of the antecedent nominal.[14,15] Note that

[14]This is a simplification. As already mentioned, the semantic constant of the nominal, which is also available in the anchor, is additionally needed for the correct semantic construal. This will be explained below.

[15]Crysmann (2005), and also Kiss himself, have pointed out that this mechanism of anchor percolation might give rise to spurious ambiguities, since an anchor can, in principle, be picked up at any point along the

since the anchor is already available at the NP node of the relative clause's antecedent, the relative clause can also be adjoined immediately to the NP. Thus, the identification requirement is independent of whether the relative clause is extraposed or not. That is why Kiss calls this kind of modification "Generalized Modification".

The attentive reader might have noticed three aspects of the analysis: First, given that the determiner rather than the noun introduces the anchor, the relative clause cannot be attached below the determiner, specifically to the noun itself, i.e., to N in Figure 7.1. This seems quite unusual in view of the fact that–even though the exact point of attachment of the relative clause has been subject to a controversial debate–one of the common proposals, mainly for semantic reasons, is that the relative clause must be adjoined below the determiner, i.e., to N′ or N under an NP-analysis of the noun phrase. However, at the end of Section 7.3.2, I will argue that there are neither semantic nor syntactic arguments that require an adjunction below the determiner. In fact, the semantic arguments do not play a role in the theories proposed here or by Kiss (2005). Since these theories employ the mechanism of index percolation in combination with the techniques of MRS or LRS that allow for semantic underspecification, a relative clause can be interpreted in a "low" position even if it is adjoined at some higher point in the tree structure. Thus, it can be interpreted in the restrictor of a quantifier without having to appear below the determiner. So, in the analysis proposed here, the "lowest" position a relative clause can be adjoined to is the NP, which in the following is referred to as the *canonical* position of a relative clause.

The second question that might come up is: since the anchor is introduced by the determiner and thus available in the ANCHORS set of the determiner, why can the relative clause not adjoin to D/DP? Of course, this must be ruled out since it would give rise to illicit structures such as **the [who is reading a book] man*. The solution to this problem is a bit more complex and will be postponed to the end of Section 7.3.6, when I will have introduced and explained all the constraints of generalized modification. To put it briefly, this kind of adjunction will be prohibited by a scope constraint, which will be independently introduced to account for the scope effects of Fox and Nissenbaum (1999) (see the examples in (247) above).

The final question one might ask is how a nominal's anchor is introduced when there is no determiner, as in plural NPs and mass nouns. Obviously, these bare nouns can be modified by a relative clause, as in *dogs that bark* and *juice which has pulp in it*. Since I claim that the only way a nominal can be modified by a relative clause is via the anchor (as I will argue in the following section), I suggest that in the case of bare nouns, their anchor has to be introduced by the nouns themselves. This is not considered to be problematic with regard to the fact that some special treatment of bare nouns is needed anyway. A well-formed noun phrase must

percolation path. As illustrated for the complex NP *the construction of a bridge* in Figure 7.1, the anchor of the head noun *bridge* could be retrieved at any one of the nodes D, NP_1, PP, N′, NP_2, and S. See Crysmann (2005) for an approach to controlling spurious ambiguities in relative clause extraposition. See also Crysmann (2013) for an extension to complement clause extraposition.

have both some restrictive semantics associated with nouns and some operator semantics associated with determiners. In the absence of an overt determiner, some mechanism is needed to provide the operator semantics. One way of capturing this would be to introduce a unary branching construction as proposed by Beavers (2003), who simply modifies the nominalization analysis of Ginzburg and Sag (2001, 191–192). A constraint could then be added that (optionally) introduces the noun's CONTENT value into the ANCHORS set of the noun phrase. From here, it will be percolated further up via the Nonlocal Feature Principle. Hence, a relative clause can adjoin either canonically to the bare NP or occur in extraposed position.

To conclude, in the previous and in this section, I have demonstrated how the nominal's index and semantic constant are introduced as an anchor and percolated up the tree. In the following, I will specify how the relative clause is adjoined and picks up the anchor. I will introduce a Schema of Generalized Modification–a revised version of Kiss' Generalized Modification–that licenses the attachment of a relative clause to any phrase that contains a suitable anchor.

7.3 The Attachment of the Relative Clause

This section is concerned with the attachment of a relative clause and introduces several principles and constraints to account for the clause-boundedness of extraposition, for relative clauses with elliptical antecedents, for the scope effects of relative clause extraposition, for extraposition from topicalized phrases, and for a locality constraint on relative clause extraposition from objects.

7.3.1 Picking up the Anchor: The Schema of Generalized Modification

In this section, I introduce the Schema of Generalized Modification–a further development of Kiss' (2005) Generalized Modification–that describes phrases consisting of a head daughter and a generalized modifier. A generalized modifier is a modifier that may not only appear in situ, i.e., next to the element that it semantically modifies, but it may also be extraposed. Relative clauses, for example, are generalized modifiers, but I claim that any kind of modifier that may extrapose can be considered a generalized modifier. When a generalized modifier appears in an extraposed position, it semantically modifies an element that is embedded within the phrase it adjoins to. The relation to the modified element is established by means of an anchor consisting of the element's index and semantic constant, which is percolated throughout the tree as described in the previous sections. It is proposed that generalized modifiers are distinguished from "regular" modifiers (which can only adjoin to the element that they semantically modify) in that the former must interact with the anchor in order to be licensed.

In the following, I present the Schema of Generalized Modification with respect to relative clause modification. A restrictive relative clause may be syntactically adjoined to any phrase that contains a suitable antecedent for the relative pronoun. To find out what a suitable antecedent is, recall the properties of restrictive relative clauses that were already mentioned in Chapter 6.2:

(258) Morphosyntactic and semantic properties of a restrictive relative clause:

a. The relative pronoun agrees with the head noun (antecedent), i.e., they have identical ϕ-features (person, number, and gender).

b. The restrictive relative clause falls in the restrictor of the quantifier of the head.

c. Restrictive relatives are interpreted as intersective modifiers of the head, not as non-intersective modifiers (as, for example, *alleged*).

d. The relative pronoun and the head noun are translated into the same variable (have the same index), which is bound by the same quantifier.

It follows from these properties that a suitable antecedent for a relative pronoun is a nominal whose ϕ-features can be identified with the ϕ-features of the relative pronoun and which is translated into the same variable as the relative pronoun. Moreover, the semantic restrictions imposed on the relative pronoun must be added to the restrictions that are already imposed on the index of the antecedent.

Since the CONTENT value of a noun, which contains the noun's PHI, VAR, and INDEX values, is now available in the ANCHORS set of every phrase dominating the noun's determiner (unless it has already been "picked up" by a relative clause in a fashion to be described below), it is possible to formulate a local constraint that establishes the correct semantic relationship between the extraposed relative clause and its antecedent, even if the antecedent is deeply embedded within the phrase to which the relative clause adjoins.

However, before I present this constraint, I have to say a few words about the structural assumptions concerning relative clauses. I assume the analysis developed by Sag (1997), with a few modifications as described below. In Sag (1997), the relative clause is considered to function as an adjunct in a head-adjunct structure, modifying a nominal projection.[16] As for the internal syntactic structure, the relative clause is assigned a structure that is headed by the highest verb rather than by an empty relativizer as proposed in Pollard and Sag (1994) (cf. Chapter 5.2 for a review of these two analyses). The MOD value of the relative clause is coindexed with the relative word in *wh*-relatives and with the gap inside non-*wh*-relatives, respectively. It requires the relative clause to be adjoined to a nominal projection whose INDEX value can be identified with the INDEX value of the relative pronoun (or the

[16]Note that in order to guarantee the correct semantic construal, Sag (1997, 473–475) treats head-relative phrases as a special subtype of *head-adjunct-phrase*. See Chapter 5.2.2 for details. Since I employ a different semantic framework, i.e., LRS instead of the HPSG semantics of Pollard and Sag (1994) and Ginzburg and Sag (2001), the semantic details of the relative clause constructions will be different in my analysis.

gap, respectively). In a simplified way, the MOD value of a relative clause can be given as MOD [HEAD *noun*, INDEX *i*], where *i* is the index of the relative pronoun. It is hence ensured that the relative pronoun and its antecedent are coindexed.

For the analysis proposed here, however, we have to make a few crucial changes to Sag's theory. First, as was explained in detail in the previous section, it is now assumed that a relative clause can be attached not only to a nominal projection, but to any kind of major phrase (e.g., NP, VP, PP, S).[17] Therefore, the MOD value of the relative clause is no longer categorially restricted to be of type *noun*. Secondly, since the phrase to which the relative clause adjoins is not necessarily the nominal that the relative clause semantically modifies, its INDEX value is not necessarily the one that is to be identified with the index of the relative pronoun. However, the index of the relative clause's antecedent is now available in the ANCHORS set of the relative clause's syntactic sister, as explained in the sections above. Therefore, the MOD value of the relative clause must now be specified as follows: MOD [NLOC|INH|ANCHORS {...[INDEX *i*]...}]. That is, the relative clause syntactically modifies (adjoins to) a phrase which must contain in its ANCHORS set an anchor whose INDEX value can be identified with the index of the relative pronoun. Since the anchor's INDEX value is the head noun's index, it follows that the relative pronoun and its antecedent are coindexed. Thus, the semantic identification requirement is not restricted to the syntactic sister of the relative clause, but is mediated through the ANCHORS feature.

According to these new assumptions, which were already proposed by Kiss (2005), it is not required anymore that a relative clause adjoin to the phrase that it semantically modifies. Instead, a relative clause can now adjoin to (i.e., syntactically modify) a phrase which *contains* the element that it semantically modifies. For this reason, I follow Kiss in calling this kind of modification *Generalized Modification*.

While "regular" modification yields a phrase of type *head-adjunct-phrase*, I will now introduce a new phrasal schema that licenses generalized modification. I will call this type of phrase *head-generalized-modifier-phrase (hd-gen-mod-ph)*. The schema licenses the adjunction of a relative clause to a phrase that contains a suitable antecedent. For ease of reference, I will often refer to it as the Schema of Generalized Modification, or GenMod Schema. It is subject to the following conditions:[18]

[17] See Kiss (2005, section 2.2) for empirical motivation.

[18] Note that these conditions are preliminary. The GenMod Schema will be supplemented with further constraints in the discussion to follow.

(259) Head-Generalized-Modifier Schema (preliminary, Version I)

In a *head-generalized-modifier-phrase*, the following conditions hold:

a. the EXCONT value of the non-head daughter is of the form $\alpha \wedge \beta$;

b. there is an element A in the ANCHORS set of the head daughter such that

i. the INDEX value of A is identical with the INDEX value of an element in the ANCHORS set of the non-head daughter's MOD value, and

ii. the MAIN value of A is a component of β.

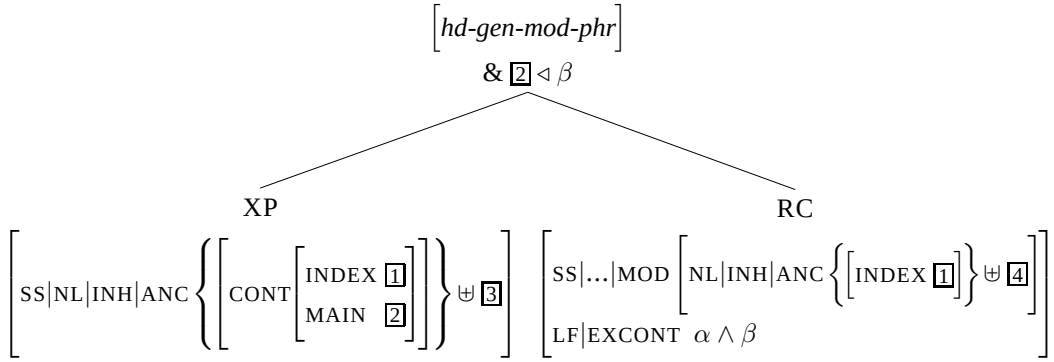
hd-gen-mod-ph $\Rightarrow$

$$\left(\begin{bmatrix} \text{HD-DTR } \boxed{0} \begin{bmatrix} \text{SS}|\text{NLOC}|\text{INH}|\text{ANC} \left\{ \left[\text{CONT} \begin{bmatrix} \text{INDEX } \boxed{1} \\ \text{MAIN } \boxed{2} \end{bmatrix} \right] \right\} \uplus \boxed{3} \end{bmatrix} \\ \text{DTRS} \left\langle \boxed{0}, \begin{bmatrix} \text{SS}|\text{LOC}|\text{CAT}|\text{HEAD}|\text{MOD} \left[\text{NLOC}|\text{INH}|\text{ANC} \left\{ \left[\text{INDEX } \boxed{1} \right] \right\} \uplus \boxed{4} \right] \\ \text{LF}|\text{EXCONT } \alpha \wedge \beta \end{bmatrix} \right\rangle \end{bmatrix} \\ \& \ \boxed{2} \lhd \beta \end{bmatrix}\right)$$

The constraint on *hd-gen-mod-phrase* describes a phrase whose head daughter must have a non-empty ANCHORS set. The non-head daughter is a modifier with an EXCONT value of the form $\alpha \wedge \beta$, i.e., it is an intersective modifier. I assume that the semantic contribution of the modifier is given as a component of α. The modifier's MOD value is an element that is specified to have a non-empty ANCHORS set. The INDEX value ($\boxed{1}$) of one of the anchors in this set must be identified with the INDEX value of an anchor contained in the ANCHORS set of the head daughter. In addition, the MAIN value of this anchor must be a component of the second conjunct of the EXCONT value of the modifier ($\boxed{2} \lhd \beta$).

In terms of a tree structure, the constraints on phrases of type *hd-gen-mod-phrase* can be schematically depicted as shown in (260). Here I have assumed that the modifier is a relative clause (RC).

(260) Illustration of the Head-Generalized-Modifier Schema (preliminary, Version I)



In other words, in a head-generalized-modifier phrase, a relative clause is adjoined to (syntactically modifies) a phrase that must have a non-empty ANCHORS set. Recall that for one of the elements in the relative clause's MOD|...|ANCHORS set, the INDEX value is identical to the index of the relative pronoun. This value must be identified with the INDEX value of a suitable anchor in the head daughter's ANCHORS set (1). Since the (INDEX and MAIN) values of the anchor are actually the values of the head noun, it follows that the relative pronoun is coindexed with its antecedent. The relative pronoun thus has local access to its antecedent, even if the antecedent appears deeply embedded within the phrase to which the relative clause adjoins. Since the INDEX feature comprises the PHI and VAR values, it is ensured that the relative pronoun and its antecedent bear the same ϕ-features, and that both are translated into the same variable. Hence, the properties (258a) and (258d) shown above for restrictive relative clauses are fulfilled.

The requirement that the anchor's MAIN value be a component of a conjunct of the relative clause's EXCONT value ($\boxed{2} \triangleleft \beta$) ensures that the main semantic constant of the nominal antecedent is added to the semantic contribution of the relative clause. Thus, the meanings of the nominal and the relative clause are intersectively combined, in fulfillment of desideratum (258c).

Finally, the constraint on *hd-gen-mod-ph* also ensures that the relative clause contributes a restriction to the quantifier that is expressed by the determiner of the head noun (property (258b)). This actually follows from an interplay of several factors: The relative pronoun and the antecedent are translated into the same variable, as explained above, which is bound by some quantifier. When the nominal combines with its determiner, the Semantics Principle (see (237a)) ensures that the semantic contribution of the nominal falls in the restrictor of this quantifier. When the meanings of the relative clause and its antecedent are now conjoined (according to the constraints on *hd-gen-mod-ph*, as explained in the previous paragraph), it follows that the relative clause also contributes to the restriction of this quantifier.

In Section 7.3.4 below, I will provide a precise analysis of a sentence with an extraposed relative clause which illustrates all the details just described. In particular, it will become clear how the meaning of the extraposed relative clause falls into the restrictor of the quantifier of the antecedent.

For now, to illustrate the basic mechanism of generalized modification, a simplified tree structure for the sentence *A woman arrived who was smiling* is given in Figure 7.2, which shows the adjunction of the extraposed relative clause that semantically modifies the subject of the main clause. As can be seen, the determiner (*a*) introduces the INDEX and MAIN values of the head noun (*woman*) as an anchor, which propagates to the NP and to S. The relative clause combines with this S node to yield a phrase of type *hd-gen-mod-phrase*. The relative clause identifies the INDEX value within its MOD|...|ANCHORS set with the INDEX value of the head daughter's anchor (1). Since the INDEX value of the relative clause's

MOD|...|ANCHORS set is coindexed with the *wh*-word of the relative clause, it follows that the PHI values of the relative pronoun are identified with those of the antecedent (3[PER *3rd*, NUM *sg*, GEN *fem*]), and that the relative pronoun and the antecedent are both translated into the same variable, here x (the VAR value). Moreover, the embedding constraint 2 $\lhd \delta$ enforces the semantic predicate (the MAIN value) of the head noun to be a component of the second conjunct of the EXCONT value of the relative clause, which results in the semantic expression $\mathsf{smile}'x \wedge (\ldots \mathsf{woman}' \ldots)$.[19] Finally, since the semantic contribution of the head noun ($\mathsf{woman}'x$) is in the restrictor of the existential quantifier (see the EXCONT value of the NP; this follows from the Semantics Principle in (237a)), and since the noun's main semantic predicate and the semantic contribution of the relative clause form a conjunction ($\mathsf{smile}'x \wedge (\ldots \mathsf{woman}' \ldots)$), the overall logical form of the complete sentence is $\exists x[(\mathsf{smile}'x \wedge \mathsf{woman}'x) \wedge \mathsf{arrive}'x]$, as given in the EXCONT value of the root node.

[19] The first conjunct contains the semantic contribution of the relative clause, which is here $\mathsf{smile}'x$, ignoring the details concerning tense and aspect.

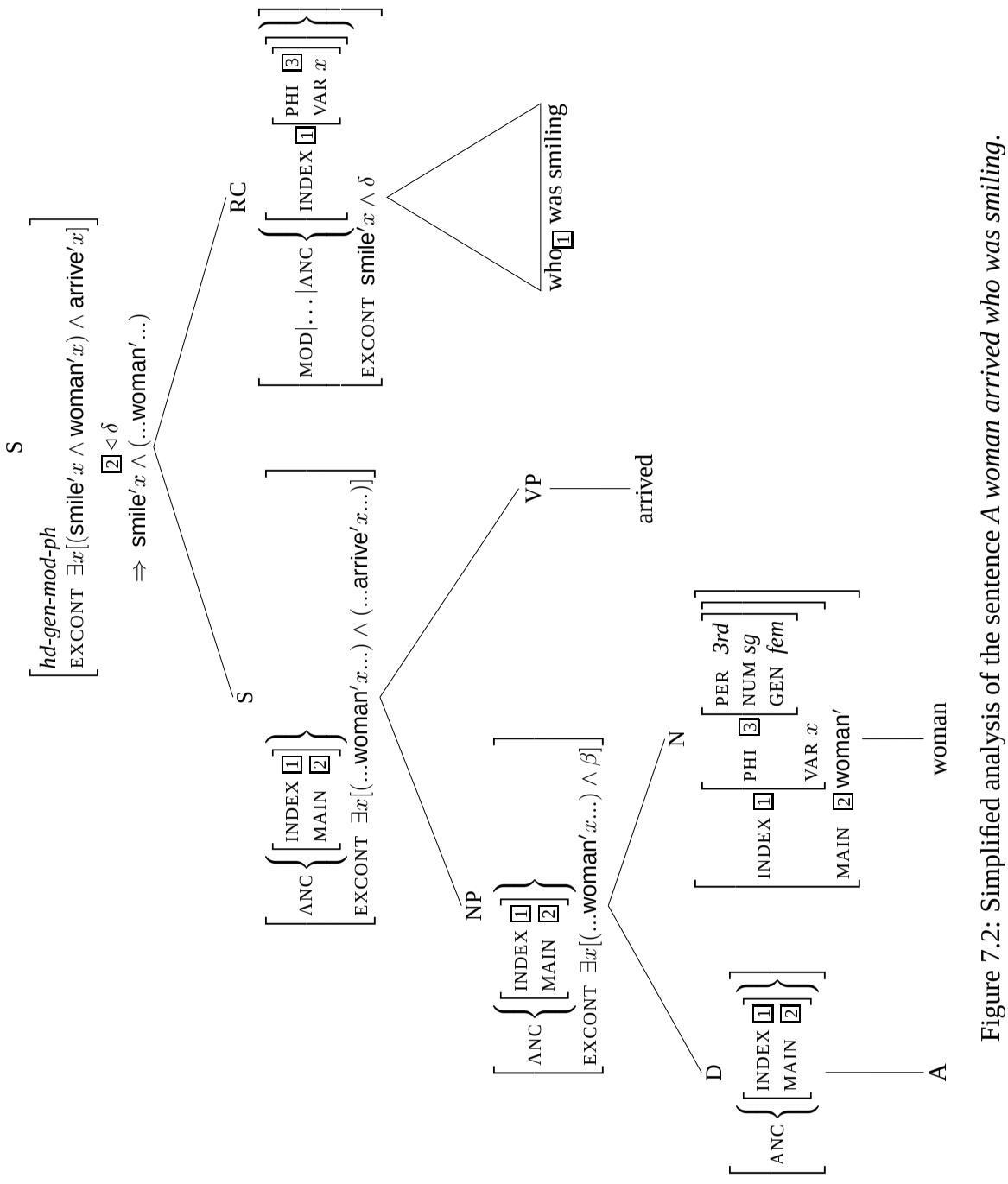


Figure 7.2: Simplified analysis of the sentence *A woman arrived who was smiling*.

This example has illustrated that the constraints on the new phrase type *hd-gen-mod-phrase* introduced in (259) above yield the correct semantic construal of an extraposed relative clause. In essence, the constraints that have been presented so far are equivalent to Kiss' (2005) condition of Generalized Modification, modulo the adaptation to LRS.

Recall that for determiners with obligatory relative clauses, we need to be able to enforce the appearance of a relative clause within the sentence. As explained in Section 7.2.2 above, such determiners obligatorily introduce an anchor for the nominal they select. It now has to be ensured that this anchor is indeed picked up by a relative clause. All we have to do is provide a mechanism that cancels an anchor once it is "used". This is achieved by requiring the anchor that is identified by a relative clause to be bound off in the same way that a trace is bound in a head-filler structure. I therefore add a constraint to the schema of head-generalized-modifier phrases which specifies the TO-BIND|ANCHORS value of the head daughter to contain exactly one element that is token-identical to the anchor in the head daughter's INH|ANCHORS set whose INDEX value is identified with the INDEX value in the MOD|...|ANCHORS set of the adjoined relative clause (see (261)). In combination with the Nonlocal Feature Principle (256) it follows that this anchor is subtracted from the set of anchors that are passed up to the mother, and that it is no longer available for modification further up in the tree.

(261) Head-Generalized-Modifier Schema (preliminary, Version II)

In a *head-generalized-modifier-phrase*, the following conditions hold:

a. the EXCONT value of the non-head daughter is of the form $\alpha \wedge \beta$;

b. there is an element A in the ANCHORS set of the head daughter such that

   i. the INDEX value of A is identical with the INDEX value of an element in the ANCHORS set of the non-head daughter's MOD value, and

   ii. the MAIN value of A is a component of β, and

   iii. the TO-BIND|ANCHORS set of the head daughter is either empty or is the singleton set containing A.

hd-gen-mod-ph $\Rightarrow$

$$\left(\left[\begin{array}{l}\text{HD-DTR } \boxed{0}\left[\begin{array}{l}\text{SS|NLOC}\left[\text{INH|ANC}\left\{\boxed{5}\left[\text{CONT}\left[\begin{array}{l}\text{INDEX } \boxed{1}\\ \text{MAIN } \boxed{2}\end{array}\right]\right]\right\} \uplus \boxed{3}\right]\right]\\ \text{TO-BIND|ANC}\left\{\left(\boxed{5}\right)\right\}\end{array}\right]\\ \text{DTRS}\left\langle \boxed{0}, \left[\begin{array}{l}\text{SS|LOC|CAT|HEAD|MOD}\left[\text{NLOC|INH|ANC}\left\{\left[\text{INDEX } \boxed{1}\right]\right\} \uplus \boxed{4}\right]\\ \text{LF|EXCONT } \alpha \wedge \beta\end{array}\right]\right\rangle\end{array}\right] \;\&\; \boxed{2} \lhd \beta\right)$$

Note, however, that the anchor in (261) is only optionally bound in a head-generalized-modifier phrase, as indicated by the parentheses. This means that a relative clause may still

be adjoined without its compatible anchor being canceled. In this case, the anchor is passed up further in the tree, which means that it can be picked up by yet another relative clause. An anchor can thus be used more than once. This option is desired and, in fact, necessary in order to account for sentences in which a nominal is modified by multiple relative clauses. An example is cited from Keller (1995, 2) in (262):

(262) A paper $\__j$ $\__k$ just came out [which you might be interested in]$_j$ [which talks about extraposition]$_k$.

So, in order to be able to account for both, multiple relative clauses and obligatory relative clauses, I employ a combination of two constraints: the optional binding of an anchor when it is used, which allows it to be used more than once, and additionally a constraint on the root node of an utterance that requires that no anchors be left, i.e., that the ANCHORS set be empty at the sentence boundary. The exact formulation of the latter constraint will be shown in Section 7.3.3 below.

Both constraints together ensure that NPs with determiners like *derjenige/diejenige/dasjenige* ('the+that') are obligatorily modified by a relative clause. Since these determiners obligatorily introduce an anchor, they can only appear in a sentence that also contains a compatible relative clause that cancels their anchor, otherwise the sentence will not be licensed. In the case of determiners like *ein/eine/ein* ('a'), *der/die/das* ('the'), *a*, and *the*, for which the introduction of an anchor is optional, a relative clause is not needed in the sentence and, in fact, cannot be adjoined when no anchors are introduced.

7.3.2 Anchor-Modifiers vs. Canonical Modifiers

At this point, I would like to draw the reader's attention to the fact that the GenMod Schema (the constraint in (259)/(261)) is formulated so as to be able to apply to any kind of intersective modifier. It is not restricted to relative clause modifiers. This is a desired generalization under the assumption that modifiers other than relative clauses may be subject to extraposition. For PP modifiers, this is widely accepted, as the following examples from Guéron (1980, 637) in (263a) and Müller (1995, 216) in (263b) demonstrate:

(263) a. A **man** appeared *with green eyes*.

b. daß eine **Frau** den Raum betreten hat *mit blauen Augen*
that a woman the room entered has with blue eyes
'that a woman with blue eyes entered the room'

Wilder (1995) and Stucky (1987), in fact, assume that all postnominal modifiers may extrapose. Wilder (1995, 286), providing the examples in (264), notes that "in cases where APs or genitives are able to appear at the right edge of DP, extraposition of genitives and APs becomes marginally possible." Stucky (1987) states, "perhaps the generalization should

be that all posthead categories are extraposable," and gives the example in (265) to show that postnominal adjective phrases may be extraposed.[20]

(264) a. We need **someone** *more intelligent than John* in this post.
b. We need **someone** in this post *more intelligent than John*.

(265) a. I want to see **someone** at every window *alarmed and alert*.
b. **Nothing** ever shows up on her table *even remotely palatable*.

It is therefore natural to assume that all the modifiers that may extrapose may be subject to generalized modification. From our perspective, that means that they syntactically modify (adjoin to) a phrase that has a non-empty ANCHORS set, and the semantic relation to the element that they semantically modify is mediated through an anchor contained in this set. These modifiers can thus appear higher in the tree than the place where they have to be interpreted.

There are other modifiers that have to appear next to the element that they semantically modify. As the following examples from Wilder (1995, 285) in (266) and from Stucky (1987, 389) in (267) show, prenominal adjectives are not extraposable:

(266) a. das *auf der Kunstausstellung wegen seiner Maltechnik von vielen gelobte*
the on the art-exhibition on-account-of its technique by many praised
Bild
picture
'the picture which was praised by many for its technique during the art exhibition'

b. * das **Bild** *von vielen gelobte*
the picture by many praised
'the picture praised by many'

c. * Wir haben das **Bild** gesehen, *von vielen gelobte*.
we have the picture seen by many praised
'We have seen the picture which was praised by many.'

(267) * It appears I have given the assignment to a **fool** after all (,) *complete and utter*.

In order to account for the distinction between these two kinds of modifiers, we could introduce two types, *anchor-modifier* and *canon(ical)-modifier*. Modifiers that may extrapose, including relative clauses, are of type *anchor-modifier*. They require the phrase they (syntactically) modify to have a non-empty ANCHORS set, i.e., their MOD value must be specified as shown above for relative clauses: MOD [NLOC|INH|ANCHORS {...[INDEX *i*]...}], where *i* is the index of the modifier that must be identified with the index of the element that is

[20] Although the extraposed constituents in the examples cited are often considered to be reduced relatives, they display the surface shape of APs. It is not clear that they are reduced relatives.

semantically modified. Due to the anchor percolation mechanism, the modified element can appear deeply embedded within the phrase to which the modifier adjoins. Anchor-modifiers then function as adjuncts in head-generalized-modifier phrases.

Canonical modifiers, on the other hand, only modify their sister constituent, both syntactically and semantically. Therefore, they do not interact with an anchor and do not specify any particular value for their MOD|...|ANCHORS attribute. Instead, they must identify their own index with the index of the element they adjoin to, hence their MOD value is specified to be MOD [LOC|CONT|INDEX *i*]. These modifiers are adjuncts in "ordinary" head-adjunct phrases.

If the assumption of Stucky and Wilder is correct that all postnominal modifiers are extraposable, while prenominal modifiers may not extrapose, then one could classify the postnominal modifiers as *anchor-modifiers*, while the prenominal modifiers are of type *canon-modifier*.

It should be pointed out that the existence of two schemata for the adjunction of modifiers might give rise to spurious ambiguities. Anchor-modifiers, e.g., relative clauses, neither specify a particular category nor a particular INDEX value for the element they syntactically modify. Instead, they only require a particular INDEX value within the ANCHORS set of the (syntactically) modified element. Therefore, they could function as adjuncts in "ordinary" head-adjunct structures, too. For example, the adjunction of a relative clause to the NP whose nominal head it semantically modifies would be licensed by both, the schema of *head-generalized-modifier-phrase* (since the NP contains the nominal's anchor) as well as the schema of *head-adjunct-phrase* (see Figure 6.2 in Section 6.2 for an illustration of the latter). One way of excluding this would be to restrict the regular head-adjunct schema in such a way that it requires the non-head daughter to belong to the type *canon-modifier*. As a consequence, assuming that restrictive relative clauses belong to the incompatible type *anchor-modifier*, the adjunction of relative clauses can only be licensed by the Schema of Generalized Modification, giving rise only to phrases of type *head-generalized-modifier phrase*.

A further consequence that follows from this last assumption concerns the position of attachment of in situ relative clauses. Given that in the present theory it is the determiner that introduces the nominal's anchor, a relative clause cannot be adjoined below the determiner, i.e., to N′ (the "Partee-structure" (Partee, 1973, 511–513)), but it must be attached to the NP or higher. This is not problematic semantically, since the proposed analysis of generalized modification, employing techniques of underspecified semantics, allows the relative clause to be interpreted in a deep position even though it syntactically appears higher up in the tree. Therefore, the semantic arguments in favor of the Partee-structure, which are based on a compositional semantic treatment, where it is assumed that restrictive relative clauses must combine via the semantic composition rule of predicate modification with the noun they semantically modify, lose validity (Partee (1973, 511–513, 1975, 229–231), and Heim

and Kratzer (1998, 88)).

That the attachment site of relative clauses is crucial for syntactic reasons is claimed by Sag (1997). Based on evidence that bare relatives must precede *wh*-relatives, he argues that one needs to syntactically distinguish between the two in that bare relatives must adjoin to N′, while *wh*-relatives are adjoined to NP. The following examples are provided as independent evidence to demonstrate that *wh*-relatives, but not bare relatives, may modify nominals without an obvious internal structure consisting of a specifier and an N′:

(268) a. **Who** *who/that you like* does Sandy also like?

b. * **Who** *you like* does Sandy also like?

However, there is counter-evidence to the claim that bare relative clauses must attach below the determiner, as shown by Holler and Webelhuth (2011, 34):

(269) a. The list doesn't even include [**the house and the car**] *I want for my family*.
(http://mergerguru.com/?p=1178)

b. The durability was problematic on these boards, to say the least, and **none** *I've seen* have held together.
(http://www.kitesurfingbuddies.com/mistral-flow-45912.html)

Under the assumption that bare relatives can only modify an N′ and not an NP, it should not be possible for the bare relative in (269a) to adjoin to the conjoined NP. The sentence in (269b), in which a bare relative modifies the one-word element *none*, is also problematic. N′ is defined as a nominal element that is looking for a determiner, but *none* does not need a determiner. Therefore, if *none* is analyzed as a pronoun, it should be an NP, and the bare relative should not be able to modify it according to Sag's claim. If one alternatively assumes that *none* is a determiner that selects an elliptical nominal, the example remains problematic for Sag's theory.[21]

Thus, on the lack of any syntactic or semantic evidence that a relative clause must be able to adjoin to N′, i.e., below the determiner, the assumption that relative clauses are attached to NP or higher is not problematic. Hence, there does not seem to be a problem with the prediction of the present theory that the canonical position of a restrictive relative clause is the adjunction to NP.

To give a short interim summary, I have introduced a new phrase type, called *hd-gen-mod-phrase*, which licenses the attachment of a relative clause to any phrase that contains a suitable antecedent. The semantic and morphosyntactic relation between the relative clause/relative pronoun and its antecedent is achieved by means of an anchor which is introduced by the noun's determiner and which makes available the index and the main semantic predicate of the head noun at the extraposition site. The constraints on *hd-gen-mod-phrase*

[21] See Section 7.3.5 below, where I provide an analysis of cases like (269b), assuming *none* to be a determiner.

enforce the coindexation of the relative pronoun with its antecedent and account for the correct semantic construal of the extraposed relative clause as an intersective modifier.

What is novel compared to the analysis of Kiss (2005) (and also Crysmann (2013)) is that the approach presented here accounts for the cases of obligatory relative clauses. This is achieved through the obligatory introduction of the anchors by the respective determiners in combination with the cancelation of those anchors that have been used. As already noted, a further constraint is needed that ensures that all anchors that have been introduced within a sentence are bound off in that sentence. This is the subject of the following section.

7.3.3 The Anchors Saturation Principle

In the previous section, I have introduced a constraint that optionally binds an anchor that is picked up by a relative clause. The cancelation of the anchor provides means for enforcing the presence of a relative clause in cases where it is required. The optionality of the cancelation, on the other hand, is necessary in order to be able to license the modification by multiple relative clauses, as was shown in (262). In order to prevent the wrong case that an anchor introduced by a determiner like *derjenige/diejenige/dasjenige* ('the+that') is *not* bound off when a corresponding relative clause is attached (and if there is also no other relative clause higher up in the tree structure that might still bind this anchor), I introduce a constraint that requires the root node of a sentence to have an empty ANCHORS set. It ensures that in a well-formed sentence, all anchors that are introduced are bound off higher in the structure. The constraint, which I will call the *Anchors Saturation Principle*, is shown in (270).

(270) Anchors Saturation Principle:

$$\begin{bmatrix} \textit{clause} \\ \text{SS|STATUS } \textit{complete} \end{bmatrix} \Rightarrow \left[\text{SS|NLOC|INH|ANCHORS}\,\{\}\right]$$

I here employ the *synsem* attribute STATUS, which was introduced by Richter (1997, 68, 73). It has the two possible values *complete* and *incomplete*, which indicate whether a sign is syntactically complete or whether it can combine with further signs to yield a complete sign. The Completeness Principle ("Vollständigkeitsprinzip", p. 73) ensures that a sign can only be syntactically complete if it is saturated, and another principle ensures that every unembedded sign must be complete ("Illokutionsprinzip 3", p. 180).

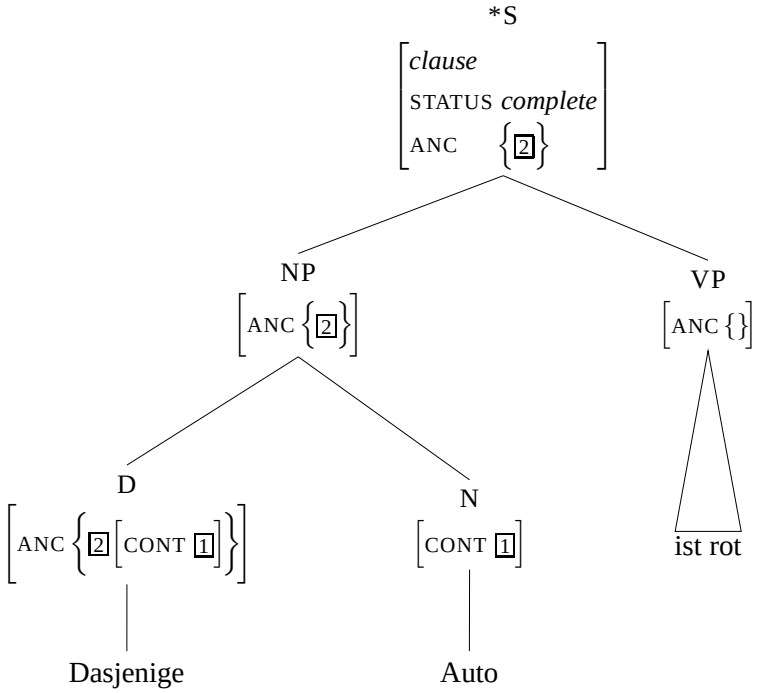
Furthermore, it is specified for the phrasal schemata what the status of their daughters must be. For example, in a head-adjunct phrase, the non-head daughter must be syntactically complete ([STATUS *complete*]), while the head daughter is incomplete ([STATUS *incomplete*]) since it here combines with the non-head daughter and yields a further projection. The STATUS value of the resulting head-adjunct phrase is unspecified. In a head-marker schema, the non-head daughter must be a syntactically complete marker. The head-daughter is incomplete, but when it combines with the marker, the resulting head-marker phrase is [STATUS *complete*].

So, the Anchors Saturation Principle in (270) says that any sign of type *clause* which is syntactically complete must have an empty ANCHORS set. It thus ensures that a root clause, which is an unembedded sign and therefore syntactically complete, is only well-formed if it contains no unused anchors. That is, all anchors that are introduced in a sentence must also be bound by a relative clause inside that same sentence.

Thus, when a determiner like *derjenige/diejenige/dasjenige* ('the+that') obligatorily introduces an anchor, the Anchors Saturation Principle ensures that a relative clause appears within the sentence to pick it up, otherwise the sentence will be ungrammatical. This is demonstrated for the ungrammatical case in (271a). As can be seen in the tree structure in (271b), the anchor that is obligatorily introduced by the determiner *dasjenige* cannot be bound off within the sentence, since there is no relative clause, so that the ANCHORS set of the root node is not empty. But this violates the constraint in (270). Hence, in combination with the obligatory introduction of an anchor by this lexical class and the binding mechanism introduced above, the Anchors Saturation Principle enforces the obligatory presence of a relative clause for determiners like *derjenige/diejenige/dasjenige* ('the+that').

(271) a. Dasjenige Auto *(das vor der Garage steht) ist rot.
the+that car that in front of the garage stands is red
'The very car *(that is in front of the garage) is red.'

b.



A further desirable effect of the Anchors Saturation Principle is that it accounts for the clause-boundedness of relative clause extraposition (the Right Roof Constraint (Ross, 1967/1986)). An extraposed relative clause cannot appear outside of the minimal clause which contains its antecedent, as demonstrated in (272) for English and in (273) for German (see also Chapter 2.2.1). The German example in (274) shows that this constraint also

applies to infinitival clauses.[22]

(272) a. * [$_{CP}$ That **a gun** went off] surprised noone *which I had cleaned*.
(Ross, 1967/1986, 4)

b. * [The fact [$_{CP}$ that **somebody** walked into the room]] is irrelevant *who I knew*.
(Kayne, 1994, 118)

(273) a. [$_{CP}$ Daß Peter sich auf **das Fest** gefreut hat *das Maria veranstaltet*
That Peter REFL to the party looked-forward has that Mary organized
hat], hat niemanden gewundert.
has has nobody surprised
'That Peter was looking forward to the party which Mary has organized surprised nobody.'

b. * [$_{CP}$ Daß Peter sich auf **das Fest** gefreut hat] hat niemanden
That Peter REFL to the party looked-forward has has nobody
gewundert *das Maria veranstaltet hat*.
surprised that Mary organized has
(Wiltschko, 1997, 384)

(274) * Um [**all den Leuten**$_i$ zu helfen] ist Lisa nach Köln gefahren *die von der*
in-order all the people to help is Lisa to Cologne driven who by the
Überschwemmung überrascht wurden$_i$.
flood surprised were
'Lisa went to Cologne in order to help all the people who were surprised by the flood.'

In (272a), the relative clause cannot be extraposed out of the subject clause *that a gun went off* to the end of the matrix clause. The *that*-clause is a head-marker phrase and therefore syntactically complete, i.e., [STATUS *complete*], as mentioned above. According to the constraint in (270), its ANCHORS set must be empty. But that means that the anchor that is introduced for the noun *gun* must be bound off within the phrase that is the head-daughter of the head-marker phrase, i.e., *a gun went off*. It follows, of course, that the noun's anchor cannot be percolated further, so that the relative clause cannot be attached any higher in the tree. The present theory thus correctly predicts that the relative clause can only be realized in canonical position (275a), or it can be extraposed to the end of the *that*-clause (275b):

(275) a. [$_{S_1}$[$_{CP}$ That [$_{S_2}$[$_{NP}$[$_{NP}$ **a gun**] [$_{RC}$ *which I had cleaned*]] [$_{VP}$ went off]]$_{S_2}$]$_{CP}$ surprised noone]$_{S_1}$.

b. [$_{S_1}$[$_{CP}$ That [$_{S_2}$[$_{S_3}$[$_{NP}$ **a gun**] [$_{VP}$ went off]]$_{S_3}$ [$_{RC}$ *which I had cleaned*]]$_{S_2}$]$_{CP}$ surprised noone]$_{S_1}$.

The reasoning is equivalent for (272b) and the German sentences in (273) and (274), under the assumption that the German complementizers *dass* ('that') and *um* ('in order (to)') are markers.

[22]Example (274) is from Kathol (1995, 321), cited in Müller (1999, 221). Glosses and translation are provided by H.W.

In the case of an unmarked embedded sentence, the head that selects it can be assumed to require its selectee to be [STATUS *complete*], so that the constraint in (270) ensures that a relative clause whose antecedent is within the embedded sentence cannot appear outside of it.

I formulate the Right Roof Constraint as a theorem, as shown in (276), and state that this theorem follows from the Anchors Saturation Principle given in (270).

(276) Theorem (Right Roof Constraint):
A relative clause may not occur outside the minimal clause that contains its antecedent.

7.3.4 An Example Analysis of Relative Clause Extraposition

In this section, I provide a detailed example to illustrate the approach to relative clause extraposition that has been introduced in the previous discussion. The sentence to be analyzed is given in (277), and the syntactic and semantic details of the analysis are shown in the tree structure in Figure 7.3.

(277) Pat bought **a dog** yesterday *which is brown*.

Let us start with the syntactic mechanisms. The determiner *a* selects the SYNSEM value of the noun *dog* via its SELECT feature (2). As described in section 7.2.2 above, it is lexically specified that the determiner (optionally) introduces the CONTENT values (INDEX and MAIN) of the noun into its ANCHORS set (5). This anchor is then percolated up the tree (7) by means of the Nonlocal Feature Principle (given in (256)). When the relative clause *which is brown* adjoins to the VP (VP_2), it can identify the INDEX value of this anchor (8) with the INDEX value of the element in its MOD|...|ANCHORS set and thus "pick up" the anchor. Since there is no further relative clause in the sentence for which the anchor of the noun *dog* would be needed another time, the anchor is canceled at this point by introducing it into the TO-BIND value of VP_2. As an effect of the Nonlocal Feature Principle, the ANCHORS sets of the mother node (VP_3) as well as of the root node S are empty. The root node thus satisfies the Anchors Saturation Principle in (270).

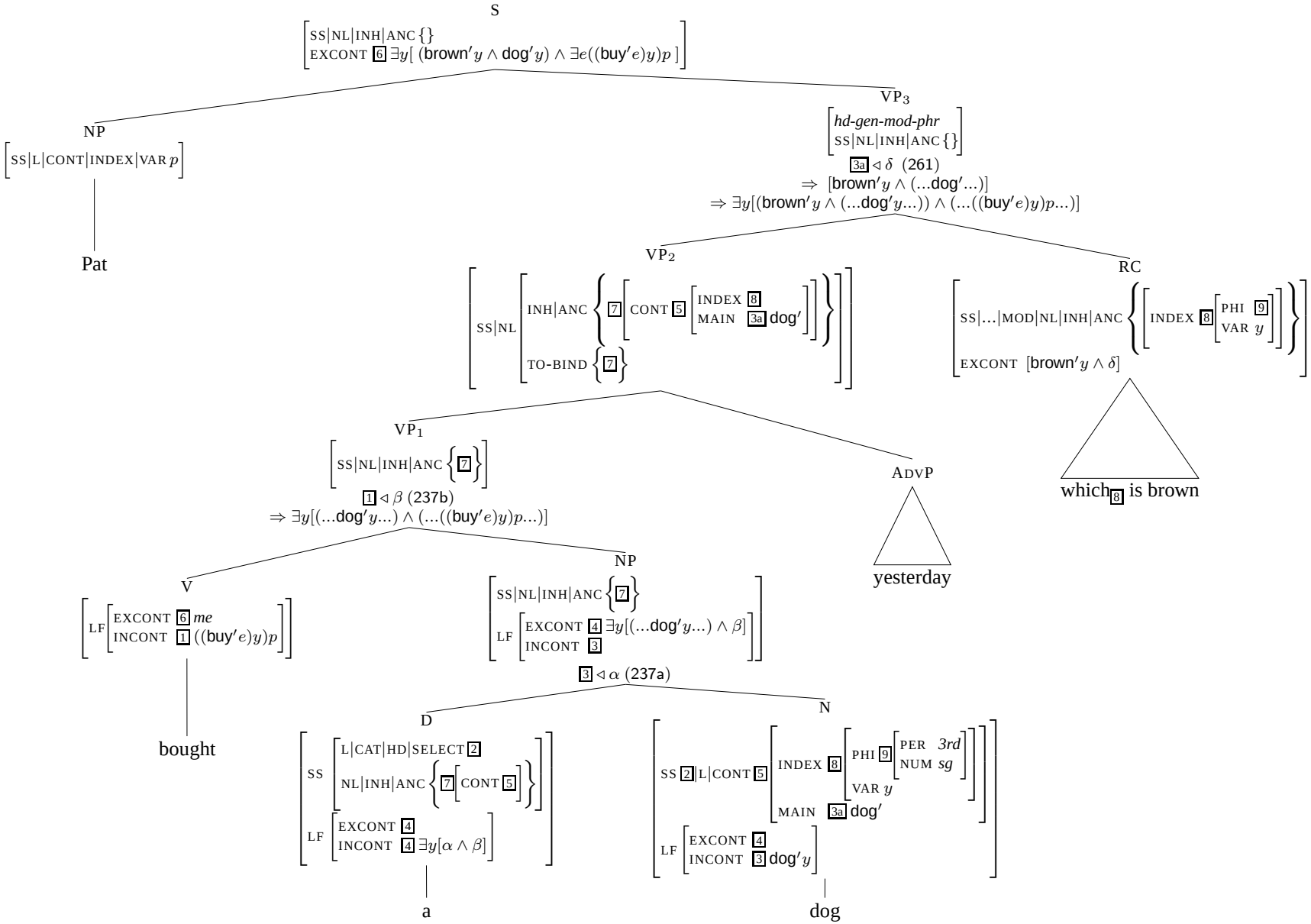


Figure 7.3: Semantic analysis of the sentence: *Pat bought a dog yesterday which is brown.*

I now turn to the semantic details of the analysis. When the determiner and the noun combine to form an NP, the Semantics Principle in (237a) requires that the INCONT value (i.e., the main semantic contribution) of the noun be a component of the restrictor of the quantifier ($\boxed{3} \lhd \alpha$). The logical form (the EXCONT value) of the NP can thus be specified as $\exists y[(...\mathsf{dog}'y...) \wedge \beta]$. When the NP complement combines with the verb (*bought*), the INCONT value of the verb must be a subexpression of the scope of the NP's quantifier ($\boxed{1} \lhd \beta$), according to the Semantics Principle in (237b). It follows that the logical form of the VP *bought a dog* is of the form $\exists y[(...\mathsf{dog}'y...) \wedge (...((\mathsf{buy}'e)y)p...)]$. The semantic contribution of the adverb *yesterday* is ignored here for simplicity, since it is not relevant for demonstrating the crucial facts of my analysis of relative clause extraposition.

When the relative clause is adjoined to VP_2, the resulting VP_3 is of type *head-generalized-modifier-phrase*. The constraint on this type, i.e., the GenMod Schema in (261), ensures that the INDEX value of the element in the relative clause's MOD|...|ANCHORS set is identified with the INDEX value of the anchor in the VP and, thus, with the index ($\boxed{8}$) of the head noun *dog*. Since the INDEX value of the relative clause's MOD|...|ANCHORS set is also identified with the index of the relative pronoun,[23] it follows that the relative pronoun *which* is coindexed with its antecedent *dog*. This implies that both are translated into the same variable (here: y, indicated by the INDEX|VAR value) and that their ϕ-features are identical ($\left[\text{PER } \textit{3rd}, \text{NUM } \textit{sg}\right]$, as specified in the lexical entry of *dog*). Thus, the GenMod Schema correctly accounts for the properties (258a) and (258d) (see section 7.3.1) for the restrictive relative clause in sentence (277).

The second requirement of the GenMod Schema is that the MAIN value of the anchor (and thus of the head noun) be a component of the second conjunct of the EXCONT value of the relative clause ($\boxed{3a} \lhd \delta$). That gives us the expression $[\mathsf{brown}'y \wedge (...\mathsf{dog}'...)]$ for the logical form of the relative clause. Together with the constraints of the Semantics Principle imposed on the NP *a dog* and VP_1 (*bought a dog*), the logical form of the sentence at this point can be specified to be $\exists y[(\mathsf{brown}'y \wedge (...\mathsf{dog}'y...)) \wedge (...((\mathsf{buy}'e)y)p...)]$. We can see that the relative clause in this sentence functions as an intersective modifier (property (258c)) since its semantic contribution is conjoined with the semantic contribution of its antecedent, and it contributes to determining the restriction of the determiner (property (258b)).

Finally, when the VP_3 combines with its subject (*Pat*), which has the VAR value p, the final logical form of the complete sentence is correctly specified as $\exists y[(\mathsf{brown}'y \wedge \mathsf{dog}'y) \wedge \exists e((\mathsf{buy}'e)y)p]$. Note that the event variable is bound with the narrowest possible scope.

This example has demonstrated that the semantic construal of an extraposed relative clause is correctly predicted by the theory of relative clauses and relative clause extraposition presented in the sections above, specifically through the interplay of the lexical constraints on determiners for introducing the noun's index and main semantic predicate as an anchor,

[23] This identification follows from the constraint on the type *wh-rel-cl* and the lexical entry of the relative pronoun, as explained in Sections 5.2.2 and 7.3.1 above.

its percolation up the tree via the Nonlocal Feature Principle to make the noun's index and main predicate available at any phrasal node dominating the noun, and finally the Schema of Generalized Modification to attach the relative clause and establish the relationship to its antecedent.

In this respect, the analysis presented here is similar to the approaches provided by Kiss (2005) and Crysmann (2013), which make the same correct predictions concerning the licensing of extraposed relative clauses. However, in some respects, my analysis crucially differs from their approaches and thus leads to some novel achievements.

First of all, the analysis proposed here accounts for cases with obligatory relative clauses, as shown above. This is achieved by the constraint on the respective determiners to obligatorily introduce an anchor, in combination with the two mechanisms that ensure that the anchor is picked up, namely the binding of the anchor when the relative clause is attached and the Anchors Saturation Principle that ensures that no anchors are left at the sentence boundary.

A further improvement will be that the proposed theory will be able to account for the scope effects of relative clause extraposition noticed by Fox and Nissenbaum (1999) (see the examples in (247) above). This achievement results from using the techniques of underspecified semantics and employing discontinuous representations provided by the framework of LRS. To account for these cases, a further constraint will be added to the Schema of Generalized Modification. This will be presented in Section 7.3.6 below.

Finally, the present approach licenses relative clauses with elliptical antecedent NPs, i.e., cases where the antecedent noun is missing. Since the determiner–and not the noun as in Kiss' theory–introduces the anchor of the noun, all that is needed is an appropriate analysis of noun-elliptical NPs. This is what we will turn to next.

7.3.5 Relative Clauses with Elliptical Antecedents

Relative clauses can modify NPs in which the noun is elided. Such constructions are possible with relative clauses in situ ((278a) and (279a)) as well as with extraposed relative clauses ((278b) and (279b)).

(278) a. diejenige/die/eine (Frau) die dort steht
the+that/the/a woman who there stands
'the very/the/a woman who is standing there'

b. Ich habe diejenige/die/eine (Frau) bewundert, die dort steht.
I have the+that/the/a woman admired who there stands.
'I've admired the very woman who is standing there.'

(279) a. Many/Some/Those (guests) that arrived early are drunk already.

b. Many/Some/Those (guests) are drunk already that arrived early.

In this section, I show how the theory introduced above can be extended to account for relative clauses with elliptical antecedents. The same Schema of Generalized Modification is used to license the relative clauses in these sentences. The essential tool that is needed is the anchor that establishes the relationship between the relative clause and its semantic antecedent. The difficulty that needs to be overcome is that in these cases the noun that is the semantic antecedent of the relative clause is missing.

Recall that in the analysis proposed above, it is the determiner that introduces the anchor of the noun. More specifically, since the determiner lexically selects the SYNSEM value of the nominal via its SELECT feature, it has access to the nominal's CONTENT and introduces it as an anchor into its ANCHORS set, as illustrated again for the lexical entry of *diejenige* in (280).

(280) Lexical entry of a determiner with an obligatory relative clause:

$$\left[\begin{array}{l}\textsc{phon}\left\langle \textit{diejenige}\right\rangle \\ \textsc{ss}\left[\begin{array}{l}\textsc{loc}|\textsc{cat}|\textsc{head}\left[\begin{array}{l}\textit{determiner}\\ \textsc{select}\left[\textsc{loc}|\textsc{cont}\ \boxed{1}\right]\end{array}\right]\\ \textsc{nonloc}|\textsc{inh}|\textsc{anchors}\left\{\left[\begin{array}{l}\textit{index-local}\\ \textsc{cont}\ \boxed{1}\end{array}\right]\right\}\end{array}\right]\end{array}\right]$$

Crucially, since this is a lexical constraint, the anchor can be introduced by the determiner even if the noun is not phonologically realized in the sentence. All that is needed is an appropriate analysis of the constructions consisting of an overt determiner and an elided noun, which I will call *noun-elliptical NPs* in the following, and a mechanism that enables the anchor to percolate up the tree in such constructions.

For these purposes, I adopt the analysis of noun ellipsis proposed by Branco and Costa (2006), which is built on Van Eynde's (1998; 2003a; 2003b; 2006) functor treatment presented in Section 7.2.1. The noun ellipsis constructions are taken to be noun phrases in which the structure assumed for NPs with overt nouns is preserved (i.e., the (overt or covert) noun functions as the head of the NP and the determiner is the functor daughter), but without positing a phonologically null element for the missing noun.

Recall that Van Eynde treats the determiner as a functor which selects the nominal as its head. The SYNSEM value of the nominal is structure-shared with the SELECT value of the functor. Hence, it is present in the functor, and all the syntactic and local semantic properties of the constituent resulting from the combination of the functor with its head are known even if the head is not phonologically realized.

It is therefore straightforward to implement a unary schema that licenses noun phrases with elided nouns. The noun-ellipsis-functor schema in (281) is a slightly modified version of Branco and Costa's schema and shows the relevant syntactic constraints. It is similar to the head-functor schema, i.e., the schema for "regular" (non-elliptical) noun phrases. The difference is that in a noun-ellipsis-functor phrase there is only one daughter, which does not

function as the head daughter.[24] For this reason, the properties of the phrase which are shared with its head daughter in the normal case are shared with the corresponding information in the determiner's SELECT value instead.[25]

(281) Syntactic constraints on *noun-ellipsis-functor*:

$$\textit{noun-ellipsis-functor} \Rightarrow \left[\begin{array}{l} \text{SS|LOC|CAT} \left[\begin{array}{ll} \text{HEAD} & \boxed{1}\,\textit{noun} \\ \text{MARKING} & \boxed{2} \end{array}\right] \\ \text{DTRS} \left\langle \left[\text{SS|LOC|CAT} \left[\begin{array}{ll} \text{HEAD|SELECT} & \left[\begin{array}{ll} \textit{synsem} & \\ \text{LOC|CAT|HEAD} & \boxed{1} \\ \text{LP} & \textit{empty} \end{array}\right] \\ \text{MARKING} & \boxed{2} \end{array}\right]\right] \right\rangle \end{array}\right]$$

The schema licenses a phrase that consists of only one daughter, the functor daughter, which determines the MARKING value of the mother. The HEAD value of the mother node is shared with that of the functor's SELECT value, which corresponds to the unexpressed noun. Furthermore, the HEAD value of the mother must be of type *noun*, which ensures that only functors selecting nominals can be part of noun-elliptical NPs.

In addition, it has to be ensured that not all determiners can be the functor daughters of such noun-ellipsis-functor phrases, as shown in (282):

(282) a. the/a/every *(woman) who is standing over there
b. many/some/those (guests) that arrived early
c. None (*flowers) that I know of are in the window.[26]

In German, most determiners may combine with a phonologically realized nominal or with a null element (283).[27]

(283) diejenige/die/eine/jede/jene (Frau) die dort steht
the+that/the/a/each/that (woman) who there stands

In order to control for the various combinatorial restrictions, an additional requirement is imposed on the type *noun-ellipsis-functor*: the functor daughter must select an element which is specified as [LP *empty*]. The feature LP (LEFT PERIPHERY) (Nerbonne and Mullen, 2000) indicates the status of the left periphery of a nominal structure. It may take the values *empty*, *full*, or *one*.[28] Note that by "nominal structure/nominal" I here mean the element

[24] Hence, *noun-ellipsis-functor* must be a subtype of *nonheaded-phrase*.

[25] In Branco and Costa's approach, the valence values of the mother are also structure-shared with those of the element in the daughter's SELECT value. I have omitted them here for reasons of simplicity.

[26] This example is based on Nerbonne and Mullen (2000, 139).

[27] See Netter (1996, Ch. 4.6), Nerbonne and Mullen (2000), Lobeck (1995), and Beavers (2003), among others, for further examples of noun-elliptical NPs in English and German.

[28] As mentioned by Nerbonne and Mullen (2000, 130), the ideas of their analysis go back to a talk "Edges and Null Nominal Heads" presented by John Nerbonne at the 1994 HPSG Conference in Copenhagen, in which a boolean feature "Left-Periphery Empty" [LPE ±] was used, which was adopted by Netter (1996, 164-170) in his dissertation on German NP structures. Nerbonne and Mullen's analysis covers English as well as German.

corresponding to an N′ in an NP-approach, i.e., excluding any specifiers. Nominals with a phonologically empty head at their left edge are specified as [LP *empty*]. In fact, the only element that is lexically specified as LP-*empty* is the null element.[29] Nominals whose leftmost constituent is the overt anaphoric *one* have the LP value *one* (e.g., *(every) one, (the) one on the table*). All other nominals, i.e., nominals with a phonologically realized noun and/or a modifying adjective at their left edge, are specified as [LP *full*] (e.g., *(the) cat, (the) black cat, (the) black one* in English, and *(der) Mann* ('(the) man'), *(der) alte Mann* ('(the) old man'), *(der) alte _* ('(the) old _ '), *(der) alte _ mit Hut* ('(the) old _ with hat') in German).

Since LP is a SYNSEM feature, determiners may impose restrictions on the LP values of the nominals they select. Most English determiners can only appear with phonologically realized nouns and are thus specified as selecting an LP-*full* nominal (e.g., *the, a/an, every*). Those determiners that can also appear in noun-elliptical NPs are specified as [SELECT|LP *full* ∨ *empty*] (e.g., *many, some*). The determiner *none* must not combine with an overt noun (or anaphoric *one*) and thus selects an LP-*empty* nominal only. *Either* and *those*, as well as most determiners in German, are allowed to combine with either phonologically realized (including *one*) or null nominals and are therefore unspecified for what sort of nominal they select.

Thus, the requirement of *noun-ellipsis-functor* that the functor daughter be specified as selecting an LP-*empty* element ensures that only determiners that may combine with an elliptical nominal can be the functor daughters of noun-elliptical NPs. All other determiners are precluded in this construction. Hence, the data in (278), (279), (282), and (283) are correctly predicted.[30]

[29] Nerbonne and Mullen (2000) and Netter (1996) postulate an empty category for the null nominal. However, as shown by Branco and Costa (2006) and as will become clear below, the approach can be mimicked by using unary phrase structures instead of a null category.

[30] The determiners in noun-elliptical NPs are sometimes considered to be pronouns (see, for example, Winhart (1997), Müller (1999, 157–159)). However, unlike with most other pronouns, modification and specification is allowed in these cases, as shown in (i) below and by the examples of restrictive relative clause modification in (278)–(279) and (282)–(283) above.

(i) a. die kleine (*'the small'*)
b. die mit Hut (*'the with hat'*)
c. all die (*'all the'*)

There are even cases in which the complement pattern of the elided noun is preserved, as illustrated by the following examples (example (ii) is from Netter (1996, 155)):

(ii) die starke Konzentration auf die Wirtschaft und die weniger grosse _ auf den Umweltschutz.
the strong concentration on the economy and the less large on the environment
'the strong concentration on the economy and the less large one on the environment'

(iii) She gave the first talk on gapping, and he gave the first _ on stripping.
(http://en.wikipedia.org/wiki/Noun_ellipsis; accessed October 2, 2012)

These observations suggest that the elided noun functions syntactically just like other common nouns, and hence that the determiner in a noun-elliptical NP behaves like a determiner (and not like a pronoun). For further arguments against the pronoun approach, see, for example, Netter (1996, 152–170) and Nerbonne and Mullen (2000). For an analysis of examples like (i)–(ii), see Branco and Costa (2006).

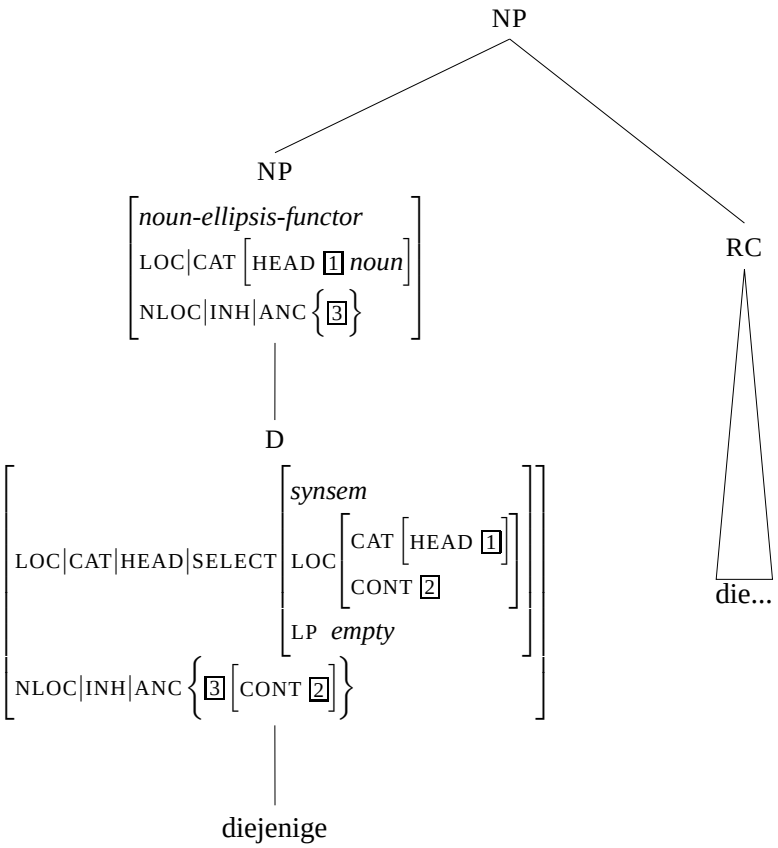
Having adopted Branco and Costa's schema that correctly licenses noun phrases with elided nouns, it is easy to add a constraint which ensures that anchors are passed up from the determiner to the mother. This is achieved by identifying the ANCHORS values of the functor daughter and the mother, as shown in (284). Note that the Nonlocal Feature Principle cannot be applied in phrases of type *noun-ellipsis-functor* since it is only defined for headed phrases.

(284) *noun-ellipsis-functor* $\Rightarrow$ $\left[\begin{array}{l}\text{SS}|\text{NLOC}|\text{INH}|\text{ANC}\ \boxed{4} \\ \text{DTRS}\left\langle\left[\text{SS}|\text{NLOC}|\text{INH}|\text{ANC}\ \boxed{4}\right]\right\rangle\end{array}\right]$

Once the anchor is contained in the ANCHORS set of the mother node of a noun-elliptical NP, it can be either percolated further up the tree by means of the Nonlocal Feature Principle and then be picked up by an extraposed relative clause, as demonstrated in Section 7.3.4 above, or a relative clause can be attached to this phrase that just consists of the determiner.

The tree structure in (285) illustrates the latter case. It shows the unary construction licensed by the phrasal schema *noun-ellipsis-functor*. The determiner *diejenige* ('the+that') forms a one-word NP. The phrase has the head features of the unexpressed noun. The CONTENT value of the selected nominal is lexically introduced into the ANCHORS set of the determiner and projected to the mother via the constraint in (284). Thus, an anchor is now available in the noun-elliptical NP even though the nominal to which it is linked is not overt, and a relative clause that modifies this elided nominal can–and in fact, must–be attached somewhere within the sentence to pick up the anchor.

(285)



In what follows, I will provide the semantic details of this construction. NP ellipsis involves a discourse anaphoric process. For its interpretation, a noun-elliptical NP relies on an antecedent, from which it inherits some syntactic and semantic properties (see Branco and Costa (2006), Netter (1996), Beavers (2003), among others). As the following examples from Lobeck (1995, 25-26) show, the antecedent can be recovered from a preceding sentence (286a), or it can be determined pragmatically (286b).

(286) a. - John caught a big fish.
- Yes, but [Mary's _] was bigger.

b. [Sarah and Geoff have two sons, Charlie and Sam. The two boys are playing with their new toys. Charlie's breaks.]
Sarah: [Sam's _] better not do that.
Geoff: [Some _] are just poorly made, I guess.

The relation between the noun-elliptical NP and its antecedent will not be further discussed here since it is a general issue that needs to be treated regardless of whether a relative clause is present or not. However, I will provide the semantic composition of the noun-elliptical NP which is needed in order to allow for the attachment of a relative clause (to the noun-ellipsis-functor phrase or in extraposed position) that modifies the covert nominal. The relevant semantic conditions are shown in (287).

(287) Semantic constraints on *noun-ellipsis-functor*:

noun-ellipsis-functor $\Rightarrow$

$$\left(\left[\begin{array}{l}\textsc{ss|loc|cont}\ \boxed{1} \\ \textsc{lf}\left[\begin{array}{l}\textsc{excont}\ \boxed{2} \\ \textsc{incont}\ \boxed{4}\left[\boxed{3} \bullet x\right] \\ \textsc{parts}\ \ \boxed{5} \oplus \left\langle \boxed{3}, \boxed{4} \right\rangle\end{array}\right] \\ \textsc{dtrs}\left\langle \left[\begin{array}{l}\textsc{ss|loc|cat|head|select}\ \left[\textsc{loc|cont}\ \boxed{1}\left[\begin{array}{l}\textsc{index|var}\ x \\ \textsc{main}\ \boxed{3}\end{array}\right]\right] \\ \textsc{lf}\left[\begin{array}{l}\textsc{excont}\ \boxed{2}\, Qx[\rho \circ \nu] \\ \textsc{parts}\ \ \boxed{5}\end{array}\right]\end{array}\right] \right\rangle\end{array}\right] \ \&\ \boxed{4} \lhd \rho\right)$$

These semantic constraints on *noun-ellipsis-functor* account for several properties of the noun-elliptical NP constructions. First of all, in a nominal projection, the local semantics (i.e., the index and the main semantic predicate) are generally those of the head noun. In the absence of this lexical element, this identity is stipulated here by identifying the CONTENT value of the mother node with the CONTENT value ($\boxed{1}$) of the element in the daughter's SELECT value.

Secondly, the EXCONT value (i.e., the logical form) of a noun phrase is that of its quantifier. For an NP with an overt noun, this follows from an interplay of the Incont Principle (234), the Excont Principle (235a), the Semantics Principle (237a), and the LRS Projection Principle (236a) (see pages 144-145), as illustrated for the NP *every dog* in Chapter 6 (page 147 and Figure 6.1). To achieve the same result for a noun-elliptical NP, the EXCONT value of the mother node is structure-shared with the EXCONT value (2) of the daughter.[31]

Thirdly, the INCONT value of a nominal projection is identical to the INCONT value of the head noun (according to the LRS Projection Principle (236b)). It is lexically specified to be the main semantic predicate of the noun applied to its referential index. When the noun is phonologically unrealized, its INCONT value is not present and hence cannot be projected to the mother node. Note that in the analysis of NP ellipsis assumed here, the determiner has access to the SYNSEM value of the elided noun. However, the (nonlocal) INCONT feature belongs to the attributes of LF, which is a feature of the sort *sign* and thus outside the SYNSEM value. What can be accessed in a noun-ellipsis-functor construction, though, is the local semantics of the elided noun, and thus its MAIN and VAR values, which constitute the INCONT value. We can therefore stipulate a constraint that says that the INCONT value of the mother node must be the application of the MAIN value of the element in the daughter's SELECT value to that same element's VAR value (3 $\bullet$ x). The bullet symbol ($\bullet$) is used here to express the application of a predicate constant to its argument(s). I assume that the MAIN value of the elided noun is a variable that will be bound contextually.

Fourthly, a nominal must contribute a restriction to the quantifier expressed by its determiner. For a noun phrase with a phonologically realized noun, this is regulated by the Semantics Principle in (237a), which states that the INCONT value of the head noun must be embedded within the restrictor of the quantifier in the non-head daughter. For a noun-elliptical NP, the INCONT value is constructed on the mother node of the noun-ellipsis-functor phrase, as explained in the previous paragraph. We can now add an embedding constraint that requires this INCONT value to be a subexpression of the restrictor of the quantifier (4 $\lhd$ ρ). It follows from this that the variable of the unexpressed noun is the same as the variable bound by the quantifier (here: x).

Finally, it must be ensured that, as in an NP with an overt noun, all the subexpressions contributed by both the determiner and the elided noun, i.e., their VAR, MAIN, and INCONT values, appear in the PARTS list of the mother node. In an NP with an overt noun, this is taken care of by the LRS Projection Principle (236c), according to which the mother's PARTS list "collects" all and only the elements of the PARTS lists of the daughters. This principle only applies to headed phrases, however, and thus not to phrases of type *noun-ellipsis-functor*, which is a subtype of the type *nonheaded-phrase*. To achieve the same effect for noun-

[31] Recall from Chapter 6 that, according to the Incont Principle (234) and the Excont Principle (235a), the EXCONT value of a quantifier is identical to its INCONT value in every phrase in which the quantifier is the non-head daughter, hence also in a noun-ellipsis-functor phrase. The INCONT value is lexically specified.

elliptical NPs, a constraint is added to the type *noun-ellipsis-functor* which says that the PARTS list of the mother consists of (i) all and only the elements of the PARTS list of the daughter (this is indicated by the tag 5 in (287)), and (ii) the MAIN value (3) of the elided noun as well as the INCONT value (4) of the mother, which is constructed so as to be identical to the INCONT value of the elided noun.[32] Note that the elided noun's VAR value is the same as the determiner's VAR value, which follows from the embedding constraint as explained above, and thus is already included in the PARTS list of the determiner (5). In consequence, all the subexpressions of the elided noun and the determiner are contributed to the overall logical form of the utterance in which the noun-elliptical NP occurs.

In conclusion, the effect of the constraint in (287) is that all the local and nonlocal semantic specifications of the elided noun (the values of CONT, INCONT, EXCONT, and PARTS) are present in the noun phrase, and the semantics of the noun-elliptical NP corresponds to the semantics of a "regular" NP (modulo the elliptical semantics). This predicts the empirical observations that "noun phrases . . . which do not have overt Ns still have interpretations involving N-semantics" (Beavers, 2003, below ex. (9)). The N-semantics is received anaphorically through ellipsis. Based on these observations, Beavers formulates the *Nominal Phrase Semantic Well-formedness Condition*: "All well-formed noun phrases must have both D-semantics and N-semantics" (2003, ex. (10)). This condition is satisfied by the proposed analysis.

In Figure 7.4, I illustrate the semantic constraints on a noun-elliptical NP that is modified by a relative clause. It shows the tree structure of the NP *diejenige _ die blond ist* as it appears in the sentence in (288).

(288) Peter liebt diejenige Frau, die schwarze Haare hat, und Tom liebt [diejenige _ ,
Peter loves the+that woman who black hair has, and Tom loves the+that _ ,
die blond ist].
who blond is

'Peter loves the very woman who has black hair, and Tom loves the very one who is blond.'

The determiner is the (functor) daughter of a unary construction of type *noun-ellipsis-functor*. It was explained above that this phrase must be of part of speech *noun* and shares the HEAD value of the element that is selected by the functor daughter.

For the determiner, the LF is provided in its lexical entry.[33] The SELECT value specifies the semantic properties of the element that the determiner selects. Since a determiner has to agree with its noun, the PHI values can be specified to be those of a third person singular feminine noun, which are those of the determiner *diejenige*. The VAR value is given as y. Since I remain uncommitted on the question of how the meaning of the elided noun is

[32] The symbol "$\oplus$" is used to append lists.

[33] I consider the determiner *diejenige* to be an existential quantifier with a uniqueness and an exhaustivity presupposition.

retrieved from its antecedent, I use the variable P here as the semantic constant for the MAIN value.

The CONTENT value of the selected noun is identified with the CONTENT value (5) of the element in the determiner's ANCHORS set. This is the anchor necessary for the relative clause to be attached higher up in the tree. It is passed up to the mother node by the constraint given in (284).

Since the mother node is of type *noun-ellipsis-functor*, the following specifications are provided by the semantic constraints shown in (287). The CONTENT value of the mother node is identified with the CONTENT value (5) of the selected noun in the daughter's SELECT value. Hence, the local semantic specifications of the NP are those of the unexpressed noun. The EXCONT value of the NP is structure-shared with the EXCONT (and INCONT) value of the daughter. The value of the mother's INCONT feature is the MAIN value combined with the VAR value of the element selected by the daughter. Here, it is $P \bullet y$, i.e., the noun's semantic predicate, which is determined by the discourse, applied to its referential index.

The PARTS list of the mother node contains all the expressions of the PARTS list of the daughter (the determiner) as well as the INCONT value (3) of the NP and the MAIN value (3a) of the selected noun.[34] Hence, as in a regular NP with an overt noun, the PARTS list of the mother node in a noun-elliptical NP contains all the elements that are contributed by the determiner and the noun, even though the latter is not phonologically realized.

The last constraint of (287) is the embedding constraint that requires the INCONT value of the mother node to be a component of the quantifier's restrictor ($3 \lhd \alpha$), thus ensuring that the elided noun contributes to the restriction of the quantifier. It follows that the EXCONT value of the NP can be specified to be an expression of the form $\exists y[(...Py...) \wedge \beta]$.

Thus, it has been demonstrated that the constraints imposed on noun-elliptical NPs, i.e., on phrases of type *noun-ellipsis-functor*, in effect simulate the semantic composition of noun phrases in which the noun is phonologically realized. Under the assumption that an elided noun semantically behaves as if it was phonologically expressed, modulo some kind of anaphoric process to retrieve the interpretation from the antecedent, this gives us the desired results.

Since the mother node of the unary construction (i.e. the NP of type *noun-ellipsis-functor*) has in its ANCHORS set the anchor of the covert noun, a relative can and, as explained in Section 7.3.3, must be adjoined either directly to this NP or in extraposed position higher up in the tree. In the latter case, the anchor is propagated throughout the tree in the fashion described above (see Section 7.2.3) until it is picked up by the extraposed relative clause. In both cases, the attachment of the relative clause is licensed by the GenMod Schema.

Figure 7.4 illustrates the in situ attachment to the noun-elliptical NP. The INDEX value in the MOD|...|ANCHORS set of the relative clause is identified with the INDEX value of

[34]The VAR value of the elided noun is already on the PARTS list since it is the same variable as that of the quantifier.

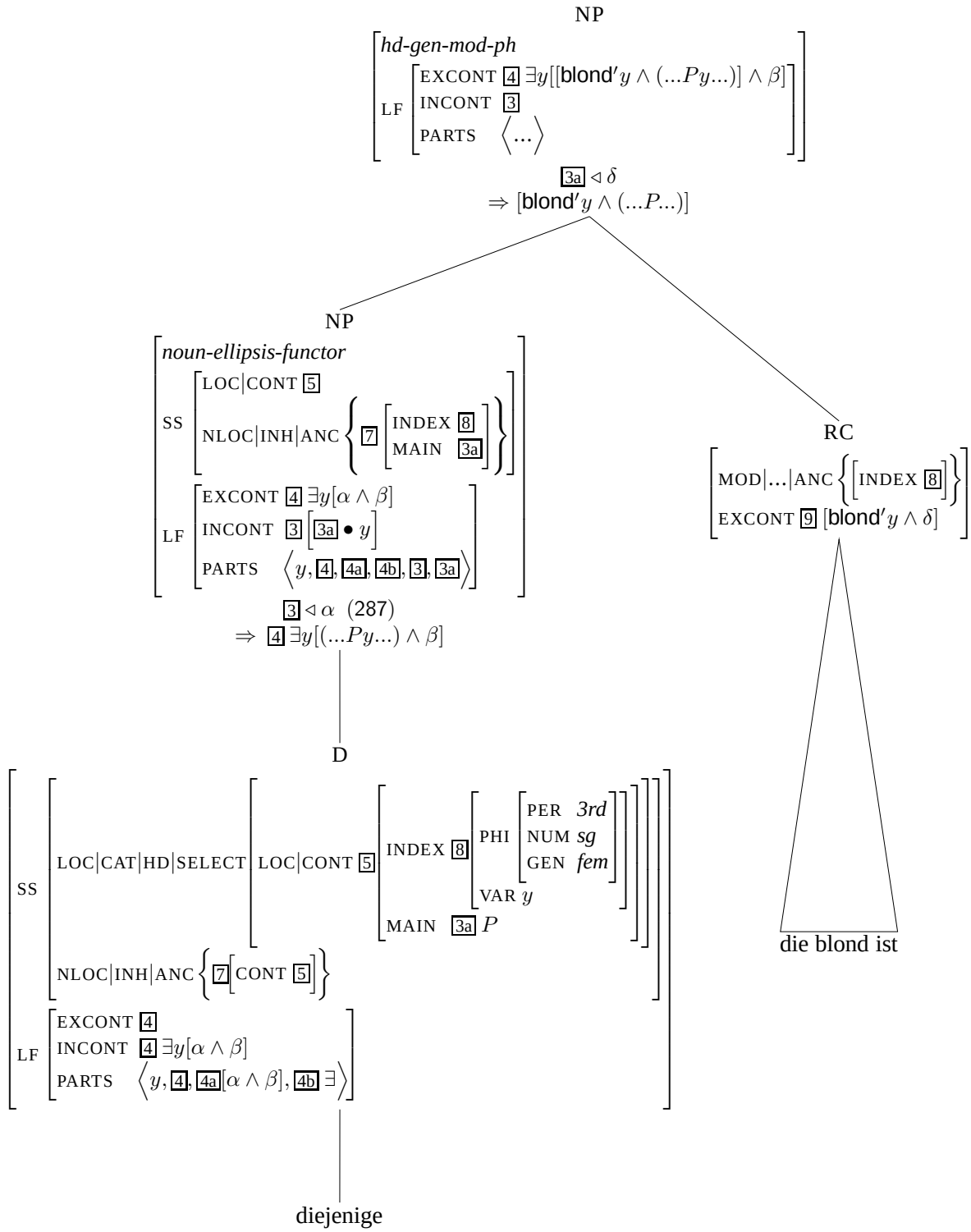


Figure 7.4: Semantic analysis of a noun-elliptical NP which is modified by a relative clause (*diejenige _ die blond ist* ('the very _ who is blond')).

the element in the ANCHORS set of the NP, which is the index of the elided noun. Hence, it is ensured that the relative pronoun and its antecedent, although the latter is not overtly expressed, agree and corefer.

Additionally, the embedding constraint of the GenMod Schema ($\boxed{3a} \lhd \delta$) guarantees that the semantic predicate of the unexpressed noun (the MAIN value, which is also present in the anchor) and the semantic contribution of the relative clause are conjoined ($\mathsf{blond}'y \wedge (...P...)$). Together with the constraints imposed on the noun-ellipsis-functor phrase, it follows that the relative clause contributes to the restrictor of the quantifier of the noun-elliptical NP. Thus, the logical form (the EXCONT value) of the modified NP can be specified as $\exists y[[\mathsf{blond}'y \wedge (...Py...)] \wedge \beta]$.

To conclude, I have presented an analysis of noun-elliptical NPs which allows such NPs to be modified by an in situ or extraposed relative clause. The modification, which is subject to the Schema of Generalized Modification, is enabled by the anchor mechanism of the theory of relative clauses that was developed in the preceding sections. The anchor is the tool that establishes the relationship between the relative clause and its antecedent nominal. Since it is introduced by the determiner of the antecedent NP, the relationship can be established even if the noun is elided.

As was mentioned above, Kiss (2005) does not offer a solution for relative clauses with elliptical antecedents. The formulation of his theory of Generalized Modification in its present form does not capture these cases since in his analysis it is the noun that introduces the anchor, and anchors in his theory are not required to license relative clauses. The analysis proposed here is thus an improvement over Kiss' theory.

In the following section, I will present a further development of the Schema of Generalized Modification, which will make it possible to capture the scope effects of relative clause extraposition noticed by Fox and Nissenbaum (1999).

7.3.6 The Relative Clause Extraposition Scope Constraint

As shown in Chapter 2.4, Fox and Nissenbaum (1999) and Fox (2002) provide evidence that extraposed relative clauses act as overt scope markers for their antecedent. Since this observation was already made by Williams (1974), who focused on comparative and result clause extraposition, Fox (2002, 71) dubbed this generalization "Williams' Generalization":

(289) Williams' Generalization

When an adjunct β is extraposed from a "source DP" α, the scope of α is at least as high as the attachment site of β (the extraposition site).

The phenomenon is demonstrated with the following contrast from Fox and Nissenbaum (1999, 136):

(290) a. I [$_{VP}$ looked very intensely for **anything** *that would help me with my thesis*].
b. * I [$_{VP}$ looked for **anything** very intensely] *that will/would help me with my thesis*.

The antecedent of the restrictive relative clause contains the 'free choice' element *any*. The sentence is well-formed when the relative clause is in canonical position (290a), but when the relative clause is extraposed (290b), the sentence becomes ungrammatical. Fox and Nissenbaum attribute this ungrammaticality to two conflicting scope requirements of 'free choice' *any*: On the one hand, it must be within the scope of a modal operator, in this case *look for*. This is a collocational licensing requirement of 'free choice' *any*. On the other hand, its scope must be as high as the attachment site of the extraposed relative clause (as stated in (289)). Since in (290b) the extraposed relative clause is adjoined to the VP and thus outside the scope of the modal verb *look for* (the licensor of 'free choice' *any*), a conflict arises which results in ungrammaticality.

That an extraposed constituent outside the scope of *look for* is in principle allowable is shown by (291). *Something* need not be within the scope of a modal expression, hence there is no scope conflict.

(291) I [$_{VP}$ looked for **something** very intensely] *that will (likely) help me with my thesis.*

Another control case is (292), which shows that in principle a relative clause may be extraposed from an antecedent headed by 'free choice' *any*, as long as the extraposition site is not higher than the modal licenser of *any*. The adverbial modifier *without making a fuss* modifies the main VP *buy anything*. The relative clause appears to the right of it. The licenser of the 'free choice' element is the auxiliary verb *would*. As shown by the bracketing, there is a configuration in which the extraposed relative clause does not appear outside the scope of the modal licenser, namely when it is adjoined to VP_3 and thus below *would*. The grammaticality of the last two cases supports Fox and Nissenbaum's proposed analysis.

(292) I [$_{VP_1}$ would [$_{VP_2}$ [$_{VP_3}$ buy **anything** without making a fuss] *that will/would help me with my thesis*]].

In order to account for this scope effect, we must ensure that the scope of the quantifier of the antecedent is at least as high as the attachment site of the extraposed relative clause. To this end, I add a further constraint to the Schema of Generalized Modification, shown in (293). For convenience, I will refer to it as the *RCE Scope Constraint (Relative Clause Extraposition Scope Constraint)*. It ensures that the semantic predicate of the phrase to which the relative clause adjoins falls within the scope of the antecedent's quantifier, or conversely, that the quantifier of the antecedent has scope over the phrase to which the relative clause is attached. This is achieved by an embedding constraint ($\boxed{6} \lhd \delta$) that requires the MAIN value of the head daughter of the head-generalized-modifier phrase to be a component of the scope of the antecedent's quantifier, which appears on the PARTS list of the head daughter. Recall

that the PARTS list is the collection of all the semantic contributions of all the signs dominated by the phrase. It therefore also contains the quantified formula ($Qx[\gamma \circ \delta]$) associated with the relative clause's antecedent. This formula can be identified as truly belonging to the antecedent's quantifier (and not to the quantifier of any other noun that might appear within the phrase) since the quantifier in the formula binds the variable (x) that is identical with the INDEX|VAR value of the anchor (which is identical to the INDEX|VAR value of the antecedent noun) and with the INDEX|VAR value of the element in the relative clause's MOD|...|ANCHORS set (which again is identified with the index of the relative pronoun).

(293) RCE Scope Constraint on *hd-gen-mod-ph* (preliminary):

hd-gen-mod-ph $\Rightarrow$

$$\left(\begin{bmatrix} \text{HD-DTR } \boxed{0} \begin{bmatrix} \text{SS} \begin{bmatrix} \text{LOC|CONT|MAIN } \boxed{6} \\ \text{NLOC|INH|ANC} \left\{ \ldots, \left[\text{INDEX } \boxed{1} \left[\text{VAR } x \right] \right], \ldots \right\} \end{bmatrix} \\ \text{LF|PARTS} \left\langle \ldots, Qx[\gamma \circ \delta], \ldots \right\rangle \end{bmatrix} \\ \text{DTRS} \left\langle \boxed{0}, \left[\text{SS|LOC|CAT|HEAD|MOD} \left[\text{NLOC|INH|ANC} \left\{ \ldots, \left[\text{INDEX } \boxed{1} \right], \ldots \right\} \right] \right] \right\rangle \end{bmatrix} \\ \& \ \boxed{6} \lhd \delta \end{bmatrix}\right)$$

The following sentences provide further evidence for the scope effect. When the relative clause is extraposed, it marks wide scope for its antecedent. But the antecedent's determiner is 'free choice' *any*, which must be within the scope of *seek/desire*. These two scope requirements cannot be satisfied at the same time, which is why the (b)-sentences are ungrammatical.[35]

(294) a. Pat seeks (very eagerly) **any job** *that can make him a lot of money*.
seek $>$ *any*

b. * Pat seeks **any job** very eagerly *that can make him a lot of money*.
*((*seek* $>$ *any*) $\&$ (*any* $>$ *seek*))

(295) a. Pat desires (very much) **any job** *that can make him a lot of money*.

b. * Pat desires **any job** very much *that can make him a lot of money*.

(296) a. John sought very furiously **any rabbit** *that might threaten his garden*.

b. * John sought **any rabbit** very furiously *that might threaten his garden*.

(297) a. Mary sought intently **any rabbit** *that might need a home*.

b. * Mary sought **any rabbit** intently *that might need a home*.

I will now illustrate with the example in (294b) how the RCE Scope Constraint accounts for the scope effect and makes sure that the sentences above with the extraposed relative

[35] I would like to thank Andrew Jonas for his judgments and for providing the examples in (296) and (297).

clauses are ruled out. The relevant details of the analysis of the sentence are shown in the tree structure in Figure 7.5.

Let me first illustrate the semantic specifications of the opaque verb *seek*, which are shown in the lexical entry in (298):

(298) Sketch of the lexical entry of *seek*:

$$\left[\begin{array}{l} \textit{word} \\ \textsc{phon}\left\langle \textit{seek} \right\rangle \\ \textsc{ss|loc|cont}\left[\begin{array}{ll} \textsc{index} & \left[\begin{array}{ll} \textsc{phi} & \textit{no-phi} \\ \textsc{var} & e \end{array}\right] \\ \textsc{main} & \boxed{1d}\,\mathsf{seek}' \end{array}\right] \\ \textsc{lf}\left[\begin{array}{ll} \textsc{excont} & \textit{me} \\ \textsc{incont} & \boxed{8}\,P(@,y) \\ \textsc{parts} & \left\langle \begin{array}{l} @, p, y, e, P, \mathsf{seek}'(@, e, p, \lambda@\lambda P.\epsilon), \mathsf{seek}'(@, e, \lambda@\lambda P.\epsilon), \mathsf{seek}'(@, e), \\ \mathsf{seek}'(@), \boxed{1d}\,\mathsf{seek}', \lambda@.\zeta, \lambda@\lambda P.\epsilon, \lambda P.\epsilon, \boxed{8}, P(@), \boxed{9}\,\exists e.\phi, \exists \end{array} \right\rangle \end{array}\right] \end{array}\right]$$

& $\boxed{1d} \lhd \phi$ (seek' is in the scope of $\exists e$)
& $\boxed{9} \lhd \zeta$ ($\exists e.\phi$ must be inside $\lambda@.\zeta$)
& $\boxed{8} \lhd \epsilon$ ($P(@, y)$ is in the scope of λP)

In contrast to the lexical entries that we have seen so far, the INCONT value of *seek* does not contain the semantic constant seek', but instead the expression $P(@, y)$, which is the scopally lowest element contributed by the word (see Richter and Sailer (2004, 126–131), Sailer (2004a, 209–210)). To account for the data with intensional and modal verbs, Richter and Sailer (2004, 126–127) use the symbol $@$ for the distinguished world variable $v_{s,0}$, and Montague's $\hat{}\phi$ becomes $\lambda@.\phi$. In addition to the other arguments, the constant seek' now also takes the world argument ($@$). The following additional scope constraints are lexically specified: the semantic constant of the verb (seek') must be within the scope of the quantifier that binds the event variable ($\boxed{1d} \lhd \phi$); the latter must be in the scope of the opaque operator $\lambda@$ ($\boxed{9} \lhd \zeta$); and finally, the expression $P(@, y)$ must be within the scope of λP ($\boxed{8} \lhd \epsilon$).

Note that here and in Figure 7.5, I use the un-curried notation [i.e., $\mathsf{seek}'(@, e, p, \lambda@\lambda P.\epsilon)$ instead of $(((\mathsf{seek}'@)e)p)\lambda@\lambda P.\epsilon$] for reasons of perspicuity. In Figure 7.5, I have also omitted any semantic details that are irrelevant for illustrating the scope effect.

Consider now the tree structure in Figure 7.5 of the sentence in (294b). As should be clear by now, the CONTENT value of the noun *job* is introduced as the anchor by its determiner *any* and then percolated up the tree ($\boxed{5}$).

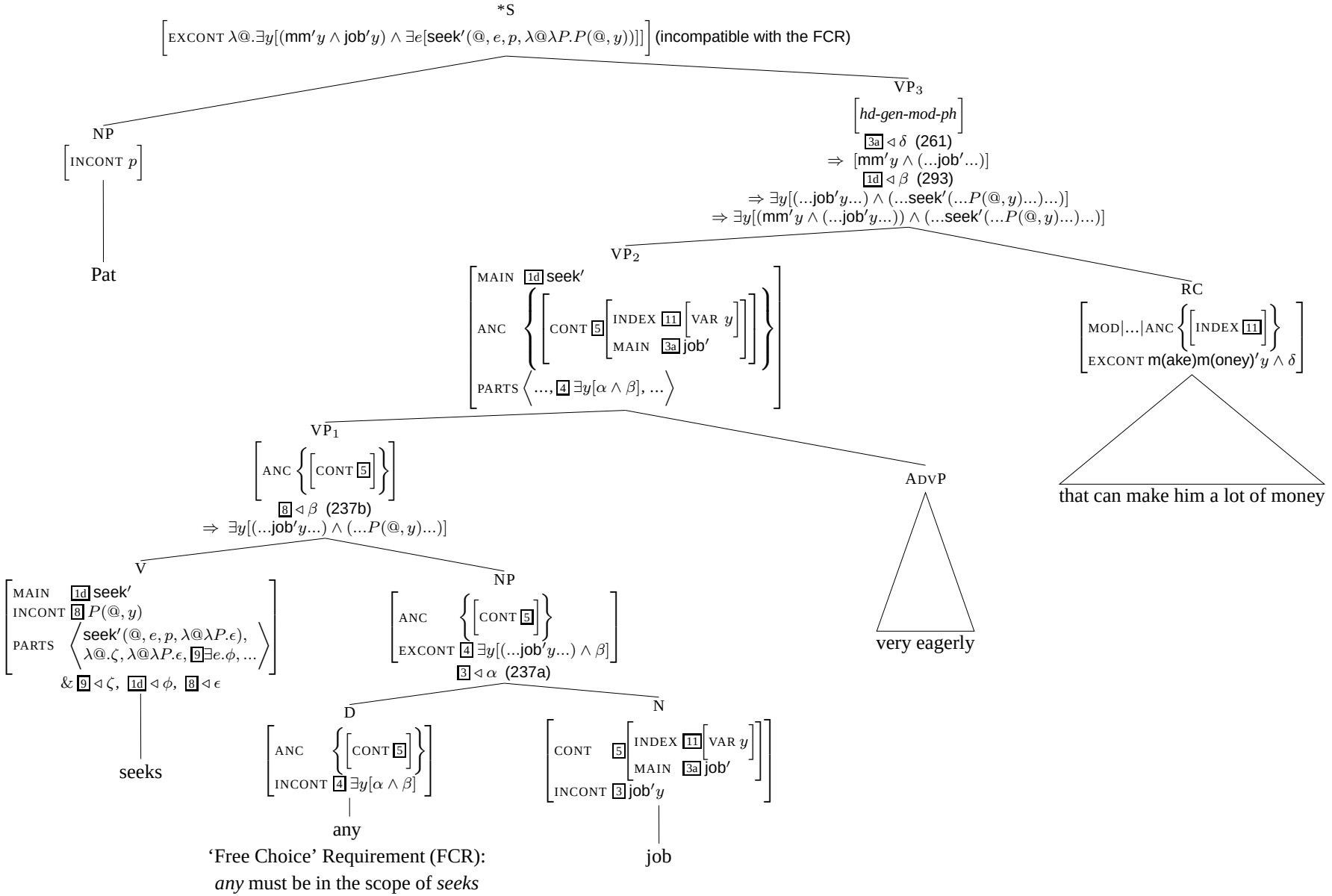


Figure 7.5: LRS analysis of the sentence: ***Pat seeks any job very eagerly that can make him a lot of money.***

I treat 'free choice' *any* as an existential quantifier that comes with the further requirement that it must be in the scope of a modal operator, in this case *seeks*. I call this requirement the *'Free Choice' Requirement* (FCR).

When the verb *seeks* combines with the NP *any job*, the Semantics Principle in (237b) requires the INCONT value of the verb to be in the scope of the quantifier of *any*, hence the logical form can be specified as $\exists y[(...\mathsf{job}'y...) \wedge (...P(@,y)...)]$. The semantic contribution of the adverb *very eagerly* is ignored here for reasons of simplicity.

For VP_2, the MAIN value is that of the verb, i.e., seek' (according to the Content Principle in (228)). The ANCHORS set contains the anchor with the noun's INDEX and MAIN values. Moreover, the PARTS list contains all the semantic contributions of all the words that are dominated by VP_2, and thus also the quantified formula $\exists y[\alpha \wedge \beta]$ contributed by the determiner *any*.

VP_2 now combines with the extraposed relative clause and yields a VP (VP_3) of type *hd-gen-mod-ph*. The constraints on phrases of this type that were already introduced in the previous sections ensure that the INDEX values of the element in the relative clause's MOD|...|ANCHORS set and of the anchor in the VP's ANCHORS set are identified (11). Furthermore, the anchor's MAIN value must be a component of the second conjunct of the relative clause's EXCONT value ($\boxed{3a} \lhd \delta$), resulting in the expression $[\mathsf{mm}'y \wedge (...\mathsf{job}'...)]$ (mm' is shorthand for $\mathsf{makemoney}'$, the constant I use to represent the semantic contribution of the relative clause in a simplified way).

The newly introduced RCE Scope Constraint shown in (293) additionally requires that the MAIN value of VP_2 (i.e., the phrase to which the relative clause adjoins) must be in the scope of the quantifier of *any* ($\boxed{1d} \lhd \beta$). As can be seen, the formula associated with this quantifier appears on the PARTS list of VP_2. Moreover, the variable bound by this quantifier (y) is identical with the variable of the noun *job* and with the VAR value of the element in the relative clause's MOD|...|ANCHORS set (which is identified with the variable of the relative pronoun). So, according to the RCE Scope Constraint, the logical form must be specified to be $\exists y[(...\mathsf{job}'y...) \wedge (...\mathsf{seek}'(...P(@,y)...)...)]$. Together with the constraint that requires the contributions of the relative clause and the head noun to form a conjunction, this yields the expression $\exists y[(\mathsf{mm}'y \wedge (...\mathsf{job}'y...)) \wedge (...\mathsf{seek}'(...P(@,y)...)...)]$. Note that, as this expression shows, the effect of the RCE Scope Constraint is that *seek* has narrow scope, i.e., it is within the scope of the quantifier ($\exists$) of *any*.

When VP_3 combines with the subject NP *Pat*, the EXCONT value is the expression $\lambda@.\exists y[(\mathsf{mm}'y \wedge \mathsf{job}'y) \wedge \exists e[\mathsf{seek}'(@,e,p,\lambda@\lambda P.P(@,y))]]$, which is the overall logical form of the sentence, taking into account all the constraints and principles imposed on the lexical entries and the phrasal nodes. What has been ignored so far is the 'Free Choice' Requirement, namely that *any* must be within the scope of *seeks*. Regarding the logical form that was just derived, however, we see that the 'Free Choice' Requirement cannot be fulfilled, since the RCE Scope Constraint in (293), which is implemented as a constraint of general-

ized modification, already requires *any* to have scope above *seeks*. Hence, in sentences in which relative clauses are extraposed from antecedents with quantifiers like 'free choice' *any* (e.g., (290b) and (294b)–(297b)), the 'Free Choice' Requirement and the RCE Scope Constraint impose conflicting requirements, which cannot be satisfied at the same time, and which correctly lead to the ungrammaticality of such sentences.

So, this illustration has shown that the RCE Scope Constraint introduced in (293) correctly accounts for Williams' Generalization, i.e., that an extraposed relative clause marks wide scope for its antecedent. Note that if there is no additional (collocational) narrow scope requirement (as the 'Free Choice' Requirement of *any*) for the antecedent's quantifier, there is no conflict in scope requirements. Consider, for example, *something* in (291). The logical form of the sentence is derived in a way analogous to that shown in Figure 7.5, i.e., *seek* (or *look for*) will be in the scope of the quantifier $(\exists)$ of *something*. But contrary to the example with 'free choice' *any*, this reading is not ruled out, since *something* is allowed to have scope above the modal verb. Hence, the grammaticality of (291) is correctly predicted.

There is one technical problem with the constraint as formulated in (293), however. In Section 7.3.2, I have argued for a distinction between two kinds of modifiers, the canonical modifiers, which are of type *canon-modifier* and which both syntactically and semantically modify their sister constituent, and the anchor-modifiers (of type *anchor-modifier*), which may be extraposed. While the adjunction of canon-modifiers is licensed by the regular head-adjunct schema, anchor-modifiers are subject to generalized modification and thus licensed (only) as non-head daughters of head-generalized-modifier phrases. It was shown for relative clauses, which belong to the type *anchor-modifier*, that the head-generalized-modifier schema licenses them either in canonical position, i.e., adjoined to NP, or in an extraposed position.

The problem with the RCE Scope Constraint as given in (293) is that the adjunction of relative clauses in canonical position is now ruled out. The reason for this is that the RCE Scope Constraint requires the phrase to which the relative clause adjoins to be in the *scope* of the antecedent's quantifier. But when the relative clause is adjoined in canonical position, it is adjoined to its antecedent NP, whose head noun must also be in the quantifier's *restrictor*. These two conflicting requirements cannot be fulfilled at the same time.

For illustration, consider the NP *a dog* that is canonically modified by the relative clause *which is brown*, as shown in the tree structure in Figure 7.6. The MAIN value of the NP is identified with that of its head, in accordance with the Content Principle (see (228)), and is thus the constant dog'. Furthermore, the noun contributes a restriction to the quantifier, as required by the Semantics Principle (see (237a)). That is, the predicate of the noun *dog* is within the restrictor of the quantifier, as shown in the EXCONT value of the NP.

When the relative clause is adjoined to the NP, the RCE Scope Constraint in (293) requires the MAIN value of this NP to be in the scope of the quantifier of the relative clause's

antecedent ($\boxed{3a} \triangleleft \beta$). However, the antecedent is the head noun of this very NP, which is already in the restrictor of the quantifier, as I have just explained. These are two contradictory requirements: a predicate cannot be a component of both the restrictor and the scope of the same quantifier.[36] It follows that the GenMod Schema does not allow the relative clause to be adjoined to this NP. More generally, since the only possibility for relative clauses to be adjoined to a constituent is via the Schema of Generalized Modification, relative clauses could never be licensed in canonical position. Of course, this is contrary to the facts.

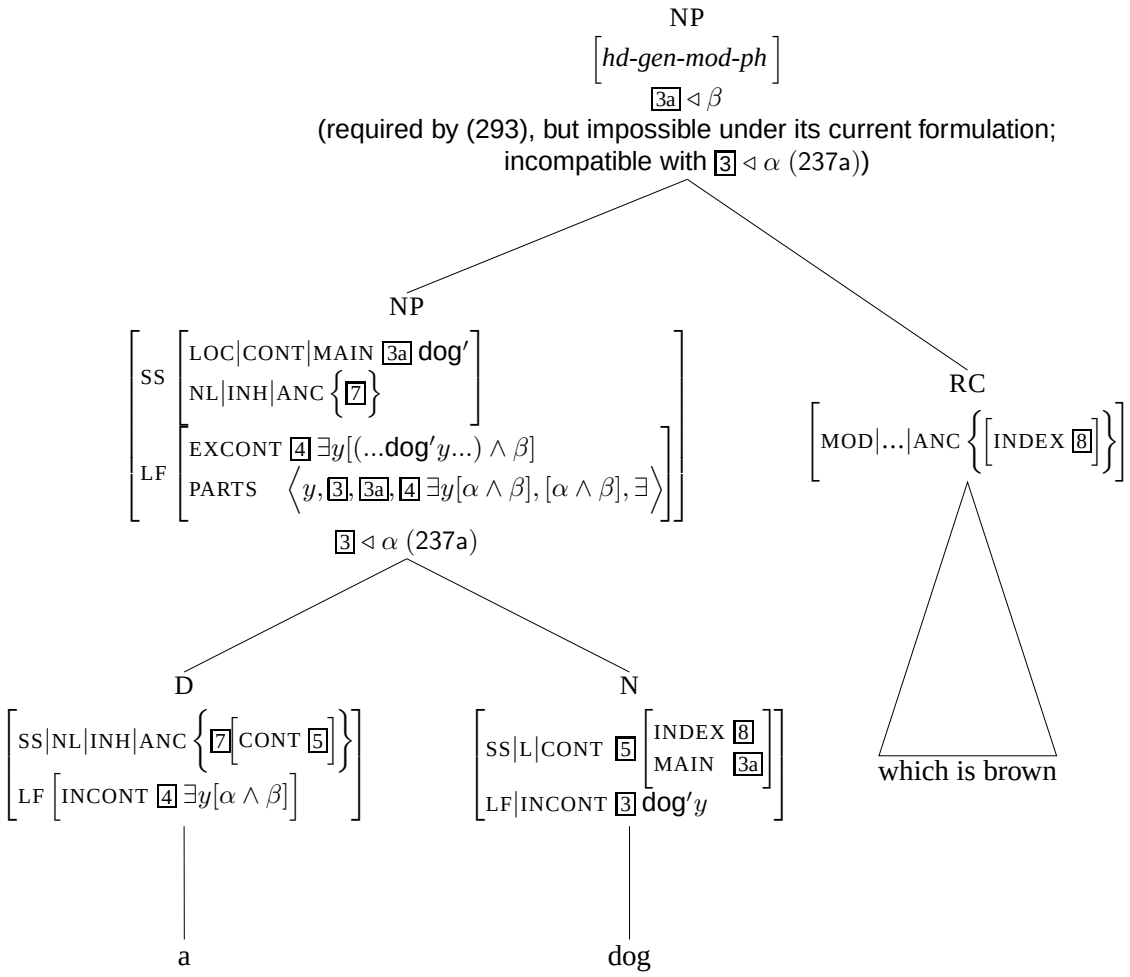


Figure 7.6: Canonical Modification by a Relative Clause: The structure is incorrectly ruled out under the current formulation of the RCE Scope Constraint in (293).

Note that the same problem occurs when noun-elliptical NPs are canonically modified by a relative clause. The relative clause adjoins to an NP-node whose elliptical head is the relative clause's antecedent. The elided noun is in the restrictor of its overt quantifier and therefore cannot also be in its scope (see Figure 7.4 in Section 7.3.5 above).

So, in order to prevent this unwanted effect and to allow for a relative clause to be adjoined in canonical position, I will modify the RCE Scope Constraint as shown in (299) below. Instead of requiring that the MAIN value of the head daughter must be a component

[36] Although technically possible, such a reading cannot be constructed from the elements of the PARTS list.

of the scope of the antecedent's quantifier (this was expressed as $\boxed{6} \lhd \delta$ in (293)), the condition is relaxed and we now require that the head daughter's MAIN value must be in the scope *or* the restrictor of the antecedent's quantifier. This new constraint is expressed as $\boxed{6} \lhd [\gamma \circ \delta]$ in (299). In other words, the predicate of the relative clause's syntactic sister must be in the restrictor or in the scope of the quantifier of the relative clause's antecedent. Recall that the antecedent's quantifier is identified by the relative clause via the anchor, and it appears in the PARTS list of the head daughter.

(299) RCE Scope Constraint on *hd-gen-mod-ph* (final):

hd-gen-mod-ph $\Rightarrow$

$$\left(\left[\begin{array}{l} \text{HD-DTR } \boxed{0} \left[\begin{array}{l} \text{SS} \left[\begin{array}{l} \text{LOC|CONT|MAIN } \boxed{6} \\ \text{NLOC|INH|ANC } \left\{ ..., \left[\begin{array}{l} \text{INDEX } \boxed{1} \left[\text{VAR } x \right] \\ \text{MAIN } \boxed{2} \end{array} \right], ... \right\} \end{array} \right] \\ \text{LF|PARTS } \left\langle ..., Qx[\gamma \circ \delta], ... \right\rangle \end{array} \right] \\ \text{DTRS } \left\langle \boxed{0}, \left[\text{SS|LOC|CAT|HEAD|MOD } \left[\text{NLOC|INH|ANC} \left\{ ..., \left[\text{INDEX } \boxed{1} \right], ... \right\} \right] \right] \right\rangle \end{array} \right] \right)$$

$$\& \ \boxed{6} \lhd [\gamma \circ \delta]$$

This new version of the RCE Scope Constraint now allows a relative clause to be adjoined canonically to its antecedent NP. Since the predicate of the head noun of the NP, i.e., the MAIN value of the relative clause's syntactic sister, is in the restrictor of the NP's quantifier, the new RCE Scope Constraint is satisfied. The adjunction of a relative clause to its antecedent NP is thus successfully licensed by the head-generalized-modifier schema.

For an extraposed relative clause, the new RCE Scope Constraint still has the effect that the semantic predicate of the phrase to which the relative clause adjoins falls within the scope of the antecedent's quantifier, as desired for the examples in (290) and (294)–(297). To see this, consider again the tree structure in Figure 7.5 above. Recall that the Semantics Principles (237b) requires that the internal content (INCONT value) of the verb (*seeks*) be in the scope of the quantifier of the NP (*any job*). This results in the expression of the form $\exists y[(...\mathsf{job}'y...) \wedge (...P(@, y)...)]$. Thus, when the relative clause is adjoined to the VP and the RCE Scope Constraint must be satisfied, the semantic predicate (the MAIN value) of the VP can only be a component of the scope (and not the restrictor) of the antecedent's quantifier, since this is where its internal content is.

At this point, I would like to draw the reader's attention to a further consequence of the RCE Scope Constraint, which was briefly mentioned already in Section 7.2.3. The GenMod Schema allows a relative clause to be attached to any phrase which contains in its ANCHORS set an anchor that provides access to a suitable antecedent of the relative pronoun. Since in the theory presented here it is the noun's determiner that introduces this anchor into its

ANCHORS set, one could assume that the relative clause could be attached to the determiner, giving rise to an ungrammatical construction as in (300):

(300) * I saw [[**a** *who was wearing a hat*] **man**] yesterday.

However, this case is ruled out by the RCE Scope Constraint. Let us assume that a syntactic structure as indicated in (300) would be possible. The relative clause would adjoin to the determiner *a* and semantically modify the noun *man*. The head noun (antecedent) of the relative clause is the noun, whose quantifier is expressed by the determiner *a*. The MAIN value of the determiner is the existential quantifer (∃).

According to the RCE Scope Constraint, when the relative clause is adjoined to the determiner, the determiner's MAIN value would have to be in the restrictor or in the scope of the antecedent's quantifier. But since the determiner's MAIN value *is* the quantifier of the antecedent, this is not possible. The (existential) quantifier would have to be in its own restrictor or scope. Of course, this is impossible. Therefore, the RCE Scope Constraint correctly rules out cases like (300).

For the same reason, a relative clause can also not be attached to the (determiner) daughter of a noun-elliptical NP. Recall from Section 7.3.5 above that noun-elliptical NPs such as *diejenige* ('the+that') in *diejenige die blond ist* ('the very one who is blond') are analyzed as NPs of type *noun-ellipsis-functor*, which take the determiner as their only daughter (see Figure 7.4). The determiner selects for the elided noun and introduces the noun's CONTENT value as an anchor into its ANCHORS set. In principle, this anchor would now be available to be picked up by a relative clause via generalized modification. However, this illicit attachment is banned by the RCE Scope Constraint, in the same way as explained in the previous paragraph. The quantifier of *diejenige* would have to be in its own restrictor or scope, which is impossible. Thus, the relative clause can only be attached to the NP. The MAIN value of the NP is the semantic predicate of the elided noun. Due to the semantic constraints on the type *noun-ellipsis-functor* (287), it is a component of the quantifier's restrictor, thus satisfying the RCE Scope Constraint.

In conclusion, the RCE Scope Constraint introduced in this section correctly accounts for the scope effects caused by relative clause extraposition. As a side effect, it also correctly rules out the possibility that a relative clause, which as an anchor-modifier must interact with an anchor to be licensed, illicitly adjoins to a determiner that introduces the anchor.

In the following section, I will integrate the RCE Scope Constraint into the schema of head-generalized-modifier phrases and summarize all the constraints of generalized modification, i.e., all the constraints on phrases of type *head-generalized-modifier-phrase*.

7.3.7 The Schema of Generalized Modification (final)

In the course of this chapter, I have presented several conditions that must hold for cases of generalized modification and specifically for modification by relative clauses. Generalized

modification allows a modifier to appear in both canonical and extraposed position, being licensed by one and the same schema, which I have called the head-generalized-modifier schema and also refer to as the Schema of Generalized Modification (GenMod Schema). The final version of this schema, which integrates all the constraints that have been introduced above, is shown in (301):[37]

(301) Head-Generalized-Modifier Schema (final)

In a *head-generalized-modifier-phrase*, the following conditions hold:

a. the EXCONT value of the non-head daughter is of the form $\alpha \wedge \beta$;

b. there is an element A in the ANCHORS set of the head daughter (referred to as the "anchor") and

   i. the INDEX value of A is identical with the INDEX value of an element in the ANCHORS set of the non-head daughter's MOD value, and

   ii. the MAIN value of A is a component of β, and

   iii. the TO-BIND|ANCHORS set of the head daughter is either empty or is the singleton set containing A, and

   iv. the MAIN value of the head daughter must be in the restrictor or in the scope of the quantifier whose variable is identified with the VAR value of the anchor.

hd-gen-mod-ph $\Rightarrow$

$$\left(\begin{array}{l}\left[\begin{array}{l}\text{HD-DTR } \boxed{0}\left[\begin{array}{l}\text{SS}\left[\begin{array}{l}\text{LOC|CONT|MAIN } \boxed{6}\\ \text{NLOC}\left[\begin{array}{l}\text{INH|ANC } \left\{\boxed{5}\left[\text{CONT}\left[\begin{array}{l}\text{INDEX } \boxed{1}\left[\text{VAR } x\right]\\ \text{MAIN } \boxed{2}\end{array}\right]\right]\right\} \uplus \boxed{3}\\ \text{TO-BIND|ANC } \left\{\left(\boxed{5}\right)\right\}\end{array}\right]\\ \text{LF|PARTS } \left\langle Qx[\gamma \circ \delta]\right\rangle \bigcirc \boxed{7}\end{array}\right]\\ \text{DTRS}\left\langle \boxed{0}, \left[\begin{array}{l}\text{SS|LOC|CAT|HEAD|MOD } \left[\text{NLOC|INH|ANC } \left\{\left[\text{INDEX } \boxed{1}\right]\right\} \uplus \boxed{4}\right]\\ \text{LF|EXCONT } \alpha \wedge \beta\end{array}\right]\right\rangle\end{array}\right]\\ \& \ \boxed{2} \lhd \beta\\ \& \ \boxed{6} \lhd [\gamma \circ \delta]\end{array}\right)$$

In the notation of tree structures, the head-generalized-modifier schema can be depicted as in Figure 7.7.

The schema describes phrases of type *head-generalized-modifier-phrase*, whose head daughter must have a non-empty ANCHORS set and whose non-head daughter is a modifier (more precisely: an anchor-modifier). In addition, the following constraints must be satisfied.

[37] The symbol "$\bigcirc$" represents the operation of 'domain union', which shuffles two lists.

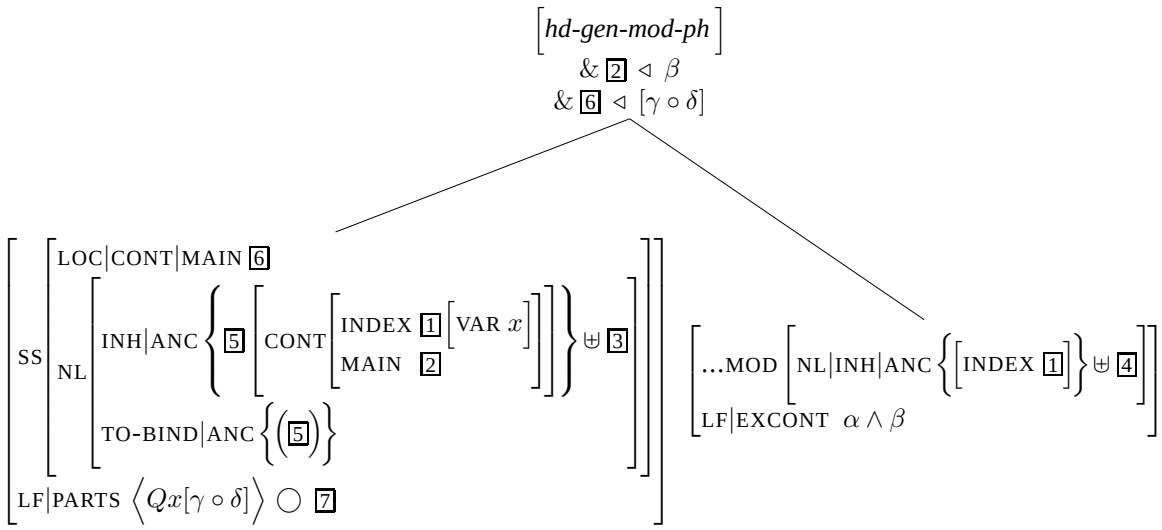


Figure 7.7: Illustration of the Head-Generalized-Modifier Schema (final)

The index of the modifier is identified with the INDEX value of an element (referred to as the "anchor") in the head daughter's ANCHORS set (1), which is identified via the anchor percolation mechanism with the index of the element that is semantically modified by the non-head daughter. Note that the index of the modifier appears in the modifier's MOD|...|ANCHORS set. In the case of relative clauses, this will be the index of the relative pronoun (via the constraints on the relative clause constructions). This coindexation ultimately guarantees that the relative pronoun and its antecedent have identical ϕ-features.

Furthermore, the MAIN value of the anchor must be a component of the second conjunct of the modifier's EXCONT value ($2 \lhd \beta$). (The first conjunct contains the semantic contribution of the modifier. For relative clauses, this must be guaranteed by the relative clause constructions). This ensures that the modifier and the semantically modified element are correctly combined in the fashion of intersective modification.

The anchor optionally appears in the TO-BIND|ANCHORS set of the head daughter. Since the Anchors Saturation Principle (see Section 7.3.3) requires a complete clause to have an empty ANCHORS set, all anchors must be bound/canceled eventually. This guarantees the presence of a relative clause in cases where they are obligatorily required (for example the determiners like *derjenige/diejenige/dasjenige* ('the+that') that require a relative clause and therefore obligatorily introduce an anchor). The binding is optional, however, in order to allow for multiple modification.

Finally, the semantic predicate of the syntactically modified phrase, i.e., the MAIN value of the head daughter, must be in the restrictor or in the scope of the quantifier of the semantically modified element ($6 \lhd [\gamma \circ \delta]$). This accounts for the scope effects of relative clause extraposition, namely that the position of the extraposed relative clause overtly marks the scope of its antecedent NP (Williams' Generalization).

7.3.8 Extraposition from Fronted Phrases

This section deals with the observations concerning the interaction of relative clause extraposition with topicalization and *wh*-movement. I propose a language-particular constraint that is able to account for the contrast found in English.

It has been widely observed that in English, extraposition from a topicalized constituent is not possible. A relative clause extraposed from an object position cannot be stranded when the VP is fronted but must stay within the VP, as the following examples show:

(302) a. John said that he would call people up who are from Boston, and [$_{VP}$ call **people** up *who are from Boston*] he will.

b. * John said that he would call people up who are from Boston, and [$_{VP}$ call **people** up] he will *who are from Boston*. (Baltin, 1981, 269)

(303) a. John said he would meet a man at the party who was from Philadelphia, and [$_{VP}$ meet **a man** at the party *who was from Philadelphia*] he did.

b. * John said he would meet a man at the party who was from Philadelphia, and [$_{VP}$ meet **a man** at the party] he did *who was from Philadelphia*.[38]

(Culicover and Rochemont, 1990, 28)

The same observation is made when the topicalized constituent is the NP-antecedent of the relative clause:

(304) a. [**Micro brews** *that are located around the Bay Area*] I like.

b. * [**Micro brews**], I like *that are located around the Bay Area*. (Kiss, 2003, 110)

(305) * [$_{NP}$ **That man**], Bill didn't invite to his party *who drinks heavily*.

(Rochemont and Culicover, 1990, 168n20)

However, when the fronted constituent is a *wh*-element, extraposition is possible:

(306) a. [**Who**] do you know *that you can really trust*?

b. [**Which argument**] do you know *that Sandy thought was unconvincing*?

(Kiss, 2003, 110)

(307) a. [**Which book**] did she write last year *that takes only two hours to read*?

(Keller, 1995, 2)

b. [**Which woman**] did he meet yesterday *who is from the south of France*?

[38] Culicover and Rochemont (1990, 28n11) claim that the example is somewhat improved when the extraposed relative clause is a focus:

(i) ? John said he would meet a man at the party who was from Philadelphia, and [$_{VP}$ meet **a man** at the party] he did, *who was from New York.*

Sentences with topicalized and *wh*-moved constituents are analyzed as instances of the phrasal type *head-filler-phrase* in Pollard and Sag (1994) and Ginzburg and Sag (2001). The fronted constituent is the filler daughter, and the head daughter is the sentential constituent which is missing the element corresponding to the filler. A crucial difference between topicalized clauses (such as (302)–(305)) and *wh*-constructions such as in (306)–(307) is that the filler daughter of the former is constrained to be [QUE { }], indicating that no interrogative *wh*-word may appear as the filler or be contained within the filler, while the filler daughter of the latter has a non-empty set as value of QUE.[39]

I make use of this distinguishing feature to account for the different behavior of topicalized and *wh*-moved elements with respect to relative clause extraposition as observed above, i.e., that a relative clause cannot be extraposed from a topicalized phrase, but it is extraposable from a fronted *wh*-element. I formulate the following constraint on phrases of type *head-filler-phrase*:

(308) Constraint on *head-filler phrase*:

$$\left[\begin{array}{l} \textit{hd-fill-ph} \\ \textsc{dtrs} \quad \left\langle \left[\textsc{ss|nloc|inh} \left[\begin{array}{l}\textsc{que}\ \{\} \\ \textsc{rel}\ \{\}\end{array}\right]\right], \boxed{1} \right\rangle \\ \textsc{hd-dtr}\ \boxed{1} \end{array}\right] \Rightarrow \left[\begin{array}{l} \textsc{dtrs} \quad \left\langle \left[\textsc{ss|nloc|inh|anc}\ \{\}\right], \boxed{1} \right\rangle \\ \textsc{hd-dtr}\ \boxed{1} \end{array}\right]$$

The constraint says that if the non-head daughter (i.e., the filler daughter) of a head-filler phrase has empty QUE and REL sets, which means that it must not be or contain an interrogative or relative *wh*-word, then the ANCHORS set of the filler daughter must be empty. Since topicalized phrases are specified as [QUE { }], the constraint ensures that all anchors that are introduced inside a topicalized phrase must be bound off within that phrase. They do not become available outside the topicalized phrase. Thus, a relative clause related to an antecedent contained in a topicalized phrase can only appear in canonical or extraposed position within that phrase, as in the (a)-sentences in (302)–(304), but it cannot appear outside of it as in the (b)-sentences.

For illustration, the tree structure for the relevant part of the sentence in (303a) is shown in Figure 7.8. The filler daughter is VP_1. Since this is a topicalized VP, its QUE and REL sets are empty. Furthermore, the constraint in (308) requires it to have an empty ANCHORS set. The anchor that is introduced by the noun *man* (or rather its determiner) must therefore be picked up by a relative clause inside the VP.[40] Here, the relative clause is adjoined to the VP, but it could also attach canonically to the NP (in both cases by the GenMod Schema, yielding a phrase of type *head-generalized-modifier-phrase*).

[39] This is based on Ginzburg and Sag (2001, 175, 228). They employ the feature WH instead of QUE, but state that "the feature WH corresponds to the feature QUE of Pollard and Sag (1994)" (p. 19; see also p. 184n16).

[40] Here and in the following tree structures, I use the shorthand notation "i" for the anchor.

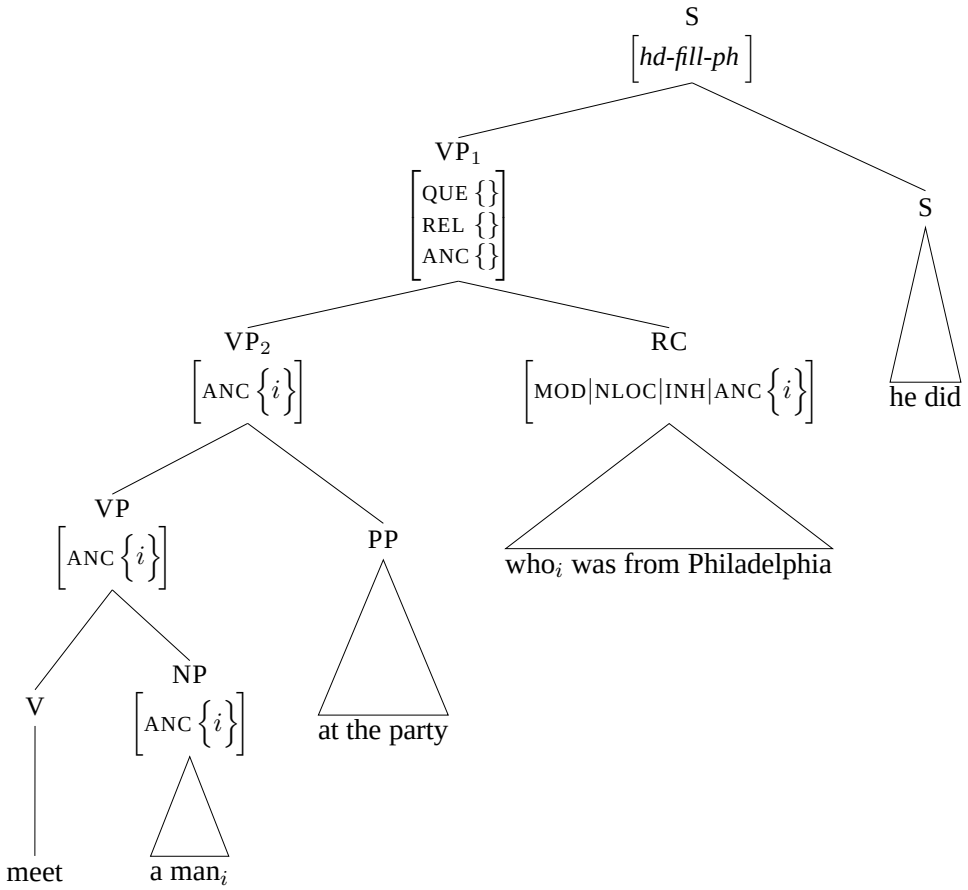


Figure 7.8: Extraposition and Topicalization: A relative clause modifying a nominal within a topicalized phrase must stay inside of this phrase.

Figure 7.9 illustrates the ungrammatical case in (303b). Since the topicalized VP_1 has an empty ANCHORS set (according to (308)), the S-node dominating it is also [ANC { }].[41] Thus, the relative clause, which is required to syntactically modify an element with a non-empty ANCHORS set, cannot be adjoined in this position and the sentence cannot be licensed.

The constraint in (308) does not apply in cases like (306) and (307), since the filler daughter contains a *wh*-word and therefore does not have an empty QUE set. These filler daughters are not required to have an empty ANCHORS set, and if an anchor is introduced inside of them, it may be percolated further up the tree so that a relative clause can be attached outside the fronted constituent and to the S node. This is illustrated for (306b) in Figure 7.10. Thus, it is correctly predicted that extraposition from a fronted *wh*-element is possible.

Note that the constraint in (308) does not only require the filler daughter to be [QUE { }],

[41] I assume that the pronoun in the matrix clause does not introduce an anchor. However, the subject of the matrix clause could in principle be the antecedent of the extraposed relative clause, as shown by the following examples (see also Kiss (2003, 110n3) for an example with NP topicalization):

(i) a. . . . and meet a man at the party **a woman** did *who was from Philadelphia*.
b. **A woman** *who was from Philadelphia* met a man at the party.

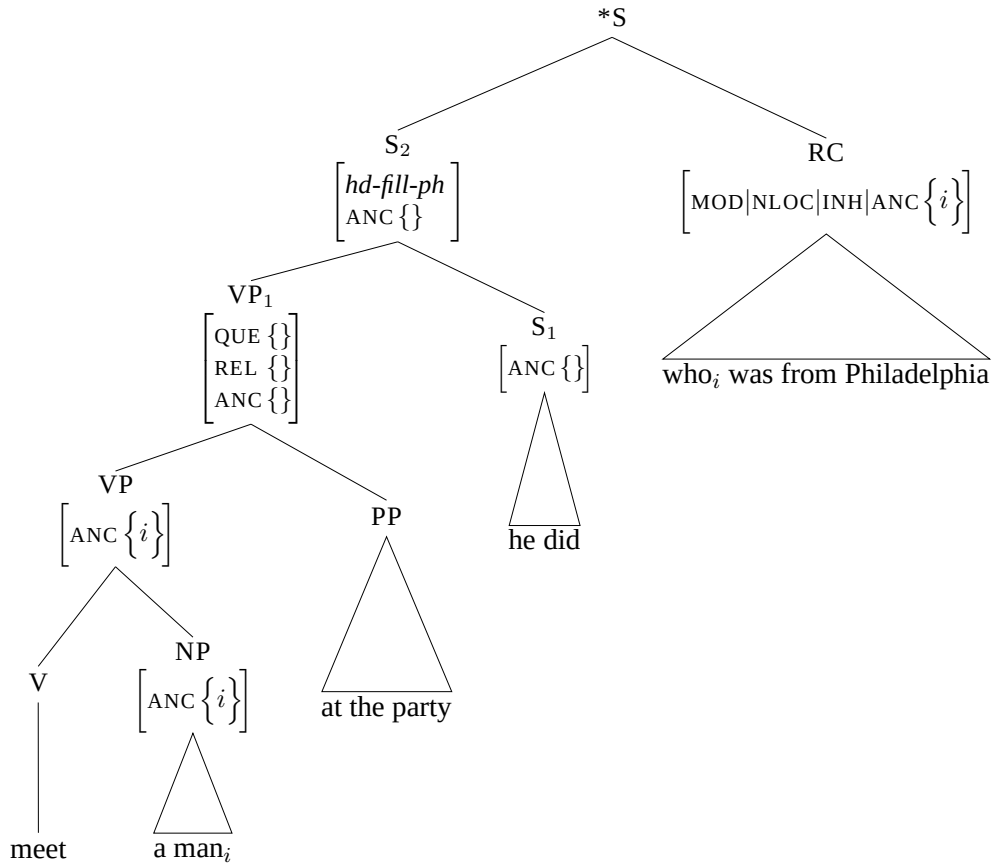


Figure 7.9: Extraposition and Topicalization: A relative clause modifying a nominal within a topicalized phrase cannot be extraposed out of this phrase.

but it also restricts the filler daughter to be [REL { }]. The reason for this is that certain relative clause constructions are also subtypes of *head-filler-phrase*, in which the relative phrase is analyzed as the filler daughter (see Chapter 5.2.2). As the example in (309) shows, however, it is possible to extrapose a relative clause from such a filler: The relative clause *who had oral surgery yesterday* (RC_2) modifies the noun *patient* that is inside the relative phrase (*whose patient*), and it is extraposed to the end of the relative clause *whose patient I called* (RC_1). Since relative words, and thus relative phrases, are specified to be [QUE { }], the constraint in (308) without the specification [REL { }] would rule out cases like (309). It would require the ANCHORS list of the relative phrase to be empty, hence the RC_2 would have to appear inside the relative phrase (the filler). So, in order to allow for extraposition from relative phrases, I add the requirement that the filler daughter must be [REL { }]. Since relative phrases have a non-empty REL set, this prevents them from being subject to the constraint, and extraposition from a relative phrase is possible.

(309) The dentist [$_{RC_1}$ [$_{RC_1}$ [$_{NP}$ **whose patient**] I called] [$_{RC_2}$ *who had oral surgery yesterday*]] required payment.[42]

The contrast observed above between topicalization and *wh*-movement in English does

[42] I would like to thank Janina Radó for helping me construct this example and Erich Groat for his judgments.

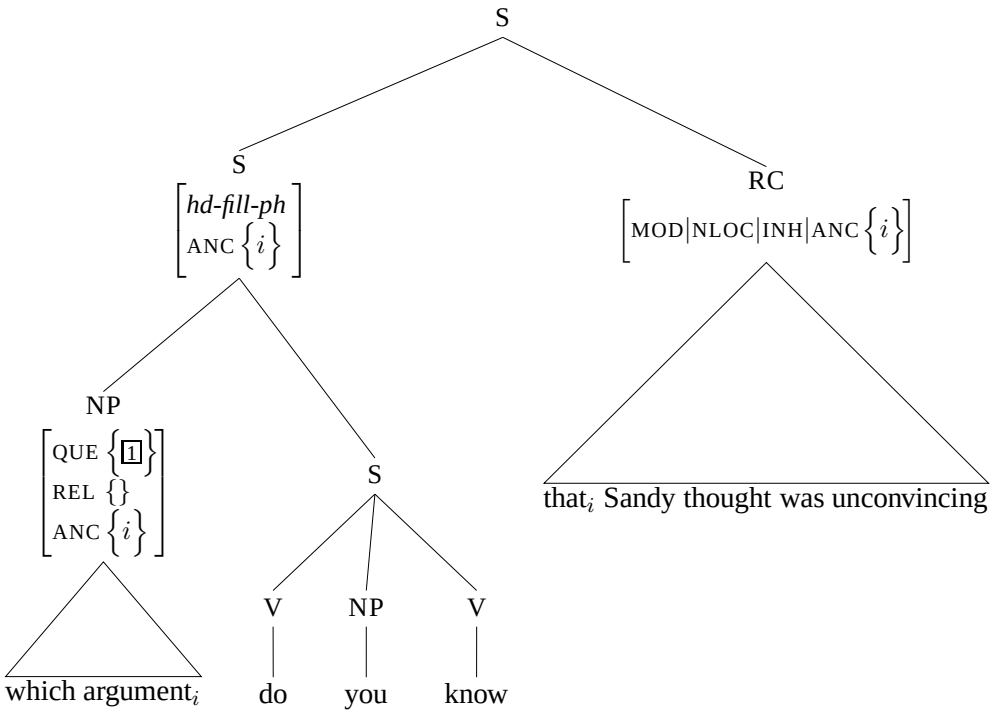


Figure 7.10: Extraposition and *Wh*-movement: A relative clause can be extraposed from a fronted *wh*-phrase.

not show up in German. Extraposition is possible from both kinds of fronted constituents, as demonstrated in (310). The constraint in (308) is thus taken to be a language-particular constraint that applies to English but not to German. Hence, in German, anchors that are introduced by elements within topicalized or *wh*-moved constituents can be freely percolated and bound off by a relative clause even outside the fronted constituent.

(310) a. **Den Mann** hat sie gesehen, *den ich gestern getroffen hatte*.

b. **Wen** hat sie gesehen, *den ich gestern getroffen hatte*? (Kiss, 2003, 113)

7.3.9 Locality Constraints

The analysis developed in this chapter correctly predicts an empirical generalization that was deduced from evidence in the literature in Chapter 2, namely that an extraposed relative clause must be adjoined to a position that is structurally higher than (the surface position of) its antecedent NP. This follows from the anchor mechanism that is necessarily used to license an extraposed relative clause: The anchor is introduced by the antecedent's determiner, and in accordance with the Nonlocal Feature Principle it is passed up only to positions higher in the tree. It is never passed down.

As a consequence, an anchor introduced by a subject can be percolated to S, but it never occurs within the VP. For this reason, the proposed analysis does not support Culicover and Rochemont's claim that a relative extraposed from a subject may be adjoined to VP (see Culicover and Rochemont (1990), Rochemont and Culicover (1990), Rochemont (1986), and the

summary in Chapter 2.2.2). Furthermore, it differs crucially in this respect from the theory proposed by Kiss (2003). Recall that Kiss employs a mechanism of lexical amalgamation of anchors in order to make an anchor of a subject available once the verb that selects this subject is introduced. Consequently, Kiss' theory allows a relative clause extraposed from a subject to be adjoined to VP.

However, in Chapter 2, we have seen convincing evidence against this claim. More specifically, we have seen evidence that a relative clause extraposed from a subject must be adjoined to S, while a relative clause extraposed from an object must be adjoined no higher than the minimal VP containing its antecedent. The evidence was based on Principle C effects, on constituency tests applying to the VP, as well as on ordering restrictions on relative clauses extraposed from distinct antecedents (in subject and object position).

Under the assumption that this evidence is correct, I have to add a further constraint to the analysis developed here, in order to prevent an anchor introduced by an object from being percolated out of the VP. The only locality constraints that I have introduced so far are (i) the Anchors Saturation Principle accounting for the clause-boundedness of extraposition and (ii) the constraint on head-filler phrases in English prohibiting extraposition from a topicalized constituent. Similar to these constraints, I propose a restriction that all anchors introduced within a VP must be bound off within that VP. The constraint is shown in (311):

(311) Constraint on *head-subject phrase*:

$$\textit{head-subject-phrase} \Rightarrow \left[\text{HD-DTR} \left[\text{SS|NLOC|INH|ANC } \{\}\right]\right]$$

The constraint requires that in a head-subject phrase, the ANCHORS set of the head daughter must be empty. That is, a VP can only combine with its subject if the former has an empty ANCHORS set. In consequence, any anchors which are introduced within the VP must be picked up by a relative clause within that VP. Hence, it is correctly predicted that an extraposed relative clause modifying an object must occur inside the VP.

7.4 Summary

In this chapter, I have developed an HPSG analysis of relative clauses and relative clause extraposition which was integrated with an LRS semantics. The analysis modifies and considerably extends a prior proposal by Kiss (2003, 2005). Canonical and extraposed relative clauses are licensed by the same syntactic and semantic constraints which are imposed on a newly introduced phrasal schema, the head-generalized-modifier schema. It describes phrases of type *head-generalized-modifier-phrase*, and I have referred to it as the Schema of Generalized Modification (GenMod Schema). The schema licenses the adjunction of a relative clause to any phrase that contains a suitable antecedent for the relative clause. The adequate semantic interpretation of the relative clause as an intersective modifier–no matter

how distant from its antecedent it occurs–is achieved by means of an anchor which consists of the nominal's index and semantic predicate and which projects almost freely through the tree structure.

Since the determiner introduces this anchor, a relative clause can appear within the sentence and modify an NP even if its head noun is covert. For the analysis of such noun-elliptical NPs, I have adapted Branco and Costa's (2006) schema of a unary phrase structure, called *noun-ellipsis-functor*, to the LRS semantics and added a constraint that passes the anchor from the single determiner daughter to the mother.

Furthermore, to account for the cases with obligatory relative clauses, for example with determiners like *derjenige/diejenige/dasjenige* ('the+that'), I have introduced three new mechanisms: First, an anchor is introduced if and only if a relative clause occurs. That is, the determiners that require the presence of a relative clause obligatorily introduce an anchor, while the other determiners only introduce one in case it will be picked up by a relative clause. Secondly, the anchor is canceled from the anchors set when it is picked up by a relative clause. This is achieved by introducing the anchor into the TO-BIND|ANCHORS set of the head daughter in a head-generalized-modifier phrase. However, this is an optional constraint in order to allow for the attachment of multiple relative clauses to the same anchor. Therefore, thirdly, the Anchors Saturation Principle is introduced which requires that in a complete clause, all anchors must have been picked up, i.e., the ANCHORS set must be empty. This constraint additionally accounts for the clause-boundedness of extraposition, i.e., Ross' Right Roof Constraint.

Moreover, I have introduced the Relative Clause Extraposition Scope Constraint as an additional constraint on the head-generalized-modifier schema. It ensures that the relative clause's antecedent NP takes scope over the phrase to which the (extraposed) relative clause is adjoined. Hence, the scope effects known as Williams' Generalization (Fox and Nissenbaum (1999), Fox (2002)) are captured.

A constraint on head-filler phrases has been introduced that captures the contrast found in English that a relative clause must not be extraposed from a topicalized phrase but can be associated with a *wh*-moved element.

Finally, a constraint on head-subject phrases ensures that relative clauses extraposed from a VP must be adjoined within the VP.

In conclusion, the analysis developed in this chapter accounts for a number of phenomena of relative clauses and relative clause extraposition that have been problems for the theories previously proposed in the literature.

Chapter 8

Adjuncts and the HPSG Binding Theory

In this chapter, I propose a new version of the binding theory in HPSG.[1] I will show that in combination with the analysis of relative clause attachment developed in the previous chapter, the theory crucially accounts for the coreference effects of relative clause extraposition which have been noted in the literature and which I have discussed in Chapter 2.3.

Binding theory accounts for the distribution of anaphors, personal pronouns, and R-expressions and defines the syntactic conditions under which coreference relations among linguistic expressions are obligatory, permitted, or prohibited. Various syntactic theories in the tradition of the Government and Binding theory, starting with Chomsky (1981) and Reinhart (1976, 1981, 1983), provide an account of coindexation possibilities in terms of the phrase structural relation of c-command. The HPSG binding theory presented by Pollard and Sag (1994) rejects these configurational formulations and instead introduces a relation called o-command which is based on the relative obliqueness of arguments of the same head, as reflected in its ARG-ST list.[2] But this analysis faces a number of problems. For example, it fails to address the binding-theoretic interaction between elements in the main clause and elements within adjuncts. In this chapter, I present a revision of the HPSG binding theory that can account for these binding phenomena. I follow Hukari and Levine (1995), who claim that a configurational relation similar to c-command is needed in order to capture the binding behavior of adjunct-internal elements. To this end, they introduce a relation called v(alence-based)-c-command and propose that Principle C must involve this configurational relation in addition to the obliqueness-based relation of o-command. They show that the (anti)reconstruction effects as well as binding effects in VP-topicalization fall out from this revised binding theory. However, as a formal definition in terms of the HPSG formalism,

[1] This chapter is based on a presentation I gave at the 18th International Conference on Head-Driven Phrase Structure Grammar in 2011. It was published in a slightly modified version in the online proceedings (see Walker (2011)). However, in particular the section on extraposition and the binding theory is considerably extended here. I am grateful to Bob Levine, Manfred Sailer, Gert Webelhuth, the audience at the HPSG conference, and three anonymous reviewers for helpful comments and discussion.

[2] I employ here the feature ARG-ST as used in more recent work within the HPSG framework to replace the SUBCAT feature as used in Pollard and Sag (1994).

Hukari and Levine's formulation of vc-command is flawed. To remedy this deficiency, I propose a revision of vc-command that is compatible with the foundations of the HPSG framework. I provide new data, including data with respect to relative clause and complement extraposition, that strongly support the proposed revision of the HPSG binding theory.

This chapter is structured as follows: I present a brief review of Pollard and Sag's (1994) binding theory in Section 8.1, and some of its problems concerning binding into adjuncts in Section 8.2. In Section 8.3, I give an outline of Hukari and Levine's (1995) valence-based binding theory. After describing its deficiencies, I propose a new formulation of vc-command and explain how it accounts for the problematic data presented earlier. Section 8.4 shows some further empirical consequences of the revised binding theory, namely that it accounts for the (anti)reconstruction effects (Section 8.4.1) and for binding phenomena in extraposition (Section 8.4.2) as well as in VP-topicalization and VP complements (Section 8.4.3). Finally, in Section 8.5, I briefly address the question of whether Principle C is pragmatic in nature, a claim that has often been made in the literature. I argue that the evidence provided in favor of these claims is not convincing enough to refute the syntactic nature of Principle C, which is also supported by psycholinguistic evidence.

8.1 Binding Theory in Pollard and Sag (1994)

The binding theory proposed by Pollard and Sag (1994) replaces the tree-configurational notion of c-command by a relation called o(bliqueness)-command, which is based on the relative obliqueness that obtains between arguments of the same head. Relative obliqueness is modeled by position on the ARG-ST list of some lexical head. The ordering corresponds to the traditional obliqueness hierarchy, with the subject (the least oblique element) appearing first (leftmost), followed by the primary object, the secondary object, and other, more oblique complements (in that order, if such exist). In the revised binding theory presented in chapter 6.8.3 of Pollard and Sag (1994), two relations, a general ("weak") relation called o-command and a "strong" relation called local o-command, are defined as follows:

(312) Let Y and Z be *synsem* objects with distinct LOCAL values, Y referential. Then Y *locally o-commands* Z just in case either:
   a. Y is less oblique than Z; or
   b. Y locally o-commands some X that subcategorizes for Z.

(313) Let Y and Z be *synsem* objects, with distinct LOCAL values, Y referential. Then Y *o-commands* Z just in case either:
   a. Y is less oblique than Z; or
   b. Y o-commands some X that subcategorizes for Z; or
   c. Y o-commands some X that is a projection of Z (i.e., the HEAD values of X and Z are token-identical).

It follows from these definitions that local o-command is a special case of o-command; the cases of local o-command are just those cases covered by clauses (i) and (ii) of o-command. O-command serves as the basis of the o-binding relation:

(314) Y *(locally) o-binds* Z just in case Y and Z are coindexed and Y (locally) o-commands Z. If Z is not (locally) o-bound, then it is said to be *(locally) o-free*.

The Binding Principles are formulated as follows:

(315) a. Principle A: A locally o-commanded anaphor must be locally o-bound.
b. Principle B: A personal pronoun must be locally o-free.
c. Principle C: A nonpronoun must be o-free.

To illustrate this binding theory, consider the following ill-formed example:

(316) * She$_i$ believes that John likes Mary$_i$.

The ARG-ST list of the matrix verb *believes* consists of the pronoun *she* and the CP *that John likes Mary*, hence *she* (locally) o-commands the CP by definition (313a) (or (312a), respectively). By repeated application of (313b) and (313c), *she* o-commands the head daughter *that* of the CP, the head verb *likes* of the subclause, and finally the arguments of *likes*. Hence, *she* o-commands *Mary*. Since the two are coindexed, *Mary* is o-bound and Principle C is violated.

8.2 Problems with Pollard and Sag's (1994) Binding Theory

Pollard and Sag's (1994) nonconfigurational binding theory cannot account for the coindexation between main clause and adjunct-internal elements. Adjuncts are not selected by heads and thus do not appear on ARG-ST lists. Hence, they do not stand in obliqueness relations to arguments.[3] It follows that an adjunct is never (locally) o-commanded, and no element within it can ever be o-bound by an element outside of the adjunct. Consequently, Pollard and Sag's theory cannot predict any Principle C effects involving nonpronominal NPs within adjuncts bound by arguments of the main clause.

But there is considerable evidence that adjuncts are transparent for binding purposes. First of all, a nonpronominal NP contained within a relative clause cannot be coreferential

[3]As will become clear in the following discussion based on Hukari and Levine (1995), approaches in which adjuncts are added to the ARG-ST list, as for example Van Noord and Bouma (1994) and Sag (2005), fail on empirical grounds since they cannot predict the complex cataphora asymmetries demonstrated below, for example the contrast between subject-based and object-based cataphora into *without*-adjuncts as shown in (318) and (319).

with an argument preceding the NP containing the relative clause, as illustrated in (317).[4] Since a relative clause functions as a modifier, a name within it is not o-commanded by a preceding argument of the matrix clause, and Pollard and Sag's binding theory incorrectly does not predict a Principle C violation for these sentences.[5]

(317) a. * She$_i$ admires the people [who work with Lola$_i$]. (Reinhart, 1983, 102)

b. * I sent her$_i$ many gifts [that Mary$_i$ didn't like] last year.
(Culicover and Rochemont, 1990, 29)

c. * I told him$_i$ about your new argument [that supports John$_i$'s theory].
(Fox and Nissenbaum, 2000, 5)

Other types of adjunct clauses also constitute a problem for the binding theory. As observed by Hukari and Levine (1995, 1996), an R-expression within a *without*-clause may not be coreferential with the subject pronoun of the matrix clause:

(318) a. * They$_i$ went into the city [without anyone noticing the twins$_i$].

b. * They$_i$ went into the city [without the twins$_i$ being noticed].

c. * They$_i$ could never do anything [without the twins$_i$ feeling insecure about it].

However, there is an asymmetry between subject and object antecedents. While cataphora into the *without*-adjunct is impossible when the pronoun is in subject position (as in (318)), it is possible when the pronoun is an object of the main clause, as shown in (319).

(319) a. You can't say anything to them$_i$ [without the twins$_i$ being offended].

b. You can't say anything about them$_i$ [without Terry criticizing the twins$_i$ mercilessly].

[4]During the discussion after the talk, Ivan Sag claimed that the acceptability of the ungrammatical examples provided in this chapter would improve in certain contexts or, for example, when the name is more deeply embedded, as in (i):

(i) She$_i$ was grateful to ALL the people who contributed to the campaign that had guaranteed Lola$_i$'s election to public office.

Sag proposes no non-structural analysis of the effect. Bob Levine replied that the reason for this effect could be processing and memory effects. Be that as it may, sentences such as in (i) contain a number of structural properties simultaneously, like constrative focus on *all* and the doubly embedded relative clauses, that might be structurally responsible for the weaker effect of Principle C as well. Moreover, as Bob Levine has pointed out to me, the necessary strong destressing of *Lola* to get the coreference might turn the name into a kind of epithet, which must be treated differently than regular names and descriptions with respect to the binding principles.

[5]Note that the original formulation of Pollard and Sag's binding theory (1992, 1994) can account for these data because o-command is defined in terms of a domination relation. Thus, the pronoun locally o-commands the phrase which dominates the nonpronominal NP within the relative clause so that the latter is o-commanded and hence o-bound by the coindexed pronoun in violation of Principle C. However, these definitions of the binding theory fail to predict binding relations in certain unbounded dependency constructions. In addition, Pollard and Sag (1994, 277) suggest to "minimally extend local o-command in such a way that unexpressed reflexive subjects of VP and predicative complements become subject to Principle A." That is why they revise the definitions and provide a totally nonconfigurational binding theory in chapter 6.8.3.

c. I lectured her$_i$ for an hour [without a single one of my points getting through to Terry$_i$].

d. I was able to criticize him$_i$ [without anyone realizing that Robin$_i$ was the object of my scorn].

e. I was able to criticize her$_i$ [without anyone realizing that I was talking about Robin$_i$].

This subject/object-asymmetry can also be found in sentences with other types of adjunct clauses:

(320) a. * She$_i$ always gets angry [if/when Kim$_i$ is criticized].

b. * He$_i$ always stops [before Freddy$_i$ says something stupid].

c. * He$_i$ came into the room [as quickly as John$_i$ could].

((9c) from Culicover and Rochemont (1990, 33))

(321) a. Sara always stops him$_i$ [before/when Freddy$_i$ acts stupid].

b. We always console her$_i$ [when Kim$_i$ is criticized].

The binding theory in Pollard and Sag (1994) does not predict these cataphora asymmetries. According to its definitions, all of the sentences in (318)–(321) should be equally grammatical.

Hukari and Levine (1995) argue that the *without*-clause has the status of a VP-adjunct by applying conventional tests for VP-adjuncthood (coordination, proform replacement, and displacement) that clearly suggest a structural difference between *without*-clauses and complements on the one hand, and between *without*-clauses and sentential adjuncts on the other. These structural differences are reflected and thus supported by contrasts in coreference possibilities. Compare the sentences in (319) to those in (322).

(322) a. * You can't tell them$_i$ [that the twins$_i$ are being offensive].

b. * You can't tell them$_i$ [that people are irritated at the twins$_i$].

Cataphora is possible from an object pronoun into a *without*-adjunct, as in (319), but not into a *that*-clause complement, as in (322). Assuming a configurational binding theory that is based on a c-command relation, Principle C prohibits the coreference in (322) since the nonpronominal is in an object clause which is clearly c-commanded by the coindexed pronoun *them*.[6] The fact that the sentences in (319) are grammatical indicates a lack of a c-command

[6] An anonymous reviewer claimed that there are variants of (322), such as in (i), which are (more) acceptable. Similarly, Ivan Sag (p.c.) provided the example in (ii), among others, as a counterexample to a structural version of Principle C.

(i) ? You can't require/expect of them$_i$ that the twins$_i$ should win every single match they$_i$ play.

(ii) I've never been able to explain to her$_i$ that Betsy$_i$'s gophers destroyed my lawn each spring.

If the PP containing the pronoun was less oblique than the complement clause containing the coindexed name,

relation in those examples and hence a structural difference between the complement clause on the one hand and the adjunct clause on the other.

Moreover, the difference in coreference possibilities between (323) and (324) is an indication of the structural difference between *without*-adjuncts and adjuncts that are clearly sentential.

(323) * They$_i$ could never do anything [without the twins$_i$ feeling insecure about it].

(324) They$_i$ hadn't been on the road for half an hour [when the twins$_i$ noticed that they had forgotten their money, passports and ID].

In both sentences, the relevant NP *the twins* appears within an adjunct clause and is coindexed with a pronoun in the subject position of the main clause. But only when the NP is within the sentential adjunct is coreference possible (see (324)). When it is inside the VP-adjunct, as in (323), coreference is not allowed. This contrast cannot be predicted by an obliqueness-based binding theory. Since neither sentential nor VP-adjuncts appear on ARG-ST lists, the nonpronominal NP *the twins* is not o-commanded and thus not o-bound by the subject pronoun in either case. The sentences should be equally grammatical. In terms of c-command, however, (323) is ruled out by Principle C since the subject pronoun c-commands the coindexed nonpronominal inside the VP-adjunct. The sentential adjunct in (324) is not c-commanded by the subject and thus the sentence is correctly predicted to be grammatical.

Finally, the subject/object-asymmetry between the sentences in (318) and those in (319) also indicates a c-command relation between the subject of the matrix clause and the adjunct in (318), but a lack of a c-command relation between the complement of the matrix verb and the adjunct in (319). It thus supports the assumption that the *without*-clause is a VP-adjunct.

All these data provide evidence that there are some binding-theoretic interactions between main clause elements and elements within adjuncts. Specifically, there is a subject/object-asymmetry in cataphora possibilities. But, as shown in detail, the HPSG binding theory in Pollard and Sag (1994) does not capture these effects. It has to be modified in order to rule out cataphora into certain adjuncts. One possible solution, which was specifically addressed by Hukari and Levine (1995), would be to add adjuncts to the ARG-ST list in the style of Van Noord and Bouma (1994) or Sag (2005), in order to preserve Pollard and Sag's purely obliqueness-based approach. The VP-adjuncts would have to be placed between the subject

these examples would be problematic for both, the binding theory proposed here as well as for Pollard and Sag's (1994) theory based on o-command. However, I argue that the PP is indeed more oblique than the *that*-clause. The following paradigm shows that only the direct object can be passivized:

(iii) a. You required that of them.
b. That was required of them.
c. * They were required that of.

The argument structure of *require* seems to be: ARG-ST <NP, NP, PP$_{of}$>. When the direct object is a *that*-clause, as in the sentences above, it is probably linearized last because of its heaviness. But with the underlying argument structure, these sentences do not constitute a problem for a binding theory based on o-command or vc-command.

and the complements. In this position, elements within the adjunct would be o-commanded by the subject but not by any objects, and the cataphora asymmetries would be correctly predicted. Sentential adjuncts, however, would have to be treated differently. Since they do not show any Principle C effects with main clause elements, they should not be placed on the ARG-ST list.

Hukari and Levine (1995) argue that this approach is problematic since this position on the ARG-ST list is implausible for adjuncts. There is ample cross-linguistic evidence, for example Keenan and Comrie's (1977) tests for relativizability which have led to the formulation of the accessibility hierarchy, that adjuncts are placed at the lower end of the obliqueness hierarchy, being more oblique than subjects, direct objects, and other objects. This is also supported by linearization facts, as the examples from Hukari and Levine (1995) in (325) show.

(325) a. Harry talked [to Margaret] [about the problem] [without paying attention to the time].

b. * Harry talked [to Margaret] [without paying attention to the time] [about the problem].

c. * Harry talked [without paying attention to the time] [to Margaret] [about the problem].

d. Harry talked [about the problem] [to Margaret] [without paying attention to the time].

e. * Harry talked [about the problem] [without paying attention to the time] [to Margaret].

f. * Harry talked [without paying attention to the time] [about the problem] [to Margaret].

The unmarked linear order seems to be that adjuncts come last. Even Pollard and Sag (1987, 181) concluded their discussion about the position for adjuncts and complement PPs and APs with the remark that "adjuncts are more oblique than complements."

However, there is an alternative solution, which was proposed by Hukari and Levine (1995) and which I adopt. This approach is presented in the next section.

8.3 A Valence-based Binding Theory

In order to account for the cataphora effects with elements inside of adjuncts, Hukari and Levine (1995) suggest to supplement the definitions of the HPSG binding theory with the new structural relation of vc-command and reformulate Principle C so that it is based on both, o-command and vc-command. In the following, I will first introduce Hukari and Levine's

valence-based binding theory. I will then propose a revision of the relation of vc-command and demonstrate that it captures all the binding effects depicted above.

Hukari and Levine (1995) propose the following command relationship in terms of configuration. Since it is similar to c-command but based on the valence of an element, they call it v(alence-based) c-command.

(326) **v(alence-based) c-command**:
Let α be an element on a valence list γ and α' the DTRS element whose SYNSEM value is structure-shared with α. Then if the constituent that would be formed by α' and one or more elements β has a null list as its value for γ, α vc-commands β and all its descendants.

This relation is added to the definitions of Pollard and Sag's (1994) binding theory; that is, it exists in addition to o-command, and Principle C is replaced by the following formulation, which I slightly adapted here:

(327) **Principle C**: A nonpronominal must neither be bound under o-command nor under a vc-command relation.

In essence, a subject vc-commands the VP and all its descendants, and a complement vc-commands all its sister constituents and their descendants. So, crucially, vc-command is a relation that exists between a subject and VP-adjuncts (including all descendants) but not between complements and VP-adjuncts. Moreover, it exists between a subject or complement and any adjuncts within more oblique complements. The revised Principle C prohibits the binding of nonpronominals under vc-command as well as o-command, thus causing the desired effects.

While I agree with the gist of Hukari and Levine's definition of vc-command, its formulation is conceptually flawed, especially as concerns the modality in the formulation, which renders it extremely suspect. In order to determine whether or not a given feature structure is legal, one has to compare it to other possible feature structures and identify whether a certain relationship holds between them. That is somewhat strange for a formalism that employs the kind of foundations that HPSG adopts. The modality in the definition might not be formally compatible with and, moreover, it might not even be formulable in a constraint-based framework like HPSG.[7] I therefore propose the following refinement:

[7]This was also endorsed by one of the anonymous reviewers, whom I would like to thank for his or her additional comments.

(328) **vc-command (revised):**[8]

Let α, β, γ be *synsem* objects, and β' and γ' signs such that β': [SYNSEM β] and γ': [SYNSEM γ]. Then α vc-commands β iff

a. γ': [SS|LOC|CAT|VAL|SUBJ $\langle\alpha\rangle$] and γ' dominates β', or

b. α locally o-commands γ and γ' dominates β'.

This revised formulation of vc-command is formally and technically clean. Moreover, it emphasizes the primacy of the subject. The subject is the least oblique and (in English) the sole obligatory argument of the verb and is in a superior structural position. This special status is reflected in its binding behavior. Subjects are strong binders; some languages possess anaphors that can only be bound by subjects.

The revised binding theory predicts all of the data provided above. The ungrammatical sentences are now correctly ruled out by Principle C. First of all, in the sentences in (317), the pronoun locally o-commands the NP containing the relative clause because they both appear on the ARG-ST list of the main verb. The NP in turn dominates the nonpronominal NP inside the relative clause so that the latter is vc-commanded by the coindexed pronoun in violation of Principle C.

Next, consider again the sentences in (318). The structure of (318a), repeated below in (329a), is given in (329b). The SYNSEM value of the subject pronoun *they* is structure-shared with the element on the SUBJ list of the VP. Under the assumption that the *without*-clause is adjoined to VP, the adjunct is dominated by the higher VP node. But then the nonpronominal NP *the twins* is also dominated by that VP. It follows from (328a) that the NP *the twins* is vc-commanded by the subject pronoun. Since the two are coindexed, Principle C is violated.

There is no Principle C effect in the sentences in (319) since the relevant nonpronominal is not vc-commanded by the coindexed pronoun. (328a) does not apply since the pronoun is an object and not a subject, and (328b) does not apply since the *without*-clause does not appear on the ARG-ST list of the main verb and therefore is not locally o-commanded by the pronoun.

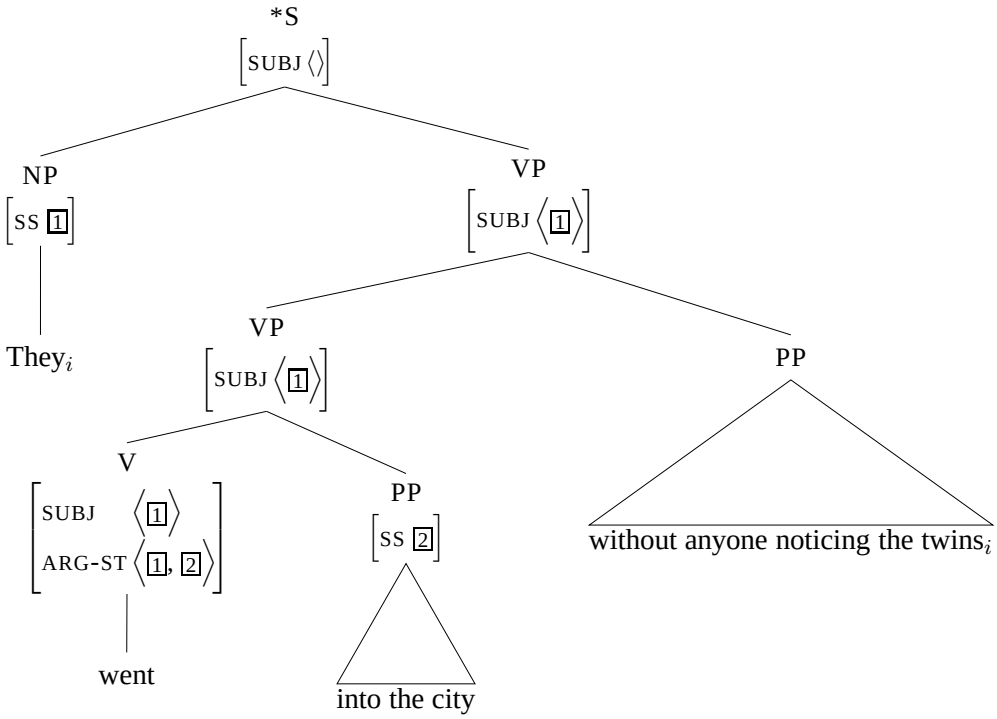
[8] Stefan Müller has suggested to change the requirement that α be on the SUBJ-list of γ' into the requirement that it be the first element on the ARG-ST list so that the definition would also apply to other languages like pro-drop languages. Along these lines, Olivier Bonami has proposed the following formulation as an alternative to (328a):

(a') γ': [SS|LOC|CAT|ARG-ST $\langle\alpha, ...\rangle$] and γ' is the HEAD-DTR of a phrase that dominates β'.

On closer inspection, however, it becomes evident that this definition fails to account for the sentences in (318). I leave it to future work to carefully scrutinize the proposal and investigate its empirical relevance. I am grateful to Stefan Müller and Olivier Bonami for their comments.

(329) a. * They$_i$ went into the city [without anyone noticing the twins$_i$].

b.



The relevant nonpronominal in (324) is not bound by the subject pronoun, either, under the assumption that the adjunct containing the nonpronominal is a sentential adjunct. It adjoins to the S node, which already has an empty SUBJ list.

8.4 Further Consequences of the Revised Binding Theory

8.4.1 (Anti)reconstruction Effects

The binding theory that incorporates both obliqueness and configuration into the formulation of Principle C has additional desirable consequences. First of all, as Hukari and Levine (1995) noticed, it can account for phenomena known as (anti)reconstruction effects, first observed by Van Riemsdijk and Williams (1981) and taken up by Lebeaux (1988/2000), in which adjuncts and complements within extracted arguments show different behavior with respect to Principle C. When a coindexed name appears inside a complement, a Principle C violation is maintained when the NP including the complement is extracted, as shown in (330). When the name is in an adjunct, as in (331), a Principle C violation is circumvented when the NP including the adjunct is fronted.

(330) a. * He$_i$ denied the claim [that John$_i$ likes Mary].

b. * Whose claim [that John$_i$ likes Mary] did he$_i$ deny t?

(331) a. * He$_i$ denied the claim [that John$_i$ made].

b. Which claim [that John$_i$ made] did he$_i$ later deny t?

With the new Principle C being based on both relations, o-command and vc-command, these effects can be straightforwardly explained. (330a) is ruled out because the pronoun (locally) o-commands the NP *the claim that John likes Mary* on the ARG-ST list of *denied*. Since the coindexed name *John* is within the clausal complement of *claim*, it is also o-commanded by the pronoun *he* by repeated application of clauses (313b) and (313c) of Pollard and Sag's (1994) definition of o-command. (331a) is correctly predicted to be ungrammatical because the name is vc-commanded by the coindexed pronoun (by (328a) or (328b)).

It is the o-command relation that is responsible for the ungrammaticality of (330b). Recall that o-command is defined in terms of "projection of", or shared HEAD features. As shown in the tree structure in Figure 8.1, *he* locally o-commands the gap on the ARG-ST list of *deny*.

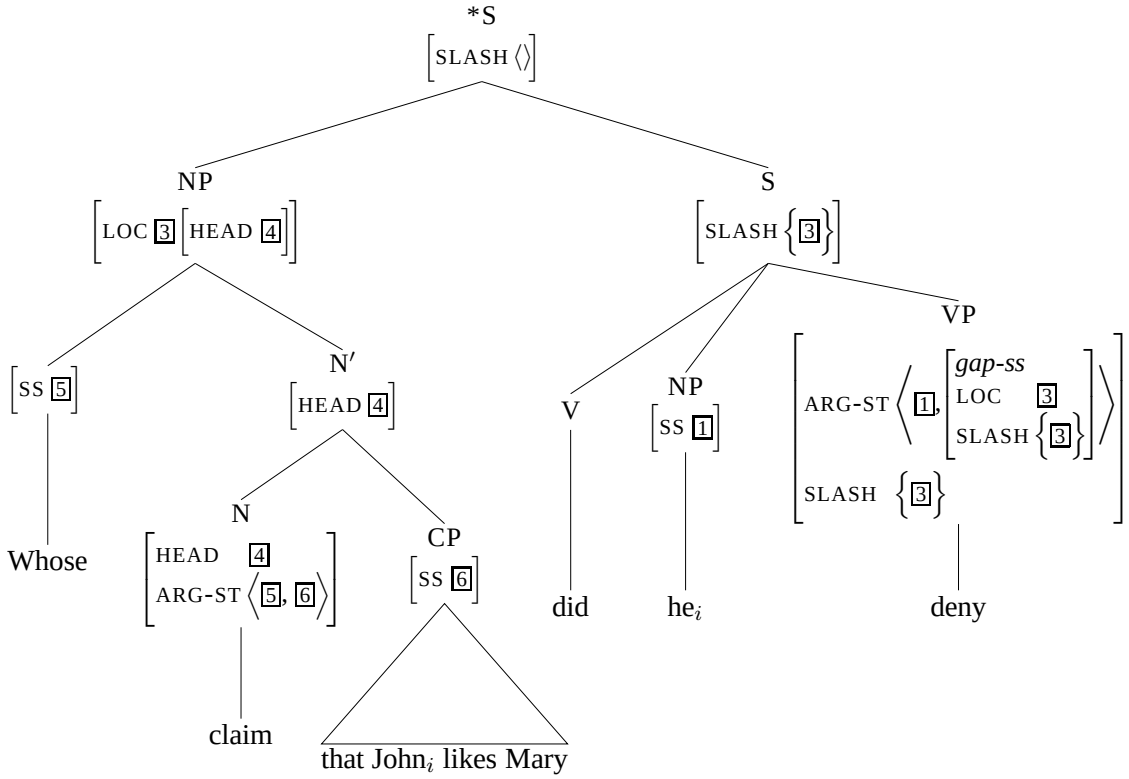


Figure 8.1: Principle C violation: A name within the complement of an extracted argument is o-commanded by the subject pronoun of the matrix clause.

Since the gap structure-shares its LOCAL value with the filler (the NP *whose claim that John likes Mary*), its HEAD value is identical with the HEAD value of the filler as well as its head daughter (*claim*). Thus, by repeated application of (313b) and (313c), *he* o-commands *claim*, the clausal complement of *claim*, and finally the coindexed name *John*, in violation of Principle C.

The tree structure for (331b) is shown in Figure 8.2. Note that according to the theory of Generalized Modification proposed in the preceding chapter, the anchor of the relative clause's antecedent is introduced by the determiner *which* and passed up to the NP, and

the relative clause combines with this NP in compliance with the head-generalized-modifier schema.

Although the head of the filler, *claim*, is o-commanded by the pronoun *he* in the same way as in (330b)/Figure 8.1, the o-command relation does not extend to the relative clause because relative clauses are not selected by the head that they modify. So, *John* inside the relative clause is not o-commanded by the matrix clause subject *he*. It is also not bound under a vc-command relation. In order for *John* to be vc-commanded by *he*, it would have to be dominated by a constituent that is locally o-commanded by *he* (according to (328b)) or by a constituent on whose SUBJ list the pronoun appears (i.e., the VP with the head *deny*) (according to (328a)). But there is no way in which such domination relations can exist, independent of which analysis is assumed for unbounded dependency constructions.

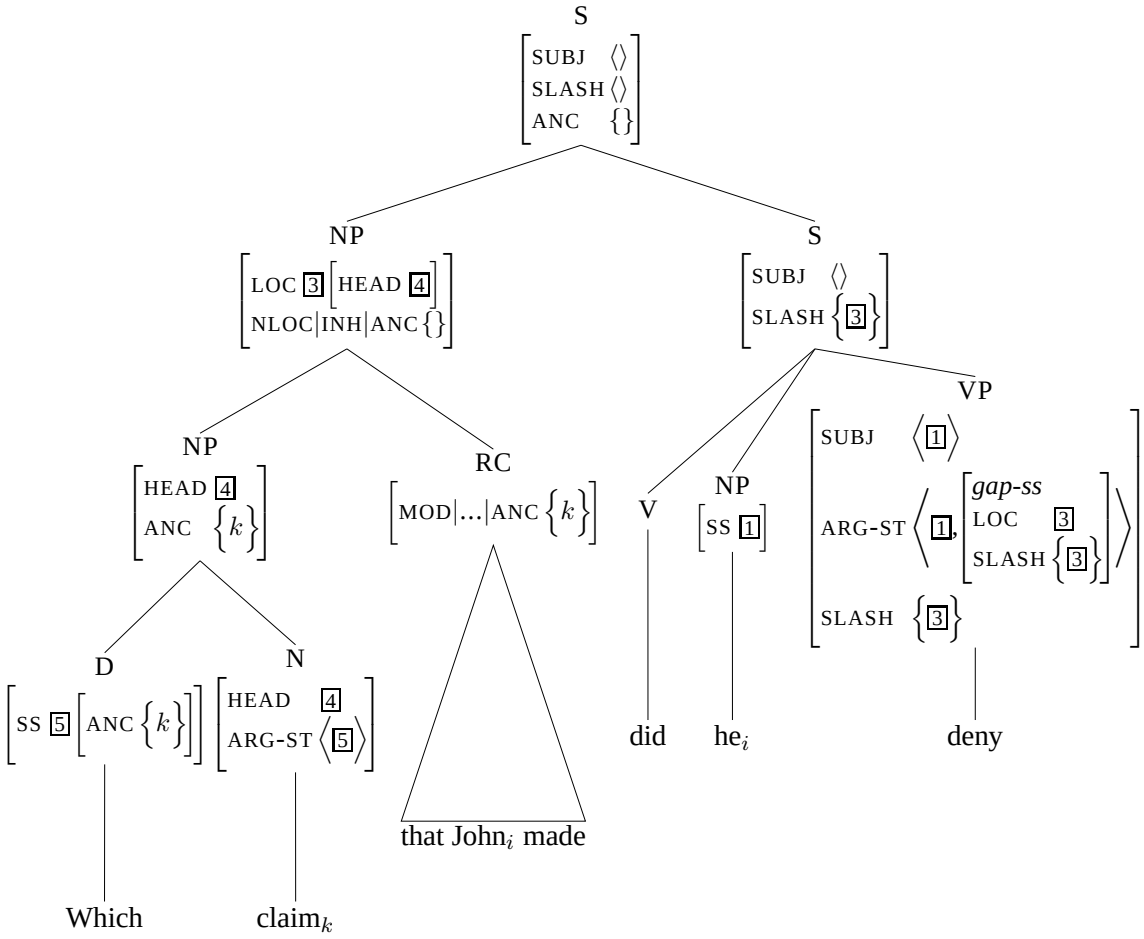


Figure 8.2: No Principle C violation: A name within an adjunct of an extracted argument is neither o-commanded nor vc-commanded by the subject pronoun of the matrix clause.

At this point, I would like to emphasize the crucial difference between o-command and vc-command: The relation of vc-command, being defined in terms of domination, breaks off at the gap site. It is not passed on from a gap to its filler. The o-command relationship, on the other hand, is passed on since it is defined in terms of the relation "projection of", or shared HEAD features. Thus, while the reconstruction effect shown in (330) can be explained in

terms of o-command and hence by the binding theory of Pollard and Sag (1994), their theory does not account for the contrast (i.e., the anti-reconstruction effect) shown in (331). The latter can be explained, however, by the valence-based binding theory proposed here.

8.4.2 Extraposition

Observations similar to the (anti)reconstruction effects can be found in extraposition constructions. Adjunct extraposition circumvents a Principle C violation, but complement extraposition does not, as the examples from Fox and Nissenbaum (1999, 139) demonstrate:[9]

(332) a. ??/* I gave him$_i$ an argument [that supports John$_i$'s theory] yesterday.
b. I gave him$_i$ an argument yesterday [that supports John$_i$'s theory].

(333) a. ??/* I gave him$_i$ an argument [that this sentence supports John$_i$'s theory] yesterday.
b. ??/* I gave him$_i$ an argument yesterday [that this sentence supports John$_i$'s theory].

It should be clear by now how the revised Principle C rules out the non-extraposed sentences. The nonpronominal is vc-commanded by the coindexed pronoun when it appears within an adjunct, as in (332a), and it is o-commanded when it is inside a complement, as in (333a).[10]

The extraposed variants are shown in the (b)-sentences. Complement extraposition in HPSG is treated as a nonlocal dependency construction similar to the SLASH-mechanism employed for movement to the left. In Chapter 5.3.2, which provided a review of the previous nonlocal dependency analyses of relative clause extraposition in HPSG, I mentioned that most of those theories are claimed to capture complement extraposition as well (cf., e.g., Keller (1994, 1995), Müller (1999), Crysmann (2013)). A crucial difference, however, is that complements, but not adjuncts, appear on the ARG-ST list of a head, whether extraposed or not. Moreover, since they are syntactically and semantically selected by a head, extraposed complements share the LOCAL value with the corresponding element on the ARG-ST list of their selecting head. In consequence, the binding theory proposed here makes the correct prediction for sentences like (333b) with complement extraposition. Disregarding the details

[9] See Chapter 2.3.1 for further evidence that relative clause extraposition may influence the binding potential within a sentence. The effects shown in (332)–(333) are also found in extraposition of PP adjuncts and PP complements (examples from Fox and Nissenbaum (1999, 139)):

(i) a. ??/* I gave him$_i$ a picture [from John$_i$'s collection] yesterday.
b. I gave him$_i$ a picture yesterday [from John$_i$'s collection].

(ii) a. ??/* I gave him$_i$ a picture [of John$_i$'s mother] yesterday.
b. ??/* I gave him$_i$ a picture yesterday [of John$_i$'s mother].

[10] In (333a), *John* is also vc-commanded by the pronoun, according to (328b).

about the extraposition mechanism,[11] the tree structure for this example is shown in Figure 8.3. As can be seen, the (SYNSEM value of the) extraposed complement clause (*that this sentence supports John$_i$'s theory*) appears on the ARG-ST list of the noun *argument*.[12] On the ARG-ST list of the verb *gave*, the pronoun *him* locally o-commands the NP *an argument*, and through a chain of HEAD identities and selection (see (313b) and (313c)) it finally o-commands the coindexed name *John* within the extraposed complement. Thus, Principle C is violated.

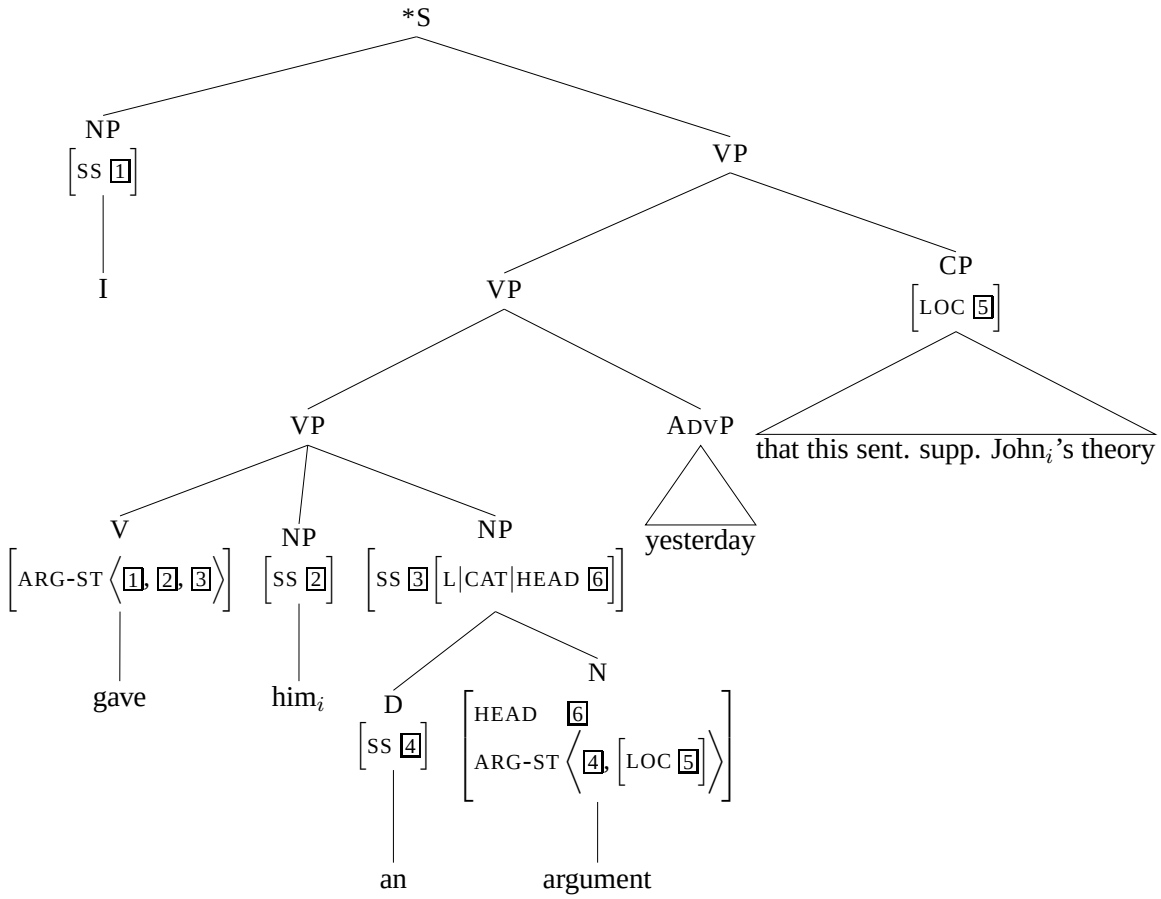


Figure 8.3: Principle C violation: The name within the extraposed complement is o-commanded by the object pronoun of the matrix clause.

Elements within adjuncts, on the other hand, are never o-commanded by arguments outside of the adjunct, as I have explained in detail above. The non-extraposed relative clause in (332a) is ruled out by Principle C under vc-command. An extraposed relative clause (or PP adjunct), however, escapes a vc-command relation. The tree in Figure 8.4 shows the syntactic structure of sentence (332b). According to the analysis of Generalized Modification developed in the previous chapter, the relative clause is adjoined to the VP in accordance with the

[11] For example, whether the nonlocal dependency is introduced by a trace, by a unary schema, or by a lexical rule.

[12] Note that if the nonlocal dependency is introduced by a trace, only the LOCAL values appear on the ARG-ST list of the noun. This is not a problem, however, since o-command is defined in terms of shared HEAD features, which are included in the LOCAL value (see (313c)).

head-generalized-modifier schema, and it picks up the anchor that is percolated up the tree from its antecedent NP *an argument*. It can be seen that even though the pronoun *him* locally o-commands the NP *an argument* (on the ARG-ST list of *gave*), it does not vc-command the coindexed name *John*, since the NP *an argument* does not dominate the extraposed relative clause containing *John*. Hence, *John* is not vc-commanded by the coindexed object pronoun, and Principle C is not violated.

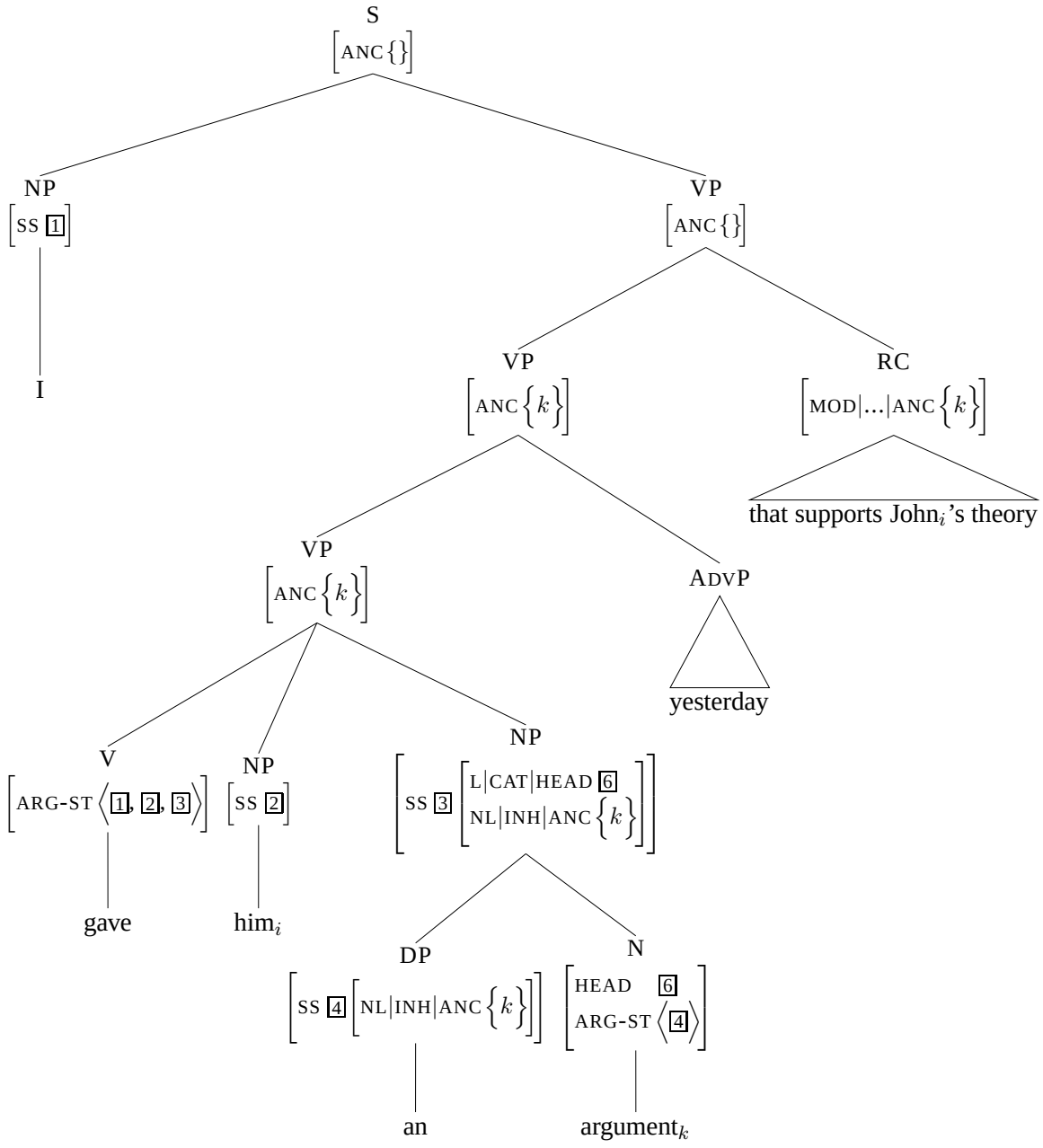


Figure 8.4: Relative clause extraposition escapes a Principle C violation.

Again, as in the cases of *wh*-moved constituents shown above, the reconstruction effect found in complement extraposition can be explained in terms of o-command, since the o-command relation, defined in terms of shared HEAD features, is passed on from the gap to the extraposed complement. The anti-reconstruction effects of relative clause extraposition

in English, as in (332), are captured by the configurational valence-based binding theory: A non-extraposed object-related relative clause is vc-commanded by a less oblique object and thus subject to Principle C. An extraposed relative clause escapes the vc-command relation, since the latter is defined in terms of domination and thus not passed on to higher positions in the tree structure.

Note that when the pronoun is in the subject position, as in (334), relative clause extraposition does not circumvent a Principle C violation.

(334) a. * She$_i$ invited many people to the party [that Mary$_i$ didn't know].
(Culicover and Rochemont, 1990, 28)

b. * She$_i$ told many people about the concert [who Mary$_i$ made nervous].
(Guéron and May, 1984, 10)

As I have shown in Chapters 2.2 and 2.3, this observation supports the assumption in the literature that a relative clause extraposed from an object must be adjoined no higher than the minimal VP containing its antecedent (see Baltin (1981), Culicover and Rochemont (1990), Guéron (1980), among others). In this position, the name within the relative clause is vc-commanded by the coindexed subject pronoun, and the sentence is correctly ruled out by Principle C. Recall that the proposed theory of Generalized Modification captures this locality generalization by imposing a constraint on head-subject phrases that requires the head-daughter (i.e., the VP) to have an empty ANCHORS set (see Chapter 7.3.9). Hence, the effect shown in (334) as well as the interpretive effects of relative clause extraposition demonstrated in (332) are correctly captured by an interaction of the proposed binding theory and the new theory of Generalized Modification.

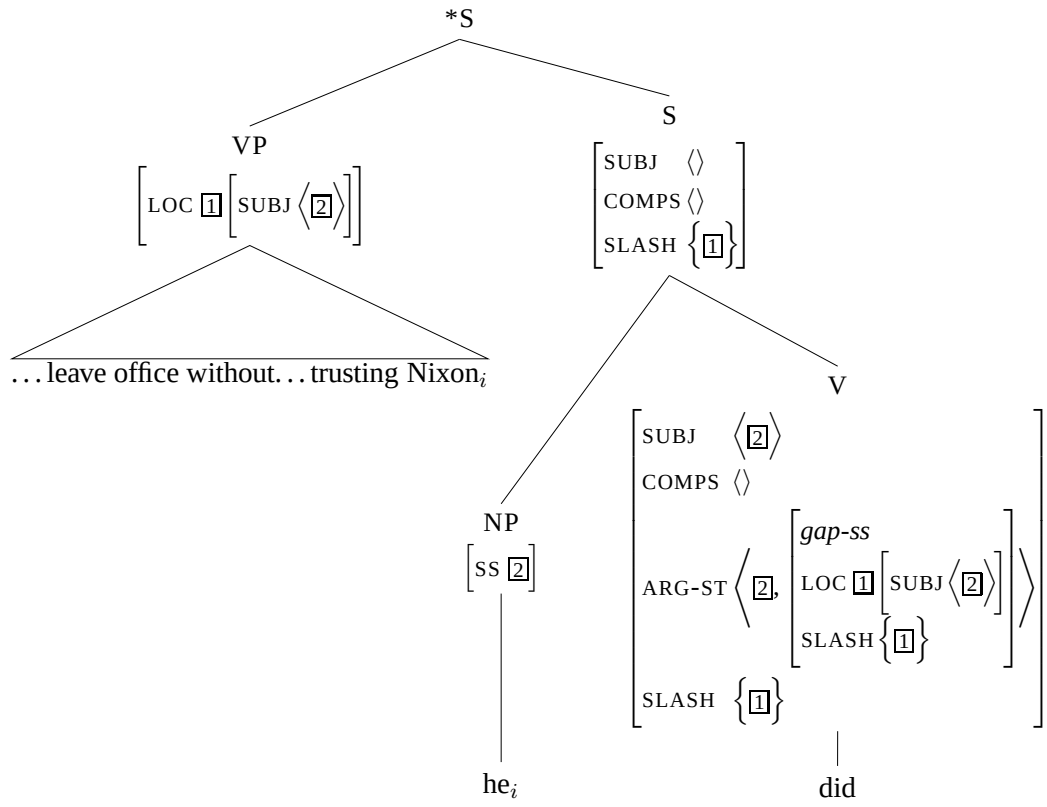
8.4.3 VP-topicalization and VP Complements

The valence-based binding theory can also explain the fact that VP-topicalization does not show anti-reconstruction effects, as demonstrated by the examples in (335) from Hukari and Levine (1995). The observation was cited by Huang (1993) and goes back to Chomsky. In contrast to argument extraction (cf. (331b)), a Principle C violation is not circumvented when a VP is fronted that includes an adjunct that contains a name coindexed with the matrix subject pronoun.

(335) a. * . . . and leave office without anyone ever trusting Nixon$_i$ he$_i$ did.

b. * . . . and gather injunctions until Richardson$_i$ had every crook behind bars he$_i$ knew he$_i$ would.

(336)



On Huang's account, these contrasts follow from the VP-internal Subject Hypothesis. But the same effects also fall out from the proposed revision of the HPSG binding theory, as noticed by Hukari and Levine (1995). As shown in (336), the SUBJ specification of the fronted VP is structure-shared with the SUBJ specification of the VP gap, which in turn is structure-shared with the SYNSEM value of the subject pronoun *he*. Therefore, all these elements share their indices. Since the SUBJ specification of the fronted VP vc-commands any constituent dominated by that VP (according to (328a)), no element within it may bear the same index, as required by Principle C.

Finally, another outcome of the revised Principle C is that it correctly predicts the ungrammaticality of sentences as in (337). The offending name is in a relative clause that is contained within a VP complement. It is bound by the pronoun complement of the matrix verb under vc-command (see (328b)), but not under o-command.

(337) * John seems to her$_i$ to have made a claim which Mary$_i$ resented.

To sum up, I have shown that the binding theory proposed here accounts for all of the problematic data given above concerning the behavior of adjunct-internal elements with respect to Principle C. In addition, in interaction with the theory of Generalized Modification developed in the previous chapter, it has some further benefits. It offers an account of the (anti)reconstruction effects and of the binding behavior in sentences with extraposition, VP-topicalization, and VP complements. In the following section, I will address the question of whether Principle C is pragmatic in nature and provide evidence that refutes this claim.

8.5 Is Principle C Pragmatic in Nature?

It has been repeatedly suggested in the literature that Principle C should be explained in semantic/pragmatic rather than in syntactic terms (cf. Bickerton (1975); Bolinger (1979); Bouma et al. (2001); Bresnan (2001); Bury and Reeve (2013); Kuno (1975); McCray (1980); among others).[13] Bresnan (2001) and Bouma et al. (2001), for example, provide contrasting pairs such as (338) and (339) to demonstrate that Principle C cannot be based on grammatical structure, or more specifically c-command, because in that case the (b)-sentences, which they assume to be structurally identical to the sentences in (a), would be incorrectly ruled out. They therefore suggest that pragmatic effects, theme/rheme conditions, and information structure must be taken into account. However, they do not provide a specific analysis. I am also not aware of any pragmatic theory covering all Principle C effects that has been integrated into HPSG.

(338) a. * She$_i$ was last seen when Lola$_i$ graduated from high school.
(cited from Reinhart (1983, 104) in Bresnan (2001, 227))

b. He$_i$'s imPOSSible, when Ben$_i$ gets one of his tantrums.
(cited from Bolinger (1979, 302) in Bresnan (2001, 227))

(339) a. * He$_i$ always gets angry when Sandy$_i$ is criticized.
(cited from Hukari and Levine (1996, p. 490) in Bouma et al. (2001, 44))

b. He$_i$ gets angry whenEVER the people Sandy$_i$ loves criticize him.
(Bouma et al., 2001, 44)

The proposals that have been provided in functionalist terms, for example, Kuno (1975), Bickerton (1975), Bolinger (1979), and McCray (1980), cannot adequately account for the coreference options of nonpronominals, as already noticed by Reinhart (1983). She carefully scrutinizes these approaches, notes that they either fail, are vague, or "not fully formalisable" (p. 98), and concludes that "the fact that when there is a discrepancy between domain relations and functional relations coreference options follow the synactic requirements, indicates that coreference restrictions are determined by syntactic properties" (p. 100).[14]

In addition, as far as I am aware, the proponents of the pragmatic approach have not provided any careful syntactic analyses of the examples they discuss. Thus, they do not

[13] Bury and Reeve argue for an information-structural account to explain the subject/object-asymmetry in the acceptability of backward coreference from extraposed relative clauses (cf. (332b) vs. (334)). However, their approach does not explain why extraposition circumvents a Principle C violation when the pronoun is in object position (cf. (332a) vs. (332b)), and they admit that "[t]his might suggest that there is a residue of cases that must involve c-command" (2013, 126n24). Moreover, the sentences they provide to argue against the relevance of a structural notion like c-command are all preceded by sentences in which the relevant names are already mentioned. This seems to suggest that Principle C violations can be obviated under certain information-structural conditions, perhaps, as proposed by Biskup (2006; 2011, Ch. 6), when the name within the relative clause is "backgrounded".

[14] The reader is referred to Reinhart (1983), especially chapter 4, for her survey of functional approaches, which I cannot reproduce here for reasons of space.

show that these data actually fall within the scope of Principle C and accordingly falsify a configurational binding theory. In the following, I will show that under a correct syntactic analysis of the sentences such as in (338) and (339), a configurational binding theory can indeed account for the contrast in coreference possibilities.

Consider Bolinger's example in (338b). In addition to it, Bolinger (1979, 302) provides the example shown in (340a), in which the temporal adjunct appears in the first position of the sentence. An adequate structural description is given in (340b), in which the *when*-clause is adjoined to S. Since such adjunct structures exist, and since, in principle, adjunct configurations are symmetrical, it follows that (341) is a plausible analysis for the sentence in (338b); that is, the sentence-final *when*-clause is also analyzed as a sentential adjunct.[15] This is additionally supported by phonological considerations. The sentence must be pronounced with an intonational break between the main clause and the subclause, which is typically indicated in written form by a comma. Under this analysis, sentences like (338b) and (339b) are not problematic for a configurational version of the binding theory. Since the names are within sentential adjuncts, they are not vc-commanded (or c-commanded) by the coindexed pronouns in the main clause, and Principle C is not violated.

(340) a. When he gets one of his tantrums, Ben is impossible.

b. [$_{S}$ [When he$_i$ gets one of his tantrums] [$_{S}$ Ben$_i$ is impossible]].

(341) [$_{S}$ [$_{S}$ He$_i$'s impossible] [when Ben$_i$ gets one of his tantrums]].

(342) * [$_{S}$ He$_i$ [$_{VP}$ always [$_{VP}$ gets angry [when Sandy$_i$ is criticized]]]]

The *when*-clauses in (338a) and (339a), on the other hand, are analyzed as VP-adjuncts, as shown in (342). Hence, the name is vc-commanded by the coindexed subject pronoun of the main clause in violation of Principle C.

Further evidence that *when*-clauses can appear in different structural positions and thus behave differently with respect to Principle C is provided by Kazanina (2005, 13–21). She argues that in the sentences in (343), the name in the *when*-clause and the pronoun in the matrix clause can be coreferential since the *when*-clause is a sentential rather than a VP-modifier. To justify her claim, Kazanina presents several arguments. First, she observes that the *when*-clauses in (343) contain a non-agentive event which is not controlled by the agent of the main clause and often causes surprise or even shock for that agent. Changing the content of the *when*-clause so that it expresses an agentive event results in decreasing acceptability of coreference between the two subjects, as shown in (344).

(343) a. He$_i$ had been staring at the control panel for over an hour when Jack$_i$ received a message from his commander.

b. He$_i$ was threatening to leave when Jack$_i$ noticed that the computer had died.

[15] I thank an anonymous reviewer for pointing out to me this symmetry of adjunct configurations.

c. He_i was about to place a few bets when Mike_i was advised that the cops were in the bar.

(344) a. ?? He_i had been staring at the control panel for over an hour when Jack_i gave an order to his soldier.

b. * He_i was threatening to leave when Jack_i turned on his computer.

c. * He_i was about to place a few bets when Mike_i started singing a song.

Secondly, Kazanina claims that *when*-clauses have different statuses depending on the various interpretations of the word *when*.[16] These include an interpretation corresponding to the subordinator *while* and thus serving to provide the background for the main event (see (345a)), and an interpretation similar to *after*, which links the subclausal event expressing a cause to the main clause event that expresses the result of that cause (see (346a)). In both cases, *when* locates the event of the main clause inside the event of the embedded clause, and a *when*-question about the main event (see (345b)/(346b)) is felicitously answered by the sentence. As the (c)-sentences in (345) and (346) show, coreference between the pronoun in the main clause and the name within the *when*-clause is impossible in these cases.

(345) a. Mary was talking on the phone when John was cooking dinner.

b. When was Mary talking on the phone?

c. $\text{He}_{*i/*k}$ was talking on the phone when John_i was cooking dinner for Mark_k.

(346) a. Kate broke the glass when John kicked the door.

b. When did Kate break the glass?

c. * He_i broke the glass when John_i kicked the door.

In the sentences in (343), in which coreference is available, *when* functions as a co-ordinator with an interpretation like "and/but suddenly at that moment". The event in the main clause serves as a setting for the event expressed by the subordinate clause. According to Kazanina, these sentences are infelicitous as an answer to a corresponding *when*-question about the main event, even when coreference is not at issue, as the following question-answer pairs show:

(347) a. When had he been staring at the control panel?

b. Larry had been staring at the control panel for over an hour when Jack received a message from his commander.

(348) a. When was he threatening to leave?

b. Mark was threatening to leave when Jack noticed that the computer had died.

(349) a. When was he about to place a few bets?

[16] Kazanina (2005) refers to Moens and Steedman (1988) and Harris and Bates (2002), who noted that *when* is ambiguous and that its different interpretations depend on the different kinds of events that it links.

b. Samuel was about to place a few bets when Mike was advised that the cops were in the bar.

The contrast in behavior between the sentences in (343) and (345)–(346) is unnatural if *when* has the same status in all of these sentences. However, Kazanina (2005) claims that it can be straightforwardly explained under the assumption that there are two different kinds of *when*. One functions as a sentential modifier that adjoins to IP (or S), and the other is a VP-modifier that adjoins to VP. So, when a question is asked about temporal properties of the VP that expects a VP-modifier as an answer, it follows naturally that the sentences in (343) and (347)–(349) are infelicitous as answers since the *when*-clauses here are sentential adjuncts. Moreover, the differences in binding behavior are correctly predicted. In (345) and (346), *when* functions as a subordinator and adjoins to VP. Hence, coreference between the main clause subject and the name within the adjunct is ruled out by Principle C. In (343), *when* is similar to a coordinator and therefore reasonably adjoined to S, where it escapes a Principle C violation.

Kazanina (2005) and Kazanina, Lau, Lieberman, Yoshida, and Phillips (2007) also provide psycholinguistic evidence that Principle C is syntactic in nature by investigating backwards anaphora in language development and in sentence processing. Based on a comprehension task with 3-6-year-old Russian speaking children, Kazanina (2005) shows that structural constraints on coreference, in particular Principle C, are respected by children already at the age of three. The Russian-specific discourse constraint on backwards anaphora, on the other hand, becomes operative in the child's grammar only at the age of 5-6. In real-time processing, the findings from several online self-paced reading studies on English and Russian reveal that backwards anaphora dependencies are processed with a grammatically constrained active search mechanism. This means that when the parser encounters a cataphoric pronoun, it actively searches for an antecedent in the following material. Importantly, during this search, it does not consider positions that are excluded by Principle C. Additionally, results from offline acceptability rating experiments show that judgments of coreference are degraded when a pronoun c-commands its antecedent (Kazanina, 2005; Kazanina et al., 2007).

Summarizing the discussion, the data that have been claimed to undermine the structural account of Principle C stop being problematic once they are carefully analyzed and a proper syntactic structure is provided. Results from psycholinguistic investigations show that structural constraints on coreference exert an influence at the earliest stage of language development and real-time processing. I therefore conclude that there is no strong evidence against the syntactic nature of Principle C.

8.6 Conclusion

In this chapter, I have argued, following Hukari and Levine (1995), that structural configurations must be taken into account in order to capture the intricate binding-theoretic interactions between adjunct-internal and main clause elements, which are not predicted by Pollard and Sag's (1994) binding theory. To this end, Hukari and Levine introduced the configurational relation of vc-command and reformulated Principle C so that it prohibits coindexation under both relations, o-command and vc-command. Phenomena such as the (anti)reconstruction and VP-topicalization effects fall out from this revision. I have developed Hukari and Levine's approach further and proposed a refinement of the definition of vc-command. My proposal has four benefits: First, my revised definition of vc-command does not involve a modality, and secondly, it motivates the special role of the subject in binding.

Thirdly, I have proposed crucially different interactions of the relations of o-command and vc-command with *wh*-moved as well as extraposed constituents. Together with the theory of Generalized Modification developed in the previous chapter, the valence-based binding theory can account for the intricate interpretive effects of relative clause extraposition.

Fourthly, I have provided new data that strongly support the proposed revision of the HPSG binding theory. Finally, I have shown that, once they are correctly analyzed, the data that have been provided against a syntactic account of Principle C can be explained straightforwardly by the configurational binding theory proposed here.

Chapter 9

Conclusion

In this dissertation, I have developed an analysis of relative clause attachment within the framework of Head-Driven Phrase Structure Grammar (HPSG) under which both canonical and extraposed relative clauses are licensed by one and the same schema. For the semantic analysis, I adopted the framework of Lexical Resource Semantics (LRS) (Richter and Sailer, 2004), which uses techniques of underspecified semantics and a standard semantic representation language to express the logical form of a sentence.

A survey of the major theoretical works on English relative clause extraposition within Generative Grammar has revealed that none of the existing theories is able to capture all the generalizations with respect to the phenomenon or to account for the data, even though a large number and diversity of methods and theories have been proposed. Previous work on relative clauses in HPSG is provided in the two major works of Pollard and Sag (1994) and Sag (1997), among others, and there exist various approaches to relative clause extraposition (e.g. Keller (1994), Müller (1999), Kiss (2005), Crysmann (2013)).

The most promising extraposition analysis in HPSG is the theory of Generalized Modification proposed by Kiss (2003, 2005), which makes use of the semantic underspecification framework of Minimal Recursion Semantics. Under this approach, a relative clause is base-generated in extraposed position and semantically related to its antecedent noun by an anchor which consists of the index and the handle of the noun and which is percolated throughout the tree. By identifying its own index and handle with those of the anchor, an extraposed relative clause receives an in-situ intersective interpretation within the restrictor of the antecedent's quantifier.

Taking Kiss' ideas as a starting point, I have proposed a new theory of Generalized Modification which considerably extends the empirical coverage of the previous analysis. The modifications allow the new theory to account for cases with obligatory relative clauses, for relative clauses with elliptical antecedent NPs, for the scope effects of relative clause extraposition noticed by Fox and Nissenbaum (1999) (Williams' Generalization (1974)), and for the coreference effects of relative clause extraposition. These properties of relative clauses are among the ten generalizations which I have formulated in Chapter 2 based on

evidence drawn from the literature, and which I claim any successful theory of relative clause extraposition must be able to capture. In the following, I summarize the main proposals and innovations of the new analysis and point out whether and how the ten generalizations are captured.

The first modification is that the determiner rather than the noun introduces the anchor. This reflects the close relationship between the determiner and the relative clause which has been observed in the literature, and it makes it possible to straightforwardly capture the first generalization:

- **Generalization 1:** The head noun of the antecedent NP of a relative clause may be elided.

I have introduced a unary phrasal schema which ensures that the anchor and the relevant semantic information of the elided nominal (which is anaphorically recovered from the context) are passed up the tree.

The fact that the determiner introduces the anchor also provides means to account for determiners with obligatory relative clauses. Such determiners must obligatorily introduce an anchor–as opposed to the canonical case of determiners which introduce an anchor only if their noun is modified by a relative clause in that sentence. Additionally, I have proposed that every anchor which is introduced must be picked up (bound off) by a relative clause. This is achieved by a combination of two mechanisms: (i) When the relative clause is adjoined, the corresponding anchor is canceled, but only optionally in order to allow for multiple relative clauses with the same antecedent. Therefore, (ii) a constraint on a complete clause requires that the anchors set of the complete clause must be empty; that is, all anchors introduced within a sentence must have been used within that sentence (the Anchors Saturation Principle). With these techniques, we can capture Generalization 2, and the Right Roof Constraint falls out of it, too:

- **Generalization 2:** Determiners may require the presence of relative clauses.
- **Generalization 3:** No clause boundary intervenes between an extraposed relative clause and its antecedent (Right Roof Constraint).

Crucially, since in the prior analysis of Kiss (2003, 2005) it is the noun which introduces the anchor and anchors may be left unused, that theory does not account for the first two generalizations. The mechanisms described above are thus decisive for covering these data.

The Schema of Generalized Modification allows a relative clause to be attached to any phrase which contains a compatible anchor. I have shown that Kiss' (2003, 2005) theory overgenerates, since it allows a verb to lexically amalgamate the anchors of all of its arguments. In contrast, the theory I have proposed allows anchors to be introduced only in the surface position of the antecedent NP. This also excludes the possibility that they are introduced by a trace or gap. Furthermore, since anchors are percolated up the tree in the manner

of nonlocal feature inheritance, a relative clause can only appear in a higher position than its antecedent, and the following generalizations are correctly predicted:

- **Generalization 4:** An extraposed relative clause is attached in a structural position higher than the surface position of its antecedent.
- **Generalization 5:** Relative clauses must not be stranded in medial position (follows from Generalization 4).
- **Generalization 6:** Extraposed relative clauses can have antecedent NPs which are embedded within PPs and NPs.

I have proposed a constraint on head-subject phrases which requires the head daughter to have an empty anchors set. In consequence, all anchors introduced within a VP must be picked up by a relative clause before the VP combines with its subject. This accounts for the locality restriction formulated in Generalization 7:

- **Generalization 7:** An extraposed relative clause must not be attached higher than the minimal VP containing its antecedent.

It follows straightforwardly from the anchor percolation mechanism that extraposed relative clauses may be related to *wh*-moved constituents in English and to *wh*-moved as well as topicalized constituents in German, as stated in Generalization 8. In order to disallow an extraposed relative clause to be related to a topicalized constituent in English, I have proposed a language-particular constraint on head-filler phrases which requires all anchors of a topicalized constituent to be bound off within that constituent.

- **Generalization 8:** In English, extraposed relative clauses can be related to *wh*-moved antecedents but not to topicalized antecedents or antecedents within topicalized phrases; in German, extraposed relative clauses can be related to *wh*-moved antecedents as well as topicalized antecedents and antecedents within topicalized phrases.

To account for the scope effects of relative clause extraposition noticed by Fox and Nissenbaum (1999) and formulated as Williams' Generalization (Williams, 1974), I have introduced the Relative Clause Extraposition Scope Constraint which ensures that the quantifier of the antecedent NP takes scope over the phrase to which the relative clause is attached. The formalization of this constraint is made possible by the techniques of underspecified semantics provided by LRS.

Finally, I have proposed a simplification and modification of the valence-based HPSG binding theory of Hukari and Levine (1995). In combination with the theory of relative clause attachment developed in this dissertation, it captures the coreference effects between

main clause and adjunct-internal elements, including the (anti)reconstruction effects discussed by Lebeaux (1988/2000), and in particular the Principle C effects of relative clause extraposition.

With the innovations described in the previous two paragraphs, the theory developed in this dissertation is able to account for the properties of relative clause extraposition mentioned in Generalization 9. It thus covers further data which are not captured by Kiss' (2003, 2005) analysis.

- **Generalization 9:** Relative clause extraposition may influence coreference options and the scope of logical operators, but it does not affect variable binding.

Another property mentioned in Generalization 9 is that relative clause extraposition does not have an effect on variable binding, that is, when a pronoun within a relative clause is bound by a quantificational expression outside the relative clause. Although it has standardly been assumed that a quantifier must c-command any pronoun that it binds, in a recent article, Barker (2012) provides empirical evidence to the effect that c-command is not a requirement for quantificational binding in English. Instead, he suggests that a quantifier must take scope over the pronoun, even if this is not a sufficient condition.

One of the examples he cites is shown in (350a). Conventional tests for VP constituency, as illustrated with a *wh*-cleft and VP-topicalization in (351), indicate that the *before*-clause can be analyzed as a VP adjunct. My theory of relative clause attachment predicts that a relative clause extraposed from an object is adjoined to VP (350b). Both sentences in (350) behave similarly. Thus, if Barker's theory can explain sentences such as (350a), where the quantifier is allowed to bind out of a complement position into a VP adjunct, it will also explain cases as in (350b). In conjunction with Barker's theory, my theory thus makes the correct predictions about quantifier/variable binding in relative clause extraposition.

(350) a. We need to get hold of (at least) one picture of every$_i$ senator [before he$_i$ leaves town for the summer]. (Barker, 2012, 622)

b. I told everyone$_i$ the fact yesterday [that he$_i$ wanted to know]. (Büring and Hartmann, 1997, 15)

(351) a. What we did was [get hold of at least one picture of every$_i$ senator before he$_i$ left town for the summer].

b. Tom said that we needed to get hold of (at least) one picture of every$_i$ senator before he$_i$ left town for the summer, and [get hold of (at least) one picture of every$_i$ senator before he$_i$ left town for the summer]$_k$ we did $\__k$.

There is a final generalization about relative clause extraposition which I have stated in Chapter 2:

- **Generalization 10:** Extraposed relative clauses may have conjoined and split antecedents.

In its present form, the theory of relative clause attachment proposed here does not explain these phenomena. However, as for the former cases, a solution is offered by Chaves (2007, Ch. 5.3 + 6.6). His theory of coordination, whose semantic foundation is based on Link (1984), allows a relative clause to modify a conjoined antecedent NP. The pluralic referent of such an NP is introduced through the conjunction. Incorporating Chaves' insights into my analysis, a pluralic anchor can be built in a similar way. It can then be picked up by an (extraposed) relative clause and thus license the interpretation of the relative clause with a plural relative pronoun.

Furthermore, Chaves (2009, Sections 3.1 + 3.2) anticipates that his analyses of coordination and of adjunct extraction in terms of cumulation can be extended to relative clauses with split antecedents: "The nominal head that each extraposed relative clause is modifying is cumulated at the coordination level.... One could... state this analysis in a more elegant way in terms of anchors" (Chaves, 2009, below example (21)). I am confident that Chaves' results and the methods he provides can be ported to my theory of relative clause attachment. The technical details must await future work, however.

As a systematic survey of the data in the literature has revealed, the empirical evidence on the phenomena of relative clause extraposition is not certain in all areas. One aspect which has been subject to debate and where the judgments have been particularly conflicted concerns the question of whether the acceptability of relative clause extraposition decreases when the antecedent NP of the relative clause is definite (the definiteness restriction) and when the main verb of the sentence is not a verb of appearance (the predicate restriction). The results of an acceptability judgment study I conducted empirically validate these restrictions, but they have also revealed that the degraded sentences should not be treated as ungrammatical. Hence, the definiteness restriction and the predicate restriction should not be regarded as purely structural, syntactic constraints of the grammar, but rather as being influenced by contextual and pragmatic factors. Since these are weak constraints, I did not incorporate them into my analysis.

To conclude, the analysis of relative clause attachment developed in this dissertation seems to be the only theory in existence that captures all of the empirical generalizations about relative clause extraposition mentioned above, under the optimistic assumption that the techniques it provides will allow for relative clauses with split antecedents.

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