Radical non-configurationality without shuffle operators: An analysis of Wambaya

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Abstract

The word order facts of radically non-configurational languages pose a challenge to HPSG approaches which assume both that the surface order of words is the yield of the (tectogrammatical) tree and standard HPSG-style cancellation of valence lists. These languages allow discontinuous noun phrases, in which modifiers appear separated from their head nouns by arbitrarily many other words from the same clause. In this paper, I explore an analysis which preserves tectogrammatical-phenogrammatical equivalence, and accounts for the word order facts of Wambaya with an analysis based on non-cancellation. This analysis is contrasted with other approaches to discontinuous constituents and analyses of other phenomena based on non-cancellation. Finally, I explore the implications for current models of semantic compositionality.

1 Introduction

The word order facts of radically non-configurational languages (including the Australian languages Wambaya [wmb] and Warlpiri [wbp]) pose a challenge to HPSG approaches which assume both that the surface order of words is the yield of the (tectogrammatical) tree and standard HPSG-style cancellation of valence lists. These languages allow discontinuous noun phrases, in which modifiers appear separated from their head nouns by arbitrarily many other words from the same clause. Donohue and Sag (1999) present an analysis based on linearization theory (Reape, 1994), which posits that the surface order of words need not be directly determined by the yield of the tree. In this paper, I explore the other alternative: preserving tectogrammatical-phenogrammatical equivalence, and instead accounting for the word order facts of Wambaya with an analysis based on non-cancellation. The analysis described here has been implemented in a medium-sized grammar fragment for Wambaya built on the basis of the LinGO Grammar Matrix (Bender et al., 2002; Bender and Flickinger, 2005).

2 Wambaya

Wambaya is a recently-extinct language of the West Barkly family from the Northern Territory in Australia (Nordlinger, 1998b, pc). Aside from the constraint that

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verb-headed clauses require an auxiliary in second position,[1] clause-internally the word order is free, to the point that noun phrases can be non-contiguous, with head nouns and their modifiers separated by unrelated words. Furthermore, head nouns are generally not required: argument positions that are cross-referenced through agreement markers on the auxiliary can be instantiated by modifiers only, or (for some arguments), if the referent is clear from the context, by no nominal constituent of any kind. There is a rich system of case marking, and adnominal modifiers agree with the heads they modify in case, number, and four genders. An example is given in (1).[2] In (1), *ngaragana-nguja* ('grog-proprietive', or 'having grog') is a modifier of *ngabulu* milk. They agree in case (accusative) and gender (class IV), but they are not contiguous within the sentence.

(1) Ngaragana-nguja ngiy-a gujinganjanga-ni jiyawu ngabulu.
grog-PROP.IV.ACC 3.SG.NM.A-PST mother.II.ERG give milk.IV.ACC
'(His) mother gave (him) milk with grog in it.' [wmb]

At first glance, this might look like an extraction phenomenon targeting the left periphery of the sentence. However, as illustrated in (2) (Nordlinger, 1998b, 133) it is not the case discontinuous NPs must involve the clause initial position. Here, the clause initial position is filled with a vocative,[3] and the words *jundurra* ('dust') and *bajbaga* ('big') are separated by the benefactive dative pronoun.

(2) Babaga-yi nyi-n jundurra mirnda bajbaga
sister.II-LOC 2.SG.A.PRES-PROG dust.IV.ACC 1.DU.INC.OBL big.IV.ACC
yardi.
put
'Sister you're making lots of dust for us.' [wmb]

[1] As with Warlpiri, the pre-auxiliary position can contain more than one word just in case those words form an NP constituent.

[2] This is the first clause of a biclausal structure from example (8-62) on p. 223 of Nordlinger 1998b. Note that the recipient argument and not the theme is cross-referenced on the auxiliary and that the third person object marker is in fact a zero suffix, i.e., the absence of either of the overt marks for first or second person.

Glosses are slightly adapted from the source works. This paper uses the following abbreviations:

Case		Gender/number		Verbal inflection	
PROP	proprietive	II	noun class II	A	agent
NOM	nominative	III	noun class III	PST	past tense
ACC	accusative	IV	noun class IV	PRES	present tense
ERG	ergative	NM	non-masc. (class II-IV)	PROG	progressive
LOC	locative	MASC	masculine	CONT	contemporaneous
OBL	oblique case	NEUT	neuter	PASS-PART	passive participle
ABL	ablative	SG	singular		
GEN	genitive	DU	dual		
		INC	inclusive		

[3] Vocatives are marked with locative case.

Finally, note that clauses headed by non-verbal predicates are allowed, and do not use auxiliaries.[4] In such clauses, there is no second position constraint. An example is given in (3) (Nordlinger, 1998b, 72).

(3) Buguwama mamiyaga burnaringma.
big.III.NOM that.III.SG.NOM wild.orange.III.NOM
'That's a big orange.' [wmb]

3 Previous Analyses

3.1 LFG: Constructive Case

Nordlinger (1998a) presents an analysis of non-configurationality in terms of multiple strategies for the marking of grammatical functions: Configurational languages mark grammatical functions through specific phrase structure positions, while non-configurational languages mark grammatical functions through morphology. Morphological marking of grammatical functions can be through affixes on the verb (head-marking) or on the NPs (dependent-marking).

Nordlinger notes an asymmetry in previous accounts whereby verbal affixes are believed to directly satisfy valence requirements but case markers only match what is provided in the verb's lexical entry, and proposes that instead the case markers should be treated on a par with other kinds of grammatical-function marking morphology in non-configurational languages and directly fill grammatical roles. In particular, she proposes lexical specifications like (4) (for case markers on nominal heads) and (5) (for case markers on nominal modifiers):

(4) (SUBJ ↑)
(↑ CASE) = ERG

(5) (SUBJ (ADJ ↑))
((ADJ ↑) CASE) = ERG

The first statement in each specification is an inside out equation which asserts both the existence of an appropriate grammatical function in the clause and the association between that function and the nominal the case marker attaches to. The second equation gives the case value of the of the noun (4) or the nominal constituent to which the adjective belongs (5). Since each nominal thus associates itself to the appropriate grammatical function independently, modifiers and head nouns do not need to be contiguous in the c-structure for their information to be unified at f-structure.

As a result, the c-structure rules are very simple. Nordlinger proposes the following annotated c-structure rules:

[4] Though there is a copular verb, which, when present, requires the auxiliary.

(6)
$$\begin{array}{lcccc} \text{IP} & \rightarrow & \text{XP} & & \text{I}' \\ & & (\uparrow \text{DF}) = \downarrow & & \uparrow = \downarrow \\ \text{I}' & \rightarrow & \text{I} & & \text{S} \\ & & \uparrow = \downarrow & & \uparrow = \downarrow \\ \text{S} & \rightarrow & \text{C}^{+} & & \\ & & (\uparrow(\text{GF})) = \downarrow & & \end{array}$$

The I position is filled by the auxiliary. The single position to the left of the auxiliary is filled by a maximal projection assigned some discourse function. The complement of the auxiliary is an S, consisting of at least one constituent. The S and the auxiliary are f-structure co-heads. Each sub-constituent of S either bears a grammatical function with respect to the clause or is itself the head of the clause. Though this is not explicitly stated in Nordlinger 1998a, the main predicate must also provide a list of grammatical functions, either directly in its lexical entry or indirectly through its a-structure and the general linking theory. The general principles of coherence and completeness require the verb (if there is one) to fill the head role and the nouns to fill argument roles.[5]

3.2 HPSG: Linearization

Donohue and Sag (1999) present a linearization-based analysis of Warlpiri which is also applicable to Wambaya. Their analysis is based on the DOM feature introduced by Reape (1994). Here, the DOM value of a constituent is a list of *sign*s, which include the phonological representations of the words contained within the constituent. Constructions are then classified as either compacting or liberating. Compacting constructions fuse the DOM values of their daughters into a DOM list with a single element. Liberating constructions append the DOM values of their daughters to create multi-element lists. Both types of constructions allow the phonology to be "shuffled", but only liberating constructions allow their daughters' phonology to interleave with the phonology from other constituents higher up in the tree.

On Donohue and Sag's analysis, the NP construction (7) is liberating. That is, it combines two daughters with matching CASE values, but doesn't constrain them to appear contiguously in the final phonological representation.[6] In contrast, the clausal construction (8), which realizes all valence requirements of the head, is a compacting construction.

[5] When there is no verb, a noun can be a predicator, though it is not clear how this account captures the fact that nominal predicates don't co-occur with the auxiliary.

[6] $\bigcirc$ represents the operation of 'domain union', which shuffles two lists.

(7) *mod-nom-cx:*

$$\begin{bmatrix} \text{MOTHER} & \begin{bmatrix} \text{DOM } \delta_1 \bigcirc \delta_2 \\ \text{SYN NP} \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \text{DOM } \delta_1 \\ \text{SYN } \left[\text{NP, CASE } \boxed{1}\right] \end{bmatrix}, \begin{bmatrix} \text{DOM } \delta_2 \\ \text{SYN } \left[\text{NP, CASE } \boxed{1}\right] \end{bmatrix} \right\rangle \end{bmatrix}$$

(8) *cl-cx:*

$$\begin{bmatrix} \text{MOTHER} & \begin{bmatrix} \text{DOM} & \left\langle \begin{bmatrix} \text{SYN} & \boxed{0} \\ \text{DOM} & \delta_1 \bigcirc \ldots \bigcirc \delta_n \end{bmatrix} \right\rangle \\ \text{SYN} & \boxed{0}\left[\text{VAL } \langle\,\rangle\right] \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \text{DOM} & \delta_1 \\ \text{SYN} & \begin{bmatrix} \textit{finite} \\ \text{VAL} & \langle \boxed{1}, \ldots, \boxed{n} \rangle \end{bmatrix} \end{bmatrix}, \right\rangle \\ & \boxed{1}\left[\text{DOM} \quad \delta_2\right], \ldots, \boxed{n}\left[\text{DOM} \quad \delta_n\right] \end{bmatrix}$$

This construction is subject to two linear precedence constraints which force auxiliaries to appear before all non-focused elements and a single focused element to precede everything else. These constraints thus determine the auxiliary-second order.

3.3 Summary

This section has briefly reviewed to lexicalist analyses of non-configurationality in Australian languages. The first, in LFG, relies on inside-out designators to allow case markers to directly state which grammatical function the nominal they mark belongs to, as well as phrase structure rules which allow any constituent to fill any grammatical function. The second, in HPSG, posits tectogrammatical constituents of the usual kind, but creates the surface order through domain union, allowing subconstituents to shuffle together, subject to the constraints of the grammar.

4 Non-Cancellation Analysis

The alternative explored here is based on non-cancellation of valence features. The central intuition of this analysis is that the argument positions of a head can be the target of modification independently of being filled. This is similar in spirit to Nordlinger's approach in that it allows the head to combine with its arguments in

any order (subject to the auxiliary-second constraint), relying on the matching of case requirements and case marking to sort out which dependent goes with which argument position. This is achieved through altering the head-nexus rules to preserve the SUBJ and COMPS values, and positing new rules which allow modifiers to attach semantically to arguments of the syntactic constituents they combine with.

4.1 Head-arg and head-arg-mod rules

The core of the analysis is thus two series of rules, one for argument realization and one for argument modification. I illustrate here with the rule which targets the second complement position, though there are parallel rules for subjects and the other complement positions. Generalizations across these rules are captured in the type hierarchy. The head-2nd-complement rule is shown in (9). It identifies the SYNSEM value of the non-head daughter with the SYNSEM of the second complement of the head. In addition, it records the information that this argument has been instantiated by its head (rather than just a modifier; [INST +]), and that it has also been instantiated by something ([OPT +]).[7] At the same time, it checks that the argument has not previously been instantiated by its head, by checking for [INST −] on the head-daughter's COMPS list in this position.

(9) *head-2nd-comp-phrase:*

$$\left[\begin{array}{l} \text{SYNSEM} \mid \text{COMPS} \left\langle \boxed{1}, \left[\begin{array}{ll} \text{OPT} & + \\ \text{INST} & + \\ \text{LOCAL} & \boxed{3} \\ \text{NON-LOC} & \boxed{4} \end{array}\right] \right\rangle \oplus \boxed{A} \\ \\ \text{HD-DTR} \mid \text{COMPS} \left\langle \boxed{1}, \boxed{2} \left[\begin{array}{ll} \text{INST} & - \\ \text{LOCAL} & \boxed{3} \\ \text{NON-LOC} & \boxed{4} \end{array}\right] \right\rangle \oplus \boxed{A} \\ \\ \text{NON-HD-DTR} \mid \text{SYNSEM } \boxed{2} \end{array}\right]$$

The rule which attaches modifiers to the second complement of a head is shown in (10). Like the rule in (9) above, this rule targets the second item on the COMPS list, and provides the information on the mother that it has been overtly realized ([OPT +]).[8] However, since the non-head daughter is a modifier in this case, rather

[7] The feature OPT was initially adapted from the English Resource Grammar (ERG; Flickinger 2000) feature of the same name and used, as in the ERG, to track which arguments of heads can be left unfilled ([OPT *bool*]) and which must be discharged ([OPT −]). This is enforced by various selecting environments which check that the valence lists contain only [OPT +] elements. The present analysis takes advantage of this feature in tracking argument realization, using [OPT +] to indicate that the argument position has been filled, at least by a modifier.

[8] The actual implemented analysis is a bit more complicated than this, since these same rules are also used to attach adverbs which modify the verbal complement of the auxiliary and which can't stand in for the verb itself. To handle this, the OPT value of the argument position on the

than matching the non-head daughter's SYNSEM to the complement requirement, it uses the non-head daughter's MOD value instead. This has the effect of giving the modifier the information it needs about the argument's syntactic and semantic features, to allow agreement in case, number and gender on the one hand, and construction of appropriate semantic representations on the other.[9]

(10) *head-2nd-comp-mod-phrase:*

$$\left[\begin{array}{l} \text{SYNSEM} \mid \text{COMPS} \left\langle \boxed{1}, \left[\begin{array}{ll} \text{OPT} & + \\ \text{INST} & \boxed{4} \\ \text{LOCAL} & \boxed{2} \\ \text{NON-LOC} & \boxed{3} \end{array}\right] \right\rangle \oplus \boxed{A} \\ \text{HD-DTR} \mid \text{COMPS} \left\langle \boxed{1}, \left[\begin{array}{ll} \text{INST} & \boxed{4} \\ \text{LOCAL} & \boxed{2} \\ \text{NON-LOC} & \boxed{3} \end{array}\right] \right\rangle \oplus \boxed{A} \\ \text{NON-HD-DTR} \mid \text{MOD} \left\langle \left[\text{LOCAL} \quad \boxed{2}\right] \right\rangle \end{array}\right]$$

4.2 Auxiliaries and word order

Because of the auxiliary-second word order constraint, and because the auxiliaries show agreement with both subjects and objects as well as registering reflexivization, the grammar adopts an argument-composition (Hinrichs and Nakazawa, 1990) analysis of Wambaya auxiliaries. The auxiliaries all inherit from the following type:[10]

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mother is identified with a head feature HDLESS on the modifier daughter, and the OPT value of the argument position on the head daughter is identified with the OPT value inside the modifier's MOD value. Adverbs preserve the OPT status of the argument they attach to by identifying HDLESS with MOD.OPT. Adnominal modifiers, on the other hand, are constrained to be [HDLESS +].

[9] Note that $\boxed{2}$ identifies only the LOCAL value and not the whole SYNSEM because the value for OPT (inside SYNSEM) potentially changes.

[10] The specification [FORM *fin*] distinguishes verbs with appropriate inflection for matrix clauses from those inflected to head subordinate modifying clauses. It also has the effect of disallowing auxiliaries as the complement of other auxiliaries, as the auxiliaries are only assigned other values of FORM.

(11) *arg-comp-aux:*

$$\begin{bmatrix} \text{HEAD} \begin{bmatrix} \textit{verb} \\ \text{AUX} \quad + \end{bmatrix} \\ \text{VAL} \begin{bmatrix} \text{SUBJ} \quad \langle \boxed{1} \rangle \\ \text{COMPS} \quad \langle \begin{bmatrix} \text{OPT} \quad - \\ \text{HEAD} \quad \begin{bmatrix} \textit{verb} \\ \text{FROM} \quad \textit{fin} \end{bmatrix} \\ \text{SUBJ} \quad \langle \boxed{1} \rangle \\ \text{COMPS} \quad \boxed{A} \end{bmatrix} \rangle \oplus \boxed{A} \end{bmatrix} \end{bmatrix}$$

The head-argument and head-arg-modifier phrases illustrated above are all instantiated in both head-final and head-initial versions. The general head-final and head-initial types bear the constraints in (12), where the head and non-head daughters are linked to specific positions on the ARGS list, i.e., to specific positions within the phrase. These two types use the feature MC ('main clause') to force all constituents to the right of the auxiliary to attach before any to the left, and furthermore, to allow exactly one constituent to attach to the left. That is, an auxiliary plus any number of dependents to the right is [MC *na*],[11] and a suitable daughter for either another head-initial rule or the head-final rule. An auxiliary (or auxiliary-headed constituent) that has picked up one dependent to the left is now suitable as either a matrix or a subordinate clause ([MC *bool*]), but can no longer pick up any dependents, since it is now incompatible with the head-daughter position in either head-initial or head-final rules.

(12) *aux-head-init:*

$$\begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \begin{bmatrix} \textit{verb} \\ \text{AUX} \; + \end{bmatrix} \\ \text{MC} \quad \boxed{1}\textit{na} \end{bmatrix} \\ \text{HD-DTR} \; \boxed{2}\left[\text{CAT} \mid \text{MC} \; \boxed{1}\right] \\ \text{NON-HD-DTR} \; \boxed{3} \\ \text{ARGS} \; \langle \boxed{2}, \boxed{3} \rangle \end{bmatrix}$$

aux-head-final:

$$\begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} \begin{bmatrix} \textit{verb} \\ \text{AUX} \; + \end{bmatrix} \\ \text{MC} \quad \textit{bool} \end{bmatrix} \\ \text{HD-DTR} \; \boxed{2}\left[\text{CAT} \mid \text{MC} \; \textit{na}\right] \\ \text{NON-HD-DTR} \; \boxed{3} \\ \text{ARGS} \; \langle \boxed{3}, \boxed{2} \rangle \end{bmatrix}$$

4.3 Representations

These aspects of the analysis are implemented together with analyses of a wide range of phenomena in Wambaya, including argument optionality; subject and object agreement on the auxiliary; various case frames; case, gender and number agreement between nouns and their modifiers; nouns functioning as adverbial modifiers; verbless clauses; coordination; and others. The grammar has been developed

[11] *na* stands for not-applicable. It contrasts with *bool*, which has subtypes + and −. This three-way contrast is used to similar effect in the ERG.

against a test suite comprising all of the example sentences in Nordlinger 1998b (804 examples), and presently produces appropriate semantic representations for 91% of these examples, while maintaining relatively low ambiguity.[12]

In combination with the other analyses in the grammar, the rules and lexical items sketched above assign the structure in Fig. 1 and the semantic representation in Fig. 2 to the example in (1). The nodes in the tree are labeled with their rule types to better indicate the workings of the analysis.[13] The most relevant point here is that even though *ngaraganananguja* ('with grog in it') and *ngabulu* ('milk') are at opposite ends of the sentence, they both contribute to the semantics of the theme argument (*x7* in this example).[14]

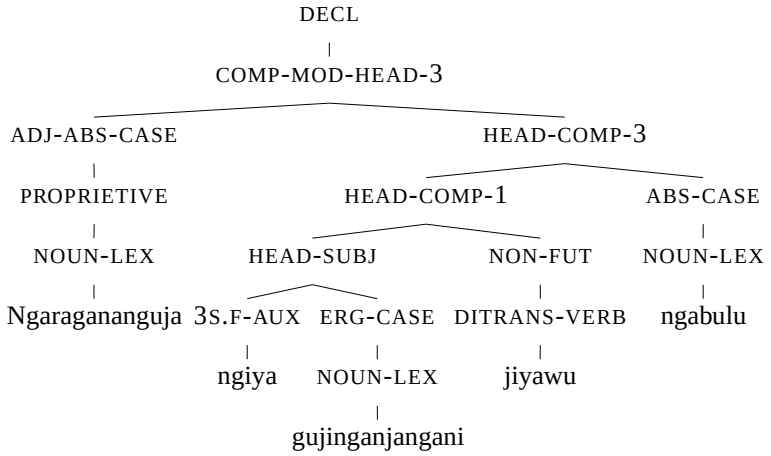

Figure 1: Derivation tree for example (1)

5 Comparison

The analysis presented here is, to my knowledge, the first to capture Australian-style discontinuous noun phrases in HPSG without resorting to shuffle or similar operators.[15] For the core data, it makes the same predictions as the existing accounts. There are interesting differences, however. The current analysis is com-

[12]There are on average 11.89 analyses per item. Some of the sources of structural ambiguity in Wambaya are not familiar from English. For example, because any noun or nominal modifier can head a clause, clausal coordination can be achieved through juxtaposition, and arguments can go unexpressed, any reasonably long sentence often has multiple parses involving coordination.

[13]Some nodes representing lexical rules have been suppressed to simplify the tree structure.

[14]Discontinuous noun phrases also raise the problem of where to introduce the quantifiers. The grammar currently has quantifiers introduced by selecting heads (e.g., verbs) and by constructions which create modifiers (e.g., the proprietive in (1)). In cases where an argument is not overtly realized, as in the ARG2 position of the **_give_v_rel** in Fig. 2, this gives rise to quantifiers with unbound RSTR values.

[15]But see Müller 2004 for an account of several related phenomena in German.

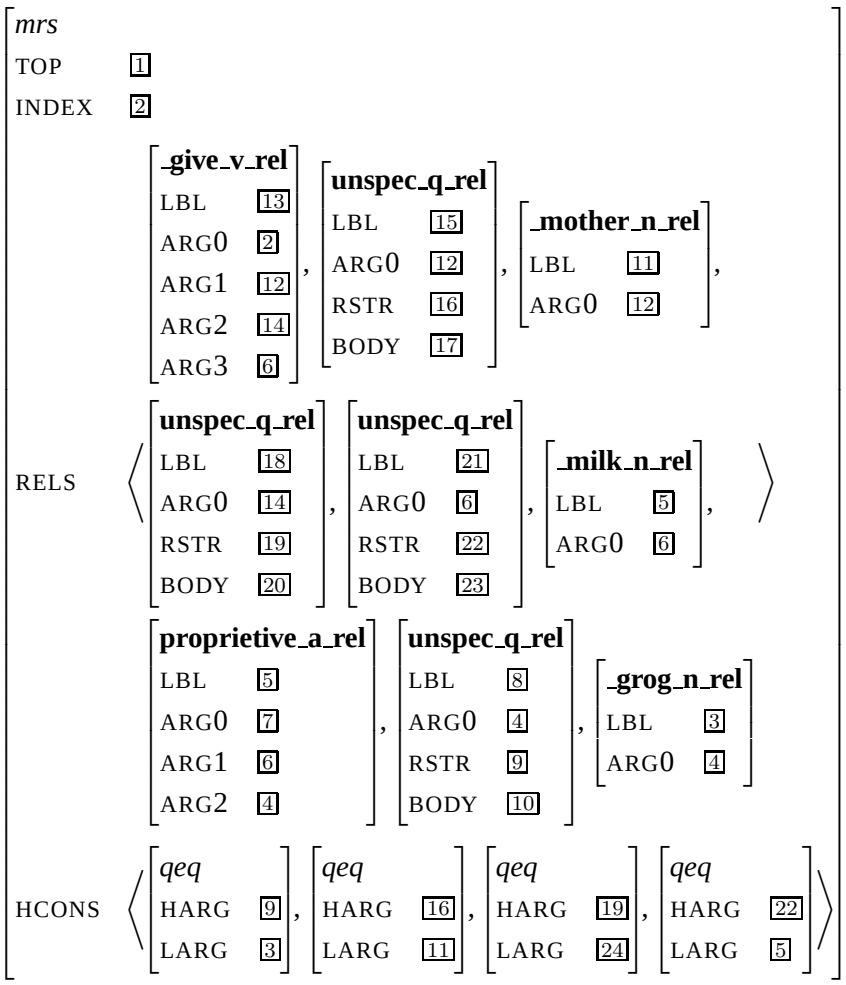

Figure 2: MRS for example (1)

pared to Nordlinger 1998a in §5.1 and to Donohue and Sag 1999 in §5.2. This analysis also bears similarities to previous non-cancellation analyses proposed in HPSG and to the treatment of relative clause extraposition in German in Kiss 2005. These are discussed in §5.3 and §5.4, respectively.

5.1 Comparison to Nordlinger 1998a

The proposed analysis, like the LFG analysis, allows for NPs to be base-generated as discontinuous. This means that the central problem is linking the pieces back together in the semantics/f-structure. On the present analysis, this is handled by matching constraints on CASE between the verb, the nominal heads, and the modifiers of nominal heads. On Nordlinger's analysis, the verbs have sets of grammatical functions that they require, and the case markers on the nouns/nominal modi-

fiers correlate case to grammatical function. The problem is that the mapping is not one-to-one. As Nordlinger shows, Wambaya has morphological ergativity. This means that both ergative and absolutive case[16] must be compatible with the grammatical function SUBJ. To avoid getting ergative subjects of intransitives, she has the ergative case marker stipulate the presence of an OBJ function as well. To avoid getting absolutive subjects of transitives, she appeals to 'morphological blocking' (Andrews, 1990). She doesn't address semitransitives (with an ⟨ erg, dat ⟩ case frame), but one possible analysis would be to have dative arguments correspond to an OBJ_θ function rather than plain OBJ. These stipulations are the side-effect of pinning the grammatical function assignment solely on case. It seems to me, however, that the grammatical function requirements of the verbs are a proxy for case, and it would be more straightforward to have the verbs give the case frames directly instead.[17]

5.2 Comparison to Donohue and Sag 1999

Like Nordlinger's analysis, as well as Pullum's (1982) metarule-based proposal and Ross's (1967) transformational account, the analysis proposed in this paper predicts that the word-order freedom of Wambaya-type languages should be clause-bounded. On the present analysis, this prediction is a result of the fact that the argument positions are all accessed through the valence lists of the head. Once a particular auxiliary's domain is complete, those arguments are no longer active. For Donohue and Sag, however, the clause-boundedness is stipulated by making the clausal construction a compacting construction. Thus Donohue and Sag predict that languages may vary on this point.

To my knowledge, the only language argued to have non-clause-bounded discontinuity of constituents is Ngarluma. Simpson (1980, 22) gives two examples of discontinuous verbal constituents:

(13) Kurna-yi thaka-lku kampa-rna-ku wantha-lku
charcoal-ACC take-PRES burn-CONT-ACC put-PRES
'(I) will pick up the charcoal still burning and put (it) (on the grass).' [nrl]

(14) Ngayi jimpayika-rnakurla-ku marrparnta-nha-pa yarnta-yi
I.NOM lose-PASS+PART-ACC find-PAST-CLITIC day/watch-ACC
nyintala-ku
you.LOC-ACC
'I found the watch you lost.' [nrl]

[16] Actually, as Nordlinger shows, Wambaya needs a tripartite distinction between ergative, nominative and accusative.

[17] Berman (2003) similarly keys grammatical function off of case in her analysis of German, and (Müller, To appear, Section 6.5) notes that this also runs afoul of the fact that case marking doesn't align perfectly with grammatical function, for example, in the case of accusative NPs serving as modifiers.

(13) is not a clear example of a discontinuous clause, even though *kurna-yi* ('charcoal') and *kampra-rna-ku* ('burn'), while non-contiguous, are interpreted together. This is because there is an alternative analysis where *kurna-yi* is simply the matrix object, and *kampra-rna-ku* its modifier.

The example in (14) appears to be a clearer case. Here, the candidate discontinuous clause is *jimpayika-rnakurla-ku* ('lose-PASS+PART-ACC') ... *nyintala-ku* ('you.LOC-ACC'). *nyintala-ku* is marked with locative case to show that it is a passive agent and accusative case to show that it is part of a modifier of an accusative argument of a higher clause.[18] However, there is at least one possible alternative analysis of (14), due to ambiguity in the functions of case in Ngarluma. Locative case, in addition to marking passive agents, is also used to mark instruments, location, and time. As in Wambaya, NPs marked with 'semantic' case (including locative) can function as modifiers of other NPs.[19] An example is in (15) (Simpson, 1980, 52), where Simpson argues that *ngathala-nguru-ku* ('I.LOC-ABL-ACC') and *mara-ngka-nguru-ku* ('hand.-LOC-ABL-ACC') don't fill the object role of *Marawanjarri-nha* ('drop'), but rather modify the unexpressed filler of that role.

(15) Marawanjarri-nha ngathala-nguru-ku mara-ngka-nguru-ku
drop-PAST I.LOC-ABL-ACC hand-LOC-ABL-ACC
'(I) dropped it from my hand.' [nrl]

Thus it is possible that *nyintala-ku* ('you.LOC-ACC') in (14) is actually an independent modifier of *yarnta-yi* ('watch-ACC'), and not a fragment of the clause headed by *jimpayika-rnakurla-ku* ('lose-PASS+PART-ACC'). In the absence of additional data on Ngarluma (or other languages with this property), it remains an open question whether there are any languages whose word-order freedom extends to the interleaving of words from different clauses.

A second difference between the present account and that of Donohue and Sag is in the treatment of coordination. Again, Donohue and Sag stipulate that the coordinating construction is compacting. On the present analysis, coordinated NPs are predicted to be continuous. This is because (per typical HPSG assumptions) coordination does not involve modification, there is no way for one coordinand to attach separately from the other. Again, I note the difference in predictions of the two analyses, but do not have definitive data to chose between them.

5.3 Comparison to other non-cancellation analyses

The standard HPSG strategy of argument cancellation is often presented as making strong predictions of locality (e.g., Sag, In Press), making, inter alia, arguments' arguments inaccessible to selecting heads. This predicts, for example, that no

[18] Simpson notes that this kind of discontinuity is not possible with clauses modifying nominative positions, and that this is functionally motivated by the fact that nominative has a null case marker.

[19] In Ngarluma, unlike in Wambaya, such modifiers can have additional case suffixes indicating which NP they are modifying.

verb selects for a clausal complement whose (embedded) object bears dative case. Whenever such non-local information is required, it has to be explicitly passed up the head path, typically through the addition of a new feature. However, there have been several proposals in the literature to use non-cancellation (either by not shortening valence lists or by making ARG-ST a head feature) to handle various phenomena. These are reviewed briefly here.

Meurers (1999) proposes non-cancellation of the SUBCAT list in order to account for nominative case on subjects fronted together with infinitival Vs, as in (16) (Meurers, 1999, 174).

(16) [Ein Außenseiter gewonnen] hat hier noch nie.
an.NOM outsider won has here still never
'An outsider has never won here yet.' [deu]

In these constructions, Meurers argues that the higher, finite verb (here, *hat* 'has') constrains the case of and agrees with the NP within the fronted VP (here, *ein Außenseiter*, 'an outsider'), even though that NP combines directly with the lower, non-finite verb (here, *gewonnen*, 'won') and fulfills its subject position. Meurers's account of the relevant facts leaves arguments on the SUBCAT list even after they are fulfilled, while changing their type information to indicate that they have been realized.

Przepiórkowski (1999) proposes ARG-ST as a head feature in order to account for so-called 'raising-across-preposition' verbs (17) (p. 213) and agreement of predicative AP/NP with complements of numerals (18) (p. 234). Regarding examples like (17), Przepiórkowski argues that the preposition *za* is not predicative and therefore has an empty SUBJ list. This means that for the matrix (raising) verb to have access to this argument, the subject of the prepositions complement must be exposed some other way. For (18), the issue is that the predicative phrase *wyrwane/wyrwanych z ziemi* can agree in case with either the numeral heading the subject (*kilka*, 'a.few.ACC') or its complement (*drzew*, 'trees.GEN'). In both cases, making ARG-ST a head feature exposes the relevant information at the right point in the tree.

(17) Uważałem go za szczerego.
considered.1.SG.MASC him.ACC for sincereACC
'I considered him to be sincere.' [pol]

(18) [Kilka drzew] było wyrwane/wyrwanych z ziemi
a.few.ACC trees.GEN be.3.SG.NEUT torn.ACC/GEN from earth
'A few trees were uprooted.' [pol]

More recently, Müller (2008) makes use of non-cancellation to provide a unified analysis of depictive secondary predicates in English and German:

(19) weil [er [die Äpfel [ungewaschen ißt]]].
because he the apples unwashed eats

'because he eats apples unwashed.' (unwashed=him or apples) [deu]

(20) weil [er [ungewaschen [die Äpfel ißt]]].
because he unwashed the apples eats
'because he eats the apples unwashed.' (unwashed=him) [deu]

(21) *weil [ungewaschen [er / der Mann [die Äpfel ißt]]].
because unwashed he / the man the apples eats
Intended: 'because he/the man eats the apples unwashed.' [deu]

(22) John$_i$ [[ate the apples$_j$] unwashed$_{i/j}$]

Müller's observation is that while German depictives can only target arguments that have not been realized at the point that the depictive attaches, English depictives do not have this restriction. He proposes an account where both English and German depictives target items on the SUBCAT list. In German, depictives are only allowed to target uncanceled arguments, while in English, they can refer to anything on the SUBCAT list (canceled or otherwise).

In summary, these previous approaches use non-cancellation to allow outside elements to:

1. constrain the case of an element inside an argument (German),
2. agree with the case of an element inside an argument (Polish), and
3. gain access to the INDEX of an element inside the constituent they attach to (English, Polish).

The analysis of Wambaya presented here is uses non-cancellation for (2) and (3). In light of the previous work discussed in this subsection, it appears what is special about Wambaya-type languages is not in fact the possibility of non-cancellation, but rather the *head-arg-mod* rules which leverage non-cancellation to license discontinuous NPs.

5.4 Comparison to Kiss 2005

Kiss (2005) makes three observations about extraposed relative clauses in German:

- Extraposed relative clauses apparently violate constraints on movement.
- Extraposed relative clauses may only form part of a partial verb phrase if their antecedents do, too.
- Extraposed relative clauses interact with variable binding.

He presents an analysis in terms of a new non-local feature ANCHORS which collects up the ⟨ index, handle ⟩ pairs[20] from all subconstituents of a constituent (discharged through a TO-BIND mechanism at clause boundaries). Relative clauses (and similar intersective modifiers) then attach semantically to an anchor within the anchors set of the head they attach to, rather than to that head itself. On this analysis, extraposed relative clauses are thus base-generated as sisters to constituents containing their antecedents. The semantic information they need access to is percolated up through the ANCHORS feature.

At a sufficient level of abstraction, the analysis presented here of Wambaya modifiers is quite similar to Kiss's proposal: Both analyses attach apparently discontinuous modifiers in their surface location, and make use of feature-passing to make the relevant information available. It follows that an ANCHORS-based analysis could be developed for the Wambaya data, though it would require some adaptation: Since Wambaya modifiers can also attach lower than the nouns the combine with and in fact in the absence of such nouns all together, the anchors for all arguments will have to be introduced by the selecting predicate. Once that modification is made, the two analyses are very similar indeed: the predicate (e.g., a verbal head) makes available a set of index-handle pairs corresponding to its arguments. The modifiers then attach syntactically to a projection of the predicate (e.g., a verbal projection) but semantically to the index-handle pair of one of its arguments.

The valence-features-based analysis presented here seems better adapted to Wambaya for two reasons: (1) The verb already records the index and handle information of its arguments through the valence features; adding this information to an anchors list seems redundant. (2) Unlike in German where the only agreement between the extraposed relative clauses and their antecedents is semantic (number and gender information) and thus can be handled through identification of indices, Wambaya modifiers also agree in case. This could be handled by making the anchors set a set of ⟨ index, handle, case ⟩ triples, but again, the case information is already available on the verb's valence lists, and it seems redundant to copy it.

Despite these similarities, there are differences in predictions between the two analyses, if one allows the anchors list to also accumulate anchors introduced by verbal modifiers (including subordinate clauses). The present analysis predicts that all NP discontinuity should be clause-bound, and furthermore that verbal modifiers (e.g., locative NPs) should be contiguous. Moving to an ANCHORS-based analysis would be one way to relax this constraint, by percolating up anchors from inside modifiers (clausal or otherwise). However, it still wouldn't allow complete freedom of realization of parts of modifiers. In particular, it would require that head daughters of modifiers (nouns or verbs) be realized lower than any discontinuous pieces of those modifiers. This is because only the head daughters would be assumed to introduce new anchors; non-heads would not be able to properly link any

[20] Kiss (2005), like the present analysis, uses Minimal Recursion Semantics (Copestake et al., 2005). For more on the semantic aspects of this analysis, see §6 below.

anchors they introduced to the rest of the semantics.

6 Discussion

The original motivation for approaching this problem was to answer the question of whether Wambaya-style radical non-configurationality could be countenanced within the formalism adopted by the Grammar Matrix (type description language, tdl, as interpreted by the LKB; Copestake 2002). Tdl does not allow for relational constraints; the value of a feature may be identified with the value of another, but not set to some function of the value of the other. Nonetheless, the formalism is Turing complete, and so it is to expected that some analysis is possible. The open question was whether a reasonably elegant analysis was available, and in particular, one which preserves most of the (other) features of HPSG and which could leverage the other analyses provided by the Grammar Matrix. The implementation work that this paper is based on has shown that such an analysis is available. As reported in Bender 2008, a majority of the types provided by the Grammar Matrix core grammar are used in the Wambaya grammar, and relatively few (4%) needed to be modified.

There is, however, one major side effect to the non-cancellation analysis: It is not compatible with the algebra for Minimal Recursion Semantics developed by Copestake et al. (2001). The purpose of the algebra is to support reasoning about the MRSs generated by a grammar. Provided that the lexical entries and grammar rules meet certain additional constraints, then a grammar that conforms to the algebra will produce only well-formed and satisfiable MRSs.

The algebra requires of the rules that they, among other things:

- Designate one or more 'holes' or positions to be filled in the semantic head daughter
- Identify these holes with the 'hook' information from non-head daughter(s)

The grammar presented here does not conform to these requirements. In particular, in order to allow modifiers (semantic heads) to attach to argument positions of the head they combine with, the grammar must make more than one hook accessible on certain kinds of constituents. The same is true of Kiss's (2005) account of German relative clause extraposition. Donohue and Sag (1999) do not present an explicit account of the semantics, but a linearization-based approach could in principle be done in a way that is consistent with the algebra of Copestake et al. (2001).

Thus one finding of the present work is that it appears that the word order facts of Wambaya and similar languages are not compatible with the combination of strict tectogrammatical-phenogrammatical equivalence and the only algebra presently available for MRS. However, that algebra was developed with reference to a grammar for a highly configurational language (namely the English Resource

Grammar) and is not necessarily the only possible way to ensure the construction of well-formed, satisfiable MRSs.

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