

Abstract

HPSG accounts of filler-gap dependencies hold considerable potential for explaining the cross-linguistic variation in unbounded dependency constructions (UDCs), specifically filler-gap dependencies. This potential comes from the SLASH specifications that are posited in all nodes along the extraction path (the path between filler and gap). However, as Hukari and Levine (1994, 1995, 1996) have observed, the HPSG analysis presented by Pollard and Sag (1994) fails to embody the generalizations required in order to explain key universal properties of UDCs, in particular the ‘registration’ of such dependencies in cases of subject- and adverb-extraction. This demonstration led Bouma et al. (2001) to propose a revised UDC analysis that avoids these difficulties by ‘threading’ the SLASH specifications through all heads within an extraction domain. However, Levine (2002) points out that this analysis encounters a new difficulty concerning the interaction of extraction and coordination. This paper revisits these issues, arguing that a small modification of the BMS analysis provides a solution to the important problem observed by Levine.

1 Introduction

1.1 Pollard and Sag 1994

Pollard and Sag (1994) [Henceforth PS94] proposed a theory of UDCs which, following earlier work in GPSG, guarantees that nonempty specifications for the feature SLASH appear throughout a syntactic structure. Their theory, which includes a Nonlocal Inheritance Principle to guide the inheritance of SLASH specifications and a Trace Principle to constrain the distribution of traces, posits structures like the one shown in Figure 1. *Wh*-subject clauses in the PS94 analysis involve no SLASHed categories, as shown in Figure 2. And the extraction of embedded subjects, because it is treated via a lexical rule sanctioning derivations like (1), involves unSLASHed embedded VPs like the lower VP in Figure 2.

$$(1) \begin{bmatrix} \text{PHON} & \langle \textit{think} \rangle \\ \text{SUBCAT} & \langle \textit{NP}, \textit{S} \rangle \\ \text{SLASH} & \{ \} \end{bmatrix} \Rightarrow_{LR} \begin{bmatrix} \text{PHON} & \langle \textit{think} \rangle \\ \text{SUBCAT} & \langle \textit{NP}, \textit{VP} \left[\text{SUBCAT} \left\langle \begin{bmatrix} \text{NP} \\ \text{LOC} \boxed{} \end{bmatrix} \right\rangle \right] \rangle \\ \text{SLASH} & \{ \boxed{} \} \end{bmatrix}$$

[†]I’d like to thank Gosse Bouma, Bob Kasper, Bob Levine, Rob Malouf, Stefan Müller, and Carl Pollard for discussion of the ideas presented in this paper. I’m particularly indebted to Bob Levine for extended discussions and helpful suggestions. Please don’t blame any of them for my mistakes. Thanks again to Stefan for patient editing . . .

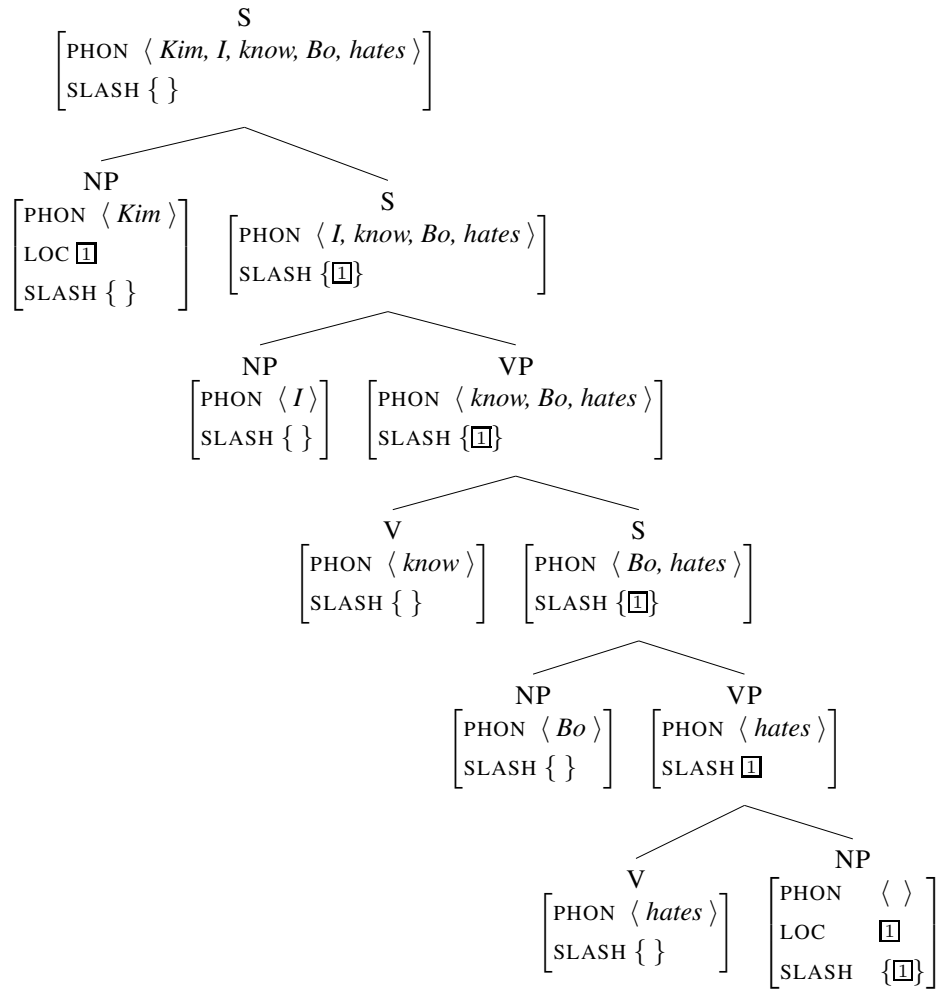


Figure 1: A Topicalization structure, as analyzed by PS94

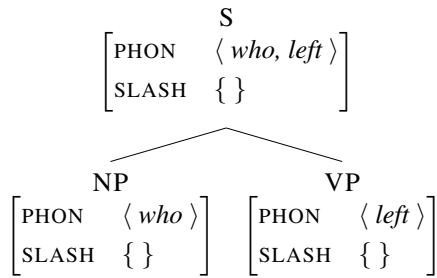
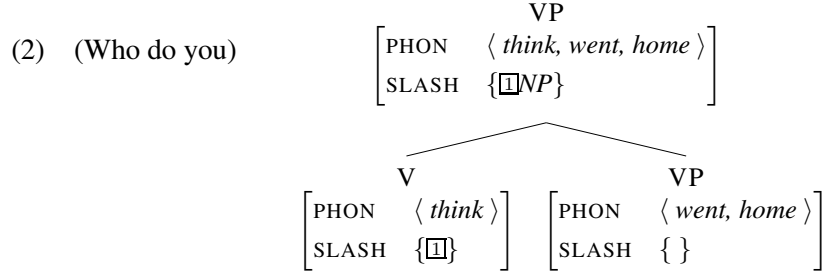


Figure 2: *Who left*, as analyzed by PS94



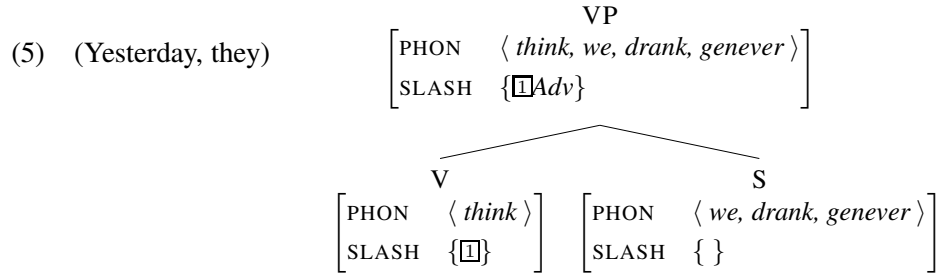
The PS94 analysis of adverb extraction is similarly piecemeal. Matrix adverb fronting like (3a) involves no SLASHed constituents at all, and ‘long-distance’ adverb fronting like (3b) is handled via a lexical rule that sanctions derivations like the one sketched in (4):

- (3) a. Yesterday, we drank genever.
 b. Yesterday, they think we drank genever.

(4)

$$\left[\begin{array}{ll} \text{PHON} & \langle \textit{think} \rangle \\ \text{SUBCAT} & \langle \textit{NP}, \textit{S} \rangle \\ \text{SLASH} & \{ \} \end{array} \right] \Rightarrow_{LR} \left[\begin{array}{ll} \text{PHON} & \langle \textit{think} \rangle \\ \text{SUBCAT} & \langle \textit{NP}, \boxed{1}\textit{S} \rangle \\ \text{SLASH} & \left\{ \begin{array}{l} \text{ADV} \\ \boxed{1} \left[\begin{array}{l} \text{MOD} \\ \boxed{1} \end{array} \right] \end{array} \right\} \end{array} \right]$$

In virtue of such lexical-rule outputs, the SLASH path terminates with the matrix V, even when a fronted adverbial modifies an embedded clause, as in (5):



But we know that many languages register UDCs (more precisely, *extraction paths*) – in diverse ways: via verb morphology, complementizer choice, otherwise impossible inversions, or even suppression of tonal downstep. In Irish, for example, the complementizer *aL* appears only in an extraction path, while *goN* is the complementizer that must appear outside the extraction path (and in sentences without any extraction dependencies at all). This is illustrated in (6):¹

¹For relevant discussion, see McCloskey 1979, 1990, 2002, from which I draw freely.

- (6) a. Dúirt mé **gurL** shíl mé **goN** mbeadh sé ann.
said I goN.PAST thought I COMP would-be he there
'I said that I thought that he would be there.'
- b. an fear **aL** shíl mé **aL** bheadh _ ann
the man COMP thought I COMP would-be _ there
'the man that I thought would be there'
- c. an fear **aL** dúirt mé **aL** shíl mé **aL** bheadh _ ann
the man COMP said I COMP thought I COMP would-be _ there
'the man that I said I thought would be there'
- d. an fear **aL** shíl _ **goN** mbeadh sé ann
the man COMP thought _ COMP would-be he_j there
'[the man]_j that thought he_j would be there'
- e. an fear **aL** dúirt sé **aL** shíl _ **goN** mbeadh sé ann
the man COMP said he COMP thought _ COMP would-be he there
'the man that he said thought he would be there'

Chamorro verb morphology is sensitive not only to the presence of an extraction path, but also to the grammatical function of the element that is extracted (or from which such an element is extracted):

- (7) a. Hayi **fum-a'gasi** i kareta
who WH.SU-wash the car
'Who washed the car?'
- b. Hayi si Juan **ha-sangan-i** hao [**fum-a'gasi** i kareta]
who UNM Juan E3S-say-DAT you WH.SU-wash the car
'Who did Juan tell you washed the car?'
- c. Hafa **um-istotba** hao [ni **malagao'-na** i lahi-mu]
what WH.SU-disturb you COMP WH.OBL-want-3sg the son-your
'What does it disturb you that your son wants?'

Similar phenomena are found in numerous languages. The ones I am familiar with as of this writing are the following: Irish Complementizer Alternations (McCloskey 1979, 1990, 2002), Chamorro Verb Morphology (Chung 1982, 1995, 1998), Palauan Verb Morphology (Georgopoulos 1985, Chung & Georgopoulos 1988), Icelandic Expletive Subjects (Maling & Zaenen 1978), Kikuyu Downstep Suppression (Clements 1984), French Stylistic Inversion (Kayne & Pollock 1978), Spanish Stylistic Inversion (Torrego 1984), Yiddish Verb Inversion (Diesing 1990), Ulster English Quantifier Floating (McCloskey 2000), Afrikaans (Du Plessis 1977), Thompson Salish Verb Agreement² (Kroeber 1997). In all such

²The Thompson phenomenon discussed by Kroeber may submit to a substantially different kind of analysis that does not require lexical sensitivity to UDCs.

cases, it should be straightforward to construct an HPSG analysis based on the distinction between SLASHed and unSLASHed constituents. For example, the Irish complementizer alternation illustrated above can be simply analyzed by letting *aL* (whether analyzed as a functional head or as a marker) select for a SLASHed clause, while *goN* selects for an unSLASHed clause (or else, if further data is taken into consideration, selects for a clause that is unspecified for SLASH).

However, as Tom Hukari and Bob Levine (HL) have shown at length, the PS94 analysis of UDCs does not lend itself to a straightforward account of the relevant cross-linguistic details. HL observe two important universal generalizations about the registration of UDCs. The first concerns subject extraction:

- (8) Hukari and Levine (1994, 1996): In languages where extraction is registered, the extraction of a verb's subject is registered.

Recall from section 1 that in the case of matrix *wh*-clauses, PS94 posit no SLASHed elements at all. And in the case of the extraction of embedded subjects, the lower VP and its V are both unSLASHed. Hence, if the account of extraction registration is based on SLASHed elements, PS94 fails to provide a description of subject extraction at all, since verbs whose subjects are extracted are all unSLASHed, as are the elements these verbs combine with. If PS94 were adapted to Irish, for example, it would incorrectly predict that embedded subject extraction should occur with only *goN*, not *aL* in the lowest clause of examples like (6b,c).

The second generalization isolated by HL concerns adjunct extraction:

- (9) Hukari and Levine (1995): In all languages where extraction is registered, extraction of adjuncts is registered.

This phenomenon, illustrated for Irish in (10), is also problematic for the analysis of UDCs in PS94.

- (10) a. Ceén uair **aL** tháinig siad 'na bhaile _
 which time_j COMP came they home t_j
 'what time did they come home'
 b. Ceén fáth **aL** dhúirt tú **aL** tháinig sé _
 which reason_j COMP said you COMP came he t_j
 'why did you say he came'

If verbs of saying, thinking, etc. are themselves SLASHed, but select an unSLASHed complement (as in (5)) then here too we should expect to find *goN* in the lowest clause of the extraction domain, not *aL*. This prediction is falsified by examples like (10b).

1.2 BMS 2001

Bouma, Malouf and Sag's (2001) [BMS's] HPSG analysis of UDCs offers a solution to these problems. BMS were influenced by the work of Przepiór-kowski

(1999a,b,c) and others, who provide considerable evidence for the idea that many adverbials in diverse languages should be analyzed as complements selected by a verbal head, rather than as adjuncts that select for a VP constituent. Any proposal along these lines puts adverbials in a position comparable to that of complements. This opens the door to an analysis of extracted adverbials that is on a par with the analysis of extracted complements. For example, a verb may morphologically register the fact that its adverbial complement is extracted in the same way that it registers complement extraction. If adverbial extraction can be assimilated to extracted complements, then the SLASH-based analysis of extraction registration can easily be maintained.

Another influence on BMS was the fact that the existence of *wh*-traces had been called into question. Sag and Fodor (1994) present arguments undermining the claims that had previously been made in favor of the existence of *wh*-traces and Sag (2000) offers new challenges to the existence of such traces, arguing that theoretically critical coordinate structure extraction restrictions follow naturally if it is assumed that there are no phonetically unexpressed elements in *wh*-trace position.

These two factors led BMS to an analysis that lacks *wh*-traces, and where both subjects and adverbs are selected by the verb. Once all such elements are lexically selected, it is straightforward, as BMS show, for a particular morphological verb class to require extraction of a particular dependent, to disallow such extraction, or to be indifferent to such matters.

BMS introduced the feature DEP(ENDENTS) in addition to ARGUMENT-STRUCTURE and the VALENCE features. The values of these features are interdependent, i.e. they are constrained by the following two general principles:

(11) Argument Structure Extension:

$$\left[\begin{array}{c} word \\ SS|L|CAT|HD\ verb \end{array} \right] \Rightarrow \left[\begin{array}{c} SS|L \\ CAT \left[\begin{array}{c} HD \quad \boxed{3} \\ ARG-ST \quad \boxed{A} \\ DEPS \quad \boxed{A} \oplus LIST \left(\left[\begin{array}{c} MOD \left[\begin{array}{c} HD \quad \boxed{3} \\ KEY \quad \boxed{2} \end{array} \right] \right] \right) \\ CONT|KEY \quad \boxed{2} \end{array} \right] \end{array} \right] \right]$$

(12) Dependent Realization:

$$word \Rightarrow \left[\begin{array}{c} SS|L|CAT \\ VAL \left[\begin{array}{c} SUBJ \quad \boxed{A} \\ COMPS \quad \boxed{B} \ominus list(gap-ss) \end{array} \right] \\ DEPS \quad \boxed{A} \oplus \boxed{B} \end{array} \right]$$

According to these principles, feature structures like the following are all licensed:

$$\begin{aligned}
(13) \quad & \text{a. } \left[\text{SS|L|CAT} \left[\begin{array}{ll} \text{HEAD} & \text{verb} \\ \text{VAL} & \left[\begin{array}{ll} \text{SUBJ} & \langle [1] \text{NP} \rangle \\ \text{COMPS} & \langle [2] \text{NP} \rangle \end{array} \right] \\ \text{DEPS} & \langle [1], [2] \rangle \\ \text{ARG-ST} & \langle [1], [2] \rangle \end{array} \right] \right] \\
& \text{b. } \left[\text{SS|L|CAT} \left[\begin{array}{ll} \text{HEAD} & \text{verb} \\ \text{VAL} & \left[\begin{array}{ll} \text{SUBJ} & \langle [1] \text{NP} \rangle \\ \text{COMPS} & \langle [2] \text{NP}, [3] \text{'advbl'} \rangle \end{array} \right] \\ \text{DEPS} & \langle [1], [2], [3] \rangle \\ \text{ARG-ST} & \langle [1], [2] \rangle \end{array} \right] \right] \\
& \text{c. } \left[\text{SS|L|CAT} \left[\begin{array}{ll} \text{HEAD} & \text{verb} \\ \text{VAL} & \left[\begin{array}{ll} \text{SUBJ} & \langle [1] \text{NP} \rangle \\ \text{COMPS} & \langle \rangle \end{array} \right] \\ \text{DEPS} & \langle [1], [2] \left[\begin{array}{l} \text{gap-ss} \\ \text{NP} \end{array} \right] \rangle \\ \text{ARG-ST} & \langle [1], [2] \rangle \end{array} \right] \right] \\
& \text{d. } \left[\text{SS|L|CAT} \left[\begin{array}{ll} \text{HEAD} & \text{verb} \\ \text{VAL} & \left[\begin{array}{ll} \text{SUBJ} & \langle [1] \text{NP} \rangle \\ \text{COMPS} & \langle [2] \text{NP} \rangle \end{array} \right] \\ \text{DEPS} & \langle [1], [2], [3] \left[\begin{array}{l} \text{gap-ss} \\ \text{'advbl'} \end{array} \right] \rangle \\ \text{ARG-ST} & \langle [1], [2] \rangle \end{array} \right] \right] \\
& \text{e. } \left[\text{SS|L|CAT} \left[\begin{array}{ll} \text{HEAD} & \text{verb} \\ \text{VAL} & \left[\begin{array}{ll} \text{SUBJ} & \langle [1] \text{NP} \rangle \\ \text{COMPS} & \langle \rangle \end{array} \right] \\ \text{DEPS} & \langle [1] \left[\begin{array}{l} \text{gap-ss} \\ \text{NP} \end{array} \right], [2] \rangle \\ \text{ARG-ST} & \langle [1], [2] \rangle \end{array} \right] \right]
\end{aligned}$$

(13e) corresponds to the case of subject extraction, because, following Ginzburg and Sag (2000, Ch. 6), there is a construction admitting clauses whose only daughter is a VP whose unexpressed subject is a gap.³

³Unwanted verbs with non-singleton SUBJ values are ruled out by the constraint in (i):

$$(i) \left[\begin{array}{l} \text{word} \\ \text{SS|L|CAT} \left[\begin{array}{ll} \text{HEAD} & \text{verb} \end{array} \right] \end{array} \right] \Rightarrow \left[\text{SS|L|CAT|VAL|SUBJ} \quad \langle [] \rangle \right]$$

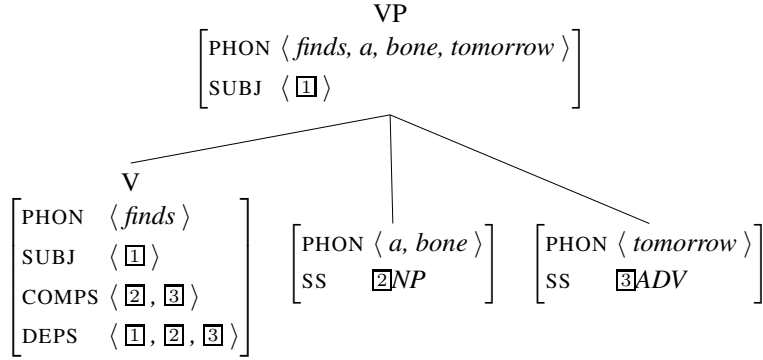


Figure 3: BMS 2001 analysis of an adjunct as complement

In the BMS analysis, the adverb selected by a verb has a MOD value whose KEY value is identified with the verb's KEY value, according to the Argument Structure Extension principle. This allows instantiated lexical entries like the one sketched in (14):

$$(14) \left[\begin{array}{c} \text{PHON } \langle \text{finds} \rangle \\ \text{SS|L} \left[\begin{array}{c} \text{CAT} \left[\begin{array}{c} \text{HD } \boxed{5} \\ \text{VAL} \left[\begin{array}{c} \text{SUBJ } \langle \boxed{1} \rangle \\ \text{COMPS } \langle \boxed{2}\text{NP}, \boxed{3} \left[\begin{array}{c} \text{MOD} \left[\begin{array}{c} \text{HD } \boxed{5} \\ \text{KEY } \boxed{6} \end{array} \right] \end{array} \right] \rangle \end{array} \right] \\ \text{DEPS } \langle \boxed{1}\text{NP}[3sg]_i, \boxed{2}_j, \boxed{3} \rangle \\ \text{CONT} \left[\text{KEY } \boxed{6} \text{find_rel}(e, i, j) \right] \end{array} \right] \end{array} \right] \end{array} \right]$$

This in turn gives rise to head-complement structures like the one in Figure 3. This syntactic analysis is straightforward. However, as we will see later, the semantic analysis that BMS assumed is inadequate in a number of crucial respects.

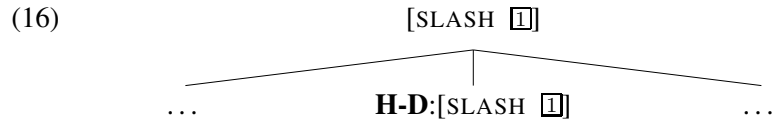
To handle extraction, BMS appealed to the SLASH Amalgamation Constraint first proposed by Sag (1997):

And, finally, the Principle of Canonicity, which requires that all signs are canonical, works together with the various grammar rules to ensure that noncanonical members of an ARG-ST list are never locally realized.

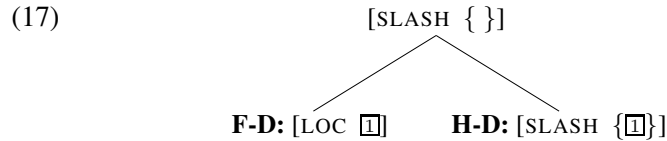
(15) SLASH Amalgamation Constraint:

$$word \Rightarrow \left[\begin{array}{c} \text{SS} \left[\begin{array}{c} \text{LOC} \left[\begin{array}{c} \text{CAT} \left[\begin{array}{c} \text{DEPS} \left\langle \left[\text{SLASH } \boxed{1} \right], \dots, \left[\text{SLASH } \boxed{n} \right] \right\rangle \right. \\ \left. \text{BIND } \boxed{0} \right. \end{array} \right] \\ \text{NL} | \text{SLASH } \left(\boxed{1} \cup \dots \cup \boxed{n} \right) \ominus \boxed{0} \end{array} \right] \end{array} \right] \end{array} \right]$$

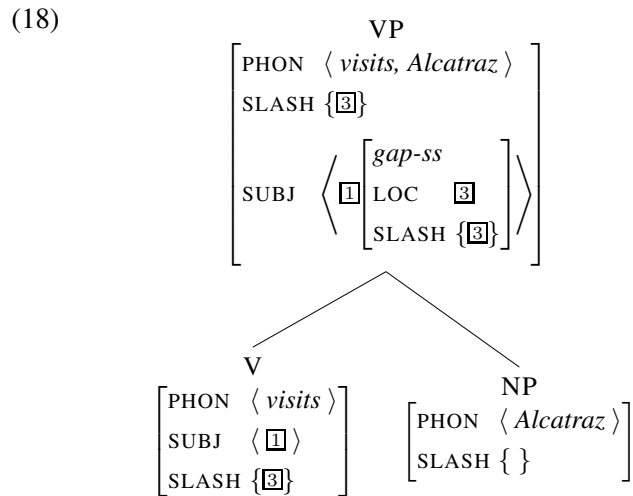
This works together with a simple approach to SLASH inheritance, where in the general case, the head daughter and its mother simply share their SLASH specifications, as in (16):



In gap-binding constructions, however, the head daughter's SLASH value is 'cancelled off', leaving the mother with a smaller SLASH value, as shown in (17):



The BMS proposal allows complement-extraction and subject-extraction to be treated via structures like those in Figure 4 and in (18):



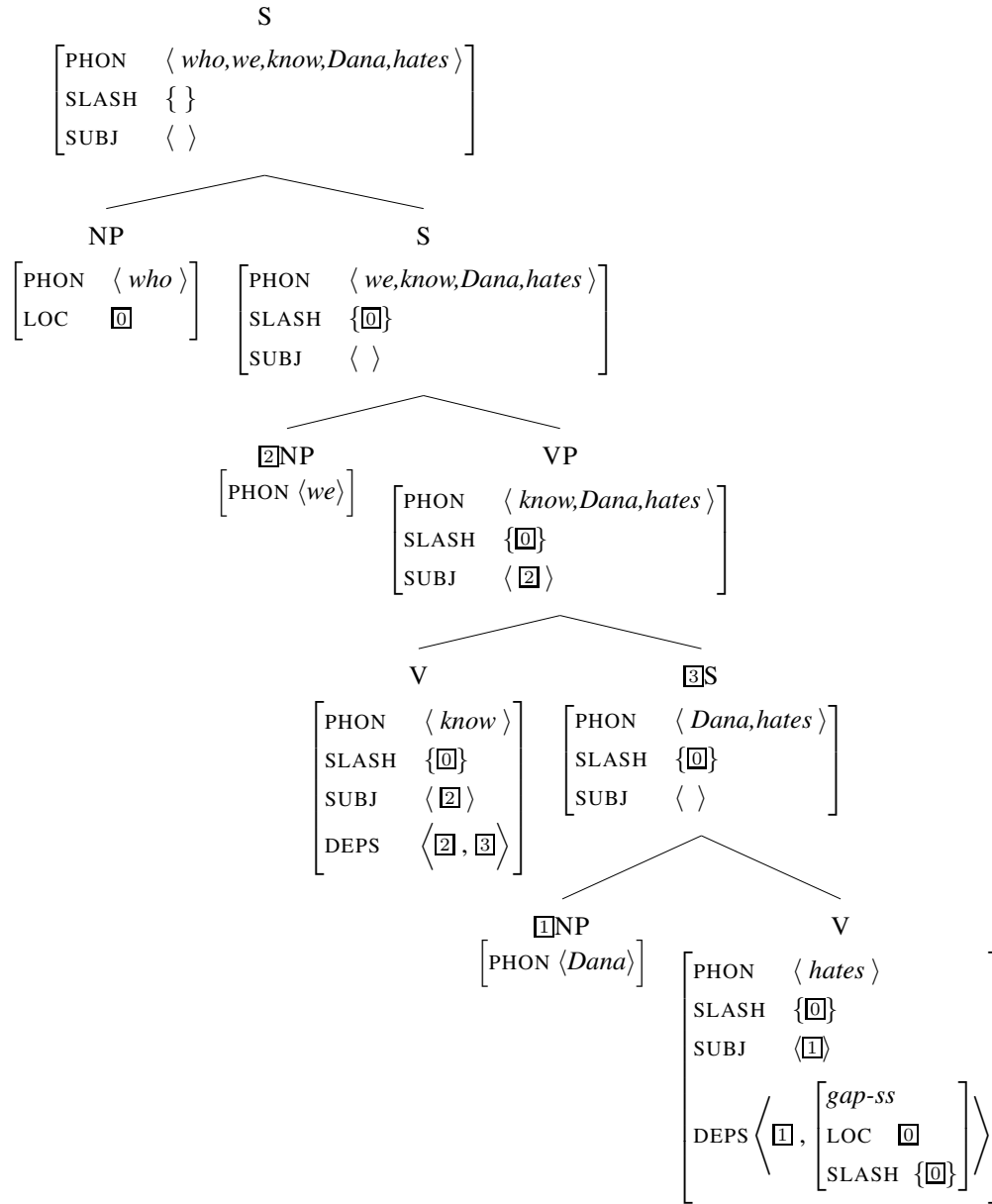


Figure 4: Complement extraction, as analyzed in BMS 2001

Note that all verbs along the extraction path in Figure 4 are SLASHed, as is the verb whose subject is extracted in (18). Unlike the PS94 analysis of extraction, the BMS proposal distributes SLASH precisely where the languages discussed earlier register complement and subject extraction.

Now, when an adverbial is on a verb's DEPS list, one option is for it to be of type *gap-ss*. But all feature structures of this type must be SLASHed in the BMS analysis,⁴ hence verbs selecting unrealized adverbials must themselves be SLASHed (by SLASH-Amalgamation), as shown in (19):

$$(19) \left[\begin{array}{c} \text{PHON} \quad \langle \text{visits} \rangle \\ \\ \text{SS} \quad \left[\begin{array}{c} \text{LOC|CAT} \\ \\ \text{DEPS} \quad \left\langle \begin{array}{c} \boxed{1}, \boxed{3}, \\ \left[\begin{array}{c} \text{gap-ss} \\ \text{LOC} \quad \boxed{5} \\ \text{SLASH} \quad \{\boxed{5}\} \end{array} \right] \end{array} \right\rangle \\ \\ \text{ARG-ST} \quad \langle \boxed{1}, \boxed{3} \rangle \\ \\ \text{NL|SLASH} \quad \boxed{2} \cup \boxed{4} \cup \{\boxed{5}\} \end{array} \right] \end{array} \right] \left[\begin{array}{c} \text{VAL} \quad \left[\begin{array}{c} \text{SUBJ} \quad \langle \boxed{1}\text{NP[SLASH } \boxed{2}] \rangle \\ \text{COMPS} \quad \langle \boxed{3}\text{NP[SLASH } \boxed{4}] \rangle \end{array} \right] \end{array} \right] \end{array} \right]$$

And this in turn gives rise to adverb-extraction structures like the one in Figure 5. Thus, the extraction of an adverb is registered on all verbs of the extraction path (the path between the adverbial and its 'gap'). The BMS analysis of UDCs registers the extraction dependency in all the places that it is morphologically, lexically, tonologically or syntactically registered in the languages considered above, correcting the inadequacies of the PS94 extraction analysis.

2 A Semantic Problem and its Solution

The Problem. Despite its attractiveness, the BMS analysis of UDCs encounters certain difficulties. For example, Levine (2002) poses the question of whether the BMS analysis can be reconciled with examples like (20):

- (20) In how many seconds flat did Robin find a chair, sit down, and whip off her logging boots?

Because in the BMS analysis, an adverb selected by a verb identifies its MOD value's KEY value with the verb's KEY value, (20) poses a dilemma: if the extracted adverb is associated with a dependent of each verb (*find*, *sit*, and *whip*), then three contradictory KEY values must be equated. Intuitively, (20) requires that the adverb modify the coordinate structure (since this sentence has a cumulative reading and its meaning is a question about the duration of a tripartite event),

⁴The constraint that ensures this is: $\text{gap-ss} \Rightarrow \left[\begin{array}{c} \text{LOC} \quad \boxed{1} \\ \text{NL|SLASH} \quad \{\boxed{1}\} \end{array} \right]$.

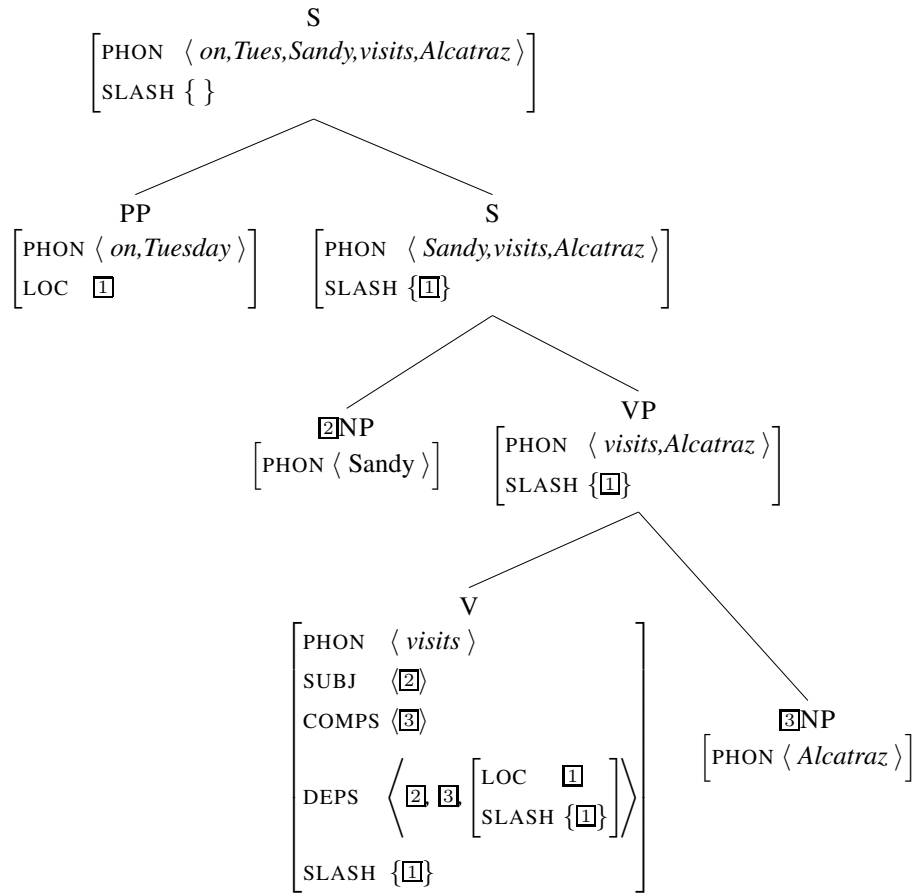


Figure 5: Adjunct extraction, as analyzed by BMS 2001

yet the BMS analysis assumes that all postverbal adverbials are complements, and hence it lacks any way to associate the adverb with the appropriate adjunct position, and no way to assign it the correct scope. On the other hand, Levine argues, if there are adverbial traces that can appear wherever adverbs can appear (as in the PS94 analysis), then these examples are unproblematic – the adverbial trace is in a position adjoined to the coordinate structure, and hence outscopes the conjunction.

A Revision of the BMS Analysis. Since returning to the PS94 analysis leaves us without an account of the Hukari-Levine generalizations noted earlier, it seems prudent to seek a revision of the BMS analysis that provides a solution to the problem noted by Levine. In the remainder of this paper, I explore what I believe is a relatively minor modification of the BMS analysis that resolves this problem without introducing traces of the sort that Levine argues would provide an alternative account of data like (20).

Bouma et al. (in unpublished work) already observed that the BMS analysis requires a stipulation stated in terms of a binary relation they call *successively-out-modify*. This is necessary in order to ensure that the linear order of postverbal adjuncts determines their relative scope:

(21) Robin reboots the Mac [frequently] [intentionally]. **intnl(freq(reboot..))**

(22) Robin reboots the Mac [intentionally] [frequently]. **freq(intnl(reboot..))**

This unattractive stipulation can be eliminated by returning to a lexical-rule (LR)-based analysis like that originally proposed by van Noord and Bouma (see also Przepiórkowski 1999). For convenience, I will formulate this lexical rule as a unary schema that simply extends a verb’s ARG-ST list, i.e. as in (23), where the daughter is the ‘LR input’ and the mother is the ‘LR output’:⁵

(23) Adverb Addition Schema:

$$\left[\begin{array}{l} \text{PHON } \boxed{C} \\ \text{SS|L|CONT } \left[\begin{array}{l} \text{LTOP } \boxed{4} \\ \text{HCONS } \boxed{B} \oplus \langle \boxed{1} \leq \boxed{2} \rangle \\ \text{RELS } \boxed{D} \end{array} \right] \\ \text{ARG-ST } \boxed{A} \oplus \left\langle \left[\begin{array}{l} \text{LTOP } \boxed{4} \\ \text{MOD } \left[\begin{array}{l} \text{HD } \textit{verb} \\ \text{CONT|LTOP } \boxed{2} \end{array} \right] \end{array} \right] \right\rangle \end{array} \right] \rightarrow \left[\begin{array}{l} \text{PHON } \boxed{C} \\ \text{SS|L } \left[\begin{array}{l} \text{CAT|HD } \textit{verb} \\ \text{CONT } \left[\begin{array}{l} \text{LTOP } \boxed{1} \\ \text{HCONS } \boxed{B} \\ \text{RELS } \boxed{D} \end{array} \right] \end{array} \right] \\ \text{ARG-ST } \boxed{A} \end{array} \right]$$

⁵This replaces the Argument Structure Extension principle given in (11). I am aware that by eliminating DEPS, I raise controversial issues about the role of binding theory in the treatment of Principle C effects, but these are orthogonal to the matters at hand. I follow Copestake et al.’s presentation of MRS throughout. In particular, lexical constraints are assumed to ensure that the local top (a handle) of a verb or a scopal adverb is equal to that of its predication, modulo quantifiers ($=_q$).

In (24), I also formulate this LR in terms of the construction theory laid out in Sag to appear (see in addition Sag et al. 2003, Ch. 16), where constructs are treated as feature structures:

$$(1) \left[\begin{array}{c} \text{MOTHER} \\ \text{DTRS} \end{array} \left[\begin{array}{c} \text{PHON } \boxed{C} \\ \text{SS|LOC|CONT} \left[\begin{array}{c} \text{LTOP } \boxed{4} \\ \text{HCONS } \boxed{B} \oplus \langle \boxed{1} \leq \boxed{2} \rangle \\ \text{RELS } \boxed{D} \end{array} \right] \\ \text{ARG-ST } \boxed{A} \oplus \left\langle \begin{array}{c} \text{LTOP } \boxed{4} \\ \text{MOD } \left[\begin{array}{c} \text{LOC } \left[\begin{array}{c} \text{CAT|HEAD } verb \\ \text{CONT|LTOP } \boxed{2} \end{array} \right] \end{array} \right] \end{array} \right\rangle \end{array} \right] \right]$$

$$\left[\begin{array}{c} \text{PHON } \boxed{C} \\ \text{SS|LOC} \left[\begin{array}{c} \text{CAT|HEAD } verb \\ \text{CONT} \left[\begin{array}{c} \text{LTOP } \boxed{1} \\ \text{HCONS } \boxed{B} \\ \text{RELS } \boxed{D} \end{array} \right] \end{array} \right] \\ \text{ARG-ST } \boxed{A} \end{array} \right] \end{array} \right]$$

The constraint in (23) requires that the local top ($\boxed{4}$) of the selected adverb is also the verb's local top. In addition, it ensures that the local top ($\boxed{1}$) of the daughter verb is less than or equal to the adverb's MOD value's local top ($\boxed{2}$). This means that when a verb combines with a scopal adverbial complement, the verb's predication will always be within the scope of that adverbial, as shown in (24). In addition, selected adverbials must be able to modify verbal expressions (hence the [HEAD *verb*] specification in the adverbial's MOD value: (Note that no further LOC, CAT, SUBCAT or HEAD identity is enforced.)

$$(2) \left[\begin{array}{c} \text{PHON } \langle found \rangle \\ \text{SS|LOC|CONT} \left[\begin{array}{c} \text{LTOP } h_4 \\ \text{RELS } \left\langle \begin{array}{c} find-rel \\ \text{LBL } h_1 \\ \text{ARG1 } i \\ \text{ARG2 } j \end{array} \right\rangle \\ \text{HCONS } \langle h_1 \leq h_2 \rangle \end{array} \right] \\ \text{ARG-ST} \left\langle NP_i, NP_j, \left[\begin{array}{c} \text{LTOP } h_4 \\ \text{MOD } \left[\begin{array}{c} \text{LOC } \left[\begin{array}{c} \text{CAT|HEAD } verb \\ \text{CONT|LTOP } h_2 \end{array} \right] \end{array} \right] \end{array} \right] \right\rangle \end{array} \right]$$

Here the selected adverb, if scopal, will have to include the verb's local top, and hence the verb's predication, within its scope. The use of \leq , rather than $=_q$ (the only relation used by Copestake et al. (in press)), is crucial to this analysis.

Notice that the mother in (22) (the 'LR output') says nothing about the KEY value of the verb or that of the MOD value. In addition, when a verb selects two adverbials, the first adverbial's local top enters into an \leq relation with the local top of the second adverbial's MOD value. This ensures that subsequent scopal adverbials will always outscope prior adverbials (and that all such adverbials will include the verb's predication in their scope).

The only two resolved mrs-s that satisfy the constraints imposed by (23) for an example like (24a) are shown in (24b,c):

(3) a. Kim found a chair in 30 seconds.

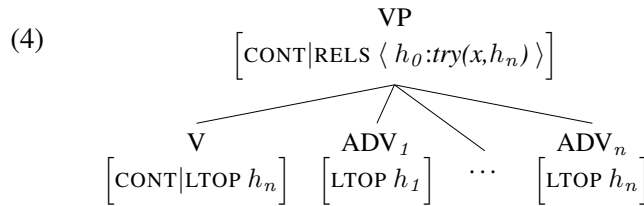
- b.
$$\left[\begin{array}{l} \text{LTOP } h_0 \\ \text{RELS } \langle h_1:\text{found}(k,y), h_2:a(y,h_3,h_1), h_3:\text{chair}(y), h_0:\text{in-30-secs}(h_2) \rangle \end{array} \right]$$

in-30-secs(a (y, chair(y), found(k,y)))
- c.
$$\left[\begin{array}{l} \text{LTOP } h_0 \\ \text{RELS } \langle h_4:\text{found}(k,y), h_0:a(y,h_3,h_1), h_3:\text{chair}(y), h_1:\text{in-30-secs}(h_4) \rangle \end{array} \right]$$

a (y, chair(y), in-30-secs(found(k,y)))

The handle (h_0) of the quantifier a is within the preposition's scope in (23b), but outside it in (23c).

It is important to understand that the adverbial complement's scope remains 'clause-bounded' under this proposal. A verb like *believe* or *try* selects a verbal phrase as complement and lexically identifies the local top of the relevant complement with the appropriate semantic argument (the second argument of *believe-rel* or *try-rel*). Since a VP's local top will be identified with that of the rightmost adverbial in an example like (24), all of the adverbs must be within the scope of the embedding handle-embedding relation:



In short, my proposal entails that the scope interactions of selected scopal adverbials parallel that of true adjuncts, but in the opposite order. (see Copestake et al. (in press) discussion of *Kim apparently almost succeeded*, which has only an **apparently(almost(succeeded(k)))** reading.

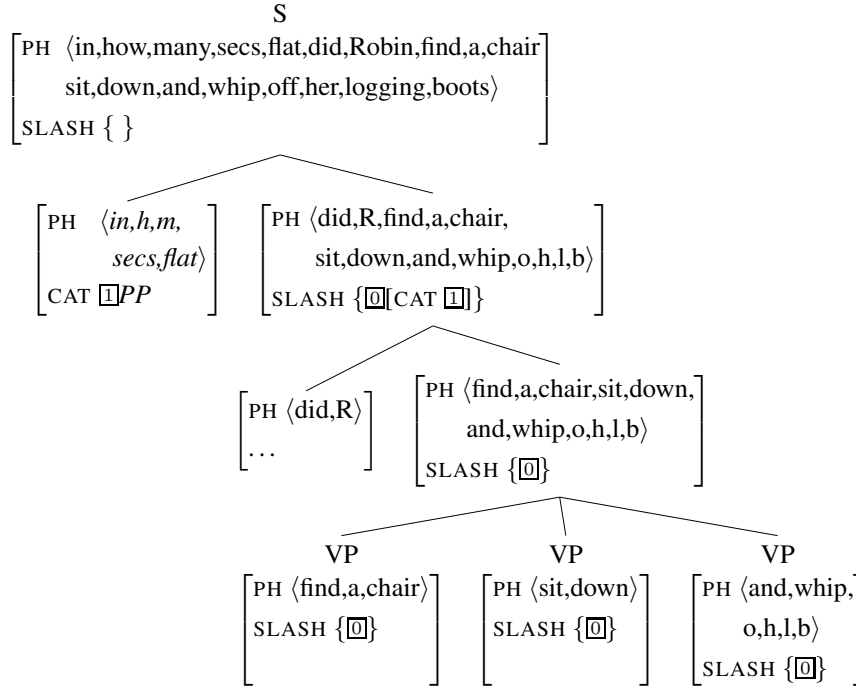


Figure 6: Extracted adjunct scopes over coordination

Extracted Adverbials Scope over Conjunctions. The proposal just made bears on the problem raised by Levine. In head-filler constructions of all sorts, it is reasonable to assume that the filler daughter's CAT and INDEX values are identified with those of the head daughter's SLASH member.⁶ Now reconsider Levine's example in (20) above. In this case, the CAT and INDEX values of the adverbial filler (the PP *in how many minutes flat*) will be identified with those of the member of the SLASH set, which will in turn (via standard HPSG principles governing the inheritance of SLASH specifications) be identified with the SLASH members of the selected adverbials, as sketched in Figure 6.

The SLASH values also make their way down to the verbs *find*, *sit*, and *whip*, where they are amalgamated from the selected adverbial, as in the BMS analysis. Making familiar assumptions about gaps, the CAT value of each selected adverbial is identified with the CAT value of its SLASH value. Since MOD is within CAT, it follows that the filler's MOD value must outscope each verbal predication.

Following Copestake et al. (in press), I assume that conjunctions embed the local tops of the conjuncts as their arguments, roughly as in Figure 7.

⁶Given MRS, it would be an unwanted complication to identify the entire CONT value of filler and the gap in a UDC. Identifying the LTOP of the filler daughter with that of the SLASH value would also impose unwanted scope restrictions when the filler is scopal.

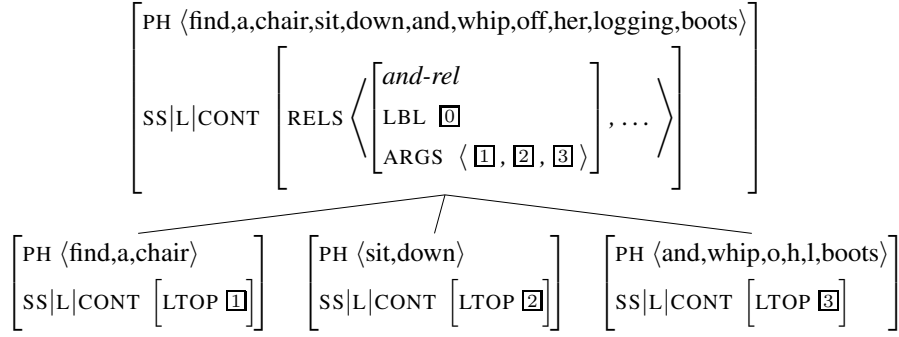


Figure 7: Local tops in coordinate adjunct-extraction structure

Since each conjunct’s local top is embedded as an argument of the conjunction, the only way the filler adverbial can simultaneously outscope *find-rel*, *sit-rel*, and *whip-rel* is for that adverbial to outscope the *and-rel* (since, given the nature of MRS, the adverbial’s relation can only appear once in a resolved *mrs* structure). The correct scoping thus results from the resource-sensitive nature of MRS. Assuming a variant of *and-rel* that provides the appropriate cumulative event interpretation discussed by Levine, his example (20) is properly analyzed, as sketched in (24):

$$(24) \quad \left[\begin{array}{l} \text{LTOP } h_0 \\ \text{RELS } \langle h_0:\text{how-many}(x,h_1,h_2), h_1:\text{second}(x), h_2:\text{in}(h_3,x), \\ h_3:\text{and}(h_4,h_5,h_6), h_4:\text{a}(y,h_7,h_8), h_7:\text{chair}(y), h_8:\text{found}(k,y), \\ h_5:\text{sit-down}(k), h_6:\text{whip-off-h-l-boots}(k) \rangle \end{array} \right]$$

Note that the use of \leq , rather than $=_q$ (as in Copestake et al. in press), is crucial, as this is what allows the *and-rel* to ‘slip in’ to the resolved *mrs* structure. Also crucial is the fact that only CAT and INDEX information is identified in a UDC. That is, in a filler-gap structure like (4), because MOD is a HEAD feature and HEAD is within CAT, it follows that the MOD value of the fronted adverb is identified with the adverb on the verb’s ARG-ST list, and this is sufficient to guarantee that a fronted scopal adverb will always outscope the verb whose adverbial argument is extracted. However, nothing identifies the LTOP of the sentence-initial adverb with that of the adverbial on the verb’s ARG-ST (which is in fact identified with the verb’s LTOP by the constructional constraint in (1) above). When the verb combines with an adverbial complement by a head-complement construction, a stronger identity is enforced (synsem identity, let us assume) and this will include LTOP identity. Hence a locally selected adverbial, i.e. a complement, will have local scope, but an extracted adverbial will have more scope possibilities, as discussed above.

The question remains of how to deal with other examples involving adverbs that follow a coordinate-structure, e.g. (25) from Levine 2002. Exactly the same

analysis developed above extends to these examples if they are analyzed in terms of a rightward extraction scheme of the sort that would also treat examples like (26a), where a left-adjoined (true) adjunct is within the scope of the extracted PP.

- (25) Robin [found a chair, sat down, and whipped off her logging boots]
[in twenty seconds flat].
- (26) a. Sandy [[rarely visited a friend] because of illness].
b. Sandy [rarely [visited a friend because of illness]].

The **because (rarely ...)** reading associated with (26a) is associated with the rightward extraction of the *because*-phrase. This should be contrasted with the **rarely (because ...)** reading associated with (26b), where the *because*-phrase is directly realized as a complement of *visited* and *rarely* modifies the resulting VP.

Alternatively, the ellipsis-based theory of right-node raising developed by Beavers and Sag (2004) could also provide an analysis of examples like (25). Since MOD is within HEAD, their constraint (27) already guarantees that a common right-peripheral element outscopes all conjuncts. The modification required in order to deal with (25) is to extend their ‘Optional Quantifier Merger’ principle to include adverbial relations. Space limitations prevent me from exploring this option here.

3 Conclusion

It appears that the traceless adverb-as-complement analysis can be reconciled with coordination. The revision of the BMS analysis I have presented here gives a principled answer to the important question raised by Levine about the interaction of adverbial extraction and cumulative conjunction, while at the same time providing a coherent, unified approach for systematizing the massive evidence for the ‘Adjuncts-as-Complements’ approach provided by van Noord and Bouma (1994), Przepiórkowski 1999a,b,c, Manning et al. and others. Here I have modified the BMS analysis in three ways: (1) by eliminating DEPS, (2) returning to van Noord and Bouma’s lexical rule analysis of adverb addition, and (3) introducing \leq constraints. In so doing, I have preserved the elegant account that BMS provide of Hukari and Levine’s (1995) observation that adverb and subject extraction are both morphosyntactically registered in languages that locally register extraction dependencies.

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