A New Approach to Feature Instantiation in GPSG*

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I. Introduction

It has been known for quite some time that the instantiation of
agreement features on conjoined NPs presents a challenge for any adequate
theory of agreement. Unlike other syntactic categories, for which
agreement features in coordinate structures distribute from the mother
node onto each conjunct, conjoined NPs can require non-identity between
features of the mother and the features of one or more conjuncts. A
notorious case in English concerns the conjunction and which typically
requires plural agreement on the mother, even if all conjuncts have
singular agreement. Moreover, the instantiation of agreement features
for number is dependent on the following implicit hierarchy of feature
values for number: [1 Person] > [2 Person] > [3 Person]. If two or more
conjuncts differ in their values for person, the mother node will inherit
the feature of that conjunct whose feature value is highest on the person
hierarchy. These facts about person and number agreement concerning and
are illustrated by the coordinate structure in (1).[1]

(1)
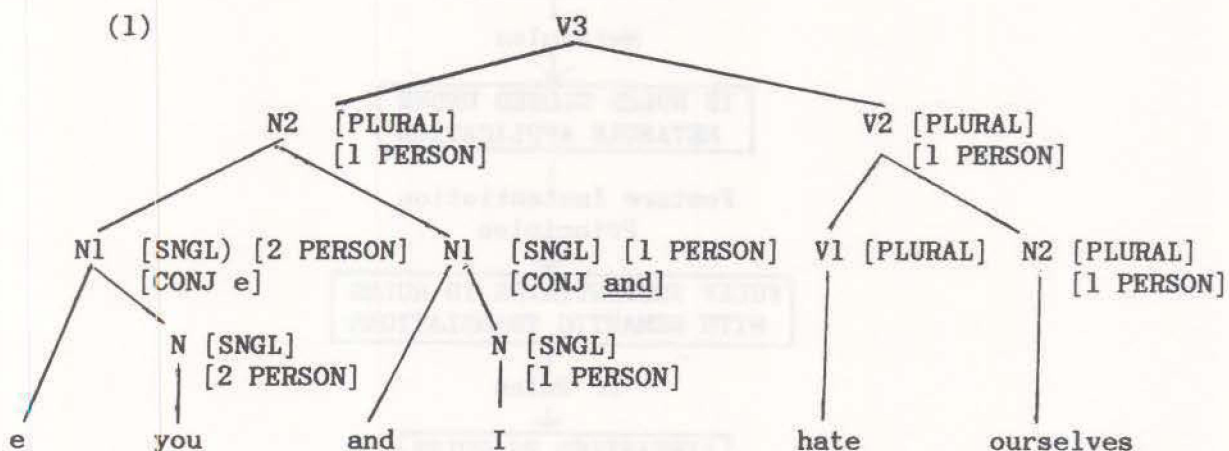
That the subject NP is in fact plural and first person can be derived
from the first person plural form of the reflexive pronoun is object
position.

Crosslinguistically, non-identity of features in conjoined NPs is
not restricted to person and number, but can also involve gender as in the
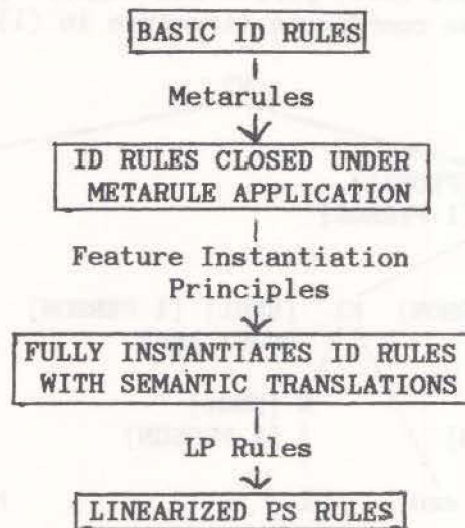French example in (2).[2]

(2) Un savoir   et une adresse   merveilleux
     'a knowledge (MASC) and a skill (FEM) marvellous (MASC PLURAL)'
     a marvellous knowledge and skill

In this paper I do not address the general issue of covariance of
agreement features in conjoined NPs, but rather discuss an interesting
subcase of this more general problem, namely agreement patterns of

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conjoined NPs which depend on the linear order of the conjuncts involved. In particular, I am concerned with agreement between verbs and conjuncts nearest to the verb in a following coordinate NP. Although this phenomenon has been pointed out with respect to English—compare the examples in (3) taken from Bach (1983)—I will mainly concentrate on examples from German and Russian because of the richer morphology and the greater variability of word order in these languages. Moreover, in Russian the conjunction 'i' 'and' can appear in front of every conjunct in a coordinate structure which will prove to be an important detail when we discuss the ramifications of agreement controlled by the conjunct nearest to the verb for the process of feature instantiation in Generalized Phrase Structure Grammar (GPSG). I will assume familiarity with the theory of GPSG as characterized in Gazdar/Pullum (1982). The basic organization of the theory as outlined in that paper can be summarized as in (4).

(3)   a.   There was a detective and three policemen in the room.
        b.   There were three policemen and a detective in the room.
            (Bach 1983,83)

(4)

$$\boxed{\text{BASIC ID RULES}}$$
$$\downarrow \text{Metarules}$$
$$\boxed{\begin{array}{c}\text{ID RULES CLOSED UNDER}\\ \text{METARULE APPLICATION}\end{array}}$$
$$\downarrow \begin{array}{c}\text{Feature Instantiation}\\ \text{Principles}\end{array}$$
$$\boxed{\begin{array}{c}\text{FULLY INSTANTIATES ID RULES}\\ \text{WITH SEMANTIC TRANSLATIONS}\end{array}}$$
$$\downarrow \text{LP Rules}$$
$$\boxed{\text{LINEARIZED PS RULES}}$$

The schema in (4) shows that in a GPSG as defined in Gazdar/Pullum (1982) feature instantiation properly precedes the linearization of syntactic constituents. My main claim in this paper is that such an ordering cannot be maintained if one wants to account for agreement controlled by the first conjunct of a coordinate structure. In order to account for such agreement patterns, one should rather conceive of feature instantiation principles as a set of wellformedness constraints on linearized and semantically translated PS rules. But before I can make this alternative proposal more precise, let me present the relevant data in German and Russian.

II.   The Data

     According to Drach's Law the finite verb in German declarative clauses occupies the second position in the sentence. Usually the first constituent is the subject, but it can also be fronted prepositional phrase as in (5), an adverbial as in (6), or the dummy es as in (7).

(5) a. Zu der Sitzung kamen (3PL) die neue Professorin
'To the meeting came   the new professor
          und alle Assistenten.
          and all assistants.'

   b. Zu der Sitzung kam (3SG) die neue Professorin (3SG)
      und alle Assistenten.

   c. *Zu der Sitzung kam (3SG) alle Assistenten (3PL) und
      die neue Professorin (3SG).

(6) a. Nächste Woche könnt (2PL) Fritz und Du uns besuchen.
'Next   week   may   Fritz and you us visit.'

   b. Nächste Woche kann (3SG) Fritz (3SG) und Du uns
      besuchen.

   c. *Nächste Woche kann (3SG) Du und Fritz (3SG) uns
      besuchen.

(7) a. Es protestierten (3PL) die Fraktion der SPD und die Grünen.
'It protested   the faction of the SPD and the
Greens.'

   b. Es protestierte (3SG) die Fraktion der SPD (3SG) und die
      Grünen.

   c. *Es protestierte (3SG) die Grünen (3PL) und die Fraktion
      der SPD (3SG).

If the subject NP is a conjoined NP as in (5)-(7), finite verb can either
agree with the conjunct nearest to the finite verb, or with the conjoined
NP as a whole. In the latter case the verb will always be marked as
plural, as in (5)a-(7)a. But if the agreement is controlled by the first
conjunct and if that conjunct is marked as singular, the finite verb is
singular, as in (5)b-(7)b. Agreement with any one conjunct is restricted
to the nearest conjunct only, as the ungrammaticality of (5)c-(7)c shows.

The same phenomenon can be found in Russian. If the verb precedes
a coordinate structure with the conjunction 'i'meaning 'and', the verb
can either agree with the coordinate structure as a whole, which is
exemplified in sentences (8)a and (9)a, or the verb can agree with the
nearest conjunct, which is the case in sentences (8)b and (9)b.

(8) a. Prepodavalis' (PL) čerčenie i matematika.
'Was taught   graphics and mathematics.'

   b. Prepodavalos' (Neut SG) čerčenie (Neut SG) i
      matematika.

(9) a. Na sobranie prišli (PL) professor i pjat' studentov.
'To the meeting came the professor and five students.'

   b. Na sobranie prišel (Masc SG) professor (Masc SG) i
      pjat' studentov.

For the purposes of this paper I will only analyse coordinate stuctures which appear as subject NPs following the verb. Corbett (1982) claims that in Russian agreement controlled by the conjunct nearest to the verb is also possible if the subject coordinate structure precedes the verb. Under certain circumstances this is also possible in German, but because of interference by other factors such as semantic salience of the conjuncts involved, these data have to await further study.

III.   Theoretical Significance of the Data

If one wants to account for the agreement facts in German and Russian in a GPSG as outlined in (4), the following problem arises. Since agreement features are instantiated on the basis of unordered constituents, there is a priori no guarantee that the daughter constituent matching the agreement features on the mother will be the conjunct nearest to the verb. If one wanted to maintain the overall organization of GPSG outlined in (4) and thus apply feature instantiation to unordered constituents, one would have to distinguish the conjunct controlling agreement from all others by means of some special syntactic feature label. Of the categories used in GPSG, the one that comes to mind, of course, is the head feature, especially since we are dealing with a case of identity between agreement features which are, after all, head features. And identity between head features is commonly handled by the Head Feature Convention. Thus, one might propose a PS rule as in (10) to generate coordination structures like du und deine Freunde in the German sentence in (11).

(10)   N [BAR 2] --> H [CONJ e], N [BAR 2] [CONJ und]$^+$

(11)   Natürlich kannst (2SG) Du (2SG) und deine Freunde bleiben.
   'Of course can   you and your friends stay.'
   You and your friends can stay, of course.

The linearization rule in (12) would further guarantee that the conjunct controlling agreement, i.e. the head conjunct, will precede the non-head conjuncts.

(12)   H [BAR 2] [+CONJ] < N [BAR 2] [+ CONJ]

The first problem for this type of approach, which I will refer to as the "Head Daughter analysis", concerns the number of ID rules and linearization rules that have to be stated separately, if agreement features are instantiated on unordered constituents for a language such as German. In addition to a general coordination schema as in (13), which is modelled after the schema proposed by Gazdar/Klein/Pullum/Sag (1982) for English, the rule in (10) has to be posited along with the linearization statement in (12) to account for coordinate structures controlled by the first conjunct. Moreover, in order to account for coordinate structures with the same agreement pattern, but with und appearing before the last conjunct only, a third PS rule as in (14) would have to be stated.

(13)   a.   CAT' $\longrightarrow$ CAT'[CONJ α_0], CAT'[CONJ α_1]$^+$

          b. α is in {⟨und,e⟩, ⟨e,und⟩ ⟨weder,noch⟩, ⟨oder,e⟩,
              ⟨e,oder⟩,⟨sowohl,als auch⟩}

(14) N [BAR 2] $\longrightarrow$ H [BAR 2] [CONJ e] , N [BAR 2] [CONJ e]$^+$,
      N [BAR 2] [CONJ und]

Notice that the number of rules necessary to generate all the relevant coordinate structures whose first conjuct agrees with a preceding VP would have to be even greater for a language like Russian. In additionn to the ID rules in (10) and (14), in which und would be replaced by i, we would need a rule as in (15), since in Russian all conjucts may be preceded by i.

(15) N [BAR 2] $\longrightarrow$ H [BAR 2] [CONJ i] , N [BAR 2] [CONJ i]$^+$

The second, and main objection to the Head Daughter analysis follows from the first one. Because such an analysis forces us in the case of German to use three separate rules in addition to a generalized rule schema for coordinate structures, the resulting grammar misses a number of significant generalizations. Unlike the analysis that I will present below, the head daughter analysis fails to treat coordination as a unified phenomenon by means of one generalized rule schema as in (13), but has to state three separate, and partially redundant PS rules. Moreover, even NP conjunction cannot be treated as a single phenomenon because two distinct ID rules are needed for the distribution of the lexical item und.

Furthermore, by disassociating the LP rule in (12) from the ID rules (10) and (14), it treats the linearization of constituents and the agreement pattern of conjoined NPs as logically independent, when, in fact they are crucially related. Because the rules are independent, the analysis suggests that there might be languages that do have ID rules like (10) and (14), but instead of (12) an LP rule requiring the head to alwyas appear as, say, the third conjunct. But to my knowledge, no such language exists and for perceptual reasons is unlikely to exist.
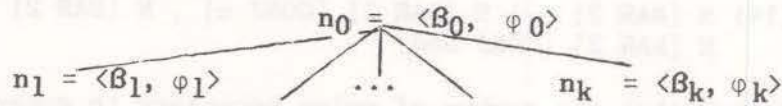
If, on the other hand, we allow feature instantiation principles to operate on linearized and semantically translated constituents, we can generate all relevant coordinate structures in German by just one generalized schema as in (11). To account for agreement controlled by the first conjunct, we only have to state one additional feature instantiation constraint, regardless of the distribution of the lexical item und in coordinate structures.

Let us briefly outline this alternative approach to feature instantiation. At the heart of my proposal is a one-to-one and onto mapping from constituents of PS rules specifying immediate dominance relations only to nodes of locally ordered trees whose nodes consist of ordered pairs of a syntactic category ß and the semantic translation φ of the syntactic expression dominated by ß.

(16)   For each ID Rule

$$\alpha_0 \longrightarrow \alpha_1, \ldots, \alpha_k$$

and ordered tree

$$n_0 = \langle \beta_0, \varphi_0 \rangle$$
$$n_1 = \langle \beta_1, \varphi_1 \rangle \quad \ldots \quad n_k = \langle \beta_k, \varphi_k \rangle$$

there is a one-to-one and onto mapping

$$f : \{\alpha\}_i \longrightarrow \{n\}_i \text{ for } o < i < k$$

such that $f(\alpha_0) = n_o$ and $\forall \alpha_i [f(\alpha_i) = \langle \beta_j \varphi_j \rangle ==> \beta_j = EXT(\alpha_i)]$

Function f in (16) maps the mother constituent of the ID rule onto the root of the tree. f has to be one-to-one so that every constituent of the ID rule is mapped onto a distinct node of thre tree, and vise versa. f also has to be onto so that every node of the tree is linked with some constituent of the corresponding ID rule. Moreover, each syntactic category ß has to be an extension of the corresponding constituent of the ID rule.

Feature instantiation principles, under this approach, can be viewed as wellformedness constraints on possible mappings f from constituents of ID rules to nodes of trees. The Head Feature Convention, for example, can be defined as in (17).

(17)   HFC: $\forall \alpha_i [\alpha_i = H [BAR n] \wedge f(\alpha_i) = n_j => HEAD(\beta_j) =$
HEAD (β_0)] for $i,j \geq 1$.

Likewise, LP rules can be conceived of as constraints on the set of possible mappings between ID rules and ordered trees. The LP rule for English that requires lexical heads of major syntactic categories to precede sister constituents can be stated as in (18).

(18) $\forall \alpha_i, \alpha_j [\alpha_i = H [BAR 0] \wedge \alpha_j \neq \alpha_i => f(\alpha_i) < f(\alpha_j)]$
for $i,j \geq 1$.

Presupposing a mapping as in (16), let us turn to an analysis of German coordinate structures controlled by the first conjunct following the verb. I follow Uszkoreit (1982) and Nerbonne (1983) whose GPSG analyses of German account for Drach's Law by treating the first constituent in German declarative clauses as the result of topicalization. Subject NPs following the verb in second position can hence be identified by the features [−TOPICALIZED] and by [+ NOMINATIVE] as the value for the case feature. In order to generate non-topicalized coordinate subject NPs whose agreement features match that of the leftmost conjunct we have to impose the constraint (19) on possible mappings f from ID rules to ordered PS markers defined in (16).

(19) $\forall \alpha_0, \alpha_i [\alpha_0 = EXT(N [BAR 2] [-TOP] [+NOM]) \wedge f(\alpha_i) = n_1$
$\wedge \exists \alpha_{j=} [\alpha_j = EXT([CONJ und])] => AGR (\beta_1) = AGR(\beta_0)]$,
where $i,j \geq 1$.

The condition in (19) specifies that for any ID rule in which the dominating category is an extension of the feature N" [-TOP] [+NOM], and which has at least one daughter with the feature CONJ und, a daughter can only be mapped onto the leftmost node in such ordered trees where that node has the same agreement features as the root of the tree.

IV. Conclusion

By treating LP rules and feature instantiation principles as constraints on possible mappings from ID rules to linearized and semantically translated PS rules we arrive at an organization of GPSG in which LP rules on the one hand, and feature instantiation principles and semantic translation principles on the other hand apply in tandem, rather than inseparate components of the grammar. Such an organization of GPSG has been independently proposed by Klein and Sag (1982) to capture significant generalizations about grammatical relations and word order in English. While their work concerns the relationship between LP statements and semantic translation principles, the argument presented in this paper rests on the interaction between feature instantiation principles and LP statements.

FOOTNOTES

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[1]The tree structure in (1) is modelled after the account of coordination given in Gazdar/Klein/Pullum/Sag (1982).

[2]The example in (2) is due to Corbett (1983).

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