

ADVERBIAL GAPS IN GENERALIZED PHRASE STRUCTURE GRAMMAR

Thomas E. Hukari

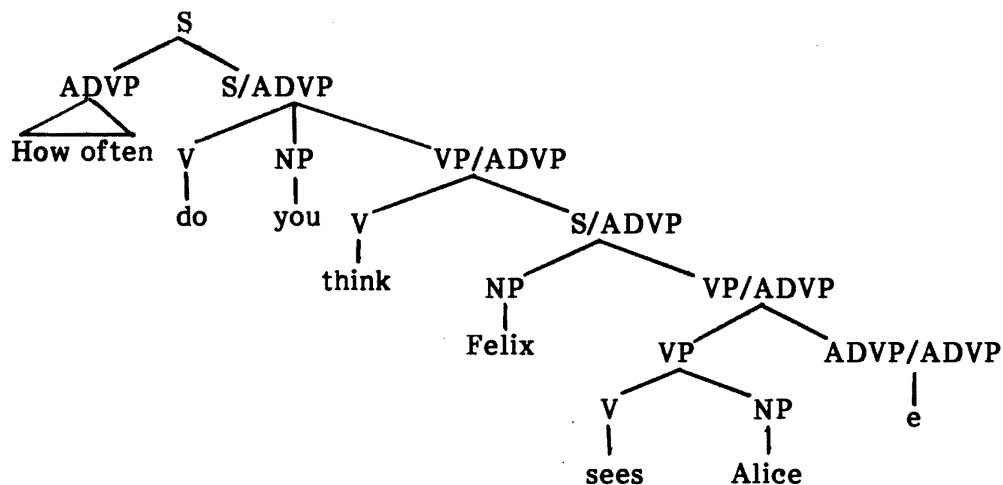
Department of Linguistics
University of Victoria

1. THE PROBLEM

Gerald Gazdar set out the foundations of a base-generated syntactic framework which has come to be known as Generalized Phrase Structure Grammar in a series of key papers (Gazdar 1979a, 1979b, 1981, 1982). A particularly significant result is his demonstration that unbounded dependency constructions (UDCs) can be described perspicuously in a context free grammar. The work on UDCs has been extended in this research paradigm in a number of articles (e.g., Gazdar, Klein, Pullum and Sag 1982, Sag 1983) and notably in the most extensive account of the theory, Gazdar, Klein, Pullum and Sag 1985 - hereafter, GKPS. I explore here an apparent problem within the context of GKPS's grammar, the treatment of adverbial gaps in interrogative constructions.

Consider tree (1).

(1)



Slash termination (the analog of a wh-trace) occurs in recursive VP.¹ It is not immediately obvious that the grammar in GKPS admits such structures. In particular, the local tree headed by the topmost VP/ADVP seemingly violates a general constraint

¹ ADVP is used for the purpose of exposition here. I follow GKPS in assuming that adverbs of frequency and manner are [+ADV] APs (. Prepositional phrase adverbials - locatives, temporals, instrumentals, etc. - will also be discussed. I leave open whether they share a common feature [+ADV], though it seems consistent with the analysis of instrumentals and benefactives in Section (4) to assume that these do not.

on feature instantiation (the migration of features). This is the Head Feature Convention (HFC), which can be stated in simplified form as follows.

(2) The Head Feature Convention

- i) The HEAD feature specifications of a head are an extension of the HEAD feature specifications of the category created by taking the intersection of the mother with the free feature specifications of the HEAD.
- ii) The HEAD feature specifications of the mother are an extension of the HEAD feature specifications of the category created by taking the intersection of the head with the free specifications of the mother.

Roughly, this says that a head and the mother agree in HEAD features if they can. If some independent principle prevents either the head or the mother from containing the feature specification in question - i.e., it is not free - then they may disagree. But nothing prevents the head from agreeing with the mother for SLASH in the offending local tree:

- (3) VP/ADVP
 VP
 ADVP/ADVP

The relevant immediate dominance (ID) rule is as follows.

- (4) VP → H, ADVP

Unslashed VP corresponds to H, the head in the ID rule, and SLASH has been freely instantiated on the mother and the non-head daughter in the tree.² Since nothing prevents the head from containing SLASH, (3) violates the HFC.

This problem extends to other cases as well. The Head Feature Convention predicts that UDC gaps will not appear off the head path except under highly restricted circumstances. For example, it predicts the fixed subject constraint in English (Bresnan 1972), blocking extraction from subordinate subjects.

- (5)*Who do you think that e loves Alice?

But apparently analogous cases are grammatical in Icelandic (cf. Maling and Zaenen 1978, 1982).

- (6) Hver sagðir þú, að ____ væri kominn til Reykjavíkur?
 Who (nom.) said you that was come to Reykjavík?

Yet it would appear that such cases violate the HFC as in the following local tree.

- (7) S/NP
 NP/NP
 VP

² Strictly speaking, SLASH is instantiated in tree (1) only if termination works the way it does in GKPS's SLASH Termination Metarule 1. See (12) and the discussion there.

The HFC seems to predict that SLASHed categories off the head path are sanctioned only under two circumstances. First, in order to achieve slash termination at all, a feature cooccurrence restriction (FCR) effectively overrides the HFC in lexically headed local trees (GKPS's FCR 6).

(8) FCR: SUBCAT \supset ~ SLASH

That is, lexical categories, which contain the feature SUBCAT(egorization), cannot contain SLASH and this causes the HFC to overlook the fact that the mother may contain SLASH while a lexical head daughter cannot, thus admitting local trees such as the following.

(9) VP/NP
 V
 NP/NP

That is, SLASH is not free in lexical V here. Second, if the HFC is satisfied because the head contains SLASH, this does not preclude SLASH from appearing on a sister.

(10) VP/NP
 VP/NP
 ADVP/NP

This accounts for parasitic gaps (cf. GKPS: 162-167). Nevertheless, this leaves the apparent residue of cases under consideration here.

Even if we somehow block the effect of the HFC here - a formal possibility discussed below - this goes counter to the Empty Category Principle (ECP) generalization, that an empty category must be governed in some strong sense of government (e.g. the initial version in Chomsky 1981), but using the most local version of c-command.³ G. Pullum has demonstrated that the ECP generalization follows without stipulation from the form of the grammar presented in GKPS, where an empty category must be lexically governed in the narrow sense of c-command (i.e., the empty category is a sister to a lexical head).⁴ Roughly, the grammar in GKPS yields the ECP generalization in the following way.

(11) ECP Generalization

- i) A category $C_i[+\text{null}]/C_i$ is the only source of an empty category and such categories are licensed only by ID rules which are induced by metarules; and
- ii) the domain of metarules is just the lexical ID rules, those which introduce a lexical head.

³ See, for example, the simplified version of c-command (Reinhart 1983: 19). That is, α c-commands β if the first branching node above α dominates β . Even in Reinhart 1976 a less local version is employed. Alternatively, the relevant notion may be Pullum's IDC-command: a node α IDC-commands a node β if and only if the mother of α dominates β (Pullum 1986).

⁴ This was presented in a Lansdowne lecture at the University of Victoria, Victoria, B.C., in October 1985. It will become clear in section 3 that the ECP is not an automatic consequence of the theory but, rather, simply true of the grammar in GKPS.

Metarules are a means in the theory for inducing new ID rules from existing ones and may be thought of as highly local analogs to transformations (or perhaps as analogs to syntactic lexical redundancy rules).

The main metarule for introducing [+NULL] and hence slash termination in GKPS is STM 1, which reads as follows.

(12) SLASH TERMINATION METARULE 1

$$X \rightarrow W, X^2 \Rightarrow X \rightarrow W, X^2[+NULL]$$

This rule takes as its input any lexical ID rule which introduces a BAR 2 category (i.e., X^2) and produces a new ID rule just like the first except X^2 contains the feature specification [+NULL] (which triggers the presence of SLASH in the tree due to a feature cooccurrence restriction: FCR: [+NULL] \supset [SLASH]). For example, STM 1 may induce either of the ID rules (13b) or (13c) from (13a).

- (13) a. VP \rightarrow H[3], NP, PP[to] (e.g., *give*)
 b. VP \rightarrow H[3], NP[+NULL], PP[to]
 c. VP \rightarrow H[3], NP, PP[to, +NULL]

However STM 1 cannot apply to the recursive VP rule (4), since it does not introduce a lexical head.

At least three lines of inquiry are possible here. If we assume that tree (1) is essentially correct, slash termination can be forced at the expense of a stipulated ID rule, though this is a departure from the ECP generalization. Alternatively, we could propose an analysis which is compatible with the ECP generalization - that adverbials are somehow introduced in lexical VP and hence are within the scope of the metarules. Lastly, we could assume that such sentences simply do not involve unbounded dependency gaps.⁵

While this third alternative is certainly worth investigating, it faces serious problems in light of island phenomena and I turn to this in section 2 before exploring the other two approaches below. It will be shown that rejecting an UDC analysis of interrogative adverbials is not credible.

Section 3 explores the possibility of overriding the HFC by positing a stipulated slash-termination ID rule for VP adverbials. I will show that one can easily override the HFC in such an ID rule by following a somewhat different approach to slash termination, one advocated by Hukari and Levine (1987) for independent reasons. This approach may offer a viable solution for PP adverbials which do not permit preposition stranding.

I conclude in section 4 that the second approach is plausible in some cases, that some adverbials are accessible to the slash termination metarule because they may appear in

⁵ Yet another alternative is of course to reject the theory as presented in GKPS and to posit some other mechanism for regulating UDCs. See for example Pollard (1985), who also points out that, given Shieber's work on Swiss German (Shieber 1985) showing that natural languages are not context free, it is an open issue whether metarules should be constrained as in GKPS or, for that matter, whether other mechanisms should replace them.

lexical VP, either introduced by a metarule or appearing as optional complements in ID rules. These include adverbial PPs which permit stranding.

Section 5 raises the question of how sentences such as the following are derived.

(14) Felix hit flyballs in the park yesterday to members of the local scout patrol.

We have no explanation for the appearance of the locative and temporal adverbials between the complements of *hit* in (14) since such adverbials are not present in lexical VP in the analysis of section 4. I propose that the *to*-PP is, in effect, extraposed. Extraposition raises a number of general questions which are addressed in this section. I tentatively conclude that the extraposition of PP complements is sufficiently different from UDCs that a separate feature should be posited.

2. ADVERBIAL WH-PHRASES WITHOUT GAPS

Since adverbial modifiers are optional elements in sentences, we see no anomalies as we do in the cases of missing complements or subjects. Further there are no anomalies in inflection (e.g., nominative versus accusative case, subject-verb agreement). Suppose we simply say that no gap is involved in examples such as (15).

(15) How often did you say that you thought that Felix saw Alice?

Clearly some scope interpretation rule would be required in the semantic translation of such examples, since the *wh*-phrase may modify the matrix VP, the next lower VP or the lowest one, *saw Alice*.

The problem with this approach arises if we assume that island phenomena such as the complex NP constraint and the *wh*-island constraint are handled in the syntax of UDCs. If they are then these barriers will require an independent explanation for gapless adverbial *wh*-phrases, since these constraints hold here as well.

(16) How often did you say that you heard the claim that Felix saw Alice?

(17) How often did you say that you wondered who Alice saw?

(16) exemplifies the complex NP constraint and (17), the *wh*-island constraint. It would appear then that interrogative adverbials appear in UDCs despite the lack of direct evidence of gaps.⁶

A possible counterargument can be found in the work of M. Geis (1985), though that is not his intent. Geis notes that certain situational adverbs - locatives and temporals - may occur sentence-initially but apparently are not preposed via UDCs. For example, they cannot be interpreted as modifying the infinitives in the following examples (Geis' (6a)-(8a)).

⁶ This is of course the line of argumentation taken in Chomsky (1977), whatever one may make of his more doubtful cases (e.g., *tough*-movement). The fact that the data under consideration here involve overt *wh*-morphology certainly strengthens the case for grouping such adverbials with other instances of UDCs.

- (18) Today, Sam will ask John to take the job.
 (19) On Friday, Bill decided to move to Boston.
 (20) On Friday, Bill was eager to marry Sue.

However he notes that corresponding interrogative adverbs admit this interpretation. (The examples are mine.)

- (21) When has Sam asked John to take the job?
 (22) When has Bill decided to move to Boston?
 (23) When is Bill eager to marry Sue?

The latter examples would seem to dispel any counterhypothesis that sentence-initial interrogative adverbs are simply base generated initially without the presence of SLASH (i.e., Geis' treatment of (18)-(20). However he also cites examples (from Lakoff 1972) where the noninterrogative adverb may be interpreted with respect to a lower clause.

- (24) a. I think Sam smoked pot last night.
 b. Last night, I think Sam smoked pot.

If such adverbs may be interpreted 'downstairs' under certain conditions, then by extension such an analysis is logically possible for corresponding interrogatives. Conceivably the interpretation rule operates on structure, is sensitive to properties of verbs and passes the adverb down to a subordinate clause. If so, such an interpretive rule - while more restricted than UDCs - might well accidentally mimic the island constraints by not passing through verbs which take interrogative complements and not passing through NPs. This hypothesis is irrelevant in the case of interrogative locatives and temporals (cf. (21)-(23)), since the crucial reading under the UDC hypothesis goes through, where the interrogative is associated with the infinitive.⁷

But since adverbs are a disparate class (if a class at all), it perhaps behooves us to consider manner and frequency adverbs (i.e., -ly adverbs) in this light. While my intuitions are not sharp, it seems to me that such adverbs can be interpreted with respect to infinitives, though many cases may be recalcitrant.

- (25) How often did Alice finally convince Felix to perform at her club?
 (26) How often did Felix finally decide to perform at Alice's club?
 (27) How slowly/carefully did Alice force Felix to go over the homework before turning it in?
 (28) How slowly/carefully did Felix finally decide to go over his homework before turning it in?

Also, we seem to have rather clear cases of long-distance interpretation.

- (29) How often did you say Alice believes Felix plans to perform at her club?
 (30) How carefully did you say Alice believes Felix decided to go over the homework before turning it in?

⁷ Even if a tree exists where SLASH is not present - an analog to the noninterrogative case - the fact that there is an interpretation where the wh-phrase modifies the infinitive would seemingly indicate that an unbounded dependency construction exists as well.

These facts, coupled with the wh-island constraints, strongly suggest that such adverbs involve unbounded dependency constructions despite the lack of apparent gaps. The alternatives are either to force slash termination of adverbials by an ID rule or to assume they may appear in lexical VP where they are accessible to the slash termination metarule.

3. A SLASH TERMINATION ID RULE

Suppose that tree (1) is essentially correct. But we have seen that it appears to violate the Head Feature Constraint. Further, the adverb is not even accessible to the main slash termination metarule in GKPS, STM 1, as metarules are restricted to lexical ID rules (those which introduce lexical heads) and clearly the recursive VP rule (4) would not qualify. Consider the following ID rule.

(31) VP → H, ADVP[+NULL]

This would have the same effect as ID rules induced by STM 1: the presence of the feature [+NULL] forces slash termination, where SLASH must appear on ADVP due to a FCR (FCR 19: [+NULL] ⊃ [SLASH]) and on the mother due to the feature instantiation principles (specifically, the Foot Feature Principle). However (31) does not override the HFC, thus only the following local tree goes through.⁸

(32) VP/ADVP
 VP/ADVP
 ADVP[+NULL]/ADVP

We must somehow block SLASH from appearing on the head in this configuration. Inserting a negative condition would seemingly solve the problem, as in (33).

(33) VP → H[-SLASH], ADVP[+NULL]

However ID rules are not defined in GKPS so as to permit such boolean conditions. This extension can be avoided however by linking an arbitrary feature specification - call it +F - with a feature cooccurrence constraint as follows.

(34) VP → H[+F], ADVP[+NULL]
 (35) FCR: [+F] ⊃ ¬[SLASH]

The FCR overrides the HFC, so the tree will be admissible where the head VP does not contain SLASH. A feature specification default will prevent random free instantiation of [+F].

(36) FSD: ¬[+F]

⁸ Parasitic gap configurations such as the following are correctly licensed in GKPS.

(i) VP/NP

 VP/NP

 ADVP/NP

(ii) What did John eat e without cooking e?

This arbitrary use of a feature can be avoided if we take a somewhat different tack in achieving slash termination. Hukari and Levine (1987) argue that STM 1 should be reformulated as follows.

(37) Slash Termination Metarule 1 (Revised)

$X \rightarrow W, \alpha \Rightarrow X/\alpha \rightarrow W, e$ where α ranges over the BAR 2 categories.

This approach blocks pernicious cases of parasitic gaps, though this is beyond the scope of the present paper. However the following ID₉ rule will, in effect, override the HFC without necessitating the use of ad hoc features.

(38) VP/ADVP \rightarrow H, e

Consider the following local tree.

(39) VP/ADVP

VP
e

Could the daughter contain SLASH[ADVP]? If it did, this would violate the FOOT Feature Principle which says, roughly, that the mother and at least one daughter must agree for any *instantiated* foot features - those not mentioned in the ID rule. Since SLASH[ADVP] is mentioned in the ID rule, (39) satisfies the FFP but the following would not.

(40) VP/ADVP

VP/ADVP
e

The SLASH feature on the daughter is instantiated while the one on the mother is inherited from the ID rule. In order to satisfy the FFP, the mother would have to bear a second instance of SLASH, which is impossible.¹⁰ In short, SLASH is not a free feature in

⁹ I take e to be a syncategorematic terminal element as in Hukari and Levine (1986). In point of fact, it can be dispensed with in (38).

¹⁰ A category in GKPS is a partial function. As a function, it cannot contain two tokens of the same feature. It may occur to the reader however that the definition of a category as a function may not be violated if the values for the two tokens of SLASH are absolutely identical. I will argue here at some length that this turns out to be irrelevant as far as the feature instantiation principles of GKPS are concerned.

It is shown above that when an ID rule introduces SLASH on a mother category this overrides the HEAD Feature Convention. So rule (i), which is (43) in the text, licenses local tree (ii).

(i) S/NP \rightarrow H[-SUB]

(ii) S/NP
VP

That is, SLASH is not free in the head, since (iii) fails to satisfy the FFP.

(iii) S/NP

VP/NP

However consider a tree such as (iv), where α indicates identity of values for SLASH.

the daughter and hence local tree (39) satisfies the HFC as the mother and the head agree in *free HEAD features* (cf. (2)).

This strategy is available for SLASH termination in other contexts which go counter to the ECP generalization. Pollard (1985) suggests that the restriction of slash termination to lexically headed contexts may be too parochial given the facts in Icelandic (cf. Maling and Zaenen 1982) and Norwegian (cf. Engdahl 1984) where subject extraction after a complementizer is possible (cf. (6) above). While STM 1 cannot bring about SLASH termination in subject position in English, due to the restriction to lexical rules, GKPS posit a second metarule, STM 2, which extracts subjects of finite clauses.

(41) Slash Termination Metarule 2.

$$X \rightarrow W, V^2[+\text{SUBJ}, \text{FIN}] \Rightarrow X/\text{NP} \rightarrow W, V^2[-\text{SUBJ}]$$

This correctly predicts the fixed subject constraint (Bresnan 1972).

(42) Who do you believe (*that) loves Alice?

Since the output of STM 2 contains, in effect, VP rather than S, a complementizer is impossible. In fact, the only way a metarule could possibly extract the subject in a configuration which includes a complementizer is if the complementizer is taken to be the head (i.e., the head of S-bar) and this departs from GKPS's assumption that S-bar is a projection of V. However an ID rule along the following lines will permit extraction of subjects in a language which does not show the fixed subject constraint.

(43) $S/\text{NP} \rightarrow H[-\text{SUBJ}]$ (i.e., VP)

(iv) $S/\text{NP}_\alpha/\text{NP}_\alpha$
 $\text{VP}/\text{NP}_\alpha$

It is conceivable that the mother is a possible category, since a set $\{a, a\}$ is a well-defined formal object ($\{a, a\} = \{a\}$). Note that we cannot invoke the fact that categories are partial functions, since we have two tokens of the same feature specification, SLASH is not assigned distinct values. Assuming (iv) meets the HFC, does it satisfy the FFP? As it turns out, it does not and therefore there is no possible projection where SLASH is present in the head (i.e., it is not a free feature), so (ii) is admitted by the HFC.

I discuss below reasons why the FFP should be interpreted so as to ignore gratuitous multiple tokens of feature specifications and, in conclusion, I show that this is, in fact, the only correct interpretation of the FFP in GKPS.

GKPS (1985: 165) argue that parasitic gaps are not admitted in trees involving subject extraction via SLASH termination metarule 2 (STM 2). STM 2 introduces SLASH on the mother category.

(v) STM 2
 $\bar{X} \rightarrow \bar{W}, S[\text{FIN}] \Rightarrow X/\text{NP} \rightarrow W, \text{VP}[\text{FIN}]$

(vib), for example, is derived from (via) by STM 2, where SUBCAT[40] verbs include *believe*.

(vi) a. $\text{VP} \rightarrow H[40], S[\text{FIN}]$
 b. $\text{VP}/\text{NP} \rightarrow H[40], \text{VP}[\text{FIN}]$

(vii) Who do you believe saw himself/* _____ in the mirror?

While local tree (viii) is admitted by the grammar, GKPS argue that (ix) is not.

A solution employing ID rule (38) may be a viable approach to a problem of preposition stranding. General locative and temporal adverbial PPs do not permit stranding (cf. Hornstein and Weinberg 1981).¹¹

- (44) a. On which day will Harry deliver the lecture?
 b.*Which day will Harry deliver the lecture on?
- (45) a. In which country do they hold elections every Thursday?
 b.*Which country do they hold elections every Thursday in?

If these adverbials are accessible to UDCs only through ID rule (38), preposition stranding is clearly impossible, since an adverbial phrase does not even appear on the right-hand side of the rule. This then seems to be a promising solution at least in the case of locative and temporal PPs, which do not permit stranding.

4. ADVERBS IN LEXICAL VP

Some adverbs permit preposition stranding, a fact which does not follow from a slash termination ID rule (38).¹² Consider the following.

- (46) a. With which tool did Felix fix the radiator?
 b. Which tool did Felix fix the radiator with?
- (47) a. For whom did Felix sing that song?
 b. Who did Felix sing that song for?

Suppose we say such adverbial PPs are in lexical VP. In point of fact, the line between

(viii) VP/NP

V

VP[FIN]

(ix) VP/NP

V

VP[FIN]/NP

The latter violates the FOOT feature principle, since the daughter VP contains instantiated SLASH while the mother does not. That is, SLASH is inherited in the mother and, further, the authors assume that the mother cannot contain a second token of SLASH[NP] (i.e., VP/NP/NP).

But, as noted above, $\{\alpha, \alpha\} = \{\alpha\}$ -- VP/NP is equivalent to VP/NP/NP and vice versa, if both tokens of NP are identical. If a tree such as the following passes the FFP, GKPS's argument would not go through. In fact, the distinction between inherited and instantiated features in the FFP is at risk, since for any case where a feature specification is inherited, we can imagine an analogous category containing an additional, instantiated token of the same specification.

(x) S/NP _{α} /NP _{α}
 VP/NP _{α}

It may not be immediately obvious that multiple tokens of specifications is relevant to the case at hand, since one might assume that the NP gap in the VP daughter in (x) could not be identical to the inherited SLASH[NP] specification on the mother. The latter would have to be nominative (since the AGR value in finite VP forces this). In point of fact, the NP value of SLASH in the daughter would also be nominative if STM 2 applied in a subordinate structure, as in the following example,

modifiers and complements is fuzzy in this domain.¹³ Possibly instrumental adverbs are introduced as optional complements by the following metarule.

(48) Instrumental Metarule.

$VP \rightarrow W \Rightarrow VP \rightarrow W, PP[\text{with}]$

Conceivably this applies to *for*-PPs as well, though for some verbs we also find the ditransitive construction.

(49) Felix fixed a sandwich for Alice.

(50) Felix fixed Alice a sandwich.

At least in these cases we may simply treat the *for*-PP as an optional complement in a basic ID rule.¹⁴

(51) $VP \rightarrow H[\#], NP, (PP[\text{for}])$

The latter solution may also be plausible for *on*-PP instrumentals, which probably are more restricted than *with*-instrumentals.

(52) a. Felix played the sonata on a violin.

b. Which violin did Felix play the sonata on?

(53) a. Felix computed the answer on my sliderule.

b. Which sliderule did Felix compute the answer on?

The line between *on*-instrumentals and locatives in lexical VP is not clear, as in the

 where *e* is given as a guide, though it would not be in the tree.

(xi)*Who do you believe *e* thinks *e* is clever?

So we would be considering a category VP/NP/NP, where the two tokens of SLASH[NP] could be identical - a set containing two tokens of the same element.

This problem would appear to arise in *tough*-constructions as well.

(xii)*This salami, this salami is difficult to slice *e*.

The offending local tree is (xiii).

(xiii) $A^1[\text{AGR}[\text{NP}]]/\text{NP}$

A

VP[INF]/NP/NP

One token of SLASH[NP] is inherited in VP and the other is instantiated. The instantiated token of SLASH forces SLASH on the mother, while the inherited one agrees with AGR in the mother by the CAP.

As it turns out, multiple tokens of the same feature specification - while formally possible if we view categories as sets - is not pernicious as far as the FOOT Feature Principle is concerned. The FFP is stated as follows (GKPS: 82).

(xiv) Definition 2: Foot Feature Principle

Let Φ_r be the set of projections from *r* where $r = C_0, \dots, C_n$.

Then $\phi \in \Phi_r$ meets the FFP on *r* if and only if

$\phi(C_0) \mid \text{FOOT-C}_0 = \cup_{1 \leq i \leq n} \phi(C_i) \mid \text{FOOT-C}_i$

$\phi(C_0) \mid \text{FOOT-C}_0$ is a subset of $\phi(C_0)$, namely the one whose domain is FOOT-C_0 . This, in turn is $\{f \mid f \in (\text{DOM}(\phi(C_0)) \cap \text{FOOT}) - \text{DOM}(C_0)\}$. Suppose we say that SLASH is in $\text{DOM}(\phi(C_0))$ twice and perhaps even in $(\text{DOM}(\phi(C_0)) \cap \text{FOOT})$ twice.

following examples.

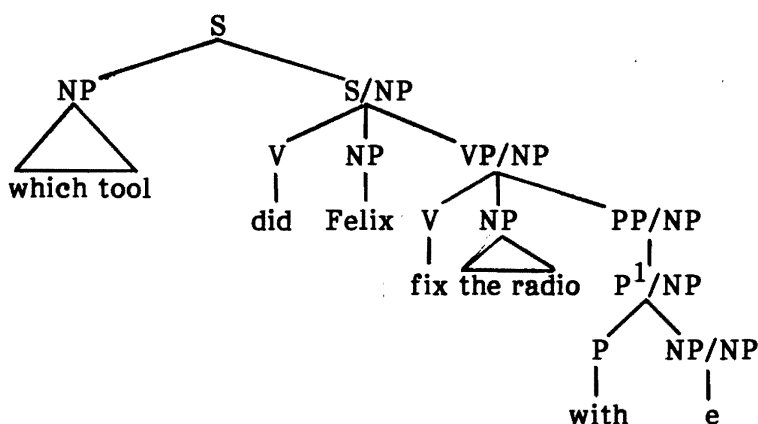
(54) Which lathe did Alice turn these posts on?

(55) Which sink did Felix wash the dishes in?

It seems reasonable to assume in all such cases that PP is in lexical VP. The question is whether it is an optional element in a lexical ID rule (i.e., in a subcategorization frame, a functional structure) or it is introduced by a metarule. I leave this open.

Suppose then that (46b) is as in the following tree (56).

(56)



Local tree (57) is well-formed, since the HFC is always overridden when the head is lexical because a FCR prevents lexical categories from containing SLASH (i.e., it is not free in lexical categories).

(57) VP/NP

V

NP

PP/NP

Even so, it cannot be in $(\text{DOM}(\phi(C_0)) \cap \text{FOOT}) - \text{DOM}(C_0)$, as it is in $\text{DOM}(C_0)$. Put differently, $\text{SLASH} \notin \{\{\text{SLASH}, \text{SLASH}\} - \{\text{SLASH}\}\}$, since the set difference here is $\{x \mid x \in \{\text{SLASH}, \text{SLASH}\} \ \& \ x \notin \{\text{SLASH}\}\}$, the empty set.

11 Grammaticality judgements vary in this domain and it is possible that locatives may pattern more like instrumentals (discussed below) under certain circumstances, as in (i) Which restaurant did John meet Mary at?

Some speakers may accept this under the interpretation where a prearranged rendezvous is involved.

12 It is relevant to note that stranding would be impossible even given the earlier analysis in (34) through (36), since the presence of [+NULL] forces SLASH termination due to a feature specification default in GKPS: FSD 3: -[NULL]. If a [+NULL] category is a mother in local tree it will violate this default and be inadmissible, hence it must terminate in the phonologically null lexical item e.

13 Bresnan (1972: 165), for example, treats instrumentals as optional complements.

14 This is essentially GKPS's treatment, though the PP is not optional in their ID rule.

We arrive then at a strong hypothesis: prepositional phrases which permit stranding are in lexical VP, those which do not are outside. This result is reminiscent of Hornstein and Weinberg's (1981), though the analysis above is framed in a well-defined theoretical context in contrast to HW's use of reanalysis in the domain of a lexical head. PP in recursive VP is accessible to termination through an ID rule (38) but stranding is impossible since that entails free instantiation of SLASH on a nonhead in recursive VP, which violates the HFC. PP in lexical VP is accessible to termination via STM 1 but stranding is possible since free instantiation of SLASH on a nonhead is permitted without violating the HFC, as lexical V cannot contain SLASH.

5. ADJECTIVAL ADVERBS AND PP EXTRAPOSITION

We have not determined whether adjectival adverbs - those treated as AP[+ADV] in GKPS (e.g., *ly*-adverbs) - appear in recursive or lexical VP. The facts are not clear. I tentatively conclude in this section that such adjectival adverbs are in recursive VP. This entails extraposition of complements when the adverb appears between the verb and a complement, though PP extraposition seems warranted in other cases as well. A new categorial feature - SHIFT - is posited in order to account for differences between PP extraposition and unbounded dependency constructions.

No analog to stranding exists in adjectival adverbs since they do not take internal constituents which would be accessible to extraction. For example, they do not permit complements even if corresponding adjectives do.

(58) Felix was tired of the commotion.

(59) Felix left tiredly (*of the commotion).

These adverbs seem to be permitted between a verb and its complements, which on first blush might lead one to believe they appear in lexical VP like instrumentals.

(60) Felix sends roses frequently to his grandmother.

(61) Harold talks to Alice often about his problems.

However locatives and temporals also interrupt elements in lexical VP.

(62) Felix sent roses on Valentine's Day to his grandmother.

(63) Harold talked to Alice in the park about his problems.

Hornstein and Weinberg (1981) note that preposition stranding is blocked in these contexts.

(64) a. Who does Felix send roses to frequently?

b. *Who does Felix send roses frequently to?

(65) a. Which problems does Felix talk to Alice about often?

b. *Which problems does Felix talk to Alice often about?

(66) a. Who did Felix send roses to on Valentine's Day?

b. *Who did Felix send roses on Valentine's Day to?

They assume the PP complement is extraposed when a temporal or a locative intervenes and that adjectivals occur in minimal VP due to scrambling. It is not obvious to me that the two cases should be distinguished, although the facts are not altogether clear in this domain as grammaticality judgements are somewhat fuzzy. For example, if an adjectival

adverb is quantified stranding is much better.

(68)?Who does Felix send roses most often to?

(69)?Which problems does Felix talk to Alice most frequently about?

Suppose we say that both types of adverbs block stranding and that they do not occur in lexical VP. We can assume that whenever complement PPs follow such adverbs they are extraposed. This raises certain questions. If extraposition involves the feature slash we would predict that the extraction site should be an island, though this is not the case.

(70) Who does Felix [talk to e e] frequently about his problems?

(71) Who did Felix [talk to e e] in the park about his problems?

That is, the lowest VP in these examples - [talk to e e] should be an island, otherwise it would contain two tokens of SLASH, which is impossible.¹⁵

(72) VP/NP/PP[about]

V

PP[to]/NP

e

A second problem involves the possibility that such rightward dependencies are bounded, which certainly does not follow from the use of SLASH.

(73) a. ? Harold told me that Felix talks to Alice frequently about his problems a few minutes ago.

b. * Harold told me that Felix talks to Alice frequently a few minutes ago about his problems.

(74) a. Marsha persuaded Felix to talk to Alice frequently about his problems a few minutes ago.

b. * Marsha persuaded Felix to talk to Alice frequently a few minutes ago about his problems.

That is, it appears that the dependency cannot extend beyond the relevant head path, as discussed below. However Gazdar (1981) concludes that rightward dependencies are unbounded on the strength of the following examples.¹⁶

(75) a. I have wanted to know exactly what happened to Rosa Luxemburg for many years.

b. I have wanted to know for many years exactly what happened to Rosa Luxemburg.

(76) a. I had hoped that it was true that Rosa Luxemburg had actually defected to Iceland for many years.

b. I had hoped that it was true for many years that Rosa Luxemburg had actually

¹⁵ See footnote 10. The argument here is, of course, not compelling since cases of multiple extraction are well documented in the literature (e.g., Maling and Zaenen 1982, Rivero 1980, Rizzi 1978). Cases of putative multiple extraction exist in English if one assumes tough-movement involves SLASH, as do GKPS.

¹⁶ (i) Which violin would this sonata be easy to play on?
Gazdar cites Postal (1974), citing Witten (1972) for examples (75) and Janet Fodor, personal communication, for (76) and (77) (Gazdar's (71)-(73)).

defected to Iceland.

- (77) a. I have wanted to meet the man who spent so much money planning the assassination of Kennedy for many years.
 b. I have wanted to meet for many years the man who spent so much money planning the assassination of Kennedy.

I am not so sure these go through unless *for many years* is a parenthetical (with appropriate comma pauses). Cases where a complement - an agent phrase - intervenes do not strike me as grammatical.

- (78) a. Felix is believed (by the police) to know what happened to Rosa Luxemburg (by the police).
 b. * Felix is believed to know by the police what happened to Rosa Luxemburg.
 (79) a. Felix is thought (by many people) to believe that is true that Rosa Luxemburg had actually defected to Iceland (by many people).
 b. * Felix is thought to believe by many people that it is true that Rosa Luxemburg had actually defected to Iceland.
 (80) a. Felix is believed (by the police) to have met the man who spent so much money planning the assassination of Kennedy.
 b. * Felix is believed to have met by the police the man who spent so much money planning the assassination of Kennedy.

Unfortunately the relevant data do not come to us on a silver platter. Examples (78) through (80) may be beside the point if the agent phrase itself is extraposed whenever it is not adjacent to the passive participle, since the (b) examples may involve extraposition of both the agent and the final constituent. Leaving aside multiple extractions as in (63) and (64), we might say that (78b)-(80b) are ungrammatical because the constructions involve multiple instances of SLASH. For example, *believed to know* in (78b) may have the following local tree.

- (81) VP/PP[by],/S
 V
 e
 VP/S

The problem here is the fact that infinitives and subordinate clauses are final in lexical VP in English, so it is impossible to identify clear cases where elements from these constituents are extraposed over complements of higher verbs. We could always assume multiple extraction as in (81). It would seem that we are reduced to considering extraposition over adverbs, where the facts are unclear. In the face of examples such as (73) and (74), let us assume that extraposition of complement PP is bounded. This leaves open the possibility that some other mechanism is responsible for other cases of rightward dependencies such as heavy NP shift in (77).

Given that PP extraposition contexts are not extraction islands (cf. (70) and (71)) and taking the somewhat arguable position that we are dealing with a bounded dependency, it is less than obvious that the feature SLASH is involved. These problems vanish if we posit a second feature much like SLASH in the following metarule.

- (82) PP Extraposition Metarule.

VP → W, PP[PFORM α] => VP[SHIFT [PP[PForm α]]] → W

This feature, SHIFT, will be a HEAD feature and a control feature, though not a FOOT

feature. The top of an extraction dependency is handled by the following ID rule.¹⁷

(83) VP → H[SHIFT X²], X²

Unlike SLASH, SHIFT does not involve unbounded dependencies since it is not directed up beyond the head path by the Foot Feature Principle and is subject to a feature specification default blocking gratuitous instantiation: FSD: ¬[SHIFT].¹⁸

This prevents SHIFT from migrating off the head path, hence blocking UDCs in the ungrammatical (73) and (74) above, as in the following local trees (where // denotes SHIFT).

(84) VP//PP
 V
 S//PP

(85) VP//PP
 V
 NP
 VP//PP

SHIFT violates the FSD in both the mother and the daughter. If SHIFT were a FOOT feature, the FSD would be forgiven. Since it is not, no principle sanctions its presence in these categories, in violation of the FSD.¹⁹

Since SHIFT and SLASH are distinct features, they may cooccur as in the following tree.

¹⁷ Clearly SHIFT must then be a control feature, as the CAP must trigger agreement between PP and the value of SHIFT.

¹⁸ If I am wrong in assuming that PP extraposition is bounded, then SHIFT is a FOOT feature. Positing a distinct categorial-valued feature would still account for the possibility of apparent multiple extraction (cf. (73) and (74)) in face of the well-documented fact that multiple wh-extractions are not possible in English. Clearly a solution along these lines is also available for tough-movement constructions (cf. (i) in footnote 15), where a categorial-valued HEAD and FOOT feature, call it TUFF, could be posited at no great expense to the grammar.

¹⁹ Nothing prevents matrix S from containing SHIFT, though, yielding cases where there is no controller:

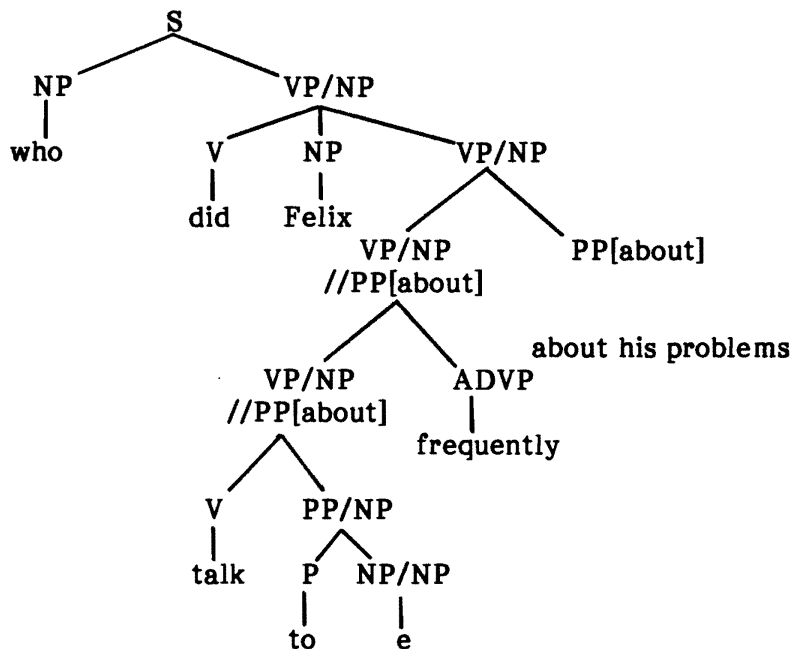
(i) [SS//PP[about]Felix[VP//PP[about][VP/PP[about]talked to Alice e] frequently]]

This strikes me as no more of a problem than analogous cases where SLASH finds no controller in GKPS's analysis.

(ii) [S/NPFelix[VP/NPtalked to Alice about e]]

We can say that these are well-formed clauses but the pragmatics blocks them from functioning as independent sentences, though this is an arguable point and perhaps some principle should guarantee that such features ultimately find a controller.

(86)



Clearly PP extraposition predicts that stranding will be impossible in these contexts (cf. (64)–(67)) since the complement PP will not be in lexical VP so free instantiation of SLASH will violate the HFC. While it may be premature to draw any firm conclusions, this seems to be a possible approach to rightward dependencies.

6. CONCLUSIONS

This paper has offered an account of UDCs involving adverbials which distinguishes between cases where preposition stranding is or is not permitted. Adverbs (or optional PP complements) in lexical VP are accessible to SLASH termination by STM 1 and also permit stranding via free instantiation of SLASH in PP in the usual way. PP adverbs which do not permit stranding are in recursive VP and would not participate in unbounded dependency constructions in the grammar presented in GKPS. However a SLASH termination ID rule (38) was proposed, following along the lines of a revision of STM 1 in Hukari and Levine (1987).

(38) VP/ADVP → H, e

Since SLASH is then inherited in any trees projected from this rule, this correctly overrides the HFC. It was also suggested that a solution along this line may work for languages which seem to permit free subject extraction (i.e., lacking the fixed subject constraint). By extension, this lends further credibility to the approach in Hukari and Levine (1987). This does however clearly show that the ECP generalization represents only the unmarked case in generalized phrase structure grammar, a state of affairs which may be overridden by an ID rule which introduces unbounded dependency features.

A possible solution to bounded rightward dependencies was proposed in the context of PP extraposition, employing a new categorial feature SHIFT. While the hypothesis that adjectival adverbs are always in recursive VP may warrant further investigation,

extraposition around locative and temporal adverbs seems plausible.

REFERENCES

- Bresnan, J. (1972). *Theory of Complementation in English Syntax*. Doctoral dissertation, published in 1979. New York: Garland Press.
- Bresnan, J. (1982). Polyadicity. Pp. 149-172 in *The Mental Representation of Grammatical Relations*. J. Bresnan, ed. Cambridge, MA: MIT Press.
- Chomsky, N. (1977). On Wh-Movement. Pp. in *Formal Syntax*. P. Culicover, T. Wasow, and A. Akmajian, eds. New York: Academic Press.
- Chomsky, N. (1981). *Lectures on Government and Binding*. Dordrecht: Foris.
- Engdahl, E. (1984). Subject Gaps: An Assymetry Between Questions and Relatives in Norwegian. Presented at the Northeastern Linguistic Society 14.
- Gazdar, G. 1979a. *Constituent Structures*. Unpublished manuscript.
- Gazdar, G. 1979b. *English as a Context-Free Language*. Unpublished manuscript.
- Gazdar, G. (1981). Unbounded Dependencies and Coordinate Structure. *Linguistic Inquiry* 12: 155-184.
- Gazdar, G. (1982). Phrase Structure Grammar. Pp. 131-168 in *The Nature of Syntactic Representation*. P. Jacobson and G. Pullum, eds. Dordrecht: Reidel.
- Gazdar, G., E. Klein, G. Pullum and I. Sag. (1982). Coordinate Structure and Unbounded Dependencies. Pp. 38-68 in *Developments in Generalized Phrase Structure Grammar: Stanford Working Papers in Grammatical Theory*, 2. M. Barlow, D. Flickinger and I. Sag, eds. Bloomington, IN: Indiana University Linguistics Club.
- Gazdar, G., E. Klein, G. Pullum and I. Sag. (1985). *Generalized Phrase Structure Grammar*. Oxford: Basil Blackwell.
- Geis, M. (1985). On the Superiority of Monostratal to Multistratal Accounts of Adverb Preposing. Presented at ESCOL.
- Hornstein, N. and A. Weinberg. (1981). Case Theory and Preposition Stranding. *Linguistic Inquiry* 12: 55-91.
- Hukari, T. and R. Levine. (1986). Parasitic Gaps, Slash Termination and the C-Command Condition. To appear in *Natural Language and Linguistic Theory*.
- Lakoff, G. (1972). Linguistics and Natural Logic. Pp. 546-665 in *Semantics of Natural Language*. D. Davidson and G. Harman, eds. Dordrecht: Reidel.
- Maling, J. and A. Zaenen. (1978). The Nonuniversality of a Surface Filter. *Linguistic Inquiry* 9: 475-497.
- Maling, J. and A. Zaenen. (1982). A Phrase Structure Account of Scandinavian Extraction Phenomena. Pp. 229-282 in *The Nature of Syntactic Representation*.

P. Jacobson and G. Pullum, eds. Dordrecht: Reidel.

- Pullum, G. (1986). On the Relations of IDC-Command and Government. Paper presented at the West Coast Conference on Formal Linguistics, Seattle, Washington.
- Pollard, C. (1985). Phrase Structure Grammar without Metarules. Unpublished manuscript.
- Postal, P. (1974). *On Raising*. Cambridge, MA: MIT Press.
- Reinhart, T. (1976). The Syntactic Domain of Anaphora. Ph.D. dissertation, MIT.
- Reinhart, T. (1983). *Anaphora and Semantic Interpretation*. Chicago: University of Chicago Press.
- Rivero, M. (1980). On Left-Dislocation and Topicalization in Spanish. *Linguistic Inquiry* 11(2): 363-393.
- Rizzi, L. (1978). Violations of the Wh-Island Constraint in Italian and the Subjacency Condition. *Montreal Working Papers in Linguistics* 11.
- Sag, I. (1983). On Parasitic Gaps. *Linguistics and Philosophy* 6: 35-45.
- Shieber, S. (1985). Evidence Against the Context-Freeness of Natural Language. *Linguistics and Philosophy* 8: 333-343.
- Witten, E. (1972). Centrality. Report No. NSF-28 to The National Science Foundation, The Computation Laboratory of Harvard University, Cambridge, MA.

