Coordinate Ellipsis
and
Apparent Non-Constituent Coordination

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Abstract

Within the tradition of Categorial Grammar, so-called 'non-constituent' coordination ('argument cluster' coordination and 'right node raising') has been analyzed in terms of the coordination of nonstandard constituents produced by the operations of type raising and composition. This highly successful research has expanded the domain of data that modern analyses of coordination must take into account. Recent HPSG work by Yatabe (2002) and Crysmann (2003) provides an interesting alternative approach to this problem in terms of the coordination of familiar, but 'elliptical' constituents. We argue that this approach is empirically superior to the Categorial Grammar analysis, both in terms of empirical coverage and cross-linguistic predictions. We reassess the relevant English data in small but important ways, and develop our own ellipsis analysis, building on Yatabe's and Crysmann's insights.

1   Introduction

In this paper we examine various coordination constructions, including constituent coordination (1a,b) as well as non-constituent coordination (NCC) phenomena such as argument cluster coordination (ACC) (1c,d), right node raising (RNR) (1e), and combinations of RNR and ACC (1f).

(1)   a. [We gave Jan a cake] and [we gave Yo a book]. (Constituent Coordination)

b. We [gave Jan a cake] and [gave Yo a book]. (Constituent Coordination)

c. We gave [Jan a cake] and [Yo a book]. (ACC)

d. We visited [Jan on Monday] and [Yo on Tuesday]. (ACC)

e. [Jan visited and Yo refused to visit] my stepmother's father. (RNR)

f. [Kim told Pat that Jan visited] and [Sandy that Yo refused to visit] [my stepmother's father] (ACC+RNR)

Phenomena such as ACC and RNR have been taken as providing strong evidence for some form of Combinatory Categorial Grammar (CCG), which allows coordination of non-standard constituents. Typical CCG analyses of NCC (Dowty, 1988; Steedman, 1989, 1996, 2000) are based on the notions of type raising ($\mathbf{T}$) and function composition ($\mathbf{B}$). An example analysis of ACC is given in (2), where the argument NPs of the verb *give* are type raised to function categories and combine to form larger constituents via function composition. The resulting constituents

are coordinated following a general coordination schema, and the coordinated constituent takes the verb *give* and the subject NP as its arguments via function application, producing a sentence:

(2)

We	gave	Jan	a record	and	Yo	a book
NP	DTV	NP	NP	$CONJ$	NP	NP

$$
\begin{array}{l}
\text{We}\quad \text{gave}\quad \text{Jan}\quad\text{a record}\quad\text{and}\quad\text{Yo}\quad\text{a book}\\
\overline{NP}\ \ \overline{DTV}\ \ \overline{NP}\ \ \ \ \overline{NP}\ \ \ \ \overline{CONJ}\ \ \overline{NP}\ \ \ \ \overline{NP}\\
\qquad\qquad \overline{TV\backslash DTV}^{<\mathbf{T}}\ \ \overline{VP\backslash TV}^{<\mathbf{T}}\qquad\qquad \overline{TV\backslash DTV}^{<\mathbf{T}}\ \ \overline{VP\backslash TV}^{<\mathbf{T}}\\
\qquad\qquad\qquad \overline{VP\backslash DTV}^{<\mathbf{B}}\qquad\qquad\qquad\qquad \overline{VP\backslash DTV}^{<\mathbf{B}}\\
\qquad\qquad\qquad\qquad\qquad \overline{\qquad\qquad VP\backslash DTV \qquad\qquad}^{<\Phi>}\\
\qquad\qquad\qquad \overline{\qquad\qquad VP \qquad\qquad}^{<}\\
\qquad \overline{\qquad\qquad\qquad S \qquad\qquad\qquad}^{<}
\end{array}
$$

(where VP = (S\NP), TV = (VP/NP), and DTV = (TV/NP))

Type raising and function composition are the same two mechanisms that independently license unbounded dependency constructions (UDCs) in CCG. In (3) the direct object of *likes* is left-dislocated and assigned a special topicalization category, and the subject NPs *Yo* and *Jan* undergo type raising. The non-topicalized constituents compose to produce a phrase of category *S/NP*, which serves as the argument of the topicalized NP to produce a sentence:

(3)

$$
\begin{array}{l}
\text{Bagels,}\qquad \text{Yo}\qquad \text{said}\qquad \text{that}\qquad \text{Jan}\qquad \text{likes!}\\
\overline{S/(S/NP)}\ \ \overline{S/VP}^{>\mathbf{T}}\ \ \overline{VP/S}\ \ \overline{S/S}\ \ \overline{S/VP}^{>\mathbf{T}}\ \ \overline{VP/NP}\\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \overline{\quad S/NP \quad}^{>\mathbf{B}}\\
\qquad\qquad\qquad\qquad\qquad \overline{\qquad\quad S/NP \qquad\quad}^{>\mathbf{B}}\\
\qquad\qquad\qquad\qquad \overline{\qquad\qquad VP/NP \qquad\qquad}^{>\mathbf{B}}\\
\qquad\qquad \overline{\qquad\qquad\qquad S/NP \qquad\qquad\qquad}^{>\mathbf{B}}\\
\qquad \overline{\qquad\qquad\qquad\qquad S \qquad\qquad\qquad\qquad}^{>}
\end{array}
$$

Since type raising and function composition are central to the CCG analysis of UDCs, and furthermore generate NCC structures more or less for free, proponents of CCG argue for its superior explanatory power on the grounds that the existence of coordinations like (1) is a direct consequence of the existence of extraction dependencies.

In this paper, we offer evidence that UDCs and NCC are best understood as independent and should not be reduced to a single underlying mechanism. We make this argument on the basis of constraints that distinguish UDCs from NCC, as well as typological data suggesting that it is not always the case that UDCs and NCC go hand in hand. We argue instead (following previous work by Yatabe 2002 and Crysmann 2003) that there is evidence that NCC should be treated instead as a form of ellipsis, something that can be captured in a straightforward manner via the linearization machinery first proposed by Mike Reape (see, for example, Reape 1994). In addition, we reassess certain generalizations about the data considered in

previous approaches to NCC in an effort to streamline the ellipsis-based analysis and expand it to a broader base.

2   Isolating NCC from Extraction

We begin by providing evidence that NCC and UDCs are two separate phenomena that should not be reduced to one another. The first piece of evidence comes from island constraints. Unlike leftward extraction, RNR fails to show island constraint effects (Wexler and Culicover, 1980). For example, in (4a) the NP *those pictures of Qaddafi* has been extracted out of a complex NP in the conjoined main clause, violating the Complex NP Constraint and thus reducing its acceptability. However, if this NP is right node raised as in (4b) the resultant sentence is unexceptional:

(4) a. ??Those unflattering pictures of Qaddafi, Yo knows several men who buy __ and Jan knows several men who sell __ .
     b.   Yo knows several men who buy __ , and Jan knows several men who sell __ , those unflattering pictures of Qaddafi.

This suggests that the two phenomena are subject to different constraints, a fact that is not predicted if they are the direct result of a single mechanism. It should be noted, of course, that island constraints themselves involve tenuous data, and acceptability of UDCs from various adjuncts depends to a large degree on context and processing factors (see, for example, Kluender 1992). But the relative ease with which the NP in (4b) can be right node raised nonetheless suggests an asymmetry between this and the extraction illustrated in (4a).

A second, and more serious criticism of the reduction of NCC to UDCs comes from typological considerations. CCG approaches make a very strong prediction about language types: since type raising and function composition are central to CCG analyses of UDCs and in turn always produce the possibility of NCC, then CCG predicts that any language that has UDCs should likewise have NCC. But there is significant evidence suggesting that this is not the case. Koutsoudas (1971), in his survey of 'conjunction reduction' (NCC, in our terms), lists fifteen languages that systematically lack ACC, RNR, and Verb/Verb coordination. Of these fifteen languages, nine are SVO. And of these nine, at least two are known to have un-bounded leftward extraction: Hausa (Davis, 1992; Newman, 2000) and Indonesian (Chung, 1976).

Let us focus on Hausa for the moment. Hausa is an SVO, *pro*-drop language with relatively little scrambling. But it does exhibit a variety of leftward extraction phenomena, including topicalization, a number of focus operations, clefting, and *wh*-extraction:

(5) a. gaa   mootoocin da su kee   duubaawaa da gyaaraawaa
        here are cars+DL   Rel 3pl,Rcnt inspecting and repairing
        'Here are the cards that they're inspecting and repairing.'

b. mee suka karantaa kuma suka rubuutaa
what 3pl,Rpf read also 3pl,Rpf write
'What did they read and did they write?' (Davis, 1992, (15))

However, according to Koutsoudas and Davis, Hausa systematically lacks any type of coordination other than S, NP, and PP coordination (see also Newman 2000). If leftward extraction is the result of type raising and function composition, whose very existence in a language entails that NCC must also exist, then CCG erroneously predicts that Hausa and languages like it must have NCC.

One possible counterproposal (following Davis's own HPSG analysis of coordination in Hausa) might be that the CCG coordination category/schema for Hausa be restricted only to 'maximal projections', which in CCG would correspond to the S, NP, and PP categories. However, this proposal, which would rule out the higher type function categories necessary for NCC, would also rule out across-the-board (ATB) extraction, which necessarily involves coordination of function categories (e.g. verbs). But as the examples in (5) demonstrate, Hausa definitely allows ATB extraction. Hence, no proposal to eliminate function category coordination from the grammar of Hausa seems tenable since in general it does not appear that any natural restriction on coordination in Hausa will simultaneously allow the various observed extraction phenomena (including ATB extraction), but rule out NCC.[1] These observations suggest that ACC and RNR should not be tied directly to extraction. Now that we have argued that extraction and NCC are separate phenomena, in the next section we present evidence that the correct analysis for NCC should be ellipsis-based.

3 Positive Evidence for an Ellipsis-Based Account of NCC

In addition to the criticisms raised above, the data in (6) are also problematic for the CCG account of ACC.

(6) a. Jan travels to Rome tomorrow, to Paris on Friday, and will fly to Tokyo on Sunday.

   b. Jan wanted to study medicine when he was 11, law when he was 13, and to study nothing at all when he was 18.

   c. Yo either visits Jan on Monday, Pat on Tuesday, or else will visit them both at the end of the week. (cf. Milward 1994)

Assuming (with CCG) that all conjuncts are constituents and that only constituents of like category can coordinate, then the constituent status of the second conjunct in the non-parallel coordination examples in (6) (e.g. *to Paris on Friday* in (6a)) is paradoxical, since unlike its two fellow conjuncts, it is not a VP. One solution to this would be to assume, following Collins (1996, 1997) and Hockenmaier

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[1]We hope to further pursue the cross-linguistic issues raised here in future research.

(2003), that the commas should be treated as conjunctions. From this assumption, one could analyze (6a) in CCG along the following lines:[2]

(7)

travels	to Rome tomorrow	to Paris on Friday	and	will fly to Tokyo Sunday
VP/PP	$VP\backslash(VP/PP)$	$VP\backslash(VP/PP)$	$CONJ$	VP

$$VP\backslash(VP/PP) \quad {}_{<\Phi>}$$

$$VP \quad {}_<$$

$$VP \quad {}_{<\Phi>}$$

In this analysis, the constituents *to Rome tomorrow* and *to Paris on Friday* are formed via type raising and function composition and are coordinated independently of the third conjunct *and will fly to Tokyo on Sunday*. This crucially requires the first comma to be a coordinator on a par with *and* (or else just the possibility of null coordination of some sort). However, such a proposal falls short on two fronts. First, while it seems initially plausible for English, allowing free null coordination will massively overgenerate. The factors that govern null coordination in English appear to be pragmatic, stylistic, and perhaps processing-based, rather than grammatical:

(8) a. i. Life... liberty... happiness. That's what we want.
    ii. ??Life, liberty, happiness is what we want.
    iii. *Life, liberty is what we want.
   b. i. We want life... liberty... happiness...
    ii. ??We want life, liberty, happiness.
    iii. *We want life, liberty.
   c. i. Jan walks... talks... chews gum...
    ii. ??Jan walks, talks, chews gum.
    iii. *Jan walks, chews gum.

In (8) the acceptability of null coordination seems inversely proportional to how many conjuncts there are, where null coordination of two conjuncts is plainly ungrammatical. This is a serious problem for the analysis in (7), since that analysis crucially involves binary coordination. Furthermore, significant pauses dramatically improve the acceptability of null coordination, regardless of how many conjuncts are involved, suggesting that this phenomenon may be best analyzed in terms of replanned sentences, rather than as instances of grammatical coordination. By contrast, the sentences in (6) are perfectly acceptable with fluid intonation, a fact that speaks against an analysis in terms of replanned sentences.

Second, if the sentences in (6) did involve two coordinations, then this would make certain semantic predictions as well, since the two coordinations would be independent of one another and thus should not bear any necessary semantic interrelationship. For example, there is no reason in principle why the sentence in (9)

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[2]Thanks to Mark Steedman for suggesting this analysis; see also the LFG approach of Maxwell and Manning (1996) which assumes something similar.

could not have an analysis where the lower (null) coordination is conjunctive and the upper (overt) coordination is disjunctive:

(9) Jan wanted to study medicine when he was 11, law when he was 13, or to study nothing at all when he was 18.

However, no such reading exists – the only acceptable reading is that Jan wanted to study medicine when he was 11, or law when he was 13, or nothing at all when he was 18. Thus on both syntactic and semantic grounds, there appears to be little evidence to suggest that the analysis in (7) will account for the data in (6) (see also Borsley (to appear) for arguments against null coordination in other contexts).

An alternative analysis, which we advocate, involves treating (6) as standard VP coordination in which the second and third conjuncts form a coordinate VP which is subject to left-peripheral ellipsis under identity with the first conjunct:

(10) Jan [[travels to Rome tomorrow], [[~~travels~~ to Paris on Friday], and [will fly to Tokyo on Sunday]]].

This eliminates null coordinators and preserves an identical structure for both constituent coordination and NCC. Right node raising is likewise amenable to this analysis, albeit with right-peripheral ellipsis within the left conjunct:

(11) Mary cooked ~~a pizza~~ and Bill ate a pizza.

Of course, regular constituent coordination is handled by an ellipsis mechanism – it is the limiting case where no material has been elided. The question is whether there is any corroborating evidence for an ellipsis-based approach. Here we think there are a number of suggestive pieces of evidence. First, the analysis in (10) captures the essential insight that the examples in (6) are semantically instances of regular VP coordination, i.e. that there are three traveling events in (6a). This is of course one of the essential insights of the CCG analysis (captured for example in terms of type raising to S-rooted categories for ACC with ditransitive verbs) which is preserved in the ellipsis-based alternative. Second, certain evidence from the coordination of unlikes also suggests an ellipsis-based account. Examples like (12), for example, are more straightforwardly analyzed as instances of left-peripheral ellipsis of the copula:

(12) a. Jan [[is a Republican] and [~~is~~ proud of it]].
      b. Jan [[wanted another doughnut] and [~~wanted~~ to leave Boston by five sharp]].

Previous HPSG proposals (e.g. Sag 2002) have analyzed (12a) in terms of features (e.g. PRED) whose values are neutralized in coordination. Likewise, in CCG it would be assumed that all predicative phrases have an (S\NP) category for predicative constructions, assigned lexically or via a metarule (see Carpenter 1992;

Beavers 2004). In both cases this involves additional construction-specific machinery. Our approach treats both this example and (12b) as simple VP coordination without additional features or category assignment. If nothing further is said, our analysis will not assign constituent status to sequences like *a Republican and proud of it*.

At first blush, it might appear that examples like the following, cited as fully grammatical by (Munn, 2000) and Yatabe (this volume), provide support for some variant of the neutralized category analysis which recognizes strings like *a demagogue and proud of it* as constituents:

(13)   a. ?Stupid or a liar is what Pat is __ .
         b. ?What he was __ was a demagogue and proud of it.

If *stupid or a liar* doesn't form a constituent in a sentence like *Pat is stupid or a liar* then one would expect it not to be extractable, an expectation seemingly contradicted by (13a). However, these examples do have analyses via ellipsis, and such analyses involve no neutralized categories, as sketched in (14):

(14)   a. Stupid ~~is what Pat is __~~ or a liar is what Pat is __ .
         b. What he was __ was a demagogue and ~~what he was __ was~~ proud of it.

Here right- or left-peripheral material is elided under identity with similar material in the other conjunct, producing examples that only appear to involve the extraction of neutralized categories. Furthermore, certain facts about the acceptability of these data may actually provide further support for an ellipsis-based analysis. In particular, UDCs of this type tend to be less acceptable than their non-coordinate counterparts:

(15)   a. ?What he was __ was [a demagogue and proud of it].
           (cf. What he was __ was a demagogue. What he was __ was proud of it.)
         b.??...and [a demagogue and angry], he was __ !
           (cf. ...and angry, he was __ !; ...and a demagogue, he was __ !)
         c.??It was [a demagogue and angry] that he appeared to be __ .
           (cf. It was a demagogue that he appeared to be __ .
           It was angry that he appeared to be __ .)

An account in which coordinated unlikes form neutralized constituents would predict that these constituents should as extractable as each conjunct would be alone. However, in an ellipsis-based analysis it is possible to understand this reduced acceptability in terms of various processing factors and competing constraints. First, the simultaneous presence of (SLASH-based) extraction and ellipsis yields a sentence whose analysis is more complex than that of sentences without

ellipsis or extraction. Furthermore, the interaction between extraction and ellipsis in these examples involves constraints that are rather at odds with one another, since in each case an extraction site has been elided, thus 'stranding' a filler without an overtly recoverable gap (despite the existence of a parallel non-elided gap). In addition, in the case of (14a), there is non-optimal focus placement since the unelided material in the right conjunct is ordinarily focused in RNR. Thus a combination of competing factors in the ellipsis-based analysis may actually explain the reduced acceptability of these examples, which remain rather difficult to explain in approaches based on neutralization.

Ellipsis-based analyses also predict the possibility of NCC of unlikes:

(16) John gave Mary a book and to Peter a record. (Crysmann 2003, citing Bob Levine.)

In CCG the composed categories *Mary a book* and *to Peter a record* would not be acceptable candidates for coordination since they have two related but distinct categories (S\NP)\(S\NP/NP/NP) and (S\NP)\(S\NP/NP/PP) respectively. But an ellipsis-based approach again reduces these to simple VP (or S) coordination, predicting their acceptability.

Ellipsis-based analyses are further supported in nominal domains:

(17) a. Every man and woman was upset by the Enron scandal.
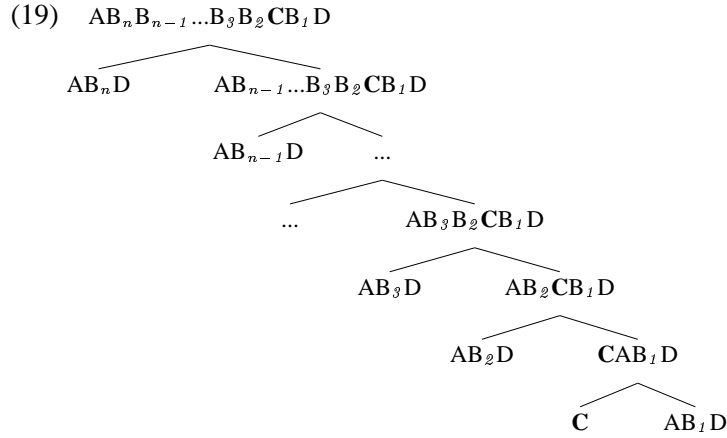   b. Old men and women are eligible for this benefit.

These examples are technically ambiguous between two readings: a pragmatically bizarre hermaphrodite interpretation and a full quantifier phrase interpretation (synonymous with, e.g. *every man and every woman*). On an ellipsis-based approach, this semantic ambiguity can be understood as deriving from a syntactic ambiguity between N̄-coordination and an elliptical NP-coordination (where the quantifier/adjective in the second NP is elided):

(18) a. Every [man and woman] was upset by the Enron scandal.
     b. [Every man] and [~~every~~ woman] was upset by the Enron scandal.

In sum, an ellipsis-based approach has several advantages. First, it unifies the analyses of NCC, constituent coordination, and coordination of unlikes. Second, it allows for the apparent extraction of neutralized coordinations while potentially explaining their reduced acceptability. Third, it eliminates the need for null coordinators and potentially ad hoc analyses of unlike coordination. And fourth, it preserves the essential insight of CCG that NCC is head-category coordination, e.g. that the ACC examples cited above are instances of coordination of verbal categories.

4 An Ellipsis-Based Analysis of NCC

We collapse our analyses of ACC, RNR, and constituent coordination into a general coordination schema that produces binary branching n-ary coordinate structures.[3] This schema is outlined in (19), where A, B_i, C, D are strings, C is a coordinator, and the conjuncts are all of the form AB_iD, where A and D are token identical material in each conjunct and the B_i material is in each case unique:

(19) $AB_nB_{n-1}...B_3B_2CB_1D$

$$AB_nD \qquad AB_{n-1}...B_3B_2CB_1D$$
$$AB_{n-1}D \qquad ...$$
$$... \qquad AB_3B_2CB_1D$$
$$AB_3D \qquad AB_2CB_1D$$
$$AB_2D \qquad \mathbf{C}AB_1D$$
$$\mathbf{C} \qquad AB_1D$$

That is to say, a coordination construction takes a coordinator C and various elements of the form AB_iD and coordinates them to produce a structure of the form $AB_n...B_2CB_1D$, where the A and D material is preserved once in the mother and all of the unique B_i material is preserved for each conjunct. The various types of coordination fall out of this schema dependent on which parts of the strings are elided under identity, i.e. which of A and D are empty strings:

(20) a. Constituent Coordination: A$= \epsilon$, D$= \epsilon$ (*John, Bill, and Mary*)

b. Argument Cluster Coordination: A$\neq \epsilon$ (*gave a dog a bone and a policeman a flower*)

c. Right Node Raising: D$\neq \epsilon$ (*Sandy cooked, and Mary ate, a pizza*)

d. Both Argument Cluster Coordination and Right Node Raising: A$\neq \epsilon$ and D$\neq \epsilon$ (*John told Mary that Bill, and Kim that Pat, was a die-hard fan of Gillian Welch*)

To formulate this schema in HPSG, we follow earlier proposals by Yatabe (2001) on RNR and Crysmann (2003) on ACC, employing the DOM list machinery motivated by work in linearization theory (e.g. Reape 1994). Yatabe and Crysmann show it is possible to formulate HPSG constructions (= 'schemata' = 'rules') that allow some elements in the daughters' DOM lists to be absent from the mother's

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[3]However, the reader should consult Borsley (to appear) for arguments against at least some forms of binary branching coordination analyses.

DOM list. In this paper we provide such an analysis of coordination that encompasses all of the types in (20); we also reassess various details of previous analyses with regard to agreement and the range of possible semantic interpretations.

Before outlining our ellipsis-based analysis, we first establish some background assumptions. We assume a theory of constructions like that sketched by Sag (2001) and Sag et al. (2003, Ch. 16). On this approach, *sign*s are feature structures whose domain includes PHON, FORM, SYN, SEM, and CNTXT, but not DTRS:

(21)
$$
\begin{bmatrix}
\textit{sign} \\
\text{PHON} & \ldots \\
\text{FORM} & \langle \ldots \rangle \\
\text{SYN} & \begin{bmatrix} \text{HEAD} & \ldots \\ \text{GAP} & \langle \ldots \rangle \end{bmatrix} \\
\text{SEM} & \ldots \\
\text{CNTXT} & \ldots
\end{bmatrix}
$$

Constructs, by contrast, are feature structures whose domain includes MOTHER (MTR) and DTRS. Constructions thus define constraints on types of constructs:

(22) a.
$$
\begin{bmatrix}
\textit{phrasal-cxt} \\
\text{MTR} & \begin{bmatrix} \textit{phrase} \\ \ldots \end{bmatrix} \\
\text{DTRS} & \langle \textit{sign}_1 \ldots \textit{sign}_n \rangle
\end{bmatrix}
$$
b.
$$
\textit{phrase}
$$
$$
\textit{sign}_1 \quad \ldots \quad \textit{sign}_n
$$

Finally, the well-formedness of a given *sign* is determined by the principle in (23).

(23) **Sign Principle:** A *sign* is well-formed only if (1) it satisfies some lexical entry or (2) it is the mother of some construct licensed by one of the grammar's constructions.

On this approach, constructions themselves are not *sign*s, but merely constraints that license configurations (*constructs*) as the mother *sign*s within them.

4.1 Head-Marking

We assume that conjunctions are a type of marker (following Sag et al. 1985). We posit a binary feature CRD that is a used to distinguish *sign*s that are non-initial daughters in a (binary branching) coordinate structure ([CRD +]) from all others ([CRD −]). A conjunction combines with a [CRD −] element to form a constituent that preserves that element's MARKING value but which is specified as [CRD +]. Both these specifications are inherited from the marker daughter, whose lexical entry obeys the following constraint:

(24)
$$
\textit{cnj-lxm} \Rightarrow
\begin{bmatrix}
\text{SYN} & \begin{bmatrix} \text{MARKING} & \boxed{1} \\ \text{SPEC} & \begin{bmatrix} \text{SYN} & [\text{MARKING} & \boxed{1}] \\ \text{CRD} & - \end{bmatrix} \end{bmatrix} \\
\text{CRD} & +
\end{bmatrix}
$$

While other markers (e.g. *that*) supply a MARKING value distinct from that of the elements they mark, a *cnj-lxm* passes the MARKING value of the marked element to its mother. This ensures that coordinations of items with non-trivial MARKING values (e.g. *that Sandy left and that Kim stayed*, where each constituent is specified as [MARKING *that*]) behave categorially like their conjunct daughters in the relevant respects. Marking constructions themselves are headed by the marked element and preserve the CRD and MARKING values of the marker while concatenating the DOM lists of the daughters:[4]

(25)

$$
hd\text{-}mk\text{-}cxt \Rightarrow
\begin{bmatrix}
\text{MTR} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{MARKING} & \boxed{3} \end{bmatrix} \\ \text{CRD} & \boxed{2} \\ \text{DOM} & \boxed{A} \oplus \boxed{B} \end{bmatrix} \\
\text{DTRS} & \left\langle \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HD} & mark \\ \text{SPEC} & \boxed{1} \\ \text{MARKING} & \boxed{3} \end{bmatrix} \\ \text{CRD} & \boxed{2} \\ \text{DOM} & \boxed{A} \end{bmatrix}, \boxed{1}\begin{bmatrix} \text{DOM} & \boxed{B} \end{bmatrix} \right\rangle
\end{bmatrix}
$$

(26) is an instantiation of the head-marker construction with a conjunction as marker:

(26)

$$
\begin{bmatrix}
\text{FORM} & \langle \text{and, that, she, left} \rangle \\
\text{DOM} & \left\langle \boxed{0}\begin{bmatrix}\text{FORM} \langle \text{and} \rangle\end{bmatrix}, \boxed{1}\begin{bmatrix}\text{FORM} \langle \text{that} \rangle\end{bmatrix}, \boxed{2}\begin{bmatrix}\text{FORM} \langle \text{she} \rangle\end{bmatrix}, \boxed{3}\begin{bmatrix}\text{FORM} \langle \text{left} \rangle\end{bmatrix} \right\rangle \\
\text{SYN} & \begin{bmatrix} \text{MARKING} \ \boxed{4}\text{that} \\ \text{HEAD} \ \boxed{5}verb \end{bmatrix} \\
\text{CRD} & \boxed{6}+
\end{bmatrix}
$$

$$
\begin{bmatrix}
\text{FORM} & \langle \text{and} \rangle \\
\text{DOM} & \langle \boxed{0} \rangle \\
\text{SYN} & \begin{bmatrix} \text{MARKING} \ \boxed{4} \\ \text{HEAD} \ coord \end{bmatrix} \\
\text{CRD} & \boxed{6}
\end{bmatrix}
\qquad
\begin{bmatrix}
\text{FORM} & \langle \text{that, she, left} \rangle \\
\text{DOM} & \langle \boxed{1}, \boxed{2}, \boxed{3} \rangle \\
\text{SYN} & \begin{bmatrix} \text{MARKING} \ \boxed{4} \\ \text{HEAD} \ \boxed{5} \end{bmatrix} \\
\text{CRD} & -
\end{bmatrix}
$$

With this analysis of coordinator lexemes in place, we turn next to the syntactic constraints on ellipsis in coordination.

4.2 Syntactic Constraints on *cnj-cxt*

We posit a single coordination construction that encodes the schema in (19):

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[4]For more on markers, see Pollard and Sag (1994).

(27) *cnj-cxt* $\Rightarrow$

$$
\left[
\begin{array}{l}
\text{MTR} \quad
\begin{bmatrix}
\text{DOM} & \boxed{A} \oplus \boxed{B_1} \oplus \boxed{C} \oplus \boxed{B_2} \oplus \boxed{D} \\
\text{SYN} & \boxed{0}
\end{bmatrix} \\[2em]
\text{DTRS} \quad
\left\langle
\begin{bmatrix}
\text{DOM} & \boxed{A}\left\langle \begin{bmatrix} \text{FRM} & \boxed{F_1} \\ \text{HD} & \boxed{H_1} \end{bmatrix},...,\begin{bmatrix} \text{FRM} & \boxed{F_n} \\ \text{HD} & \boxed{H_n} \end{bmatrix} \right\rangle \oplus \\[1.5em]
\quad \boxed{B_1}\textit{ne-list} \oplus \left\langle \begin{bmatrix} \text{FRM} & \boxed{G_1} \\ \text{HD} & \boxed{I_1} \end{bmatrix},...,\begin{bmatrix} \text{FRM} & \boxed{G_m} \\ \text{HD} & \boxed{I_m} \end{bmatrix} \right\rangle, \\[1.5em]
\text{SYN} & \boxed{0} \\
\text{CRD} & -
\end{bmatrix}
\right.
\\[3em]
\left.
\begin{bmatrix}
\text{DOM} & \boxed{C}\left\langle \left(\begin{bmatrix} \text{SYN } \textit{cnj} \end{bmatrix} \right) \right\rangle \oplus \left\langle \begin{bmatrix} \text{FRM} & \boxed{F_1} \\ \text{HD} & \boxed{H_1} \end{bmatrix},...,\begin{bmatrix} \text{FRM} & \boxed{F_n} \\ \text{HD} & \boxed{H_n} \end{bmatrix} \right\rangle \oplus \\[1.5em]
\quad \boxed{B_2}\textit{ne-list} \oplus \boxed{D}\left\langle \begin{bmatrix} \text{FRM} & \boxed{G_1} \\ \text{HD} & \boxed{I_1} \end{bmatrix},...,\begin{bmatrix} \text{FRM} & \boxed{G_m} \\ \text{HD} & \boxed{I_m} \end{bmatrix} \right\rangle \\[1.5em]
\text{SYN} & \boxed{0} \\
\text{CRD} & +
\end{bmatrix}
\right\rangle
\end{array}
\right]
$$

for $n, m \geq 0$

The domain of the mother begins with the (potentially empty) material $\boxed{A}$ from the left conjunct, but the corresponding material in the right conjunct's DOM list is elided, i.e. not preserved in the mother's DOM list. The mother's DOM list next contains some unique material $\boxed{B_1}$ from the left conjunct, the right conjunct's coordinator, if present ($\boxed{C}$), some unique material $\boxed{B_2}$ from the right conjunct, and finally some material $\boxed{D}$ from the right conjunct (where the corresponding domain elements from the end of the left conjunct's DOM list are elided). The various coordination types fall out as in (20): if $\boxed{A}$ is the empty list, there is no ACC. If $\boxed{D}$ is the empty list, there is no RNR. If both are empty, this is constituent coordination. Note that the left daughter is here required to be [CRD $-$]. This ensures that the left daughter is not itself marked for coordination, ruling out phrases like *[*and John*] [*and Mary*]. The mother's CRD value is unspecified, allowing it to be either a right daughter ([CRD $+$]) in a larger coordinate structure or else a free-standing *sign* ([CRD $-$]) which can also appear as a left daughter in a larger coordinate structure. This provides an account of contrasts like the following:

(28) a. Jan [walks [talks and [chews gum]]].

 b. Jan [[walks and talks] [or [walks and [chews gum]]]].

 c. *Jan [walks [chews gum]].

Our use of the F(O)RM value ensures that elided elements involve the same morphological forms as their licensing counterparts. For example, homophonous words (e.g. *lie* 'speak falsely' vs. *lie* 'be in horizontal position') involve distinct forms but may have identical phonological realizations. We assume (following recent work by Penn 1999, Klein 2000, and Haji-Abdolhosseini 2003), that HPSG PHON values should exhibit internal organization, corresponding to hierarchical

prosodic structures. In the next section we discuss certain semantic issues in NCC, in particular the interpretation of elided quantifier phrases, taking as our departure point previous work by Crysmann (2003).

5   Semantic Constraints on NCC

Crysmann proposes a distinction between heads and dependents in ACC. On his approach, overt and elided heads do not share their semantics (i.e. their CONT values are not identified), since this would also unify argument information:

(29)   We gave Jan a record and Yo a book.

If *gave* and its elided counterpart were semantically identified, then the indices of their arguments would also be identified, incorrectly requiring (minimally) *Jan* to be coindexed with *Yo* and *a record* to be coindexed *a book*. However, Crysmann argues that semantics of dependents *must* be shared, based on data such as (30):

(30)   a.   I gave few men a book on Friday and a record on Saturday.

      b.   ↛ I gave few men a book on Friday and I gave few men a record on
          Saturday.   (Crysmann, 2003, (12))

The argument is that *few men* and its elided counterpart must share CONT values in order to capture these judgments, since this would 'merge' the quantifiers of the two NPs, and thus prevent interpretations with multiple quantifiers. But if the semantics of elided NPs *must* be merged with that of their nonelliptical licensors, then data such as (31) are not allowed:

(31)   a. Mary sent a letter to Bill on Friday and to Peter on Saturday.

      b. ?A letter was posted from Gozo last Saturday and from Tunis this week.
                                           (Crysmann, 2003, (21))

Crysmann suggests that in (31), while the letters need not be physically identical, they must at least have identical content. But data such as (32) suggest otherwise:

(32)   a. Stanford sent a letter to Bill informing him he was accepted and to Jake
          informing him he was rejected.

      b. They found a thesis topic for Jan on Sunday and for Yo on Wednesday.

The only possible interpretation of (32) is that the letters/thesis topics are altogether different. Non-identified readings are also possible in sentences like (33):

(33)   I gave a couple of books to Pat on Monday and to Sandy on Tuesday.

Here again the reading where Pat and Sandy received different books (with different contents) is acceptable, although the merged reading is also available (likewise for (31)). Comparing this again to (30), it indeed appears that (30) is less acceptable than (32) and (33) on a disjoint quantifier reading. One could suppose that

monotone decreasing quantifiers prefer quantifier merger more than other quantifiers, although it is not clear why this should be the case. Regardless, a broader base of evidence than that examined by Crysmann suggests that independent quantification is in general an available option. Furthermore, in both ACC and RNR this optional identification is allowed only with quantifier phrases:

(34)   a. The waiter managed to evict the customers through the front door and the staff through the back door.

        b. [The waiter forced the customers] and [the manager persuaded the staff] to leave quietly.

In both examples, identification of the semantics of the elided infinitival VPs with that of the non-elided ones would lead to the same problems noted above regarding the semantic identification of heads. Thus we conclude that Crysmann's account of dependent semantics is too strong and should instead be only an option for quantifier phrases. We propose the constraint in (35):

(35)   **Optional Quantifier Merger:**
For any elided phrase denoting a generalized quantifier in the domain of either conjunct, the semantics of that phrase may optionally be identified with the semantics of its non-elided counterpart.

This constraint is encoded into the *cnj-cxt* as shown in (36). Note that (36) is meant to be read in conjunction with (27); the Ps and Qs range over the Fs, Gs, Hs, and Is from (27) (we state these as separate AVMs for expository purposes):

(36) *cnj-cxt* $\Rightarrow$

$$
\begin{bmatrix}
\text{MTR} \mid \text{SEM} \mid \text{RELS } \boxed{X_1} \oplus ... \oplus \boxed{X_i} \oplus \boxed{Y} \oplus \boxed{Z} \\[2em]
\text{DTRS} \left\langle
\begin{bmatrix}
\text{DOM} \left\langle
\begin{bmatrix}
\text{FRM} & \boxed{P^1} \\
\text{HD} & \boxed{Q^1} \\
\text{SEM} & \boxed{S_1}\begin{bmatrix}\text{IND } \textit{ref-index} \\ \text{RELS } \boxed{X_1}\end{bmatrix}
\end{bmatrix}, ...,
\begin{bmatrix}
\text{FRM} & \boxed{P^i} \\
\text{HD} & \boxed{Q^i} \\
\text{SEM} & \boxed{S_i}\begin{bmatrix}\text{IND } \textit{ref-index} \\ \text{RELS } \boxed{X_i}\end{bmatrix}
\end{bmatrix} \bigcirc \textit{ne-list} \right\rangle \\[2em]
\text{SEM} \mid \text{RELS } \boxed{X_1} \bigcirc ... \bigcirc \boxed{X_m} \bigcirc \boxed{Y}
\end{bmatrix}, \\[3em]
\begin{bmatrix}
\text{DOM} \left\langle
\begin{bmatrix}
\text{FRM} & \boxed{P^1} \\
\text{HD} & \boxed{Q^1} \\
\text{SEM} & \boxed{S_1}\begin{bmatrix}\text{IND } \textit{ref-index} \\ \text{RELS } \boxed{X_1}\end{bmatrix}
\end{bmatrix}, ...,
\begin{bmatrix}
\text{FRM} & \boxed{P^i} \\
\text{HD} & \boxed{Q^i} \\
\text{SEM} & \boxed{S_i}\begin{bmatrix}\text{IND } \textit{ref-index} \\ \text{RELS } \boxed{X_i}\end{bmatrix}
\end{bmatrix} \bigcirc \textit{ne-list} \right\rangle \\[2em]
\text{SEM} \mid \text{RELS } \boxed{X_1} \bigcirc ... \bigcirc \boxed{X_i} \bigcirc \boxed{Z}
\end{bmatrix}
\right\rangle
\end{bmatrix}
$$

where $\forall j, < \boxed{P^j}, \boxed{Q^j} > \in$
$\{< \boxed{F_1}, \boxed{H_1} >, ..., < \boxed{F_n}, \boxed{H_n} >, < \boxed{G_1}, \boxed{I_1} >, ..., < \boxed{G_m}, \boxed{I_m} >\}$

In other words, among the elements that are elided (i.e. the elements which share a FRM and HD value with a previous constituent as in (27)), some subset

of these may also share their SEM values. The RELS list of the mother includes all non-identified material from the RELS lists of each conjunct plus one copy of the identified quantifiers. For convenience, we treat the combinatoric semantics of coordinate constructions in terms of the ancillary feature CONJ, whose value we will take to be a (maximally singleton) list of relations introduced by a coordinator lexeme. The relevant constraint is the following:

(37)
$$cnj\text{-}cxt \Rightarrow \begin{bmatrix} \text{MTR} & \begin{bmatrix} \text{LTOP} & \boxed{0} \\ \text{CONJ} & \left\langle \boxed{2} \right\rangle \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \text{LTOP} & \boxed{1} \end{bmatrix}, \begin{bmatrix} \text{LTOP} & \boxed{0} \\ \text{CONJ} & \left\langle \boxed{2}\begin{bmatrix} \text{JUNCTS} & \boxed{1} \end{bmatrix} \right\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

We are assuming that a conjunction is analyzed as a boolean relation that takes only one argument – its JUNCTS argument. This corresponds intuitively to the set of semantic objects that is the argument of an *and_rel* or *or_rel*. More precisely, the conjuncts, each of which has an LTOP ('local top') corresponding to its top-level semantics, are introduced one at a time, always on the left branch of a binary branching coordinate structure. The construction in (37) identifies the LTOP of each conjunct with the conjunction's JUNCTS argument. From this it follows that the LTOPs of all the conjuncts are merged. Since handle merger in MRS is analogous to set formation, the resulting semantics correctly predicates *and_rel* or *or_rel* of the set that is the union of the semantics of all the conjuncts. Our analysis produces SEM values like the following:

(38)
$$\begin{bmatrix} \text{FORM} & \left\langle \text{walk, hop, and run} \right\rangle \\ \text{CRD} & - \\ \text{CONJ} & \left\langle \boxed{2} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{LTOP} & h_0 \\ \text{RELS} & \left\langle \begin{bmatrix} walk\_rel \\ \text{LBL} & h_1 \\ \text{WALKER} & i \end{bmatrix}, \begin{bmatrix} hop\_rel \\ \text{LBL} & h_1 \\ \text{HOPPER} & i \end{bmatrix}, \boxed{2}\begin{bmatrix} and\_rel \\ \text{LBL} & h_0 \\ \text{JUNCTS} & h_1 \end{bmatrix}, \begin{bmatrix} run\_rel \\ \text{LBL} & h_1 \\ \text{RUNNER} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

This AVM represents a conjunction over three separate predications of walking, hopping, and running, respectively.

6   Summative Agreement

We now turn briefly to the topic of agreement patterns in RNR. Yatabe (2002) discusses and analyzes examples like the following (due to Postal 1998):

(39)   The pilot claimed that the first nurse, and the sailor proved that the second nurse, **were** spies.   (Yatabe, 2002, (2))

In these sentences the plural agreement on *were* is not predicted by an ellipsis-based account, which would predict that the overt copula should agree with the right-most subject (and likewise that the elided copula is singular as well). Following Yatabe, we refer to the phenomenon illustrated in (39) as summative agreement, since the copula appears to be agreeing with an aggregate entity composed of the two entities introduced by the overt singular subjects. Yatabe's work with native speaker informants reveals that such sentences are of intermediate acceptability (only 7 of the 23 subjects he studied found this sentence to be perfectly acceptable). Despite Postal's claims to the contrary, we assume (with Yatabe) that the corresponding example with a RNRed singular VP is fully grammatical:

(40)   The pilot claimed that the first nurse, and the sailor proved that the second nurse, **was** a spy.

Because he assumes examples such as (39) are grammatical, Yatabe presents an analysis with significantly complicated agreement constraints. We suggest instead that, while singular agreement as in (40) is always grammatical, summative agreement as in (39) is, strictly speaking, ungrammatical. It is instead explicable as a performance phenomenon, i.e. as a kind of semi-sentence (Katz, 1964; Pullum and Scholz, 2003). Performance-based plural agreement is in fact widely attested, as in the following examples:

(41)   a. One of the children **are** not feeling well.

   b. Every one of the guests **are** here

   c. The pump as well as the motor **are** defective.

   d. The helicopter for the flights over the canyon **were**....

   e. Filling in for Mike and John on the weekends **are** among Stan's favorite duties.

   f. First and foremost, work from both summers **are** to be presented at two international conferences in August of this year.

Solomon and Pearlmutter (to appear) explain the frequent occurrence of such examples in terms of **semantic integration**, the degree to which two elements (e.g. helicopters and flights) are linked at the 'message level' during production. We may interpret this as near-grammatical variants likely to arise in production due to incrementally constructed aggregate entities. Furthermore, a more systematic view of Yatabe's data reveals that the acceptability of summative agreement examples for his subjects varies depending to some degree on how pragmatically plausible it is to suppose the existence of an aggregate subject:

(42)   a. The pilot claimed that the first nurse, or the sailer proved that the second nurse, was a spay/??were spies.   [Disjunction]

   b. The pilot claimed that the nurse from the United States, and the sailer also claimed that the nurse from the United States, was a spy/?*were spies.   [Coreferential subjects]

c. The pilot claimed that the nurse from the United States, and the sailer claimed that no one, was a spay/?*were spies.   [Negative quantifier]

(Yatabe, 2001, (7)-(9))

For the examples in (42), Yatabe's subjects rated these sentences as consistently lower in acceptability than (39). Notably, however, in each case the possibility of forming an aggregate entity is confounded by pragmatic factors. Disjunctions as in (42a) in general disprefer aggregate readings, as would the coreferentiality of the two subjects in (42b) and the negative quantification in (42c), where there isn't necessarily a second entity to form an aggregate with the nurse from the United States. Thus one can argue that part of the licensing of summative agreement is pragmatic in nature. Putting these observations together, treating examples such as (39) and (41) as semi-sentences whose acceptability is based on performance factors such as local context (e.g. preceding plural NPs) and the possibilities of semantic integration explains their frequent occurrence and decreased acceptability. Thus the analysis of NCC we propose in §4-§5 needs no modification for summative coordination. It predicts, correctly we believe, that singular agreement is the only truly grammatical alternative, leaving the explanation of relatively less acceptable versions of summative agreement to extra-grammatical factors.[5]

7 Double Coordinators

One possible objection to an ellipsis-based analysis of NCC is the behavior of double coordinators, which appear inconsistent with treating ACC as VP or S coordination. The French data in (43) are particularly telling (Anne Abeillé, p.c.).

(43)   a. Jean donnera   et   un livre à Paul et   un disque à Marie.
          Jean give.FUT and a   book to Paul and a   record to Marie
          'Jean will give a book to Paul and a record to Marie.'

       b. *Jean et   donnera   un livre à Paul et   un disque à Marie.
          Jean and give.FUT a   book to Paul and a   record to Marie
          'Jean will give a book to Paul and a record to Marie.'

       c. *Et Jean donnera un livre à Paul et un disque à Marie.

Assuming that the coordinator must immediately precede the coordinated elements, this data suggests that the coordination is not VP or S coordination (otherwise we would expect the conjunction to appear before the verb in the left conjunct or else before the entire sentence). Note similar data in English (Bob Borsley, p.c.):

(44)   John gave either a book to Mary or a record to Sandy.

---

[5]One might propose a similar analysis of examples like *John hummed and Mary sang, the same tune*, first noted by Vergnaud (1974) (see also Jackendoff 1977). These longstanding problems for any theory of RNR share a number of the properties just discussed with respect to summative agreement. For example, the disjunctive *John hummed or Mary sang, the same tune* is seriously degraded.

These examples suggest that the overt verb is outside of the domain of coordination. However, an alternative generalization is that the first conjunction is marking the edge of non-elided material, i.e. it occurs canonically marking the boundaries between elided and non-elided material:

(45)   a. Jan [either **gave a book to Yo on Sunday**] [or **gave a record to Sandy on Friday**].

     b. Jan [gave$_i$ either **a book to Yo on Sunday**] [$\emptyset_i$ or **a record to Sandy on Friday**].

     c. Jan [gave$_i$ a book$_j$ either **to Yo on Sunday**] [$\emptyset_i$ $\emptyset_j$ or **to Sandy on Friday**].

In this case, the coordinators do not determine the edge of the domain of coordination. This is not an unreasonable assumption, since in fact in English (unlike French) the first coordinator may occur before the verb:

(46)   a. Jan [gave either **a book to Yo**] [or **a record to Sandy**].

     b. Jan [either gave **a book to Yo**] [or **a record to Sandy**].

     c. [Either Jan gave **a book to Yo**] [or **a record to Sandy**].

These data all follow if we assume that the first coordinator may optionally float to the left in English, but not in French. We thus have further evidence that conjunction position does not determine constituent structure, and on these grounds we assume that the data presented here do not speak against our analysis. In fact, they present a further challenge to any analysis in the style of CCG, which assumes that all instances of ACC are instances of constituent coordination.

8   Conclusion

A number of residual issues remain, of which we mention three here. First, there is the matter raised in §5 regarding the constraints on the application of optional quantifier merger. Assuming that quantifier merger is optional, our analysis (like most treatments of coordination) does not account for the apparent lack of ambiguity of well-worn examples like:

(47)   a.   No book is explicit and easy to read.

     b. $\nrightarrow$ No book is explicit and no book is easy to read.

(48)   a.   Few people read the *WSJ* and vote Communist.

     b. $\nrightarrow$ Few people read the *WSJ* and few people vote Communist.

In these data the subject NPs steadfastly resist interpretations with duplicate quantifiers, instead preferring quantifier merger. We tentatively suggest that this can be regarded simply as a preference for constituent coordination. This conclusion is supported by the observation that subject quantifier duplication is possible when more material is elided:

(49) ?A letter was posted from Gozo last Saturday and from Tunis this week. (Crysmann, 2003, (21d))

(50)   Three men died in Baghdad on Tuesday and in Tikrit on Friday night.

However, these data, along with those in §5 on the behavior of monotone decreasing quantifiers and quantifier merger, require more careful examination in future work.

Second, linearization-based approaches require that phrases must be allowed to remain uncompacted (or at least partially uncompacted), in order to permit long-distance RNR, e.g.:

(51)   Merle knew the relatives wanted to visit, and Bo knew that we were going to have to let them visit, [Aunt and Uncle Leslie, who lived in Corsica].

The consequences of this also require further investigation.

Finally, as currently defined, the system we outline here also allows long-distance ACC like the following:

(52) ?We found a book that was about a Civil War hero on Monday and a WWI hero on Tuesday

The status of such examples is somewhat unclear, though it seems that they become acceptable with strong supporting contexts, such as the following:

(53)   A: Were you successful last week in finding books about war heros?

       B: We found a book that was about a Civil War hero on Monday and a WWI hero on Tuesday

In sum, though there are unresolved issues, the approach presented here, incorporating key insights of Yatabe and Crysmann, divorces UDCs from coordination on syntactic and typological grounds. It also unifies three kinds of coordination (constituent coordination, RNR, ACC) into one overarching schema, with enough flexibility to state independent constraints on each kind. Our analysis clarifies previous accounts of the semantics of ACC and interacts with independently observed performance-based properties to accommodate summative agreement in RNR.

References

Beavers, John. 2004. Type-inheritance Combinatory Categorial Grammar. In *Proceedings of COLING 2004*, Geneva.

Borsley, Robert D. To appear. Against ConjP. *Linguistics*.

Carpenter, Bob. 1992. Lexical and Unary Rules in Categorial Grammar. In Bob Levine (ed.), *Formal Grammar: Theory and Implementation*, Oxford University Press.

Chung, Sandra. 1976. On the Subject of Two Passives in Indonesian. In Charles N. Li (ed.), *Subject and Topic*, pages 57–98, New York: Academic Press.

Collins, Michael. 1996. A New Statistical Parser Based on Bigram Lexical Dependencies. In *Proceedings of the 34th Annual Meeting of the ACL*, Santa Cruz.

Collins, Michael. 1997. Three Generative, Lexicalised Models for Statistical Parsing. In *Proceedings of the 35th Annual Meeting of the ACL*, Madrid.

Crysmann, Berthold. 2003. An Asymmetric Theory of Peripheral Sharing in HPSG: Conjunction Reduction and Coordination of Unlikes. In *Formal Grammar 2003*, `http://cs.haifa.ac.il/~shuly/fg03/`.

Davis, Anthony. 1992. Empty Heads and Missing Subjects: Underspecification in Hausa VPs. In *Proceedings of CLS 28*, University of Chicago.

Dowty, David R. 1988. Type-raising, Functional Composition, and Nonconstituent Coordination. In Richard Oehrle, Emmon Bach and Dierdre Wheeler (eds.), *Categorial Grammars and Natural Language Structures*, pages 153–198, Dordrecht: Kluwer Academic Publishers.

Haji-Abdolhosseini, Mohammad. 2003. A Constraint-Based Approach to Information Structure and Prosody Correspondence. In Stefan Müller (ed.), *Proceedings of the 2003 HPSG Conference*, Stanford, CA: CSLI Publications.

Hockenmaier, Julia. 2003. *Data and Models for Statistical Parsing with Combinatory Categorial Grammar*. Ph. D.thesis, School of Informatics, the University of Edinburgh, Edinburgh.

Jackendoff, Ray. 1977. $\bar{X}$ *Syntax: A Study of Phrase Structure*. Cambridge, MA: MIT Press.

Katz, Jerrold J. 1964. Semi-sentences. In Jerrold Fodor and Jerrold J. Katz (eds.), *The Structure of Language*, Englewood Cliffs, NJ: Prentice Hall.

Klein, Ewan. 2000. Prosodic Constituency in HPSG. In Ronnie Cann, Claire Grover and Philip Miller (eds.), *Grammatical Interfaces in HPSG*, pages 169–200, Stanford, CA: CSLI Publications.

Kluender, Robert. 1992. Deriving Island Constraints from Principles of Predication. In Helen Goodluck and Michael Rochemont (eds.), *Island Constraints: Theory, Acquisition, and Processing*, pages 223–258, Dordrecht: Kluwer Academic Publishers.

Koutsoudas, Andreas. 1971. Gapping. *Foundations of Langauge* 7(3), 337–386.

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 First LFG Conference*, Stanford, CA: CSLI Publications.

Milward, David. 1994. Non-Constituent Coordination: Theory and Practice. In *Proceedings of COLING 1994*, Kyoto.

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

Newman, Paul. 2000. *The Hausa Language*. New Haven: Yale University Press.

Penn, Gerald. 1999. An RSRL Formalization of Serbo-Croatian Second Posi-

tion Clitic Placement. In Valia Kordoni (ed.), *Tübingen Studies in Head-Driven Phrase Structure Grammar, No. 132*, pages 177–197, Universität Tübingen.

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

Postal, Paul. 1998. *Three Investigations of Extraction*. Cambridge, MA: MIT Press.

Pullum, Geoffrey K. and Scholz, Barbara. 2003. Foundations of Model-Theoretic Syntax. Vienna: ESSLLI, `http://www.folli.uva.nl/CD/2003/Foundational/PullumScholz/Pullum-Scholz.pdf`.

Reape, Michael. 1994. Domain Union and Word Order Variation in German. In Johne Nerbonne, Klaus Netter and Carl Pollard (eds.), *German Grammar in HPSG*, pages 151–197, Stanford: CSLI Publications.

Sag, Ivan A. 2001. Dimensions of Locality in Natural Language. Invited Presentation, 2001 HPSG Conference, NTNU, Trondheim, Norway.

Sag, Ivan A. 2002. Coordination and Underspecification. In Jong-Bok Kim and Stephen Wechsler (eds.), *Proceedings of the 2002 HPSG Conference*, Stanford, CA: CSLI Publications.

Sag, Ivan A., Gazdar, Gerald, Wasow, Thomas and Weisler, Steven. 1985. Coordination and How to Distinguish Categories. *Natural Language and Linguistic Theory* (3), 117–171.

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

Steedman, Mark. 1989. Constituency and Coordination in Combinatory Grammar. In Mark Baltin and Anthony Kroch (eds.), *Alternative Conceptions of Phrase Structure*, Chicago: University of Chicago Press.

Steedman, Mark. 1996. *Surface Structure and Interpretation*. Cambridge, Mass: MIT Press.

Steedman, Mark. 2000. *The Syntactic Process*. Cambridge, Mass: MIT Press.

Vergnaud, Jean-Roger. 1974. *French Relative Clauses*. Ph. D.thesis, MIT.

Wexler, Kenneth and Culicover, Peter. 1980. *Formal Principles of Language Acquisition*. Cambridge, MA: MIT Press.

Yatabe, Shûichi. 2001. The Syntax and Semantics of Left-Node Raising in Japanese. In Daniel Flickinger and Andreas Kathol (eds.), *Proceedings of the 2001 HPSG Conference*, Stanford, CA: CSLI Publications.

Yatabe, Shûichi. 2002. A Linearization-Based Theory of Summative Agreement in Peripheral-Node Raising Constructions. In Jong-Bok Kim and Stephen Wechsler (eds.), *Proceedings of the 2002 HPSG Conference*, Stanford, CA: CSLI Publications.

Yatabe, Shûichi. 2004. A Comprehensive Theory of Coordination of Unlikes. In Stefan Müller (ed.), *Proceedings of the 2004 HPSG Conference*, Stanford, CA: CSLI Publications.