A Comprehensive Theory of Coordination of Unlikes

Shûichi Yatabe

University of Tokyo

Proceedings of the HPSG04 Conference

Center for Computational Linguistics
Katholieke Universiteit Leuven

Stefan Müller (Editor)

2004

CSLI Publications

http://csli-publications.stanford.edu/

Abstract

The principal aim of this paper is to present a comprehensive theory of coordination of unlikes, i.e., a theory that is capable of dealing with every phenomenon resulting from coordination of unlikes. The proposed theory accounts not just for standard cases of coordination of unlike arguments and coordination of unlike functors but also for cases involving single-conjunct agreement and what will be called each-conjunct agreement. In the course of the argumentation, it is also shown that, even in a language like English, predicate-argument agreement needs to be described in terms of a relational constraint that is not simply an identity requirement.

1 Introduction

The principal aim of this paper is to present a comprehensive theory of coordination of unlikes, i.e., a theory that is capable of dealing with every phenomenon resulting from coordination of unlikes.

Coordination of unlikes is a type of coordination in which the conjuncts do not belong to the same syntactic category, and is exemplified by the following sentences.

(1) Stupid or a liar is what Pat is.
(from Munn (2000))

(2) Sie hat Karl gefunden und geholfen.
she has Karl found and helped
'She found and helped Karl.'
(from Pullum and Zwicky (1986))

(1) involves coordination of an AP (*stupid*) and an NP (*a liar*). This example makes it clear (pace Maxwell III and Manning (1996), Crysmann (2003), and Beavers and Sag (2004)) that there are cases of coordination of unlikes that cannot be explained away as cases of conjunction reduction. (2) involves coordination of a verb subcategorizing for an accusative object (*gefunden*) and a verb subcategorizing for a dative object (*geholfen*).

Most previous theories of coordination of unlikes are more or less successful in dealing with examples like (1) and (2), but none of them can be said to be capable of dealing with every phenomenon resulting from coordination of unlikes, as will be shown below.

I will start with reviewing some of the previous theories, with a view to familiarizing ourselves with the kinds of pitfalls that a comprehensive theory of coordination of unlikes needs to circumvent, and then will go on to present an alternative theory.

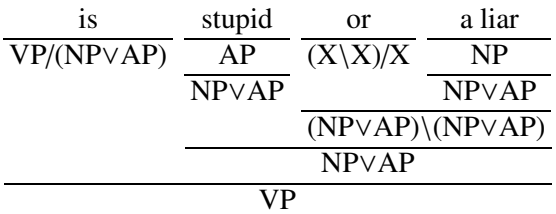


Figure 1: Coordination of unlike arguments in Bayer's theory

2 Problems with previous theories

2.1 Bayer (1996)

I will first review Bayer's theory of coordination of unlikes (Bayer (1996)) here because his is arguably one of the most well-developed of the theories of coordination of unlikes that have been proposed in the literature, and it is also the only theory of coordination of unlikes that is equipped with an explicit account of right-node raising.

Bayer's theory is couched in the terms of Lambek Categorial Grammar; the way it generates a VP of the form *is stupid or a liar* is illustrated in Figure 1. In his theory, a string belonging to the syntactic category AP also belongs to the syntactic category NP∨AP (because if something is an AP, we know that it is either an NP or an AP, intuitively speaking); likewise, a string belonging to the syntactic category NP also belongs to the syntactic category NP∨AP (because if something is an NP, we know that it is either an NP or an AP). Given this setting, what appears to be coordination of unlikes turns out not to be coordination of unlikes after all; in the example depicted in Figure 1, what appears to be coordination of an AP and an NP is in fact coordination of two strings belonging to the same category, namely NP∨AP.

Bayer demonstrates that his theory is capable of dealing with coordination of unlike arguments (exemplified by (1) above) and coordination of unlike functors (exemplified by (2) above) in a strikingly simple, unified manner. However, the theory has the following two shortcomings.

First, his theory cannot handle cases in which two or more homophonous expressions with different meanings are fused together and right-node-raised, because his theory is specifically designed so as not to allow a single expression to have more than one meaning. For instance, despite the author's claim to the contrary, his theory has difficulty in dealing with examples like (3), in which the singular common noun *Dozenten* and the plural common noun *Dozenten*, which happen to be homophonous, are fused together and right-node-raised.

(3) der Antrag des oder der Dozenten
(=der Antrag des Dozenten oder der Dozenten)

'the petition of the docent or the docents'
(from Eisenberg (1973))

Bayer notes that this example poses no problem for his theory if it is assumed (following Zaenen and Karttunen (1984) and Ingria (1990)) that morphological number is not semantically potent at the common noun level and comes to have meaning only at the NP level, and he presents some very interesting (if not conclusive) evidence for this assumption. However, this proposal is not a general enough solution for this problem, as shown by the existence of an example like (4).

(4) Peter beschreibt den, und Martin beschreibt das Quark.
(=Peter beschreibt den Quark und Martin beschreibt das Quark.)
'Peter describes the fresh cheese and Martin describes the quark.'
(from Hartmann (2000))

The word *Quark* has two senses: with the masculine article, it refers to fresh cheese, while with the neuter article, it refers to an elementary particle. It is not possible to handle an example like this in terms of morphological number that remains semantically inert at the common noun level.

Another problem with Bayer's theory is that, as the author notes himself, it is not capable of dealing with single-conjunct agreement, an agreement pattern in which two or more expressions with distinct agreement-related properties are conjoined and one of them, instead of the coordinate structure as a whole, agrees with something outside that coordinate structure. This agreement pattern is exemplified by the sentences in (5), taken from Morgan (1984).

(5) a. There was/*were a man and two women in the room.

b. There were/*was two women and a man in the room.

In each of these examples, the verb agrees with the first conjunct alone, and not with the coordinate structure as a whole. Bayer's theory is not compatible with the existence of single-conjunct agreement because the linear order between conjuncts cannot have any significance in his theory; a coordinate structure of the form [NP_{PL} and NP_{SING}], for instance, is given exactly the same status as a coordinate structure of the form [NP_{SING} and NP_{PL}], making it impossible to capture the fact that the former, but not the latter, can appear immediately after the string *There were*.

It has been claimed in Peterson (1986) and Peterson (2004) that single-conjunct agreement is an extragrammatical phenomenon.[1] Peterson's view can be summarized as follows. There is considerable intra- and inter-speaker variation in usage of single-conjunct agreement. This is because single-conjunct agreement is not something that is dictated by the grammar. Single-conjunct agreement is a 'strategy' that speakers sometimes resort to in order to determine verbal number when

[1] See Sobin (1997) for an analogous view.

it is not determined by the grammar. A 'strategy' is a working principle by which speakers extemporaneously 'patch up' gaps left by the grammar.

Peterson's view of single-conjunct agreement is problematic for the following two reasons. First, in some languages, single-conjunct agreement is a robust, established phenomenon without intra- or inter-speaker variation, as we will see shortly. Second, there is nothing special about speakers feeling unsure about certain aspects of their own language and showing variability. For instance, speakers can be unsure about the meaning of a word that is used only infrequently. Speakers can also be unsure about the pronunciation of a word that is used only infrequently. Likewise, speakers can be unsure about the syntactic rule governing an agreement pattern that is used only infrequently. There does not seem to be any particular reason to believe that this third situation involves anything special that is not involved in the first two situations.

Dalrymple and Kaplan (2000), Daniels (2002), Levy and Pollard (2002), and Sag (2003) represent interesting attempts to improve on Bayer's theory, but they do not offer new insight regarding the two problems discussed in this subsection, namely the problem of right-node raising of semantically distinct expressions and the problem of single-conjunct agreement.

2.2 Moosally (1999)

The phenomenon of single-conjunct agreement has been given an HPSG-based analysis by Moosally (1999). Discussing the agreement patterns seen in Ndebele, Moosally divides coordinate NPs in the language into the following three types:

- regular-agreement NPs, whose GEND value is identical to the GEND value of each of its conjuncts,
- partial-agreement NPs, whose GEND value is identical to the GEND value of the first (or the last) conjunct, and
- resolution-agreement NPs, whose GEND value is determined by a certain feature-resolution mechanism.

Partial-agreement NPs are the ones that exhibit single-conjunct agreement when used as the subject or the object of a verb.

This seems to be an adequate account of the Ndebele facts that Moosally discusses. However, this analysis cannot be applied to cases involving what Munn (2000) calls mixed agreement, a situation in which one coordinate structure shows a mixture of two or more agreement patterns. (6) and (7), taken from Sadler (2003), are Welsh examples that involve mixed agreement. In (6), for example, the subject noun phrase (*i ac Emyr*), which consists of two conjuncts, agrees with the preceding singular verb (*roeddwn*) and the following plural predicate nominal (*ysgrifenwyr*) at the same time; the subject NP is taking part in single-conjunct agreement and another, more regular type of agreement simultaneously. Likewise, in (7), the subject noun phrase (*i a Gwenllian*), which consists of two conjuncts, agrees with the preceding singular verb (*dw*) and the following plural anaphoric pronominal

form (*ein*). Again, the subject NP is taking part in two different kinds of agreement relations simultaneously. (Munn (2000) discusses Brazilian Portuguese examples of an analogous nature.)

(6) Roeddwn i ac Emyr yn ysgrifenwyr rhagorol.
was-1S I and Emyr PT writers excellent
'Emyr and I were excellent writers.'

(7) Dw i a Gwenllian heb gael ein talu.
am.1S I and Gwenllian without get 1PL pay
'Gwenllian and I have not been paid.'

Sadler (2003) summarizes the relevant Welsh facts as follows.

- Head-argument agreement suggests that the coordinate structure bears the agreement features associated with an initial, pronominal conjunct.
- But evidence from anaphora and predicate agreement suggests that the coordinate structure bears semantically resolved person and number agreement features.

A situation like this cannot be handled properly in Moosally's theory, let alone Bayer's theory.

2.3 Sadler (2003)

Examples like (6) and (7) above do not pose a problem for Sadler's LFG-based theory of single-conjunct agreement (Sadler (2003)). In Sadler's theory, a coordinate NP has two agreement-related features, AGR and INDEX. The AGR value of a coordinate NP is identical to the INDEX value of the initial conjunct and is utilized for single-conjunct agreement, whereas the INDEX value of a coordinate NP results from some kind of feature resolution and is utilized for agreement patterns in which the entire coordinate structure appears to be in an agreement relation with something else.

Although Sadler's account captures the above Welsh facts in a concise manner, it has the following shortcomings.

First, since Sadler's theory makes use of a feature AGR, whose sole function is to enable single-conjunct agreement, it predicts that single-conjunct agreement must be a fairly rare phenomenon. This prediction might be correct for SVO and SOV clauses, but it is not correct for VSO clauses. Single-conjunct agreement is a prevalent agreement pattern in VSO clauses, as shown in Doron (2000).

Second, more importantly, Sadler's theory cannot deal with an agreement pattern which I will call *each-conjunct agreement*. One example of each-conjunct agreement is the agreement pattern we see in English sentences in which a verb agrees with a subject NP of the form *X or Y*. As has been noted by Pullum and Zwicky (1986) and others, when an English verb has to agree with a subject NP consisting of disjunctively conjoined NPs, the verb has to agree with each conjunct. Consider the following examples.

(8) (from Sobin (1997))

a. You or I ??are/*am/*is wrong.

b. You or I must be wrong.

There is no way to make (8a) perfect, because there is no form of the verb *be* that agrees with *you* and *I* at the same time. On the other hand, (8b) is perfect because the auxiliary verb *must* agrees both with *you* and with *I*. Sadler's theory does not provide a means to capture this set of facts; although the f-structure corresponding to a coordinate NP is equipped with the AGR feature, which shows the agreement-related property of a single, designated conjunct (the initial conjunct in the case of Welsh NPs), it is not equipped with a feature that shows the agreement-related properties of conjuncts other than that single, designated conjunct.

3 The grammar of constituent coordination

In this section, I will present a novel theory of coordination of unlikes and show that it is as successful as Bayer's theory in dealing with examples like (1) and (2). The way the theory circumvents the two problems that beset Bayer's theory will be explained in later sections.

I will descibe the intuition behind the theory before presenting the theory itself. I take what has been called Wasow's generalization as the point of departure.

(9) Wasow's generalization:

An element in construction with a coordinate constituent must be syntactically construable with each conjunct. Thus, a structure of the form

D [A, B, and C]

is grammatical only if structures of the form DA, DB, and DC are each grammatical.

While it is obviously not impeccably correct in the form given here, Wasow's generalization is a succinct, insightful description of what we regularly see in cases involving coordination of unlikes. What I called each-conjunct agreement above is a prime example of what this generalization successfully captures. Now, one way to implement Wasow's generalization in one's grammatical theory would be to assume that an element in construction with a coordinate constituent has access to the syntactic property of each conjunct, not just the syntactic property of the coordinate constituent as a whole. Such a move might look like overkill, but it would provide us with a very simple and unified way to capture both single-conjunct agreement and each-conjunct agreement, as well as more standard instances of coordination of unlikes such as (1) and (2).

(10) is the gist of the proposed theory, which is based on the intuition just described.

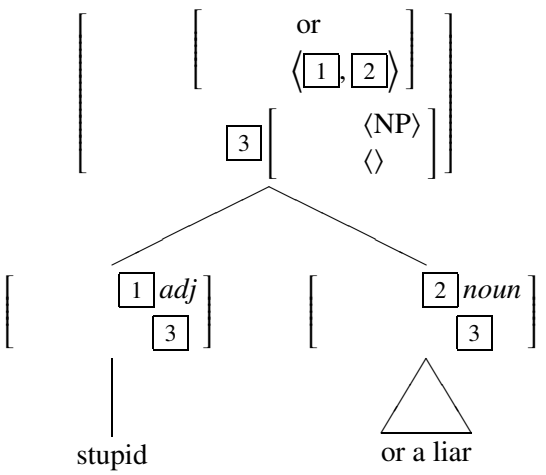


Figure 2: The internal structure of the phrase *stupid or a liar*

(10) Suppose that a coordinate structure M is made up of n conjunct daughters, $d_1 \cdots d_n$ from left to right. Then the following must hold.

(i) The HEAD value of M is

$$\begin{bmatrix} \boxed{0} \\ \langle \boxed{1}, \ldots, \boxed{n} \rangle \end{bmatrix},$$

where $\boxed{1} \cdots \boxed{n}$ are the HEAD values of $d_1 \cdots d_n$ respectively, and $\boxed{0}$ is the SYNSEM|CONT|KEY|RELN value of M.

(ii) The VALENCE value of M is identical to the VALENCE value of each of the conjunct daughters, $d_1 \cdots d_n$.

I assume that MOD is a VALENCE feature, not a HEAD feature (Yatabe (2003); Sag et al. (2003)). On this account, the internal structure of the phrase *stupid or a liar* in example (1) is claimed to be as shown in Figure 2 (assuming that a predicative nominal has a subject slot that is not overtly filled).

Given this analysis of constituent coordination, it is trivially easy to account for the existence of sentences like (1) above and (11) below, which involve coordination of unlike arguments; all that needs to be done is to set up lexical entries such as the one shown in Figure 3, which take into account the fact that subjects and complements they take may turn out to involve coordination.

(11) We emphasized Mr. Colson's many qualifications and that he had worked at the White House. (from Bayer (1996))

Notice that the only aspect in which Figure 3 deviates from what is standardly assumed in HPSG is the use of the functor symbol c within the specification of the subcategorization frame. The meaning of the functor symbol c is defined in (12)

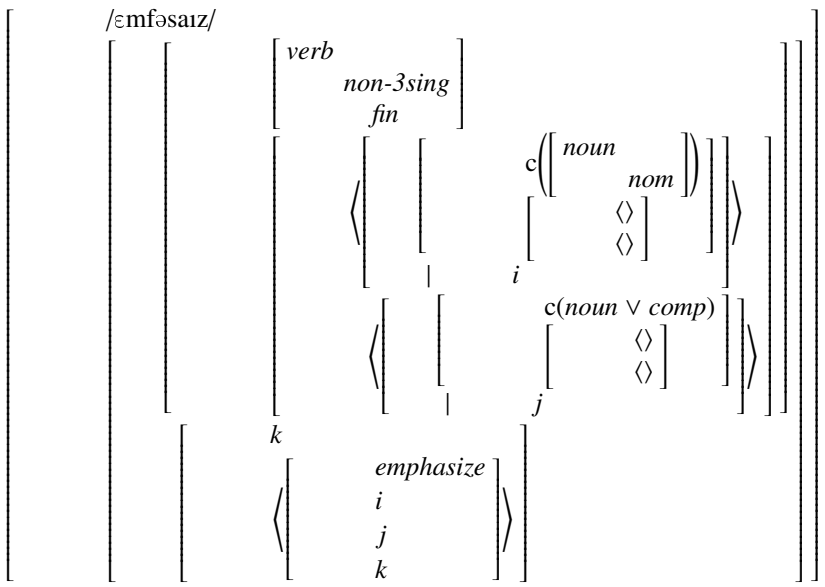


Figure 3: Part of the lexical entry for *emphasize*

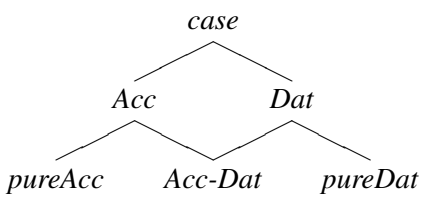
below. Roughly speaking, c(α) is an appropriate description of an object X if and only if either α is an appropriate description of X or X is a possibly nested 'coordinate structure' such that α is an appropriate description of each of its 'conjuncts'. The lexical entry in Figure 3 is in effect saying (i) that the subject of this verb must be either a nominative NP or a possibly nested coordinate structure whose conjuncts are all nominative NPs[2] and (ii) that the complement of this verb must be an NP, a CP, or a possibly nested coordinate structure each of whose conjuncts is either an NP or a CP.

(12) $\boxed{1} : \mathrm{c}(\alpha) \equiv$
$\boxed{1} : \alpha$
$\vee \left(\boxed{1} : \left[\left\langle \boxed{a_1}, \ldots, \boxed{a_n} \right\rangle \right] \right.$
$\left. \wedge \boxed{a_1} : \mathrm{c}(\alpha) \wedge \cdots \wedge \boxed{a_n} : \mathrm{c}(\alpha) \right)$

The proposed theory also successfully accounts for an example like (2), which involves coordination of unlike predicates, when combined with Levine et al.'s theory of case syncretism (Levine et al. (2001)). Specifically, example (2) can be dealt with by introducing a new sort, say, *Acc-Dat*, as a subsort of both *Acc* and *Dat*, as shown in (13). (In this illustration, I ignore cases other than the accusative case and the dative case.)

[2]This lexical entry captures only the prescriptively "correct" case assignment pattern. Further complexity will have to be introduced into the lexical entry, if we are to capture prescriptively "incorrect" case assignment patterns, described in detail in Sobin (1997).

(13)



Since the VALENCE value of the coordinate structure *gefunden und geholfen* in (2) is by assumption identical both to the VALENCE value of *gefunden* and to the VALENCE value of *geholfen*, it is correctly predicted that the coordinate structure subcategorizes for an NP whose CASE value is *Acc-Dat*, provided that *gefunden* subcategorizes for an NP whose CASE value is *Acc* and *geholfen* subcategorizes for an NP whose CASE value is *Dat*.

The theory proposed here provides us with a means to capture the contrast illustrated in (14) below, noted in Büring (2002).

(14) a. one of us/*one of you and me

b. one of the detectives/*one of Schimansky and Tanner

On the proposed account, it is possible to distinguish the grammatical cases and the ungrammatical cases by stipulating that this use of *of* subcategorizes for a plural NP or a coordinate structure made up of plural NPs, and not for a coordinate structure made up of singular NPs. Such a straightforward account is not available in other theories, where a phrase of the form [NP_{SING} and NP_{SING}] is (or at least can be) given the same status as a plural NP.

The following example is a potential problem for the proposed theory. (I owe this observation to Carl Pollard (personal communication).)

(15) Ken wants [to go to Berlin] and [for Jane to visit the city as well].

Since the proposed theory requires that the conjuncts of a coordinate structure should share the identical VALENCE value, this example is wrongly predicted to be ungrammatical, as long as we adhere to the standard HPSG analysis in which the first conjunct *to go to Berlin* is a VP while the second conjunct *for Jane to visit the city as well* is a saturated clause. In order to get around this potential problem, I assume here that the SUBJ list of the infinitival verb *go*, as well as the SUBJ list of the word *to*, is lexically specified to be an empty list, and that the first conjunct *to go to Berlin* in the above example is thus in fact a saturated clause, not a VP. Furthermore, in order to prevent this assumption from causing problems regarding our analysis of raising and control, I suggest that we adopt the theory, endorsed by Meurers (1999), Levine (2001), and others, in which a HEAD feature called SUBJECT, whose value is structure-shared with the least oblique element on the head's argument-structure list, makes information about the subject NP accessible to raising and control verbs.

4 Right-node raising

In this section, I will show how the present theory accounts for the grammaticality of (3) and (4), which was identified as a problem for Bayer's theory.

The grammaticality of examples like (3) and (4) is in fact no mystery if we adopt a theory of right-node raising (RNR) such as the one presented in Yatabe (2001), according to which there are two types of RNR: a syntactic type of RNR, which applies to two or more homophonic conjunct-final expressions only when they share the same syntactic and semantic internal structure, and a purely prosodic type of RNR, which is allowed to apply to two or more homophonic conjunct-final elements that may not share the same syntactic and semantic internal structure. On this account, two homophonous words, such as the words *Dozenten* 'docent' and *Dozenten* 'docents' or the words *Quark* 'quark' and *Quark* 'fresh cheese', are allowed to undergo the latter, purely prosodic type of RNR and give rise to sentences like (3) and (4), even though they are syntactically and semantically distinct and thus are not allowed to undergo the former, syntactic type of RNR. The Finnish example in (16) is amenable to the same explanation; it can also be viewed as resulting from the purely prosodic type of RNR.

(16) He lukivat hänen uusimman _____ ja me hänen parhaat _____
they read his newest (sg gen) and we his best (pl nom)
kirjansa.
book/books
(from Zaenen and Karttunen (1984))

It might be felt that an account like this would inevitably lead to massive overgeneration. That is not the case. Most potential cases of purely prosodic RNR can be blocked by the following constraint, which is probably reducible to principles governing the interpretation of focus and hopefully need not be stated as an independent constraint.

(17) The anti-focus constraint on right-node raising:
Expressions that are accented so as to be interpreted as contrasting with each other cannot be fused with each other.

This constraint prevents the sentence (18b) from being derived from (18a) through application of the purely prosodic type of RNR.

(18) a. Jo has visited [THAT city]$_1$ and Ed is going to visit [THAT city]$_2$.
([THAT city]$_1$ ≠ [THAT city]$_2$)

b. Jo has visited and Ed is going to visit THAT city.

The NPs [THAT city]$_1$ and [THAT city]$_2$ in (18a) are accented so as to be interpreted as contrasting with each other. Therefore, due to the anti-focus constraint on RNR, the two NPs cannot be fused together and right-node-raised.

Examples like (3) and (4) are special cases. In the 'pre-RNR stage' of (3) (that is, 'der Antrag des Dozenten oder der Dozenten'), the contrast between the singular 'docent' and the plural 'docents' is signaled not by accenting the nouns themselves but rather by accenting the preceding determiners. Likewise, in the 'pre-RNR stage' of (4) (that is, 'Peter beschreibt den Quark, und Martin beschreibt das Quark'), the contrast between 'quark' and 'fresh cheese' is indicated not by accenting the nouns themselves but by accenting the preceding determiners.[3] Purely prosodic RNR can be used only in exceptional cases such as these.

5 Each-conjunct agreement

In this penultimate section, I will present an analysis of subject-verb agreement in English, in order to show how the proposed theory provides a basis for a principled characterization of the phenomenon of each-conjunct agreement, which was identified as a problem for Sadler's theory.

The analysis that I suggest consists of the following hypotheses. I will simply describe the hypotheses first, and will try to motivate each afterwards.

> Hypothesis 1:
> VPs and NPs are both equipped with a HEAD feature called AGR.
>
> Hypothesis 2:
> Subject-verb agreement is enforced by requiring a certain relation to hold between the HEAD values (including the HEAD|AGR values) of a VP and its subject.[4]
>
> Hypothesis 3:
> Nouns can be constructed on the fly which end with a plurality marker (*-s*) but whose SYNSEM|CAT|HEAD|AGR|NUM value is *singular*.
>
> Hypothesis 4:
> There are (at least) two lexical entries for the word *and*, both of which can be used to conjoin NPs: one entry whose function is to form an NP with a plural index and another one whose function is to form an NP with a singular index.
>
> Hypothesis 5:
> The HEAD|AGR value of a verb is atomic and is required to be of type *v-agr-cat*. The type *v-agr-cat* consists of six immediate subtypes, *3sing*, *non-3sing*, *any*, *am*, *was*, and *are-were*, which are all leaf types. The value *3sing* is assigned to verbs like *is* and *walks*, *non-3sing* to

[3] I have been unable to determine if something analogous can be said about (16).

[4] The way this relation is to be integrated into the grammar is discussed in detail in Yatabe (2003), and will not be elaborated on in this paper.

verbs like the finite *walk*, *any* to verbs like *walked* and the infinite *walk*, *am* to the verb *am*, *was* to the verb *was*, and *are-were* to the verbs *are* and *were*. On the other hand, the AGR value of a noun is a feature structure that has three features, NUM, PER, and GEND.

Hypothesis 6:
The relation that is required to hold between the HEAD values (including the HEAD|AGR values) of a VP and its subject, which I will call the *subject_verb_agreement* relation, is defined as follows. The two arguments of this relation are the HEAD values of a VP and its subject, respectively.

$$
\begin{array}{l}
\mathit{subject_verb_agreement}\left(\boxed{1},\boxed{2}\right) \equiv \\
\quad \mathit{subj_v_agr}\left(\boxed{1},\boxed{2}\right) \\
\vee \quad \Big(\quad \boxed{1} : \left[\quad \left\langle \boxed{a_1}, \ldots, \boxed{a_n} \right\rangle \ \right] \\
\quad\quad \wedge \quad \Big(\mathit{subject_verb_agreement}\left(\boxed{a_1},\boxed{2}\right) \wedge \cdots \\
\quad\quad\quad\quad \wedge \mathit{subject_verb_agreement}\left(\boxed{a_n},\boxed{2}\right)\Big)\Big)
\end{array}
$$

The *subj_v_agr* relation, which is utilized in this definition, is defined as follows:

$$
\begin{array}{l}
\mathit{subj_v_agr}\left(\boxed{1},\boxed{2}\right) \equiv \\
\quad \Big(\quad \boxed{1} : \left[\quad \mathit{3sing} \ \right] \\
\quad\quad \wedge \quad \Big(\mathit{person}\left(\boxed{2}, \mathit{3rd}\right) \wedge \mathit{number}\left(\boxed{2}, \mathit{sing}\right)\Big)\Big) \\
\vee \quad \Big(\quad \boxed{1} : \left[\quad \mathit{non\text{-}3sing} \ \right] \\
\quad\quad \wedge \quad \Big(\mathit{person}\left(\boxed{2}, \mathit{1st}\right) \vee \mathit{person}\left(\boxed{2}, \mathit{2nd}\right) \vee \mathit{number}\left(\boxed{2}, \mathit{pl}\right)\Big)\Big) \\
\vee \quad\quad \boxed{1} : \left[\quad \mathit{any} \ \right] \\
\vee \quad \Big(\quad \boxed{1} : \left[\quad \mathit{am} \ \right] \\
\quad\quad \wedge \quad \Big(\mathit{person}\left(\boxed{2}, \mathit{1st}\right) \wedge \mathit{number}\left(\boxed{2}, \mathit{sing}\right)\Big)\Big) \\
\vee \quad \Big(\quad \boxed{1} : \left[\quad \mathit{was} \ \right] \\
\quad\quad \wedge \quad \Big(\Big(\mathit{person}\left(\boxed{2}, \mathit{1st}\right) \vee \mathit{person}\left(\boxed{2}, \mathit{3rd}\right)\Big) \wedge \mathit{number}\left(\boxed{2}, \mathit{sing}\right)\Big)\Big) \\
\vee \quad \Big(\quad \boxed{1} : \left[\quad \mathit{are\text{-}were} \ \right] \\
\quad\quad \wedge \quad \Big(\mathit{person}\left(\boxed{2}, \mathit{2nd}\right) \vee \mathit{number}\left(\boxed{2}, \mathit{pl}\right)\Big)\Big) \\
\vee \quad \Big(\quad \boxed{2} : \left[\begin{array}{c} \mathit{or} \\ \left\langle \boxed{a_1}, \ldots, \boxed{a_n} \right\rangle \end{array} \right] \\
\quad\quad \wedge \quad \Big(\mathit{subj_v_agr}\left(\boxed{1},\boxed{a_1}\right) \wedge \cdots \wedge \mathit{subj_v_agr}\left(\boxed{1},\boxed{a_n}\right)\Big)\Big)
\end{array}
$$

The *number* relation, which appears in the above definition, is defined as follows. (The definition of the *person* relation is given in the Appendix.)

$$
\mathit{number}\left(\boxed{1},\boxed{2}\right) \equiv
$$

$$\boxed{1}:\left[\ \ |\ \ \boxed{2}\ \right]$$
$$\vee\ \left(\ \boxed{1}:\left[\ \ \textit{singular-and}\ \right]\ \wedge\ \boxed{2}=\textit{sing}\right)$$
$$\vee\ \left(\ \boxed{1}:\left[\ \ \textit{plural-and}\ \right]\ \wedge\ \boxed{2}=\textit{pl}\right)$$

Hypothesis 1 was first proposed by Kathol (1999) and has been adopted by Bender and Flickinger (1998), Sag et al. (2003), and others. I take this hypothesis to be relatively uncontroversial, if not universally accepted.

Hypothesis 2 is essentially what has been proposed by Kathol (1999) for subject-verb agreement in German. Kathol, however, chooses not to analyze subject-verb agreement in English in the same way. He instead maintains the analysis proposed in Pollard and Sag (1994), which treats subject-verb agreement in English as index agreement; he assumes that what is involved in subject-verb agreement in English is agreement between the AGR value of a verb phrase and the INDEX value of its subject. The reason I do not accept this aspect of Kathol's analysis is the following. In the theory of constituent coordination proposed in section 3, the HEAD value (including the HEAD|AGR value) of each conjunct remains accessible at the level of the coordinate structure by being incorporated into the HEAD value of the coordinate structure as a whole. The INDEX value of each conjunct, on the other hand, is not accessible at the level of the coordinate structure. Therefore it will not be possible to capture the patterns of each-conjunct agreement within this theory if the principles governing subject-verb agreement in English are to make reference to the INDEX value of the agreement source, rather than its AGR value. Given this state of affairs, it seems at least as reasonable to explore an alternative analysis of subject-verb agreement in English as it is to modify and complicate the theory of coordination.

Hypothesis 3 makes it possible for the proposed theory to deal with examples like (19), discussed in Pollard and Sag (1994).

(19) The hash browns at table nine is getting angry.

Pollard and Sag (1994) cite this example as evidence for the view that subject-verb agreement in English is index agreement. However, if we assume that the AGR|NUM value of the word *hash browns* here can be *singular*, then the example no longer contradicts the view that subject-verb agreement in English is agreement between the AGR values of a verb and its subject, just as subject-verb agreement in German appears to be.

Likewise, Hypothesis 4 makes it possible for the proposed theory to handle examples like the following. (The two conjoined NPs *his aged servant* and *the subsequent editor of his collected papers* in (21) are intended to refer to the same individual.)

(20) Mary and John were criticizing themselves.

(21) His aged servant and the subsequent editor of his collected papers was with him at his deathbed. (from Quirk et al. (1985) (§10.39))

Example (20) shows that when two NPs with different indices are conjoined with *and*, the resulting coordinate NP functions as something plural. Example (21), on the other hand, shows that when two NPs with the same index are conjoined with *and*, the resulting coordinate NP functions as something singular. Pollard and Sag (1994) use examples of this type as another piece of evidence for the view that subject-verb agreement in English is index agreement. However, it is possible to reinterpret these facts in the following way, given Hypothesis 4. The word *and* in (20) and the word *and* in (21) are in fact different words with different meanings. Let us refer to the predicate expressed by the former as *plural-and* and to the predicate expressed by the latter as *singular-and*. Then the HEAD|CONJ value of the subject NP in (20) would be *plural-and*, whereas the HEAD|CONJ value of the subject NP in (21) would be *singular-and*; the difference between the agreement properties of the two subject NPs can now be ascribed to the difference between these two HEAD|CONJ values, rather than the difference between their INDEX values.[5]

Hypothesis 5 says nothing new about the AGR values of NPs; on the other hand, what it says about the AGR values of verbs is novel. In the standard analysis of the phenomenon, subject-verb agreement in English is assumed to be enforced by a constraint that requires the "phi-feature specifications" of a verb and those of its subject to be identical. This standard analysis, however, cannot be maintained, in view of the fact that subject-verb agreement in English resorts to the pattern of each-conjunct agreement at times.[6] Consider example (8b) (*You or I must be wrong*). If we were to treat the agreement between *must* and its subject in this sentence in terms of simple identity requirements, we would have to say that there was a type, say *1st-2nd*, which was a subtype of both *1st* and *2nd*, and that the PER value of the verb *must*, that of the first conjunct *you*, and that of the second conjunct *I* were all *1st-2nd*. While it might not be so strange to say that the PER value of the verb is *1st-2nd*, it is plainly absurd to say that the PER value of the pronoun *I* or that of the pronoun *you* is *1st-2nd*; to say that would be to say that *I* is actually not just a first-person pronoun but also a second-person pronoun and that *you* is actually not just a second-person pronoun but also a first-person pronoun.

The definition of the *subject_verb_agreement* relation in Hypothesis 6 merely says that a VP must agree with its subject and that, when the VP is a (possibly nested) coordinate structure, each conjunct must agree with the subject. The next definition, the definition of the *subj_v_agr* relation, is the central piece of this analysis of subject-verb agreement. There are seven disjuncts in the right-hand side of the definition of the *subj_v_agr* relation; the seventh disjunct deals with each-

[5]It is probably necessary to say that there are two types of *or* too, since sentences like *Either Fred or Bill are shaving themselves* are possible as well as sentences like *Either Fred or Bill is shaving himself* (Quirk et al. (1985); Peterson (1986)). This complication will be ignored in this paper. What I call summative agreement in Yatabe (2003) will likewise be ignored.

[6]Ingria (1990) also argues against what I call the standard analysis here. Most if not all of his arguments lose force, however, given the analysis of case syncretism developed in Levine et al. (2001) and the notion of purely prosodic RNR, both of which were mentioned earlier.

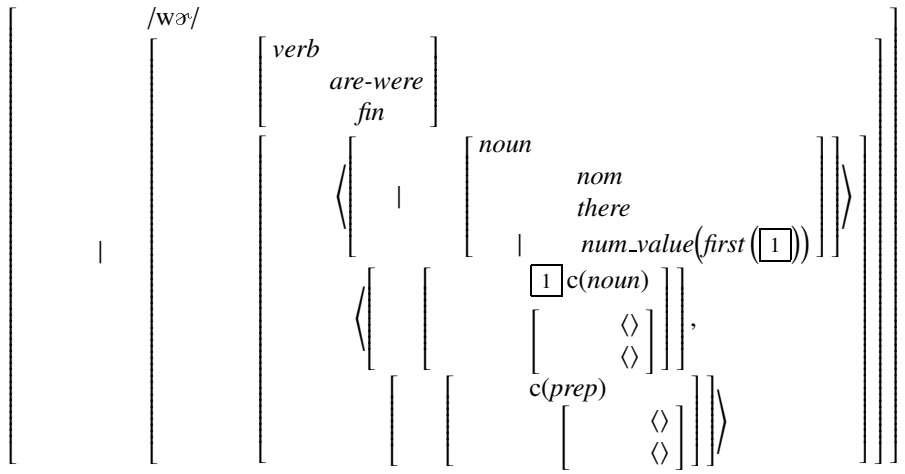


Figure 4: Part of a lexical entry that will give rise to the *there* construction

conjunct agreement and the other six disjuncts deal with the rest of the cases. The *number* relation, which is defined next, is, intuitively speaking, a relation that holds between X and *sing* (or *pl*) if and only if X can be regarded as something singular (or plural, respectively). Recall that *plural-and* and *singular-and* are the names of the relations expressed by the two lexical entries for *and* mentioned above.

All in all, the proposed theory successfully describes subject-verb agreement in English, including cases involving each-conjunct agreement. The analysis presented in this section is more complicated than many of the analyses that it is intended to supersede, and the same can be said about the analysis of single-conjunct agreement that is going to be presented in the next section. It should be recalled, however, that none of the previous theories is equipped with an adequate analysis of both each-conjunct agreement and single-conjunct agreement.

6 Single-conjunct agreement

In this final section, I will present an analysis of the *there* construction in English, in order to show how the proposed theory can deal with single-conjunct agreement, a phenomenon that was identified as a problem for Bayer's theory.

The reason why the proposed theory is capable of dealing with single-conjunct agreement is that the linear order between conjuncts is reflected in the HEAD value of the coordinate structure as a whole. The facts shown in (5) can be captured by setting up lexical entries like the one shown in Figure 4. The *num_value* function and the *first* function that are used in this lexical entry are defined as follows.

(22) $num_value\left(\left[\ \ |\ \ \boxed{1}\right]\right) \equiv \boxed{1}$

(23) $\mathit{first}(\boxed{1}) \equiv \begin{cases} \mathit{first}(\boxed{a_1}), \text{ if } \boxed{1}\text{: } \left[\quad \left\langle \boxed{a_1} \cdots \boxed{a_n} \right\rangle \right] \\ \boxed{1}, \text{ otherwise} \end{cases}$

The lexical entry in Figure 4 says (i) that the AGR|NUM value of the subject NP *there* must be identical to the AGR|NUM value of the postverbal NP when the postverbal NP is not a coordinate structure, and (ii) that the AGR|NUM value of the subject NP *there* must be identical to the AGR|NUM value of the leftmost conjunct in the postverbal NP when the postverbal NP is a possibly nested coordinate structure. This is an adequate description of what we see in examples like (5).

The following observation, due to Morgan (1984), poses a potentially serious problem for the proposed analysis.

(24) a. There were two women and a man sunning themselves on the patio.

b. There ??was/??were a man and two women sunning themselves on the patio.

There is nothing wrong with (24a). In (24b), on the other hand, *was* cannot be used, presumably because the clause-final VP *sunning themselves on the patio* requires a plural subject, and *were* cannot be used either, presumably because the verb is required to agree with the immediately postverbal NP (*a man*), which happens to be singular. These facts seem to justify the following generalization, explicitly stated in Sadler (2003): in English, "once a particular set of feature values has been associated with the coordinate NP as a whole, all agreement processes access these same values." The problem here is that the theory proposed in this paper does not associate any particular agreement-related feature values to a coordinate NP as a whole and hence does not provide a natural way to state this generalization.

The examples above, however, do not confirm the correctness of the generalization in question. The facts can be captured by setting up a lexical entry like the one in Figure 5, without the help of the generalization. The lexical entry in Figure 5 rules out the *was* version of (24b) by requiring that the AGR|NUM value of *there* (which is required to be *sing* by the AGR value of the verb and the AGR|NUM value of the first conjunct of the postverbal NP) should be identical to the AGR|NUM value of the unexpressed subject of the clause-final VP (which is required to be *pl* by the presence of the plural reflexive pronoun). The *were* version of (24b) is also ruled out, because the first conjunct of the postverbal NP, which is required to be plural by the AGR value of the verb, is in fact singular. Thus the examples do not provide a reason to accept the problematic generalization.[7]

[7]Sadler (2003) uses examples like *Either Fred or Bill is shaving himself/*themselves* and *Either Fred or Bill are shaving themselves/*himself* (Peterson (1986)), in justifying the generalization in question. These examples do not pose a problem for the proposed theory either, provided that, as suggested in note 5 above, there are two types of *or*, one producing NPs that agree with singular verbs and singular pronouns and one that produces NPs that agree with plural verbs and plural pronouns. Incidentally, it should be pointed out that the generalization in question, if true, would pose a problem for Sadler's theory as well. In Sadler's theory, the generalization means that, unlike Welsh, English

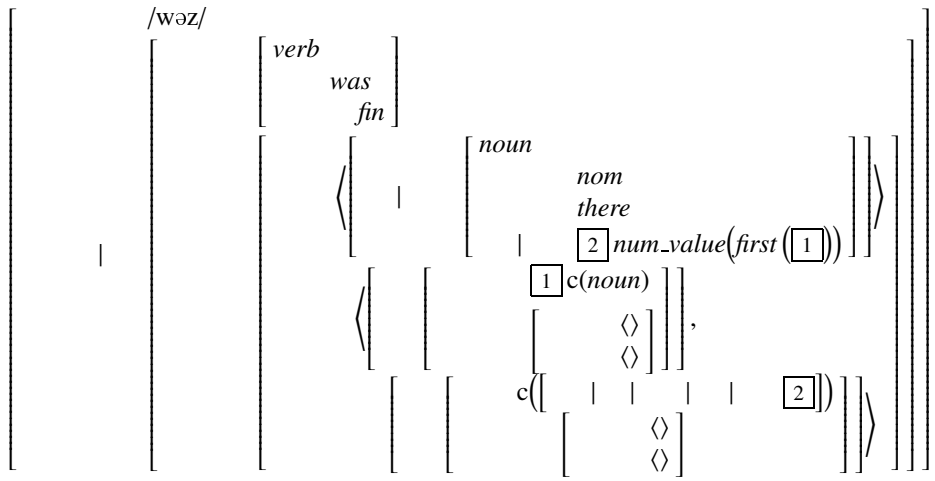


Figure 5: Part of another lexical entry that will give rise to the *there* construction

7 Conclusion

In this paper, it has been argued that it is possible to develop a reasonably simple HPSG-based theory that is capable of dealing with every phenomenon resulting from coordination of unlikes, including single-conjunct agreement and each-conjunct agreement. In the course of the argumentation, it has also been claimed that certain facts involving each-conjunct agreement provide a straightforward piece of evidence that subject-verb agreement in English must be characterized in terms of relational constraints that are not simply identity requirements.

Appendix

The *person* relation, which is referred to in the definition of the *subj_v_agr* relation in section 5, is defined as follows.

$$
\begin{aligned}
&\mathit{person}(\boxed{1},\boxed{2}) \equiv \\
&\quad \boxed{1} : [\ \mid\ \boxed{2}\ ] \\
&\vee \quad (\ \boxed{2} = \mathit{1st} \\
&\qquad \wedge \quad \boxed{1} : \left[\ \boxed{3}\ \langle \boxed{a_1}, \ldots, \boxed{a_n} \rangle\ \right] \\
&\qquad \wedge \quad \boxed{3} \neq \mathit{or}
\end{aligned}
$$

has only one agreement-related feature or that the AGR value and the INDEX value of an NP are always required to be identical to each other in English. This leads to the following problem. The sentence *There was a man and two women in the room* is grammatical in English. Therefore it must be the case that the NUM value of the NP *a man and two women* can be *sing*. Then why can we not say something like **A man and two women was running around*?

$$
\begin{array}{lll}
 & \wedge & \left(person\left(\boxed{a_1}, 1st\right) \vee \cdots \vee person\left(\boxed{a_n}, 1st\right)\right) \\
\vee & \Big(& \boxed{2} = 2nd \\
 & \wedge & \boxed{1} : \left[\begin{array}{c} \boxed{3} \\ \left\langle \boxed{a_1}, \ldots, \boxed{a_n} \right\rangle \end{array}\right] \\
 & \wedge & \boxed{3} \neq or \\
 & \wedge & \left(person\left(\boxed{a_1}, 2nd\right) \vee \cdots \vee person\left(\boxed{a_n}, 2nd\right)\right) \\
 & \wedge & \neg\left(person\left(\boxed{a_1}, 1st\right) \vee \cdots \vee person\left(\boxed{a_n}, 1st\right)\right) \Big) \\
\vee & \Big(& \boxed{1} : \left[\left\langle \boxed{a_1}, \ldots, \boxed{a_n} \right\rangle \right] \\
 & \wedge & \left(person\left(\boxed{a_1}, \boxed{2}\right) \wedge \cdots \wedge person\left(\boxed{a_n}, \boxed{2}\right)\right) \Big)
\end{array}
$$

References

Bayer, Samuel. 1996. The Coordination of Unlike Categories. *Language* 72, 579–616.

Beavers, John and Sag, Ivan A. 2004. Some Arguments for Coordinate Ellipsis in HPSG. Paper Presented at the HPSG 2004 Conference.

Bender, Emily and Flickinger, Dan. 1998. Peripheral Constructions and Core Phenomena: Agreement in Tag Questions. In Gert Webelhuth, Jean-Pierre Koenig and Andreas Kathol (eds.), *Lexical and Constructional Aspects of Linguistic Explanation*, pages 199–214, Stanford: CSLI.

Büring, Daniel. 2002. 2 × Singular ≠ Plural. *Snippets* 6, 6–7, http://www.ledonline.it/snippets/.

Crysmann, Berthold. 2003. An Asymmetric Theory of Peripheral Sharing in HPSG: Conjunction Reduction and Coordination of Unlikes. In Gerhard Jäger, Paola Monachesi, Gerald Penn and Shuly Wintner (eds.), *Proceedings of Formal Grammar 2003*, pages 47–62, available at http://cs.haifa.ac.il/~shuly/fg03/.

Dalrymple, Mary and Kaplan, Ronald M. 2000. Feature Indeterminacy and Feature Resolution. *Language* 76, 759–798.

Daniels, Michael W. 2002. On a Type-Based Analysis of Feature Neutrality and the Coordination of Unlikes. In Frank Van Eynde, Lars Hellan and Dorothee Beermann (eds.), *Proceedings of the 8th International Conference on Head-Driven Phrase Structure Grammar*, pages 137–147, Stanford: CSLI, http://cslipublications.stanford.edu/HPSG/.

Doron, Edit. 2000. VSO and Left-Conjunct Agreement: Biblical Hebrew vs. Modern Hebrew. In Andrew Carnie and Eithne Guilfoyle (eds.), *The Syntax of Verb Initial Languages*, Oxford Studies in Comparative Syntax, pages 75–95, Oxford: Oxford University Press.

Eisenberg, Peter. 1973. A Note on "Identity of Constituents". *Linguistic Inquiry* 4, 417–420.

Hartmann, Katharina. 2000. *Right Node Raising and Gapping: Interface Conditions on Prosodic Deletion*. Amsterdam: John Benjamins.

Ingria, Robert J. P. 1990. The Limits of Unification. In *Proceedings of the 28th Annual Meeting of the Association for Computational Linguistics*, pages 194–204.

Kathol, Andreas. 1999. Agreement and the Syntax-Morphology Interface in HPSG. In Robert D. Levine and Georgia M. Green (eds.), *Studies in Contemporary Phrase Structure Grammar*, pages 223–274, Cambridge: Cambridge University Press.

Levine, Robert D. 2001. Tough Complementation and the Extraclausal Propagation of Argument Descriptions. In Dan Flickinger and Andreas Kathol (eds.), *Proceedings of the 7th International Conference on Head-Driven Phrase Structure Grammar*, pages 214–228, Stanford: CSLI, http://cslipublications.stanford.edu/HPSG/.

Levine, Robert D., Hukari, Thomas E. and Calcagno, Michael. 2001. Parasitic Gaps in English: Some Overlooked Cases and Their Theoretical Implications. In Peter W. Culicover and Paul M. Postal (eds.), *Parasitic Gaps*, pages 181–222, Cambridge, Massachusetts: MIT Press.

Levy, Roger and Pollard, Carl. 2002. Coordination and Neutralization in HPSG. In Frank Van Eynde, Lars Hellan and Dorothee Beermann (eds.), *Proceedings of the 8th International Conference on Head-Driven Phrase Structure Grammar*, pages 221–234, Stanford: CSLI, http://cslipublications.stanford.edu/HPSG/.

Maxwell III, John T. and Manning, Christopher D. 1996. A Theory of Non-constituent Coordination based on Finite-State Rules. In Miriam Butt and Tracy Holloway King (eds.), *Proceedings of the LFG '96 Conference*, Stanford: CSLI, http://cslipublications.stanford.edu/LFG/.

Meurers, Walt Detmar. 1999. Raising Spirits (and assigning them case). *Groninger Arbeiten zur Germanistischen Linguistik (GAGL)* 43, 173–226.

Moosally, Michelle, J. 1999. Subject and Object Coordination in Ndebele: An HPSG Analysis. In Sonya Bird, Andrew Carnie, Jason D. Haugen and Peter Norquest (eds.), *Proceedings of the 18th West Coast Conference on Formal Linguistics*, pages 379–392, Somerville: Cascadilla Press.

Morgan, Jerry L. 1984. Some Problems of Agreement in English and Albanian. In Claudia Brugman and Monica Macaulay (eds.), *Proceedings of the Tenth Annual Meeting of the Berkeley Linguistics Society*, pages 233–247, Berkeley: BLS.

Munn, Alan. 2000. Three Types of Coordination Asymmetries. In Kerstin Schwabe and Ning Zhang (eds.), *Ellipsis in Conjunction*, pages 1–22, Tübingen: Niemeyer.

Peterson, Peter G. 1986. Establishing Agreement with Disjunctively Conjoined Subjects: Strategies vs Principles. *Australian Journal of Linguistics* 6, 231–249.

Peterson, Peter G. 2004. Coordination: Consequences of a Lexical-Functional Account. *Natural Language and Linguistic Theory* 22, 643–679.

Pollard, Carl and Sag, Ivan A. 1994. *Head-Driven Phrase Structure Grammar*. Chicago: University of Chicago Press.

Pullum, Geoffrey K. and Zwicky, Arnold M. 1986. Phonological Resolution of Syntactic Feature Conflict. *Language* 62, 751–773.

Quirk, Randolph, Greenbaum, Sidney, Leech, Geoffrey and Svartvik, Jan. 1985. *A Comprehensive Grammar of the English Language*. London: Longman.

Sadler, Louisa. 2003. Coordination and Asymmetric Agreement in Welsh. In Miriam Butt and Tracy Holloway King (eds.), *Nominals: Inside and Out*, pages 85–117, Stanford: CSLI.

Sag, Ivan A. 2003. Coordination and Underspecification. In Jong-Bok Kim and Stephen Wechsler (eds.), *Proceedings of the 9th International Conference on Head-Driven Phrase Structure Grammar*, pages 267–291, Stanford: CSLI, http://cslipublications.stanford.edu/HPSG/.

Sag, Ivan A., Wasow, Thomas and Bender, Emily M. 2003. *Syntactic Theory: A Formal Introduction*. Stanford: CSLI, second edition.

Sobin, Nicholas. 1997. Agreement, Default Rules, and Grammatical Viruses. *Linguistic Inquiry* 28, 318–343.

Yatabe, Shûichi. 2001. The Syntax and Semantics of Left-Node Raising in Japanese. In Dan Flickinger and Andreas Kathol (eds.), *Proceedings of the 7th International Conference on Head-Driven Phrase Structure Grammar*, pages 325–344, Stanford: CSLI, http://cslipublications.stanford.edu/HPSG/.

Yatabe, Shûichi. 2003. A Linearization-Based Theory of Summative Agreement in Peripheral-Node Raising Constructions. In Jong-Bok Kim and Stephen Wechsler (eds.), *Proceedings of the 9th International Conference on Head-Driven Phrase Structure Grammar*, pages 325–344, Stanford: CSLI, http://cslipublications.stanford.edu/HPSG/.

Zaenen, Annie and Karttunen, Lauri. 1984. Morphological Non-Distinctiveness and Coordination. In Gloria Alvarez, Belinda Brodie and Terry McCoy (eds.), *Proceedings of the First Eastern States Conference on Linguistics*, pages 309–320.