

## LOGIC, SYNTAX, AND GRAMMATICAL AGREEMENT\*

Geoffrey K. Pullum  
University of California, Santa Cruz

Many languages--unlike, for example, Japanese--exhibit morphological complexity traditionally described in terms of one constituent "agreeing" with another. Roughly, A is said to agree with B in a syntactic constituent C if the inflectional properties of A must be set in a way determined by certain feature inherently associated with B, so that if B is retained in C and the inflectional morphology of A is altered, the sentence can be rendered ungrammatical. Agreement is a syntactic phenomenon, but it has been argued by some--particularly Keenan (1975) and Gazdar, Klein, Pullum, and Sag (in press) to be determined in an interesting way by aspects of semantics and logic. This is the reason for the reference to logic in my title, and the presence of this paper in the proceedings of a panel session on the role of "logical grammar" within generalized phrase structure grammar.

The limits to complexity in possible agreement systems are still ill-understood and very poorly represented by current theories. In this paper I argue that despite the very considerable complexity found in grammatical agreement, present indications are that phrase structure grammars of the sort that induce context-free languages (henceforth, PSGs) can provide adequate and interesting accounts of them. I deal with a number of phenomena that have been alleged to offer difficulties for PSGs, including the supposed initial term (deep structure) agreement determination of Achenese described by Lawler (1975, 1977), the putatively non-context-free properties of Albanian agreement recently discussed by Morgan (1984), and the problem of agreement with objects as well as subjects. I will argue that claims regarding the possibility of phrase structure descriptions of agreement have been exaggerated.

### 1. General properties of agreement systems

Agreement has been treated dismissively and superficially in the Transformational grammar (TG) literature, where it has been treated at all. Occasionally Chomsky has made brief remarks about how "agreement rules...have something of the character of phonological rules of matching of feature matrices" (Chomsky 1976, 346; cf. 1965, 175-6). But this is hardly to be taken seriously. Syntactic agreement is nothing like assimilation in segmental phonology. It is not local (cf. especially Andrews 1971, 1982), and moreover, matching of feature matrices does not appear to be a general enough mechanism to encompass what we find in syntactic agreement systems. Perhaps the clearest illustration of this comes from the phenomenon of polarity switching in Semitic agreement systems, where, for example, the feminine singular may be used on a masculine noun to indicate plurality (see Barlow

1983, and also Zwicky and Pullum 1983). Further illustrations can be found in the data from Spanish and Walbiri given by from Moravcsik (1978, 351), showing something like the effect of apposition conveyed by a mismatch between third person NPs and first person verbs (as in, for example, the Spanish Nadie lo vimos 'No one (of us) saw him'). A different type of mismatching is cited from Talitsk dialect of Russian by Corbett (1983b) and is also found in Tzotzil (Judith Aissen, personal communication): plural verbs are found with singular subjects, the meaning of the clause in question conveying that the referent of the subject is acting in concert with some other entity (e.g. Tzotzil ?i-bat-ik li xune [Asp-go-3pl Art John] 'John and someone else went').

These cases are of some theoretical importance, since the assumption that features must match in agreement contexts motivates much work on ensuring appropriate assignment of feature values. For example, in the case of coordinate structures (see Farkas and Ojeda, in press; Sag, Wasow, Gazdar and Weisler, forthcoming): if are is found with plural subjects, but also with subjects that are coordinate but have singular conjuncts (Kim and Sandy are happy), the assumption is immediately made that Kim and Sandy must be a plural NP, not that mismatches of agreement features are allowed in case of coordinate subjects. This may well be correct in this case, but logically things could be otherwise. Although current theories simplify things by speaking of identity between feature values, what is needed is a more abstract view in which feature specifications are linked by the syntax, with the realization of linked features being a separate, morphological matter.

Another interesting thing about the above cases is that they clearly show the influence of semantic factors on syntactic agreement. In each case, the agreement exhibited by the verb is (to put it loosely) more appropriate to the overall meaning of the sentence than is the syntactic person or number of the subject NP. It has not gone unnoticed that agreement is determined in part by the meanings of constituents (see in particular Morgan 1972, 1984); but the phenomenon of semantic determination of agreement has not been studied in any serious way.

Consider next the question of the actual range of agreement categories that universal grammar must make available. Is there truly any sign of a grammatically specified limit on this range, or on the ways in which grammatical rules may make reference to categories within it? A brief catalog of agreement properties may be useful at this point. [1]

PERSON: There is a universal set of hierarchically ranked categories First (or Speaker-including), Second (or Hearer-including), and Third (or Other-including), which I shall notate with the feature specifications [PER 1], [PER 2], and [PER 3] respectively. But within each there are parochial (nonuniversal) subdivisions of some complexity. Many languages subdivide [PER 1] into inclusive and exclusive; many divide

[PER 2], and sometimes other person categories, to indicate various degrees of politeness or formality (four degrees in Japanese, for example); and the Algonquian and Athabaskan languages are well known to divide [PER 3] into subcategories of "obviation" (for example, in Potawatomi and Cree there are three subdivisions, "proximate," "obviative," and "farther obviative"), with uses such as distinguishing an earlier-introduced participant from a later-introduced one. Any of the subdivisions may play a role in verbal agreement.

NUMBER: There is a basic universal distinction between Singular ([NMB:1]) and Plural ([NMB:@] where @ > 1), but within Plural, Dual and Trial may be distinguished from plurality of greater degrees than 2 or 3; Whorf reported for Hopi a distinction between "Paucal" and "Multiple"; Collective may be distinguished from Individual (cf. English several fish, suggestion a collectivity, vs. several fishes, suggesting a number of individuals), and Numerated (countable) plurals may be distinguished from non-Numerated (uncountable).

GENDER: This very general category covers not only the familiar Masculine [GND:masc], Feminine [GND:fem], and Neuter [GND:neut] of Indo-European languages, but also a wide range of inherent properties of nouns with connections to metaphysical categories like humanness or animacy, and classifications like the twenty-odd noun classes of the Bantu languages. The Bantu languages alone give us some reason to think that there is no sign of a grammatical upper limit to the number of gender distinctions a language may manipulate in its agreement system.

CASE: Modifying or pronominal constituents may exhibit agreement in the feature [CASE]. Moreover, in some languages an agreement affix on the verb may indicate not only the person and/or number and/or gender of an NP controller but also its case (cf. e.g. Choctaw; Perlmutter (1982, 306), Davies (1981)). There is no sign of a grammatically principled upper limit on the number of cases a language may exhibit; the Uralic languages are famous for their large case inventories.

I think it is clear from this brief review that there is no plausibility to the notion that some principle of universal grammar restricts the class of agreement categories available to natural languages to some interestingly constrained set (cf. the strange and indefensible idea of Chomsky (1981) that linguistic theory provides a finite number of parameters on which individual grammars pick values from a finite range, making the total class of available grammars finite; see Pullum (1983) for critical discussion).

The set of person distinctions extends as far as anyone could reasonably wish for convenient reference to people and things and their relations to the context, distinguishing such entities as me, you (my buddy), you (my superior), this first guy, that second guy, that other guy, us but not you, all of us including you, and so forth. The set of number distinctions found likewise uses up just about every perceptually salient possibility for distinguishing variously sized sets: singletons, doubletons, triples, small sets, big sets, counted sets, uncounted sets, sets as aggregates, sets composed of a number of specific individuals. (Consider, for example, the rooms in a hotel are categorized: singles, doubles, triples, small meeting rooms, large meeting rooms. Why would anyone need a language that provided a significantly finer taxonomy than this in its grammatical apparatus?) And finally, with gender and case we find no apparent ceiling on the number of distinctions available, and even for attested languages they run into the dozens.

Of course, this is not to say that we will not find in each individual language that just a finite class of agreement categories is exploited (though this is not logically necessary; cf. below). The point is that universal grammar seems to be providing an unbounded array containing just all the categories one could conceivably want to use for classifying linguistic items, rather than some grammatically constrained subset of it, and unboundedly complex agreement systems seems to be constructible as a result.

A certain amount of order and restraint is found when we turn to the issue of what may agree with what. Call a constituent a controller if its properties determine the features carried by a constituent that exhibits syntactic agreement, and call the constituent exhibiting the agreement a target. The class of possible controllers is interestingly limited, as is well known. It is not random constituents in a sentence but virtually always constituents in the N projection that can be argued to be controllers. Targets are not randomly distributed across categories either. The only things that are typically taken to agree have categories other than those in the N projection: verbs (in every language that has agreement, I suggest), adjectives and articles (in some languages), and perhaps prepositions (in Welsh), complementizers (in Arabic), etc. If there are instances of nouns agreeing, it is only in the special case of predicate nominals. Clearly, what this suggests is that the noun, typically an argument semantically, is the archetypal controller, and other categories, typically functions or operators semantically, is the archetypal target. This is the generalization suggested by Keenan (1975, 302):

- (1) Function symbols may present a morpheme whose form is determined by the noun class of the argument expression.

By a "function symbol" Keenan means a terminal symbol that corresponds to a function under the mapping that assigns interpretations to syntactic constituents. (This means nothing in the context of a linguistic theory that does not provide a semantics for its syntax, of course.) And "noun class" must be interpreted to denote a class of nouns characterized by what I have earlier called an agreement feature-value cluster; in effect, a "noun class" is a category specified by reference to the features PER, NMB, GND, CASE.[2]

One approach to rendering precise the intuitive content of Keenan's generalization is the one that has led to the formulation of the Control Agreement Principle (CAP) of Gazdar, Klein, Pullum and Sag (in press; henceforth GKPS). A full statement of the CAP can only be given in the context of a detailed theory of semantic types for natural language and an integrated theory of feature instantiation principles that allows for interactions between the CAP and other universal and parochial statements. The connection between semantic type and syntax here is an unusual example of something normally thought of as syntactic or morphological having a basis in semantics or logic (hence the title of this paper). However, I do not have the space to detail the underlying semantic treatment here. For a full account, see chapter 5, section 3, and also chapters 9, and 10, of GKPS.

For present purposes, I will summarize nontechnically the essential consequences of the CAP. I will refer to denotations directly, but note that in GKPS the reference is indirect, via the types assigned to lexical items in the lexicon. The CAP guarantees (at least) the following, where "local tree" means a node and its daughter nodes (but not the content of the constituents dominated by the daughters):

- (2) Control Agreement Principle (partial paraphrase)

- a. In a local tree containing a daughter D denoting a function F on noun phrase denotations and a noun phrase D' whose denotation is the argument to F in the interpretation of that local tree, the agreement features of D are required to be identical to those of D'.
- b. In a local tree containing a daughter D denoting a function F on noun phrase denotations but no noun phrase that is the argument of that function in the interpretation of that local tree, the agreement features of D are required to be identical to those of its mother.

In GKPS, the HFC is taken to be subordinate to the CAP in the sense that it is a default statement: it operates only in cases where neither the CAP nor any other absolute conditions are contradicted. In effect, it says this:

(3) Head Feature Convention

If it is possible for a head daughter and its mother to agree on a feature value v without conflicting with any value dictated by the CAP, or by a rule, or by a feature cooccurrence restriction, then they must agree on v.

The following contexts for grammatical agreement are known from many natural languages:

- (4)
- a. verbs agree with their subject NPs
  - b. determiners agree with their nouns
  - c. attributive adjectives agree with the nouns they modify

At least some languages exemplify the following:

- (5)
- a. verbs agree with their direct objects
  - b. verbs agree with their indirect objects
  - c. prepositions agree with their object NPs

English instances (4a) and (4b), but none of the properties in (5). It also instances all of the following types of grammatically governed agreement:

- (6)
- a. reflexive and reciprocal pronouns agree with their antecedents
  - b. extracted constituents trigger agreement as if they were not extracted
  - c. the relative pronoun in a relative clause agrees with the head noun

And, finally, the much more general condition:

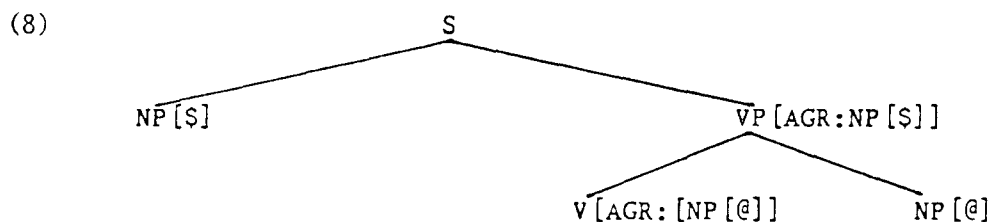
- (7) Nominal anaphors agree with their antecedents

I will not deal with (7) here. Although the undeveloped hints of Chomsky (1981) apparently seek to deduce subject-verb agreement and other agreement patterns from the principle stated in (7), it is well known that there are striking differences between the two types of system in many languages; see in particular Corbett (1983b, *passim*). I will concentrate on the syntactically much tighter systems listed in (5)-(6).

The approach taken in GKPS is to attempt the unification of (5) and (6) by formulating the CAP to cover them both. (Notice that this may be striving for too much; the CAP would be much simpler if it had only (5) to deal with, (6) falling under different principles applying to anaphoric items generally.) It would be straightforward to allow for (5c), as in Welsh and certain other languages, as well; GKPS specifically excludes preposition agreement by disallowing the cooccurrence of AGR with [-N, -V], though in fact this is unnecessary given a broader restriction applying to English, namely that only phrasal categories act as controllees for the CAP. Thus VP's have AGR values matching their subjects, but verbs do not have AGR values matching their objects. In any case, for other languages these parameters must be varied: in languages like Swahili, verbs do agree with their objects, so lexical categories must be included in the class of controllees; and in Welsh, prepositions agree with pronominal NPs, so [AGR:[NP[+PRO]]] would have to be allowed on prepositions.

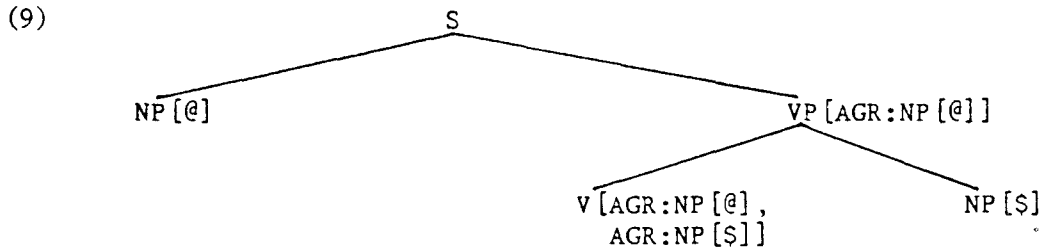
Covering (5a) and (5b) is still a problem for current research, but I believe the problem is likely to yield a solution. I will briefly sketch the line that I think would be appropriate for handling direct object agreement, and try to show how it would be modified to handle absolutive agreement. Indirect object, as in Basque or Georgian, raises further difficulties, but I think the same approach might be extensible to that case.

In an SVO language where lexical categories can be controllees, such as Swahili (but not English), the agreement markings that would be determined by the CAP alone in a transitive sentence are shown in (8).



There is a crucial question here about how the CAP and the HFC should interact. If the feature marking determined by the HFC appears, the verb will agree with just the subject. If the CAP takes precedence, we would expect verbs to agree only with their objects in transitive clauses. This is a situation that appears to obtain in some languages with ergative agreement systems--for instance, Hindi, insofar as perfect tense sentences are concerned--but must be blocked for English by not allowing transitive verbs to count as controllees in the relevant sense, so that the HFC takes over. But in Swahili and other Bantu languages, the verb agrees with both subject and object. How could this possibility be allowed for? It is not explicitly

allowed for in GKPS. But suppose that the HFC and the CAP were reformulated to interact cumulatively--to put it in procedural terms, suppose that AGR specifications that satisfied the HFC were added to a daughter that bore a CAP-determined AGR value, placing them on the beginning of a list of AGR values. We would then obtain structures like this:



Stephen Anderson has stressed in a number of recent papers (e.g. 1982, 1983) that we must distinguish the abstract morphological structure associated with a word from the simple linear arrangement of affixes and roots that we see in their syntagmatic word structure, because the two may be related in non-straightforward ways. Languages could be assumed to have verbs with abstract morphological structure representable (simplistically) as (10):

- (10) VERB STEM  
 AGREEMENT FEATURE-VALUE CLUSTER 1  
 AGREEMENT FEATURE-VALUE CLUSTER 2  
 . . .

A simple syntax-to-morphology mapping might say:

- (11) Determine values for agreement feature clusters, top down, reading feature values from the list of AGR values on the V category, left-to-right.

This would describe a language with two agreement value clusters determined in nominative-accusative fashion. To describe Swahili, for example, one merely has to say (as anyone's morphology for Swahili does) that the verb has an internal syntagmatic structure like (12):

- (12) [AFFIX-1 AFFIX-2 AFFIX-3 VERB-STEM]

and AFFIX-1 is selected according to cluster 1 in the verb's syntactic structure, AFFIX-2 according to the tense of the clause, and AFFIX-3 according to cluster 2.



Now notice that English has just a single suffix position, and in the one case where it is filled (the third person singular present indicative), the mapping principle (11) covers it. The word structure is different, namely (13):

(13) [VERBSTEM AFFIX-1]

and it shares with Swahili the rule that AFFIX-1 is selected according to cluster 1 (set by the HFC). Cluster 2 (set by the CAP) does not determine anything in the verb's syntagmatic structure in English.

Other mapping principles than (11) could cover other, strikingly different morphological systems on the basis of the same syntax. For example, consider the following alternative to (11):

- (14) Determine values for agreement feature clusters, top down, reading feature values from the list of AGR values on the V category, right-to-left.

This differs from (11) by a single parameter: the one determining the direction in which the list of AGR values is consulted is read is set to leftward instead of rightward. What it yields is an absolutive agreement pattern, where the verb suffix agrees with the direct object if there is one, and with the subject otherwise. This is what is found in Hindi in perfect tense sentences, for example.

Without meaning to suggest that there is an analysis here rather than just a program, [3] I hope I have made it clear why I think it is reasonable to examine questions of agreement in the context of a GPSG-style theory. Questions of whether GPSG can handle various types of agreement systems, such as the Bantu subject-object ones or Caucasian ergative-absolutive ones can be settled only on the basis of actual attempts to work out not only the gross syntax but also the exact statement of the feature distribution principles and their interactions; the mapping principles connecting syntactically fixed feature structure to abstract morphological structure of words; and the statement of the actual internal composition of words. Whether it can achieve descriptions of spectacularly difficult ones like Georgian (Anderson 1983), Southern Tiwa (Allen and Frantz 1978) or Chamorro (Chung 1982) is a question to be settled on the basis of serious efforts at providing a GPSG syntax plus a worked-out account of morphology for those languages, and this work has yet to be done.

Certainly it is within the realm of possibility that some agreement systems will prove too difficult for version of GPSG to cope with. It would be easier to have confidence of eventual success if it were not for the fact that some agreement systems seem remarkably irregular, riddled with ugly provisos and special

clauses. Complex agreement systems tend to have not only general systematicity but also special and peculiar wrinkles that cannot be ignored if linguistic theory is to be rigorously tested against data from agreement systems. I will have something to say about some kinds of wrinkles in what follows.

## 2. Achenese and the red herring of syntactic levels

Perlmutter (1982) provides an important critique of theories like GPSG, arguing that they cannot possibly be correct because they recognize no notion of syntactic levels. Perlmutter maintains that there are phenomena in natural languages of which no adequate account can be constructed without appeal to grammatical relations (subject, direct object, etc.) at more than one level or stratum in the syntactic description.

The critique is fundamental in its impact insofar as it is successful. It deserves not to be overlooked. However, discussion of Perlmutter's claims in the context of GPSG is quite difficult, because crucial assumptions differ between his relational grammar (RG) framework and GPSG. The most significant one in the present context is that I now believe the notion of syntactic levels is a red herring. It makes sense, I believe, to say that certain information can or cannot be extracted from the structural descriptions provided by a given grammar for a language, but it makes no sense to say that some of the information is at a different level from other information.

This viewpoint becomes particularly compelling to me in the context of work on the computational modelling of claims made by a linguistic theory. If the data structures built by the parser given a certain string as input contain certain information, and an algorithm can be devised for extracting it and displaying it if desired, this can be demonstrated simply enough. But how can the claim that a certain piece of information is "at a different level" from another be given empirical import? The question seems to make no sense. It may or may not be the case that the answer to one question (say, is the constituent xyz an NP?) is produced at an earlier stage of processing than the answer to another (say, does xyz agree with the VP uvw?), but in this sense it is trivial to define levels; a parsing algorithm can be modified to pause at any arbitrary stage of processing and set the value of a reserved variable to the structure it has currently constructed. As many such levels can be defined as one cares to name--and indeed, this is frequently done when natural language processing programs are under development, because it aids in debugging. But I am not sure there can be any linguistic reality or significance to such levels at all.

In a sense, this claim should be uncontroversial even within RG, since the notion of rules applying in sequence to yield a series of levels of representation like the derivations of TG was dropped many years ago by RG theorists. A syntactic structure is conceived of as a homogeneous graph-theoretic object containing

information about categories, grammatical relations, levels, and linear precedence simultaneously. If there is a meaningful dispute between GPSG and RG it should be about the content of the information that can be extracted and displayed in a parse, not about the way in which the information is displayed. It seems to me that the way to ensure that there is some content to the dispute is to concentrate upon the particular empirical challenges that Perlmutter has thrown down rather than the general issues about the existence of levels that he claims to be addressing. If there are indeed languages whose agreement systems simply cannot be revealingly described within GPSG, the theory may have to be rejected as inadequate. The great virtue of Perlmutter's paper is that it provides a compendium of challenge cases of this sort. I only have space here to consider one of them. Clearly, in due course the others must also be addressed by those interested in maintaining theories of syntax similar in relevant respects to GPSG.

The case I shall deal with is one of the earliest that was argued to give evidence for the independent syntactic status of "initial stratum" grammatical relations. Achenese, a language of Northwest Sumatra, has been claimed by Lawler (1975, 1977) to exhibit agreement determined by initial stratum subjecthood side by side with such things as Raising and Equi constructions whose structure is determined by reference to final stratum subjecthood. Perlmutter argues that this must defeat any theory that fails to postulate at least two distinct syntactic levels. To show that this is not true, I will give a detailed syntactic sketch of a large proportion of the Achenese data presented by Lawler in his papers. [4]

(15) Analysis of basic Achenese syntax  
Nonlexical ID rules:

S --> NP, VP  
R --> [SUBCAT nyeng], VP[(PAS)]  
 $\alpha$ [TSF  $\beta$ ] --> [SUBCAT  $\beta$ ],  $\alpha$                      $\beta$  a terminal symbol  
VP[PERF] --> ka, VP  
VP[IRR] --> ba?, VP  
NP --> N', Art  
NP --> N', R

Lexical ID rules

Sample lexical items:

VP --> V[SUBCAT 2], NP                    com 'kiss'  
VP --> V[SUBCAT 15], VP[-FIN]            ci 'try'  
VP --> V[SUBCAT 15'], VP[FIN]            uttheta 'attempt'

LP statements:

$$\text{NP} < \text{VP}$$
$$[\alpha\text{N}, \beta\text{V}, \gamma\text{SUBCAT}] < \text{X}$$

Feature cooccurrence restriction (FCR):

$$[\text{PAS}] \text{ implies } [+ \text{FIN}]$$

Defaults:

$$[- \text{FIN}]$$
$$[- \text{PAS}]$$
$$\neg [\text{TSF}]$$

Passive metarule:

$$\text{VP} \rightarrow \text{V}, \text{NP}, \text{W}$$
$$\Downarrow$$
$$\text{VP}[\text{PAS}] \rightarrow \text{V}[\text{AGR:NP}[\alpha]], \text{NP}[\alpha, \text{TSF } \underline{1e}], \text{W}$$

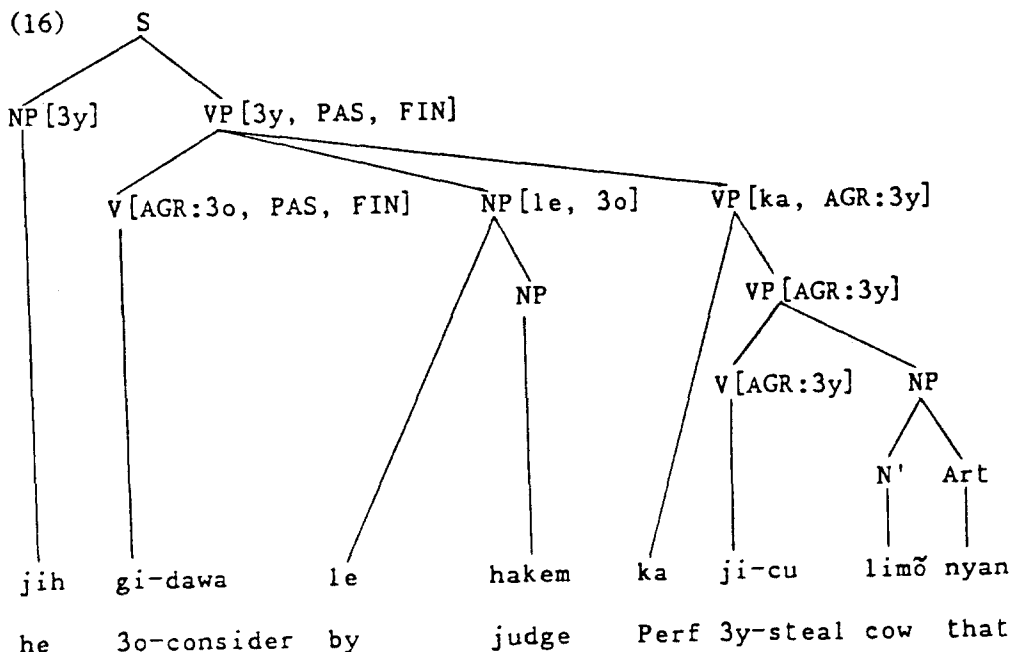
(where  $\alpha$  ranges over  $\{[\text{PER } \beta], [\text{NMB } \gamma]\}$ )

The notation and general syntactic assumptions are as in GKPS (cf. also Gazdar and Pullum 1982). ID rules state permissible mother-daughter pairings. SUBCAT is a feature of categories that takes as its value either the name of a specified grammatical item like ba? (Irrealis) or ka (Perfect) or an integer indexing a subcategory (the subcategories here, shown simply as numbers in feature brackets, are chosen to match the analogous ones in GKPS, chapter 6, and are illustrated at the right with a typical lexical item from the class). R is a relative clause. The third ID rule says that a category  $\alpha$  marked [TSF  $\beta$ ] may expand as a category [SUBCAT  $\beta$ ] (to which only the item  $\beta$  will belong) together with an instance of  $\alpha$ . The first LP statement says (with implicit universal quantification binding X) that major lexical categories with SUBCAT values precede all other (sister) categories in constituents. The feature cooccurrence restriction (FCR) says that passive constituents (PAS) are finite (FIN). Finite, as used here, incidentally, means "exhibiting verbal agreement affixes." The default statements say that the features FIN and PAS normally (ceteris paribus) have the minus value, and the default for TSF is to be absent.

Much in this is strikingly reminiscent of English. The ID rules are mostly identical except for the one expanding R. The LP rules are almost the same as what is given for English in GKPS. The only crucial elements of the description that are peculiar to Acheneese are the constraint that passives are always finite and

one detail of the passive metarule. The metarule states that for every VP rule introducing VP there is a parallel passive VP rule lacking the NP but introducing an NP marked with le and having agreement features that match the AGR feature of the verb. This differs from the analogous English metarule in two ways: the fact that the le-marked agent phrase is not optional, and the statement of the agreement relation.

Given these grammatical statements, general principles determine all aspects of the structure of most of the examples Lawler cites. One illustrative example is shown in (16).



'He is considered by the judge to have stolen that cow.'

The agreement feature-value clusters seem here are 3y (third person, younger than the speaker) and 3o (third person, older than the speaker). In this example we see that cu 'steal' agrees with what in RG terms would be its initial subject. Here the reason ji-cu agrees with jih 'he(3y)' is that (a) its mother and grandmother share its AGR value by virtue of the Head Feature Convention (HFC), (b) the AGR value of the grandmother is passed up to the dominating VP by the Control Agreement Principle (CAP) since ka ji-cu limõ nyan is a controllee with no controller, and (c) agreement between the matrix subject and verb is determined by the CAP (since the VP translates as a function taking the subject NP translation as argument). However, AGR values for the V (gi dawa) and NP (le hakem) of the matrix VP are stipulated by the passive metarule, and this overrides the HFC. [5]

Values for the AGR feature mentioned in the passive metarule may be instantiated in the tree, provided the match between the NP features and the value of the verb's AGR feature. Unlike agreement features, PAS is stipulated on the mother VP by the passive metarule, and must also be on the V by the HFC (overriding the default). [+FIN] is then determined on the matrix VP by virtue of the FCR linking PAS to FIN, and the V gets this value by the HFC. The overall result is that passive verbs agree with their agent phrases (by the passive metarule), overriding the normal case of CAP-determined agreement of finite verb phrases with their subjects.

But more than this follows from the analysis I have given. Lawler (1975) notes some curious facts about relative clause formation:

- (17) a. Verbs of relative clauses normally cannot have agreement affixes
- b. Verbs of passive relative clauses must have agreement affixes

In the RG account, it is not clear how these facts fit into the account. Presumably they would have to be stipulated separately from whatever else the grammar says. Yet they already follow from the grammar provided here. The rule expanding relative clauses introduces VP. The default for the feature FIN is [-FIN], which explains why relative clauses do not ordinarily bear agreement affixes. But the rule also has the marking [(PAS)] on the VP daughter to indicate that despite the default (that constituents are typically [-PAS]), passive VPs can occur there. Given this, since PAS implies FIN, the passive VPs will have to be finite; and this will override the negative default for FIN, for FCRs and other rules always override defaults; hence passive relative clauses will always bear agreement affixes.

This is not a major triumph. The GPSG and RG accounts each work quite nicely, and each, naturally enough, stipulates certain idiosyncratic properties of Achenese at one point or another. My point here is simply that the case of Achenese agreement cannot be said to provide a knock-down argument against GPSG. There is no glaring way in which the account offered in (15) misses a generalization about Achenese syntax. Indeed, the generalization that a GPSG account must allegedly miss--that agreement is with the initial or logical subject--has a range so narrow that little value can be placed on it: the only case of an initial subject agreement controller that is not also a final subject is the passive agent. In a sense, Perlmutter's statement "The verb of a clause...agrees with the initial [subject] of the clause" (1982, 293) is exactly analogous to the [AGR:@] specifications in the passive metarule above; both cover just the same (typologically somewhat unusual) fact about Achenese passives, and nothing else.

### 3. Albanian and syntagmatic contamination

One of the things that makes for great complexity in agreement systems is that they appear to be a primary locus for the grammaticization of formal irregularities that look as if they might be traceable to perception errors and misanalyses. I have no way of demonstrating that my speculations about origins are correct, and I will not attempt this. But I find it heuristically useful to classify cases by reference to these diachronic speculations. I will speak of contamination--a word familiar from traditional accounts of language change, with an engaging hint of a bygone view of diachrony as corruption and decay caused by unclean linguistic habits. I begin with cases that I relate to contamination in the syntagmatic plane.

It is a very common error to incorrectly place on a verb the agreement marking that would be suitable if its subject was the closest preceding NP identifiable in the string in sentences where that NP is not the subject. An interesting example of how hard it can be to avoid such errors was furnished by an acquaintance, P. P. Sah, who showed me the following sentence in his doctoral dissertation:

- (18) Whether there are any sufficient conditions remains,  
despite Chapin's attempt at a solution, highly doubtful.

Sah reports that both the native English-speaking examiners who read his thesis corrected remains to remain in this sentence. Both were wrong, of course. The NP linearly to the left of remains is plural, to be sure, but its subject is the whether clause.

It seems likely that the frequency of errors of this sort is not totally irrelevant to the issue of why certain languages deal with coordinate NP subjects whose conjuncts have distinct feature values by letting the nearest conjunct to the verb determine the agreement. This phenomenon shows up in English to some extent, as noted by Morgan (1972, 1984). In there-insertion sentences it is fairly clear:

- (19) a. There were/\*was two women and a man  
b. There was/\*were a man and two women.

But in simple (non-there-insertion) sentences in English it is not operative:

- (20) a. A man and two women were/\*was there.  
b. Two women and a man were/\*was there

Morgan (1984) notes that the English case is problematic as a source of implications for linguistic theory: it is limited to one class of subject-postposing constructions, and highly dialect-

variable; the judgements are "feeble and fleeting for many speakers, and likely to be influenced by performance factors" according to Morgan. However, Albanian shows nearest-conjunct resolution with much greater clarity and systematicity, and Morgan argues that the Albanian facts pose real difficulties for one theory, namely GPSG. I therefore want to examine the Albanian case in detail. [6]

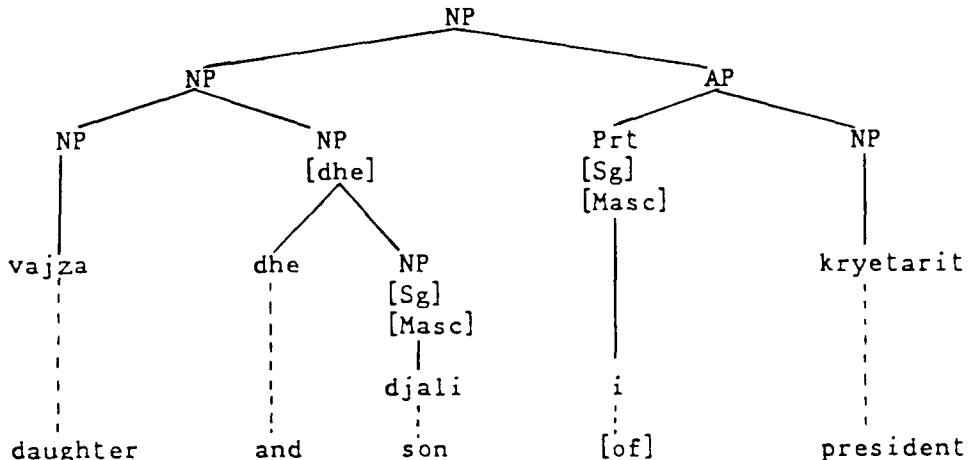
Postnominal AP or NP complements to nouns in Albanian are preceded by a preposition-like that Morgan calls a "particle" (glossable perhaps as 'of'). The particle seems syntactically to be in construction with the complement phrase. According to Morgan, it agrees with the preceding head noun in gender, number, and (in a limited way) case. Another way to put things, however, is to say that the particle takes the number, gender, and case of the NP it is in, and for simple cases this works:

(21) Albanian

- a. djali i mirë  
 boy:Nom:Def Prt:Nom:Sg:Masc  
 'the good boy'
- b. vajza e  
 daughter:Nom:Def Prt:Nom:Sg:Fem  
 kryetarit  
 president:Obl:Sg:Masc  
 'the president's daughter'

But in coordinate structures where the conjuncts have differing agreement features, the particle agrees with the nearest conjunct. This is shown schematically in (22), using Morgan's labelling of categories and omitting most feature detail:

(22)





Yet the coordinate node itself cannot be marked singular and feminine, for as Morgan points out, when it occurs as a subject NP, it triggers plural agreement in its predicate VP, as one would expect with a coordinate NP:

- (23) Vajza dhe djali i kryetarit janë të mirë.  
 daughter and son [Sg] president are [Pl] good  
 'The daughter and son of the president are good.'

In Morgan's view this is a difficulty for the whole GPSG framework: since djali 'son' and the particle i are not sisters, they are not introduced by the same phrase structure rule, and so Morgan concludes "that there are agreement phenomena that are inconsistent with the strict (CF PSG) interpretation of gpsg in requiring principles that refer directly to nodes that are not generated by the same PSG rule."

I certainly think that there is an unresolved theoretical problem here, namely how we can allow in a general way for resolution of agreement clash through nearest-conjunct selection. It is clear that a theory of what Pullum and Zwicky (forthcoming) call principled resolution is needed. Some idea of what it must cover can be gained from a study of Corbett (1983a), especially pp. 179-180. What is interesting is that there are not only languages like Latin, which agree with Albanian in that the final (and thus nearest) conjunct determines the agreement in a case where the subject NP precedes the verb (see (24a)), but also languages like Slovene which resolve the conflict by letting the first (and thus furthest away) conjunct determine the agreement in such cases (see (24b)).

(24)a. Latin

et ego et Cicero meus flagitabit  
 and I and Cicero my will-demand(3sg)  
 'both my Cicero and I will demand [it]'

b. Slovene

groza in strah je prevzela vso vas  
 horror(f) and fear(m) has seized(f) whole village  
 'Horror and fear has seized the whole village.'

Corbett notes that neither the normal number agreement (which would yield plural on prevzela 'seized') nor gender resolution (which would yield the unmarked masculine) has operated. Resolution in favor of the first conjunct is much less common than resolution in favor of the nearest conjunct, but it has been attested in Serbo-Croat and Latin in some cases as well as Slovene.

The facts Corbett reviews--which are usefully supplemented by Morgan's Albanian data--suggest that it is a parochial matter whether a language allows nearest-conjunct resolution, first-

conjunct resolution, or neither, and the conflicting evidence from Latin argues that it may be either dialect-particular or construction-specific within a language, so that there is no possibility (so far as is yet known) of a universal principle defining the contexts in which a given resolution strategy is admissible in a language.

Let us therefore turn to the formal question: if nearest-conjunct agreement must be handled syntactically by stipulation in the rules of the grammar (the worst case scenario, of course, but the one Morgan's argument is implicitly predicated on), does its apparent reference to non-sister nodes pose a problem for CF-PSG-equivalent grammatical devices? It is interesting that in the first of the two unpublished papers from which GPSG work initially sprang, i.e. Gazdar (1979a), it was made fully explicit that reference to non-sister node pairs is not inconsistent with context-free grammars, except insofar as the latter term is restricted entirely to unembellished Type 2 rewriting systems, which, as Stanley Peters has remarked, were always the wrong mathematics for the context-free languages (CFLs). Drawing on the work of Joshi and Levy (1977) and Joshi, Levy and Yueh (1978), Gazdar introduces rules such as (25a), interpreted as suggested by the paraphrase in (25b).

(25) a.  $A \rightarrow \omega / (\varphi \text{---} \psi) \ \& \ \delta (\alpha \text{---} \beta)$

b. A may be the label of a node n in a tree T if the string immediately dominated by n is  $\omega$ , and  $\varphi \text{---} \psi$  is a proper analysis of T (for some strings X and Y), and there is a path from root to frontier in T that has the form  $W\alpha ABZ$  (for some sequences W and Z)

This is quite a rich format for a rule of grammar.[7] Yet as Gazdar stressed, "Boolean combinations of left-right and up-down contexts are permitted, and these contexts can even be scattered" within the formalism of Joshi et al., yet still the only languages induced are context-free, and parsing is actually faster, by a constant factor, when such context-sensitive rules are employed. The key to the restriction in power is that, as suggested by (25b), the rules are being interpreted as filters on trees rather than rewriting operations on strings.

The upper limit on the richness of structure admissible in context-sensitive conditions that remain CFL-inducing is simple to state. Any filter on trees that can be expressed as a frontier-to-root finite-state tree automaton (Thatcher 1973) can be employed in a grammar without of itself enabling that grammar to analyze non-context-free languages. It is therefore clear that Morgan cannot be right in his claims about the implications of Albanian agreement, because it is clear enough how to construct a

finite-state tree automaton to verify agreement of postnominal particles. There is a finite number of combinations of case, number, gender, person, and definiteness values (72, to be precise). The particular one on the NP node that is the right branch in a coordinate NP can be encoded into the state of the automaton and passed up toward the root. The same is true of the agreement feature-value cluster on the particle.

I believe, therefore, that nearest-conjunct agreement and similar phenomena cannot in principle provide a formal challenge to current phrase structure theories.[8] But this is not because an agreement system that would make a language non-CF is impossible to imagine. It is straightforward to construct an example of an agreement system that no CF-PSG could handle. Simply require two constituents to agree on their value for a feature that can have infinitely many values, and typically a CF-PSG will not be able to describe the result. Consider a language in which the verb of a clause had to agree with the subject NP in virtue of a class membership property of some kind, and there were infinitely many classes. A simple example of such a property would be one based on the terminal string. Suppose the verb had to carry an agreement suffix that mirrored the terminal string of the subject NP, and there was recursion in NPs, so that there were infinitely many distinct NPs. The result for English (with the agreeing verbs underlined) would look like this:

- (26) a. Susie sings-susie softly to herself.  
 b. The bishop is-the-bishop angry.  
 c. Several large and ugly mountain gorillas  
were-several-large-and-ugly-mountain-gorillas  
 sitting near the fountain.

This, of course, would render a language non-CF. The subset containing just subject NP, verb, and suffix has the form xcx where x ranges over an infinite set of strings, and (under any but a limited class of choices of this set) a language from which such an infinite subset can be extracted by intersection with a regular set (a condition easily met) is non-CF.

Has such an agreement system ever been attested? The answer seems to be no; but at least one argument was given in the earlier literature based on a phenomenon reminiscent of the imaginary case above. Postal (1964) claimed that Mohawk had a construction that required an intransitive subject or direct-object NP to be both present in the syntactic structure of the sentence and incorporated into the morphology of the verb, in a manner similar to what is seen in (26). Pullum and Gazdar (1982), however, have shown that the empirical conditions are not in fact satisfied by Mohawk: non-matching incorporated stems are permitted too, in an unbounded class of cases (though the sentences in question have quite different interpretations).

It is interesting that this is not because natural languages are context-free in general, as Pullum and Gazdar were

conjecturing might be the case. It has recently been shown that the essential property here, namely reduplication over an unbounded domain, is found in some natural languages. Culy (forthcoming) has described a case of unbounded reduplication in Bambara (Mande) noun derivation, and Alexis Manaster-Ramer, in unpublished work, has collected a number of cases from languages such as Polish, Turkish, and even English. His most convincing English case is the construction illustrated in (27).

- (27) a. Top UCLA eye specialist or no top UCLA eye specialist, I still can't see a thing.  
b. \*Top UCLA eye specialist or no top Los Angeles oculist...  
c. \*Top UCLA eye specialist or no top UCLA Med School eye doctor...

The construction appears to demand actual string identity between the N' constituents separated by or no. It is simple to construct arguments from this to the effect that English cannot be a CFL (finally resolving the open question discussed by Pullum and Gazdar 1982). Some mechanism of phrase reduplication that in principle can allow for the description of non-context-free languages is called for in the case of these constructions (interestingly, rather similar in their semantics across several unrelated languages); but this makes it all the more interesting that this mechanism is not exploited in the agreement system of any language as far as is known, though logically it could have been.

Summarizing, the phenomenon of nearest-conjunct resolution, which may conceivably have its roots in the way speakers are prone to make errors of both perception and production that are explicable by reference to the notion "syntagmatically nearest NP". It does not, however, have the dire consequences for GPSG accounts that Morgan sees in it. Only agreement based on an infinite set of categories could readily yield consequences of this sort, and although that situation does not seem beyond the range of what is conceivable in a natural language, it has not been attested, except insofar as reduplication is viewed as the extreme case of agreement, namely stringwise identity.

#### 4. Somali and paradigmatic contamination

The preceding section dealt with peculiarities in agreement systems that look as if linear proximity in the string might have had something to do with their origin. Some irregularities in agreement systems look to me as if they might have arisen as a result of perception errors of a different type--paradigmatic rather than syntagmatic. Instead of linear adjacency in the string being responsible for the misperception, it is relatedness within the syntactic or morphological paradigm.

The clearest case I know of is the one discussed in Zwicky and Pullum (1983) from Somali. Somali has a fairly complex agreement system, affecting (at least) nouns, determiners, pronouns, and verbs. Since subject NPs can co-occur with resumptive pronouns even in simple sentences, even a short sentence with a meaning like 'The truck left' can exhibit agreement in four places:

(28) Somali

baab̀ur-kii wuu tegay  
 truck the he left  
 (masc) (masc) (masc) (masc, 3sg)  
 'The truck left.'

But it is possible for all four agreement locations to have a misleading superficial form. Consider this example:

(29) dibí-dii wàyy tegeen  
 oxen the they left(3pl)  
 'The oxen left.'

First, dibí 'oxen' is of course masculine plural; but here its plurality is indicated in a morphologically irregular way: the tone pattern of the singular form dibi is switched to the characteristically feminine tone pattern. (If this seems strange, note that the feminine singular is the unmarked agreement form in Qoranic Arabic and occurs instead of plural forms in many contexts; there may have been some influence of Arabic on Somali.) Second, the article dii also shows number by gender polarity: dii is the feminine determiner, indicating plurality when attached to an intrinsically masculine noun. Third, wàyy is the masculine plural pronoun, but (in a coincidental similarity to the pattern of German) it happens to be homophonous with the feminine singular pronoun. This means that all three of the elements in the sentence indicating the gender and number that the verb should take are misleading feminine in their phonological form. The surprising wrinkle that results in the grammar of Somali is that the verb can indeed take feminine singular agreement in this sentence:

(30) dibí-dii wàyy tegtay  
 oxen the they left(fem.sg.)  
 'The oxen left.'

The form tegtay is the feminine singular agreement form. It shows up in this sentence with a masculine singular subject under conditions that led Hetzron (1972) to describe the pattern as "playful agreement." In his view, when a sentence looks sufficiently feminine that it could almost fool you, the language playfully allows the verb agreement to be feminine too; a kind of morphosyntactic transvestitism.

Zwicky and I argue in some detail that this is not in fact the correct view on which to build a synchronic account. In particular, the notion "characteristically feminine pattern" applied to nouns is not one that can be rendered precise. There is something to it, one feels, and it seems likely that the historical emergence of this agreement option was influenced by the feminine flavor of examples like (30); but to achieve a synchronic account that covers exactly the right class of cases, all that is necessary is an additional, optional morphosyntactic rule, stated informally in (31):

(31) Somali Optional Agreement Rule

Assign [GND:fem, NMB:pl] to a verb in a finite clause with a plural subject containing an irregularly pluralized noun

The notion "irregularly pluralized" can be made completely precise in Somali grammar; it corresponds to the class of "subplurals" that the standard grammars of the language set up (see Zwicky and Pullum for references). Nothing less than (31) accounts for the facts of the Somali agreement pattern under consideration, and nothing more is necessary. The form of the grammar is more complex than if (31) were not in it. The (hypothesized) perceptual error of seeing sentences like (30) as morphosyntactically feminine may offer a hint of a diachronic explanation of what went on, but does not simplify, or play any role in, the grammatical statement.

Again we note that the synchronic description of an agreement system may have to contain specific and rather ad hoc-looking rules that in their special domains override what general principles would dictate (cf. the case of Achenese agreement with agent-phrases).

## 5. Conclusion

Complexity may arise in agreement systems in a number of ways. First, the classification in terms of agreement categories defined for NPs and superimposed on non-nominal categories by agreement principles may be arbitrarily rich. There is little sign of narrow, finite limits in universal grammar to the complexity of something like concord in noun class. However, as long as the classification within each individual language is finite, the resultant agreement systems will be describable in terms of a phrase structure grammar.

Second, rule-stipulated "quirky" agreement may be superimposed on the more general patterns characterized in terms of the CAP and the HFC, as in the case of agreement with agent phrases in Achenese; but the Achenese case, at least, is handled nicely by an interaction of the special stipulations of the rule system and the

general ceteris paribus universal conditions.

Third, exceptional patterns suggestive of an origin in syntagmatic perception errors may develop, the phenomenon of nearest-conjunct agreement resolution being an example; but these do not seem to introduce complexity that cannot in principle be handled by a phrase structure grammar (though phenomena that are beyond the range of context-free grammars are now known to exist in natural languages).

And fourth, exceptional patterns relating to paradigmatic similarities may evolve, as in the case of Somali "playful agreement"; but again, a simple and quite conventional description in terms of familiar concepts is likely to be available in those cases.

It remains to be seen whether it will continue to be the case, as research continues to elucidate the remarkable complexity of grammatical agreement systems, that phrase structure descriptions of such systems will be successful in describing them and accounting for their general properties. No one can be certain of the outcome.

#### NOTES

\* This paper is a slightly revised version of "How complex could an agreement system be?", which was presented at the First Eastern States Conference on Linguistics in September 1984, and published in the proceedings of that conference. It was presented at the Workshop on Formal Grammars organized at Matsuyama University by the Logico-Linguistic society of Japan and the Linguistic Society of Korea in December 1984. The contributions of Judith Aissen, Stephen Anderson, Michael Barlow, Annie Bissantz, Greville Corbett, Gerald Gazdar, Takao Gunji, Ewan Klein, Byung-Soo Park, David Perlmutter, Ivan Sag, and Arnold Zwicky, in conversation, correspondence, and published work, have been very useful. The research reported here was partly supported by the System Development Foundation via a gift to the Center for the Study of Language and Information at Stanford University, and partly by the Syntax Research Center at the University of California, Santa Cruz. Thanks to Nancy Rankin for research assistance.

[1] Moravcsik (1978) and Zwicky (1977) have been very useful in the preparation of this catalog. See these papers for relevant references, which I do not repeat here.

[2] In GKPS, the binary feature PLU is used for number; NMB is a more general proposal that, for example, might allow for several different values (singular, dual, trial, paucal, plural) in languages other than English. Gender happens not to be treated in GKPS; the feature GND should be regarded as general enough to cover, for example, the twenty-odd genders usually called noun classes in Bantu languages.

[3] Gerald Gazdar has pointed out to me a significant formal problem. A theory of grammar has to provide not just a grammatical formalism with a clearly defined syntax but also a semantics for that formalism--that is, a consistent way of interpreting it in a model, making clear for each possible statement in terms of the formalism what that statement conveys. A fairly obvious semantics for the formalism of feature specifications would be one that says a feature specification denotes a property of a category, and the most natural algebra for such an interpretation would make notions like "is the value that category C has for feature F" functions; in other words, a category could only have one value for a given feature. This simple semantics for features and categories could not be maintained if the proposals in the text were to be developed, and some different semantics, at least for statements involving AGR values, would have to be developed. I have no space to discuss this issue here.

[4] I am grateful to Annie Bissantz for allowing me access to her unpublished paper on Achenese (Bissantz 1984), which discusses several of the important issues that the language raises in a GPSG context. She is not responsible for any peculiarities or inadequacies of in the following analysis, however.

After completing this paper, I became aware of the existence of Durie (1984), a doctoral dissertation on the syntax of Achenese (spelled "Acehnese" by Durie). Durie's interpretation of the facts Lawler discusses is quite different. In brief (and this will make sense only after reading at least a summary of Lawler's claims such as I give below), Durie's claim is that Achenese has free constituent order in S, and when a transitive subject follows its verb it is marked with le. I have not yet given close consideration to Durie's analysis, but at a first reading it looks convincing in many ways. There is no question that some of what I say here should now be reconsidered. It may even be that the analysis I supply, which is intended to deal with the situation characterized by Lawler, does not apply at all to Achenese (or Acehnese) as it really is, and I do not know whether there is a language that would call for the analysis I propose here. This matter obviously needs further investigation.

[5] Strictly speaking, this is not the case given the formulation of the HFC given in GKPS, summarized in (3) above, as Gerald Gazdar has pointed out to me subsequent to my completing the earlier version of this paper. The HFC in GKPS would demand that the head features of the verb here be identical to those on the VP because legal instantiations exist in which they are identical. The requirements of the CAP would be overridden because the CAP operates in a different domain: the HFC affects the VP rule domain while the CAP operates in the S rule domain. I failed to notice



that the interaction was not what I wanted when I originally prepared this paper and worked out the analysis of the Achenese facts. However, there is an already available version of the theory under which my analysis works. Ivan Sag has argued (though not in published work) that the HFC should apply only to instantiated head features, not the rule-stipulated ones that are at issue here. His reasons for advocating this different formulation are independent of the case of Achenese, and relate to English-internal considerations. His proposal would allow the analysis I am suggesting. On the other hand, note that if Durie's analysis, briefly mentioned in footnote 4 above, turns out to be correct, then my treatment here may not be needed, and the GKPS version of the HFC may be adopted. These issues are unresolved at present.

[6] I ignore here a principle of allomorph selection that Morgan also discusses, whereby tɛ is realized as e if it is immediately preceded by and (in some sense) in the complement of the noun with which it agrees. Again Morgan alleges that this will "require an agreement principle that can refer directly to nodes that are not sisters," which would be "inconsistent with gpsg." Since the generalization Morgan gives in terms of "c-command" and "lexical controller" seem to be inconsistent with the details of the structures he assumes, I will not discuss this case here. It seems, incidentally, to exemplify government (in the traditional sense) rather than agreement (cf. Zwicky, forthcoming).

[7] It is also a format which turned out not to be needed for the description of natural languages in most of the work subsequently done in GPSG. Having experimented with such rules, Gazdar's later papers (1979b, 1982, etc.) found virtually no call for them in actual practice.

[8] One might rather ask how, for example, an RG approach would handle such facts; the reliance on adjacency in defiance of the normal grammatical relations is something of an anomaly from the RG standpoint.

#### REFERENCES

- Allen, Barbara J., and Donald G. Frantz. 1978. Verb agreement in Southern Tiwa. Proceedings of the Fourth Annual Meeting of the Berkeley Linguistics Society, 11-17. Berkeley Linguistics Society, Berkeley CA.
- Anderson, Stephen R. 1982. Where's morphology? Linguistic Inquiry 13, 571-612.

- Anderson, Stephen R. 1983. On representations in morphology: case marking, agreement and inversion in Georgian. Natural Language and Linguistic Theory 2, 157-218.
- Andrews, Avery D. 1971. Case agreement of predicate modifiers in Ancient Greek. Linguistic Inquiry 2, 127-152.
- Andrews, Avery D. 1982. Long distance agreement in modern Icelandic. Jacobson and Pullum (eds), 1-34. D. Reidel Publishing Company, Dordrecht, Holland.
- Bissantz, Annette. 1983. Achenese verb agreement in GPSG. Unpublished paper, Ohio State University.
- Chomsky, Noam. 1965. Aspects of the theory of syntax. MIT Press, Cambridge, MA.
- Chomsky, Noam. 1976. Conditions on rules of grammar. Linguistic Analysis 2, 303-351.
- Chomsky, Noam. 1981. Lectures on Government and Binding. Foris publications, Dordrecht, Holland.
- Chung, Sandra. 1982. Unbounded dependencies in Chamorro grammar. Linguistic Inquiry 13, 39-77.
- Corbett, Greville. 1983a. Resolution rules: agreement in person, number, and gender. In Gazdar, Klein, and Pullum (eds), 175-206.
- Corbett, Greville. 1983b. Hierarchies, Targets, and Controllers Agreement Patterns in Slavic. Croom Helm, London & Canberra.
- Davies, William D. 1981. Choctaw Clause Structure. Unpublished Ph.D. dissertation, University of California, San Diego.
- Durie, Mark. 1984. A Grammar of Acehnese. PhD thesis, the Australian National University, Canberra, Australia.
- Farkas, Donka, and Almerindo Ojeda. In press. Agreement and coordinate NPs. To appear in Linguistics.
- Gazdar, Gerald. 1979a. Constituent structures. Unpublished paper, University of Sussex.
- Gazdar, Gerald. 1979b. English as a context-free language. Unpublished paper, University of Sussex.
- Gazdar, Gerald. 1982. Phrase structure grammar. Jacobson and Pullum (eds), 131-186.
- Gazdar, Gerald; Ewan Klein; and Geoffrey K. Pullum (eds) 1983. Order, Concord, and Constituency. Foris Publications, Dordrecht, Holland.
- Gazdar, Gerald; Ewan Klein; Geoffrey K. Pullum and Ivan Sag. In press. Generalized Phrase Structure Grammar. Basil Blackwell, Oxford/Harvard University Press, Cambridge MA.
- Gazdar, Gerald, and Geoffrey K. Pullum. 1982. Generalized phrase structure grammar: a theoretical synopsis. Indiana University Linguistics Club, Bloomington.
- Greenberg, Joseph H., Ed. 1978. Universals of Human Language, Volume 4: Syntax, Stanford University Press, Stanford, California.

- Hetzron, Robert. 1972. Phonology in syntax. Journal of Linguistics 8.251-265.
- Joshi, A.K. and L.S. Levy. 1977. Constraints on structural descriptions: local transformations. Siam Journal of Computing 6. 272-284.
- Joshi, A.K., L.S. Levy, and K. Yueh. 1978. Local constraints in the syntax and semantics of programming languages. Proceedings of the 5th Annual Symposium on Principles of Programming Languages.
- Keenan, Edward L. 1975. The functional principle: generalizing the notion 'subject of'. Papers from the Eleventh Regional Meeting, Chicago Linguistic Society, 298-309. Chicago Linguistic Society, Chicago IL.
- Lawler, John M. 1975. On coming to terms in Achenese: the function of verbal dis-agreement. Papers from the Parasession on Functionalism. Grossman, San, and Vance eds., 398-408. Chicago Linguistic Society, Chicago, Illinois.
- Lawler, John M. 1977. A agrees with B in Achenese: a problem for relational grammar. Peter Cole and Jerrold M. Sadock, eds., Syntax and Semantics 8: Grammatical Relations, 219-248. Academic Press, New York.
- Moravcsik, Edith A. 1978. Agreement. Universals of Human Language Volume 4 Syntax. Greenberg (ed.), 331-374.
- Morgan, Jerry. 1972. Verb agreement as a rule of English. Papers from the Eighth Regional Meeting, 278-286. Chicago Linguistic Society. Chicago, Illinois.
- Morgan, Jerry. 1984. Some problems of agreement in English and Albanian. Proceedings of the Berkeley Linguistics Society.
- Perlmutter, David M. 1982. Syntactic representation, syntactic levels, and the notion of subject. The Nature of Syntactic Representation. Jacobson and Pullum (eds), 283-340.
- Postal, Paul M. 1964. Limitations of phrase structure grammars. Fodor and Katz (eds). The Structure of Language: Readings in the Philosophy of Language. 137-151.
- Pullum, Geoffrey K. and Gerald Gazdar. 1982. Natural languages and context-free languages. Linguistics and Philosophy. 471-504.
- Pullum, Geoffrey K. and Arnold M. Zwicky. Forthcoming. Phonological resolution of syntactic feature conflict. To be presented at the Linguistic Society of America's Annual Meeting, Baltimore MD.
- Sag, Ivan; Thomas Wasow; Gerald Gazdar; and Steven Weisler. Forthcoming. Coordination and how to distinguish categories.
- Thatcher, James W. 1973. Tree automata: an informal survey. Alfred V. Aho (ed.) Currents in the Theory of Computing. Prentice Hall, Englewood Cliffs, N.J.

- Zwicky, Arnold M. 1977. Hierarchies of person. Papers from the Thirteenth Regional Meeting, Chicago Linguistic Society 13. 714-733. Chicago Linguistic Society, Chicago, Illinois.
- Zwicky, Arnold M. and Geoffrey K. Pullum. 1983. Phonology in syntax: the Somali optional agreement rule. Natural Language and Linguistic Theory 1, 385-402.
- Zwicky, Arnold M. Forthcoming. German adjective agreement in GPSG. To appear in Working Papers in Linguistics, Ohio State University.