Toward a Linearization-Based Approach to Word Order Variation in Japanese

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Abstract

Japanese is a strongly head final language, but the order of nonhead elements in a given sentence is relatively free, as the examples in (1) illustrate.

(1) a. Hanako-ga kono hon-o yonda (koto)
Hanako-NOM this book-ACC read (matter)
'(That) Hanako read this book.'

b. kono hon o Hanako ga yonda (koto)

In this paper, I provide a general characterization of word order variation of this type in terms of a linearization model (Dowty, in press; Reape, in press; Pollard, Kasper and Levine, 1992), which allows for the treatment of discontinuous constituency and semi-free word order without appealing to movement transformations or otherwise complicated analyses bound to the notion that word order results from the terminal yield of syntactic trees.

A treatment of this type is motivated in part by the observation that sentential modifiers in Japanese often appear between complements of a given verb.[1] For example, in (2) the linear order of the adjunct *gakko de*, 'at school,' and the complements *Hanako* and *Haruka* appears to be quite free.

(2) a. Hanako-ga gakko-de Haruka-ni kisuoshita
Hanako-NOM school-at Haruka-DAT kissed
'Hanako kissed Haruka at school.'

b. gakko-de Hanako-ga Haruka-ni kisuoshita

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[1] Kasper (in press) discusses a similar phenomena in the German *Mittelfeld*, and demonstrates that a solution based on "flat" syntactic structures, with adjuncts and complements as sister constituents, can provide an account for both the syntax and semantics of these constructions, albeit in a complicated way.

c. Hanako-ga Haruka-ni gakko-de kisuoshita

If we adopt ID schemata of the type posited for earlier versions of HPSG (Head-driven Phrase Structure Grammar, Pollard and Sag 1987, 1993) it would be assumed that, in the case of (2), *Hanako ga* and *Haruka ni* would combine (all at once) with the verb *kisuoshita* by way of some head-complement schema (cf. P&S 1993, Schema 3) and that the sentential adverb *gakko de* would combine with the resulting phrase by way of a separate head-adjunct schema (P&S 1993, Schema 5). An analysis such as this, however, does not allow adjuncts to appear interspersed with complements, unless the principles of constituent ordering are reformulated to allow for discontinuous constituents.

Linearization, however, allows us to "have our cake and eat it too." With phrase-structural and linear-precedence relations occupying two distinct levels of description, it is quite easy to formulate an account where elements unrelated on one level are in fact related (that is, ordered together) on another. In the case above, the adjunct *gakko de* is taken to be on a different phrase-structural level than the complements *Hanako* and *Haruka*. However, using a simple operation, these elements can be "unioned" into the same "word order domain," with the predictions in (2) following naturally, by way of LP constraints that allow for free variation of nonhead elements in the same such domain.

1 Preliminaries

In Japanese, complements and other co-dependents of a given head may appear in relatively free linear variation, as the examples in (1) and (2) illustrate.

(1) a. Hanako-ga sono hon-o yonda
Hanako-NOM that book-NOM read
'Hanako read that book'

b. sono hon o Hanako ga yonda

(2) a. Hanako-ga Haruka-ni gakko-de kisuoshita
Hanako-NOM Haruka-DAT school-at kissed
'Hanako kissed Haruka at school.'

b. Haruka ni Hanako ga gakko de kisuoshita

c. gakko de Hanako ga Haruka ni kisuoshita

d. Haruka ni gakko de Hanako ga kisuoshita

e. Hanako ga gakko de Haruka ni kisuoshita

f. gakko de Haruka ni Hanako ga kisuoshita

In addition to cases like these, Japanese also exhibits (to a certain extent) word order variation which would traditionally fall under the rubric of "scrambling." The examples in (3) illustrate that co-dependents of one head, *sase*, intermingle with those of another, *age*.

(3) a. Haruka-wa Hanako-ni hon-o Ayako-ni age-saseta
Haruka-TOP Hanako-DAT book-ACC Ayako-DAT give-made
'Haruka made Hanako give the book to Ayako.'

b. hon o Haruka wa Hanako ni Ayako ni agesaseta

c. Hanako ni Haruka wa hon o Ayako ni agesaseta

d. *Ayako ni Haruka wa Hanako ni hon o agesaseta (out with meaning of (2a))

In this paper, I provide an account of the word order variation exemplified in (1), (2) and (3), in a linearization model situated within the framework of HPSG. In addition, I will suggest ways in which this model can be extended to account for well-known examples in which order is subject to certain construction-specific constraints, as in (4).

(4) a. yama ni ki ga aru
mountain LOC tree NOM exist
'Trees are on the mountain.'

b. ?*ki ga yama ni aru

c. Hanako-ga atama-ga warui
Hanako-NOM head-NOM dull
'Hanako is not so bright.' (literally, 'Hanako has a dull head.')

d. *atama ga Hanako ga warui

e. Haruka-wa Hanako-ni hon-o Ayako-ni age-saseta
Haruka-NOM Hanako-DAT book-ACC Ayako-DAT give-made
'Haruka made Hanako give the book to Ayako.'

f. *Ayako ni Haruka wa Hanako ni hon o agesaseta
(out with the same interpretation as (e))

The paper is organized as follows: In §1, I introduce the linearization model, taking the examples in (1) as pedagogical tools. §2 extends the analysis to handle slightly more complicated cases like (2) and (3), while §3 involves a tentative proposal to account for examples like those in (4), as well as a brief discussion of issues for further research and conclusions of the present study.

Before moving on, however, let me point out that Japanese exhibits (at least) one other kind of word order variation, which Saito (1992) treats as "long-distance scrambling." In these cases, a non-subject element of an embedded finite clause is scrambled to the front of the matrix clause, as the examples in (5) illustrate.

(5) a. Haruka-wa [Hanako-ga Mariko-ni kisuoshita]-to omotteiru
Har.-TOP Han.-NOM M.-DAT kissed-CMP thinks
'Haruka thinks that Hanako kissed Mariko.'

b. Mariko ni Haruka wa Hanako ga kisuoshita to omotteiru

c. *Hanako ga Haruka wa Mariko ni kisuoshita to omotteiru

I believe, however, that word order variation of this type should be treated by a separate mechanism (namely, as an unbounded dependency) and have left the problem for a future study.

2 Linearization

2.1 An HPSG-based Linearization Model for Japanese

While most current syntactic theories assume (either explicitly or implicitly) that linear ordering arises from or because of phrase structure, and that sentences are in fact characterized by their phrase structure, the linearization model assumes instead that natural language syntax can be characterized in terms of two interrelated, yet distinct, levels of representation: (1) constraints on phrase structure, projected from valence properties of lexical items (also **tectogrammar**), and (2) separate constraints on word order (**phenogrammar**), which may or (crucially) may not depend on tectogrammatical relations such as sisterhood and so forth (Pollard, Kasper and Levine 1992, henceforth PKL). That is, tectogrammatical structure concerns itself with "the steps by which a sentence is built up from its parts, but without regard to the actual form that these combinations take" (Curry 1963) while phenogrammatical structure addresses *how* words and phrases are realized as strings, the final output of the human natural language system.

With these basic assumptions in mind, we posit here an HPSG-based variant of the linearization model based on the work of Reape (1991, in press), in which the phenogrammatical notion of **word order domain** is introduced. And, although we will part with Reape on a number of points throughout the paper, the underlying assumptions will be much the same. Namely, each tectogrammatic combination will have associated with it the formation of a new, more inclusive phenogrammatic (i.e., word order) domain, such that elements in a daughter's order domain may become elements in the mother's order domain. This, among other things, allows tectogrammatically nonadjacent elements to be ordered adjacently in the phenogrammar, and, crucially, even tectogrammatic non-sisters to be ordered with respect to each other phenogrammatically.[2] We introduce here the details of our model first by a simple, illustrative example, followed by a series of extensions. I'll try to introduce the relevant aspects of HPSG as I go along, but readers desiring a more comprehensive introduction to the framework are referred to P&S 1993.

Consider, then, the sentences in (6) below. It should be noted that the cases presented here exhaust the word order possibilities for Japanese. That is, any word order variation not exemplified here will be taken for our purposes to be ill-formed and is, in reality, extremely marked at best.

(6) a. Hanako-ga sono hon-o yonda
Hanako-NOM that book-NOM read
'Hanako read that book'

b. sono hon o Hanako ga yonda

We note first that the difference in meaning between the two sentences presented in (6), if any, is highly pragmatic (Gunji 1987). That is, older information tends to appear earlier in the sentence, but beyond that differences are minimal (see also Kuno 1978). Also, it should be noted that while (I think) most speakers would agree that the examples in (6) are both well within the set of acceptable Japanese utterances, most speakers will not, for example, accept all six permutations of the noun phrase arguments of a ditransitive verb. This variation, however, appears to be highly idiosyncratic. That is, an example which is less acceptable to one speaker may be perfectly acceptable to another who has an easier time imagining the pragmatic conditions that would give rise to that particular ordering. For the purposes of our account, we will assume (as a first approximation) that the noun phrase arguments of a given verb may appear in any order, and that, pragmatic differences aside, sentences such as (6a) and (6b) mean the same thing.[3]

Now, in HPSG, the principle type of linguistic object is taken to be a **sign** – a structured complex of syntactic, semantic and phonological information that corresponds to words, phrases or perhaps even something larger like text. For instance, the sentences in (6a) and (6b) both have signs associated with them, as do noun phrases such as *sono hon o*, and words like *yonda*. These signs (and their internal features) are modelled by typed feature structures, where different types of feature structures permit different sets of appropriate features whose values in turn must be feature structures of an appropriate type. A grammar of HPSG, then, can be thought of as a recursive description of all the types of feature structures permitted in a given language. Signs are taken to

[2] This represents quite a break, even from earlier systems, such as Generalized Phrase Structure Grammar (Gazdar, Klein, Pullum and Sag, 1982), in which separate Linear Precedence rules were employed to constrain the order of sisters in a given structure.

[3] This assumption is consistent with Ross (1967), N. McCawley (1976) and Chomsky (1976), in which word order variation of this type is treated as "stylistic" or PF movement.

have (at least) the features PHON and SYNSEM, whose values are a bundle of phonological information and a bundle of syntactic and semantic information, respectively. For our purposes, we'll gather this information into objects of type **node**, encoded in our system by the feature NODE. Phrasal signs also have a DTRS feature whose value is a bundle of phrase-structural information about the daughter signs of the sign in question. We take the DTRS attribute to be the locus for the type of information we presently associate with tectogrammatical structure.

Phenogrammatical information, on the other hand, will be encoded in our system by the feature DOM, certain points about which are summarized below (adapted in part from Reape 1991:126):

i. DOM is taken to encode the phenogrammatical structure of a sign in that it is directly related to that sign's phonological string by way of the Consituent Ordering Principle.[4]

ii. The value of DOM will be a list (i.e., an ordered set) of elements of type node. That is, each element of the DOM list will consist of all the information in the corresponding constituent with the exception of that constitent's DOM and DTRS (and in more advanced versions of HPSG, the QSTORE and RETRIEVED-QUANTS).[5]

iii. DOM is defined on all signs (phrasal and lexical).[6]

iv. The DOM value of a lexical sign will be token identical to that sign's NODE value.

v. Nonlexical domains are composed compositionally from smaller domains, in a manner to be made precise below.

vi. In certain cases (to be made precise below) the elements of a constituent's domain may also belong to the mother's domain.

As an example, consider a sample lexical entry below in (7) corresponding to a typical lexical sign (say, for the verb *yomu*, 'to read') and note that its DOM value is simply a singleton list containing a node which in turn consists of the sign's PHON and SYNSEM values. Note also that since the entry in (7) is a lexical sign, the DTRS attribute is undefined.[7]

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[4]This relation is made explicit shortly.

[5]It is probably desirable to narrow the conception of node as much as possible, in keeping with the spirit of Dowty's "minimalist syntax," i.e., to construe nodes as containing as little information as possible. Kasper (p.c.), however, has suggested that we probably need at least the PHON and SYNSEM values of a sign, and Reape takes "nodes" (he doesn't use the term) to be whole signs. Anyway, this is an interesting area for further study.

[6]This differs from Reape, who defines DOM only for phrases.

[7]This doesn't look much like the real lexical entry for anything in that specific information concerning the PHON and SYNSEM values has been left out for expository purposes. The point of the example is to illustrate how DOM values are defined on lexical signs.

(7) *A lexical instantiation schema:*

$$\begin{bmatrix} \text{NODE} & \boxed{1}\begin{bmatrix}\text{PHON} & \boxed{2}\\ \text{SYNSEM} & \boxed{3}\end{bmatrix} \\ \text{DOM} & \langle \boxed{1} \rangle \end{bmatrix}$$

Now, phrases in HPSG are licensed by constraints known as ID (Immediate Dominance) schemata. The schemata are taken to be a set of universal, highly underspecified descriptions on phrasal signs, from which every language makes a selection.[8] A phrasal sign is taken to be well-formed with respect to phrase structural relations if it satisfies exactly one ID schema (cf. the ID Principle of P&S 1993).

It also appears that these schemata can be straightforwardly extended to accommodate the linearization model. That is, I'd like to propose first that ID schemata should be used not only to license tectogrammatical combinations, but also to control phenogrammatical information by way of the DOM attribute.[9]

The extended ID schemata needed for the examples in (6), then, will look something like the ones below.[10] The first schema licenses flat head-complement structures (like Japanese sentences), and the second licenses head-adjunct structures. This version of the head-adjunct schema will allow us to form noun phrases like *sono hon o*, but will not allow adjuncts to appear interspersed among complements. That is, it is not quite what we ultimately want, but will suffice for now.[11]

$$\begin{bmatrix} \text{DTRS} & \begin{bmatrix} \text{HEAD DTR} & \begin{bmatrix} \text{NODE} & \boxed{2}\begin{bmatrix}\text{SYNSEM} \ldots \begin{bmatrix}\text{SUBCAT} \ \langle \boxed{3'}, \ldots, \boxed{n'} \rangle \end{bmatrix}\end{bmatrix} \\ \text{DOM} & \langle \boxed{2} \rangle \end{bmatrix} \\ \text{COMP DTRS} & \left\langle \begin{bmatrix}\text{NODE} \ \boxed{3}\begin{bmatrix}\text{SYNSEM} \ \boxed{3'}\end{bmatrix}\end{bmatrix}, \ldots, \begin{bmatrix}\text{NODE} \ \boxed{n}\begin{bmatrix}\text{SYNSEM} \ \boxed{n'}\end{bmatrix}\end{bmatrix} \right\rangle \end{bmatrix} \\ \text{DOM} & \mathbf{permute}(\langle \boxed{2}, \ldots, \boxed{n} \rangle) \end{bmatrix}$$

$$\begin{bmatrix} \text{DTRS} & \begin{bmatrix} \text{HEAD DTR} & \begin{bmatrix} \text{NODE} & \boxed{3}\begin{bmatrix}\text{SYNSEM} \ \boxed{1'}\end{bmatrix} \\ \text{DOM} & \langle \boxed{3'} \rangle \end{bmatrix} \\ \text{ADJUNCT DTR} & \begin{bmatrix} \text{NODE} & \boxed{4}\begin{bmatrix}\text{SYNSEM} \begin{bmatrix}\text{LOC} \begin{bmatrix}\text{CAT} \begin{bmatrix}\text{HEAD} \begin{bmatrix}\text{MOD} \ \boxed{1'}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix} \\ \text{DOM} & \langle \boxed{4'} \rangle \end{bmatrix} \end{bmatrix} \\ \text{DOM} & \mathbf{permute}(\langle \boxed{3}, \boxed{4} \rangle) \end{bmatrix}$$

[8] That is, of 6 or 7 universally available schemata in the set posited in P&S 1993, a language like Japanese may select 4 or 5.

[9] The claim that each tectogrammatical combination be associated with the formation of a new word order domain follows immediately from this proposal.

[10] An interesting question arises as to whether these schemata are "universal" or "parameterized" for a specific language. This issue will become moot later, as I show it is possible to "factor" some universal relation between tectogrammatical and phenogrammatical processes into an (appropriately) universal principle. I have postponed such a move, however, once more for the sake of expositional clarity.

[11] I've left out some information here to avoid cluttering the picture. For instance, the head in the first schema must be lexical. The key thing to note is how the tectogrammatical processes are related to the formation of the DOM value for the mother's sign.

Note that, for now at least, these schemata do the work of Reape's "Domain Principle" in that they mediate between tectogrammatic notions (like "head" and "daughters") and the phenogrammatic information encoded in the DOM attribute. The generalization here is quite simple: in both cases above (at this preliminary stage!), the DOM value of the mother is some permutation of the the list one of whose elements is the NODE value of the head and the rest of whose elements are the NODE values of the non-head head daughters. It is important to recognize here that these ID schema say nothing about the order in which these elements may or may not permute, nor do they make explicit any relationship between the DOM value and the phonetic/phonological realization of the string associated with any given sign. We will address that issue at this time.

The order of elements in a given DOM value can be determined in two ways, and, usually, the final ordering of these elements will result from a combination of the two. First, we introduce here the notion of LP constraints of the form $\phi_1 \prec \phi_2$. These rules, in our system, are taken to be constraints only on well-formed DOM values (as opposed to, say, sequences of daughter signs, as in the more traditional conception of these rules). Informally, a sequence of nodes, σ satisfies an LP constraint, $\phi_1 \prec \phi_2$ iff every element of σ which satisfies ϕ_1 precedes every other element of σ which satisfies ϕ_2, or, equivalently, if every element of σ which staisfies ϕ_2 follows every other element that satisfies ϕ_1.

In addition to LP constraints, the order of elements in a DOM value can be constrained by more general constraints on signs as a whole (which makes sense since the attribute DOM is defined on all signs).[12] For example, the constraint below could be used as a "head-final constraint."[13]

(8) *A preliminary head-final constraint:*

$$\left[\text{DTR}\left[\text{HEAD DTR}\left[\text{DOM}\ \boxed{1}\right]\right]\right] \Rightarrow \left[\text{DOM}\ \left\langle\left[\ \right] \prec \boxed{1}\right\rangle\right]$$

As mentioned earlier, the permissible orders of elements in DOM will usually be determined by an interaction of both types of constraints mentioned here. But how does this ordering correspond to the ordering of elements of the PHON value? Well, if we take PHON also to be a list, the Constituent Ordering Principle, adapted from Reape (1991:134) can be used to mediate between DOM and PHON in a straightforward manner.

$$\textbf{sign} \Rightarrow \begin{bmatrix} \text{PHON}\ \boxed{1} \circ \cdots \circ \boxed{n} \\ \text{DOM}\ \left\langle\left[\text{PHON}\ \boxed{1}\right], \ldots, \left[\text{PHON}\ \boxed{n}\right]\right\rangle \end{bmatrix}$$

This states simply that the PHON attribute is required to be the concatenation of the values of the PHON attributes of the nodes in the DOM sequence.

[12] This is even less surprising when we consider that, formally, LP constraints are just a special case of the general constraints on signs.

[13] This is only an example; our head-final constraint actually looks slightly different.

We now have the necessary formal machinery to posit word order constraints (LP constraints and constraints on signs that refer to the DOM value) that will correctly predict the word order possibilities in (6).[14]

So, turning now to the examples, it appears that one generalization we'd like to capture is that, in Japanese, there is a strong tendency for heads to appear after non-head elements in a given sequence. And, as alluded to before, there appear at first to be two ways to capture this generalization. On the one hand, we could plausibly posit an LP constraint like the one in (9). Recall that this is a constraint on well-formed DOM values.

(9)

$$\textit{nonhead} \prec \textit{head}$$

Informally, the equation in (9) states that any nonhead in a given DOM (since any nonhead element will satisfy the left half of the equation) must precede the sequence in DOM that satisfies the right half – namely, the sequence containing the syntactic head. In HPSG, however, information about whether any given element is a head cannot be determined by looking at an object of type node, since NODE contains only the values PHON and SYNSEM, and nothing in these two values encodes this type of information. It appears, then, that the constraint in (9) will not work.

What we need to do, it seems, is to pursue the other alternative and to posit a constraint on signs that will ensure that the last element of any DOM sequence will be the head. One candidate, of course, would be the constraint posited in (8) above. This version of the head final constraint, however, incorrectly rules out examples like (2a), (2b), (2d), (2e), in which the head of the construction is phrasal. That is, in these cases, the adjunct *gakko de* would be required by the constraint in (8) to precede the entire DOM value for the head, which, since it is phrasal, would include not only the NODE value of the verb *kisuoshita*, but also the NODE values for both of its complements, *Hanako ga* and *Haruka ni*.

Alternatively, then, I propose the following, stated first informally, and then expressed in our feature logic:

Head-final constraint: In a (headed) phrasal sign, the final node of that sign's DOM must be the final node of the head daughter's DOM.

$$\left[\text{DTRS}\left[\text{HEAD DTR}\left[\text{DOM}\ \langle\ldots,\boxed{1}\rangle\right]\right]\right] \Rightarrow \left[\text{DOM}\ \left(\left[\ \right] \prec \boxed{1}\right)\right]$$

That is, in a sign with final DOM element [1], [1] follows every other element of that sign's DOM value, or, equivalently, if [1] is in the sign's domain, then every other element of that domain precedes it.

[14]Throughout this first example, we will ignore the markers *ga* and *o* for the sake of simplicity. A discussion of these is provided in the last section.

To see how this works, consider the phrase (from (6)) *sono hon*, 'this book.' Now, in this case, the noun *hon* is taken to be the head, while *sono* is an adjunct. The phrase as a whole, then, will be licensed by the preliminary version of our head-adjunct schema (above). Now, the DOM value of this phrase, according to head-adjunct schema, will be some permutation of the DOM value of the lexical sign corresponding to *sono* concatenated with the DOM value of the lexical sign *hon*. That is, the head-adjunct schema tells us that the following two DOM values are possible:

$$\left[\text{DOM}\ \left\langle \begin{bmatrix}\text{PHON}\ \textit{sono}\\ \text{SYNSEM}\ \alpha\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{hon}\\ \text{SYNSEM}\ \beta\end{bmatrix} \right\rangle\right] \text{ and } \left[\text{DOM}\ \left\langle \begin{bmatrix}\text{PHON}\ \textit{hon}\\ \text{SYNSEM}\ \beta\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{sono}\\ \text{SYNSEM}\ \alpha\end{bmatrix} \right\rangle\right]$$

Now, since the last node of the DOM value of the head of the construction (cf. [1] in the equation above) is in the DOM value for the phrase, the head-final constraint tells us that the every other element in this domain must precede it. That is, the lexical sign corresponding to *hon* is the head daughter, and its DOM value (of course) will look like this (cf. the lexical DOM instantiation template in (7)):

$$\left[\text{DOM}\ \left\langle \begin{bmatrix}\text{PHON}\ \textit{hon}\\ \text{SYNSEM}\ \beta\end{bmatrix} \right\rangle\right]$$

So every other element (namely, the node value for the adjunct *sono*) must precede it in the domain for the phrasal sign in question. Thus, the second possibility (where *hon* precedes *sono*) is correctly ruled out.

Consider now the sentence as a whole. Assuming that we have successfully formed phrasal signs corresponding to the complements *Hanako ga* and *sono hon o*, and the head verb *yonda*, the head-complement schema above tells us that the DOM value of the output phrasal sign will be some permutation of the list one of whose members is the NODE value for *yonda*, and the rest of whose elements are the NODE values for *sono hon o* and *Hanako ga*. Six possibilities are therefore licensed by the schema:

$$\left[\text{DOM}\ \left\langle \begin{bmatrix}\text{PHON}\ \textit{sono hon o}\\ \text{SYNSEM}\ \alpha\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{hanako ga}\\ \text{SYNSEM}\ \beta\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{yonda}\\ \text{SYNSEM}\ \gamma\end{bmatrix} \right\rangle\right]$$

$$\left[\text{DOM}\ \left\langle \begin{bmatrix}\text{PHON}\ \textit{hanako ga}\\ \text{SYNSEM}\ \beta\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{sono hon o}\\ \text{SYNSEM}\ \alpha\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{yonda}\\ \text{SYNSEM}\ \gamma\end{bmatrix} \right\rangle\right]$$

$$\left[\text{DOM}\ \left\langle \begin{bmatrix}\text{PHON}\ \textit{yonda}\\ \text{SYNSEM}\ \gamma\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{hanako ga}\\ \text{SYNSEM}\ \beta\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{sono hon o}\\ \text{SYNSEM}\ \alpha\end{bmatrix} \right\rangle\right]$$

$$\left[\text{DOM}\ \left\langle \begin{bmatrix}\text{PHON}\ \textit{yonda}\\ \text{SYNSEM}\ \gamma\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{sono hon o}\\ \text{SYNSEM}\ \alpha\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{hanako ga}\\ \text{SYNSEM}\ \beta\end{bmatrix} \right\rangle\right]$$

$$\left[\text{DOM}\ \left\langle \begin{bmatrix}\text{PHON}\ \textit{hanako ga}\\ \text{SYNSEM}\ \beta\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{yonda}\\ \text{SYNSEM}\ \gamma\end{bmatrix}, \begin{bmatrix}\text{PHON}\ \textit{sono hon o}\\ \text{SYNSEM}\ \alpha\end{bmatrix} \right\rangle\right]$$

$$\left[\text{DOM} \left\langle \begin{bmatrix} \text{PHON } \textit{sono hon o} \\ \text{SYNSEM } \alpha \end{bmatrix}, \begin{bmatrix} \text{PHON } \textit{yonda} \\ \text{SYNSEM } \gamma \end{bmatrix}, \begin{bmatrix} \text{PHON } \textit{hanako ga} \\ \text{SYNSEM } \beta \end{bmatrix} \right\rangle \right]$$

Of these, the head-final constraint will rule out all those where some element of DOM follows that element which is the final domain member of the head daughter (since every other node is required to precede this element). Note that all but the first two fail this condition. Now, considering our previous hypothesis that all non-head elements in a simple Japanese sentence can occur in any order, no further LP rules are needed to predict the word order variation in the examples in (6). That is, the two word order domains remaining after applications of the head-adjunct schema and our head-final constraint, in conjunction with the Constituent Ordering Principle, will predict all and only those examples in (6) to be well-formed. This is a correct prediction.

Note also that this analysis predicts that the interpretation of (6a) and (6b) will be equivalent, since no independent manipulation of the semantics took place at any stage of this derivation.[15] As noted before, this is also a correct prediction.

3 Domain Union

With this lengthy example finally under our belts, we are now in a position to extend the analysis to account for more interesting examples involving the interspersal of adjuncts among complements of a given head (exemplified in (2)), and scrambling (exemplified in (3)).

3.1 Sentential Adverbs

Recall that in (2), we saw that sentential adverbs such as *gakko de* may appear interspersed among the complements of a verb like *kisuoshita*. The examples are repeated here in (10).

(10) a. Hanako-ga Haruka-ni gakko-de kisuoshita
Hanako-NOM Haruka-DAT school-at kissed
'Hanako kissed Haruka at school.'

b. Haruka ni Hanako ga gakko de kisuoshita

c. gakko de Hanako ga Haruka ni kisuoshita

d. Haruka ni gakko de Hanako ga kisuoshita

e. Hanako ga gakko de Haruka ni kisuoshita

[15]In P&S 1993, NP arguments of a given verb, regardless of their surface order, are associated with a "role" in the verb's argument structure, and, by way of the Semantics Principle, with the semantics of the sentence as a whole.

f. gakko de Haruka ni Hanako ga kisuoshita

Examples like these pose a problem for the linearization model we have presented in the previous section. That is, our model will at present correctly allow the sentences in (10c) and (10f), but will incorrectly rule out the remaining grammatical examples (as well as any ungrammatical ones).

The problem stems from the fact that the complements of the verb *kisuoshita* combine with the verb all at once, creating a phrasal sign whose DOM value is some permutation of the DOM values of the verb and all the complements. The head-adjunct schema then allows the adjunct *gakko de* to combine with this phrase, forming a (larger) phrasal sign whose DOM value is, in our present system, merely some permutation of a list containing the NODE value of the adjunct and the NODE value of the (phrasal) head. This leaves only four possibilites (let γ below represent the disjunction of the (two) allowable permutations of *Hanako-ga Haruka-ni kisuoshita*):

$$\left[\text{DOM}\ \left\langle\begin{bmatrix}\text{PHON}\ \textit{gakko de}\\ \text{SYNSEM}\ \alpha\end{bmatrix},\begin{bmatrix}\text{PHON}\ \gamma\\ \text{SYNSEM}\ \beta\end{bmatrix}\right\rangle\right]\ \text{and}\ \left[\text{DOM}\ \left\langle\begin{bmatrix}\text{PHON}\ \gamma\\ \text{SYNSEM}\ \beta\end{bmatrix},\begin{bmatrix}\text{PHON}\ \textit{gakko de}\\ \text{SYNSEM}\ \alpha\end{bmatrix}\right\rangle\right]$$

Now, the latter of these will be ruled out by the head-final constraint (the node value of the head daughter in this case is taken to be the node whose PHON is γ and whose final element must be the node value corresponding to *kisuoshita*) leaving only one place for *gakko de* to appear in the string – at the beginning.

What we need, it appears, is some mechanism by which sentential adverbs can appear in the same word order domain as the complements of the sentence which the adverb modifies. Reape handles these cases in terms of (word order) domain union, and we will adopt the spirit of his analysis here.[16]

Recall that in the previous section, we noted that two elements that were not sisters in the tectogrammar could in principal be ordered with respect to each other in the phenogrammar. In this case, that is exactly what we need. Our proposal thus far, however, does not give us any means to accomplish this. So we will modify the system at this time in order to allow such a possibility.

To begin, we introduce the **sequence union** relation $\cup_{\langle\rangle}(A, B, C)$, defined as follows:

(11) For three sequences $A = \langle a_1, \ldots, a_m\rangle$, $B = \langle a_{m+1}, \ldots, a_{m+n}\rangle$, and $C = \langle c_1, \ldots, c_{m+n}\rangle$, $\cup_{\langle\rangle}(A, B, C)$ just in case there is a self-bijection π of $\{1, \ldots, m+n\}$ such that:

i. the restrictions of π to $\{1, \ldots, m\}$ and $\{m+1, \ldots, m+n\}$ are order-preserving; and

ii. for each $i = 1, \ldots, m+n, a_i = c_{\pi(i)}$.

[16] **The implementation will be different.**

Informally stated, the sequence C will be the result of sequence-unioning two sequences A and B (also written $A \cup_{\langle\rangle} B$), such that C contains all and only the elements of A and B and any pair of elements from A or B can be found in C in the same order. In formal language theory $\cup_{\langle\rangle}$ is akin to the (perhaps) more familiar shuffle operator.

We take domain union, then, to be just the sequence union of two DOM values, leaving us the task of (1) introducing a means by which we can state positively when domain union must occur, and (2) modifying the schemata to "trigger" domain union in these cases.[17]

In order to accomplish this, we (following Reape again) introduce the attribute UNION, with values ranging over + and −. This feature can be taken to specify which elements must be unioned into some word order domain, and which elements must not. Also, the logical possibility of being unspecified for UNION exists. We will assume here that UNION can be specified lexically, and that certain constructions can require their arguments to be UNION + or −.

We are now in a position to modify the head-adjunct schema to require that elements like *gakko de* be sequence unioned into the word order domain of the head daughter.[18]

Taking $\cup_{\langle\rangle}$ now to be domain union, the revised head-adjunct schema would then look like this:

$$\begin{bmatrix} \text{DTRS} & \begin{bmatrix} \text{HEAD DTR} & \begin{bmatrix} \text{NODE} & \begin{bmatrix} \text{SYNSEM} & \boxed{1'} \end{bmatrix} \\ \text{DOM} & \boxed{3} \end{bmatrix} \\ \text{ADJUNCT DTR} & \begin{bmatrix} \text{NODE} & \boxed{4} \begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{MOD} & \boxed{1'} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{UNION} & - \end{bmatrix} \end{bmatrix} \\ \text{DOM} & \boxed{3} \cup_{\langle\rangle} \langle \boxed{4} \rangle \end{bmatrix}$$

And this is the only change we will need to account for all the examples in (10). More explicitly, the head adjunct schema tells us that the DOM value of its output phrasal sign will be the result of domain unioning the singleton sequence of the adjunct's NODE with the DOM of the head daughter. In the case of our example, the DOM value of the head daughter will be one of two possibilities:

$$\begin{bmatrix} \text{DOM} & \left\langle \begin{bmatrix} \text{PHON} & \textit{Haruka ni} \\ \text{SYNSEM} & \alpha \end{bmatrix}, \begin{bmatrix} \text{PHON} & \textit{Hanako ga} \\ \text{SYNSEM} & \beta \end{bmatrix}, \begin{bmatrix} \text{PHON} & \textit{kisuoshita} \\ \text{SYNSEM} & \gamma \end{bmatrix} \right\rangle \end{bmatrix}$$

$$\begin{bmatrix} \text{DOM} & \left\langle \begin{bmatrix} \text{PHON} & \textit{Hanako ga} \\ \text{SYNSEM} & \beta \end{bmatrix}, \begin{bmatrix} \text{PHON} & \textit{Haruka ni} \\ \text{SYNSEM} & \alpha \end{bmatrix}, \begin{bmatrix} \text{PHON} & \textit{kisuoshita} \\ \text{SYNSEM} & \gamma \end{bmatrix} \right\rangle \end{bmatrix}$$

[17] And, ultimately, formulating a Domain Principle which will mediate between tectogrammar and phenogrammar in a universal way.

[18] We take this shuffling operation to be obligatory in Japanese head-adjunct structures. The Domain Principle presented in the next section will allow us to take a more sophisticated view of matters. More importantly, the Domain Principle will allow us to predict what a sign's DOM value will be by appealing to the UNION feature, thereby freeing us from stipulating language-specific phenogrammatic information into the ID schemata (which are taken to be universal).

The NODE value of *gakko de* will be:

$$\begin{bmatrix}\text{PHON } \textit{gakko de}\\ \text{SYNSEM } \delta\end{bmatrix}$$

So the head adjunct schema predicts that one of the two sets of possible DOM values for the whole phrase will be (taking just one of the two possibilities for the DOM value of the head):

$$\left\langle \begin{bmatrix}\text{PHON } \textit{gakko de}\\ \text{SYNSEM } \delta\end{bmatrix} \right\rangle \cup() \left\langle \begin{bmatrix}\text{PHON } \textit{Hanako ga}\\ \text{SYNSEM } \beta\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{Haruka ni}\\ \text{SYNSEM } \alpha\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{kisuoshita}\\ \text{SYNSEM } \gamma\end{bmatrix} \right\rangle$$

And, by the definition of sequence union, any of the following permutations will be allowed as the DOM value for the phrase as a whole:

$$\left\langle \begin{bmatrix}\text{PHON } \textit{Hanako ga}\\ \text{SYNSEM } \beta\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{Haruka ni}\\ \text{SYNSEM } \alpha\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{kisuoshita}\\ \text{SYNSEM } \gamma\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{gakko de}\\ \text{SYNSEM } \delta\end{bmatrix} \right\rangle$$

$$\left\langle \begin{bmatrix}\text{PHON } \textit{gakko de}\\ \text{SYNSEM } \delta\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{Hanako ga}\\ \text{SYNSEM } \beta\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{Haruka ni}\\ \text{SYNSEM } \alpha\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{kisuoshita}\\ \text{SYNSEM } \gamma\end{bmatrix} \right\rangle$$

$$\left\langle \begin{bmatrix}\text{PHON } \textit{Hanako ga}\\ \text{SYNSEM } \beta\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{gakko de}\\ \text{SYNSEM } \delta\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{Haruka ni}\\ \text{SYNSEM } \alpha\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{kisuoshita}\\ \text{SYNSEM } \gamma\end{bmatrix} \right\rangle$$

$$\left\langle \begin{bmatrix}\text{PHON } \textit{Hanako ga}\\ \text{SYNSEM } \beta\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{Haruka ni}\\ \text{SYNSEM } \alpha\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{gakko de}\\ \text{SYNSEM } \delta\end{bmatrix}, \begin{bmatrix}\text{PHON } \textit{kisuoshita}\\ \text{SYNSEM } \gamma\end{bmatrix} \right\rangle$$

However, the first of these will be ruled out by an application of the head-final constraint (with the last element of the head daughter's DOM being the domain element associated with the lexical head *kisuoshita*). A similar set of three permutations would be generated by sequence-unioning the singleton list corresponding to the NODE value of *gakko de* (as above) with the other possible DOM value for the head. The result is six possibilities, corresponding exactly to the sentences in (10a) - (10f).

3.2 Clause Union and Scrambling

A similar analysis can be applied to treat cases where complements of a lower clause intermingle with those of a higher clause, as is the case in the Japanese causative construction. The relevant examples are repeated here in (12).

(12) a. Haruka-wa Hanako-ni hon-o Ayako-ni age-saseta
Haruka-TOP Hanako-DAT book-ACC Ayako-DAT give-made
'Haruka made Hanako give the book to Ayako.'

b. hon o Haruka wa Hanako ni Ayako ni agesaseta

c. Hanako ni Haruka wa hon o Ayako ni agesaseta

d. *Ayako ni Haruka wa Hanako ni hon o agesaseta (out with meaning of (2a))

In these cases, it appears that what we want is for the elements of the DOM value associated with the lower verb phrase to be sequence unioned into the DOM value of the mother. Setting up our model to allow this, however, raises some interesting technical issues.

Consider first the lexical entry for the causative morpheme *sase*, and note especially that it selects for complements that are both UNION + and UNION – [19].

$$\begin{bmatrix} \text{PHON } \textit{sase} \\ \text{SYNSEM} \begin{bmatrix} \text{HEAD } \textit{verb} \\ \text{SUBCAT} \left\langle \begin{bmatrix} \text{SYNSEM NP-ga} \\ \text{UNION } - \end{bmatrix}, \begin{bmatrix} \text{SYNSEM NP-ni} \\ \text{UNION } - \end{bmatrix}, \begin{bmatrix} \text{SYNSEM VP-inf} \\ \text{UNION } + \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

This has the intended effect of allowing the DOM of the VP complement to be domain-unioned into the DOM of the mother. For this to work, we first need to posit a new schema that will allow us to form verb phrases. Such a schema should look something like this:[20]

$$\begin{bmatrix} \text{NODE} \left[\text{SYNSEM} \left[\text{LOCAL} \left[\text{CATEGORY} \left[\text{SUBCAT } \langle \boxed{1} \rangle \right] \right] \right] \right] \\ \text{DTRS} \begin{bmatrix} \text{HEAD DTR} \left[\text{NODE} \left[\text{SYNSEM} \left[\text{LOCAL} \left[\text{CATEGORY} \left[\text{SUBCAT } \langle \boxed{1}, \ldots, \boxed{n} \rangle \right] \right] \right] \right] \right] \\ \text{COMP DTRS } \left\langle \left[\text{SYNSEM } \boxed{2} \right], \ldots, \left[\text{SYNSEM } \boxed{n} \right] \right\rangle \end{bmatrix} \end{bmatrix}$$

We are then left with two (reasonable possibilities): (1) we could revise the head-complement schema to concatenate into the output sign's DOM the DOM values on those daughters which are UNION –, while domain unioning the DOM values of the UNION + complements; or (2) take the phenogrammatic information out of the schemata all together, and posit some general principle that will do the same work. Such a constraint, then, would encode the general relationship between tectogrammar and phenogrammar. Quite obviously, we will choose the latter here, as it is more elegant and, in fact, more explanatory. The principle works as follows:

The Domain Principle: In a phrasal sign, let [0] be the head daughter's domain, let $[1], \ldots, [m]$ be the domains of the UNION + daughters and $[m+1], \ldots, [n]$ the node values of the UNION – daughters. Then the DOM value of the phrase is:

$$\boxed{0} \cup_{()} \boxed{1} \cup_{()} \ldots \cup_{()} \boxed{m} \cup_{()} \text{ permute}\left(\boxed{m+1}, \ldots, \boxed{n}\right)$$

[19] In earlier versions of HPSG, the values on SUBCAT lists were taken to be of type *synsem*. So, in order to allow verbs to select for the UNION attribute, we must either make it part of SYNSEM or allow verbs to select for a *synsem* object and to specify whether its complement in UNION + or UNION –. We will choose the latter here.

[20] Note: I have left the phenogrammatical information out of this schema, for reasons we will see immediately below.

That is, the Domain Principle guarantees that any phrase of the form:

$$\left[\text{DTRS}\left[\begin{array}{l}\text{HEAD DTR}\left[\begin{array}{l}\text{NODE}\left[\text{SYNSEM}\ldots\left[\text{SUBCAT}\ \langle\boxed{1''},\ldots,\boxed{m''}\rangle \cup_{\langle\rangle} \langle\boxed{m+1''},\ldots,\boxed{n''}\rangle\right]\right]\\ \text{DOM}\ \boxed{0}\end{array}\right]\\ \text{COMP DTRS}\ \langle\left[\begin{array}{l}\text{NODE}\left[\text{SYNSEM}\ \boxed{1''}\left[\text{UNION}\ +\right]\right]\\ \text{DOM}\ \boxed{1}\end{array}\right],\ldots,\\ \left[\begin{array}{l}\text{NODE}\left[\text{SYNSEM}\ \boxed{m''}\left[\text{UNION}\ +\right]\right]\\ \text{DOM}\ \boxed{m}\end{array}\right]\rangle\cup_{\langle\rangle}\\ \langle\left[\text{NODE}\ \boxed{m+1}\left[\text{SYNSEM}\ \boxed{m+1''}\left[\text{UNION}\ -\right]\right]\right],\ldots,\\ \left[\text{NODE}\ \boxed{n}\left[\text{SYNSEM}\ \boxed{n''}\left[\text{UNION}\ -\right]\right]\right]\rangle\end{array}\right]\right]$$

will have as its DOM value, the DOM value specified in the statement of the Domain Principle above.

Returning to our example, the net effect of the lexical entry for *sase* above, plus the head complement schema of §2 (with the phenogrammatical information removed) together with our new Domain Principle, will be to create a word order domain like the one below, where Σ abbreviates a description ranging corresponding to the disjunction of the possible word order domains associated with the embedded VP.

$$\left[\text{DOM permute}\left\langle\left[\begin{array}{l}\text{PHON}\ \textit{Haruka wa}\\ \text{SYNSEM}\ \alpha\end{array}\right],\left[\begin{array}{l}\text{PHON}\ \textit{Hanako ni}\\ \text{SYNSEM}\ \beta\end{array}\right],\left[\begin{array}{l}\text{PHON}\ \textit{sase}\\ \text{SYNSEM}\ \gamma\end{array}\right]\right\rangle \cup_{\langle\rangle} \Sigma\right]$$

The net effect, then, is a DOM value that includes not only the arguments of the matrix verb *sase* but also the complements of the lower verb *age* (and *sase* and *age* themselves). The head final constraint from the previous subsection requires that *sase* be the last element in this domain, while the rest of the elements can scramble freely, subject to the restriction that the elements from Σ must remain in the same order relative to other elements of Σ (cf. the definition of sequence union). This allows all the sentences in (12) to be generated (including the ungrammatical one).[21]

It will also allow sentences like the following, in which an NP argument of the matrix clause appears between *age* and *sase*. These are definitely ungrammatical, so this constitutes an overgeneration.

(13) *Hanako ni hon o Ayako ni age Haruka wa sase

In this case, the head final constraint did not help us, since *age* is not the head of the phrase that contains the relevant DOM. It is attached to the head, however, by a lexical process, so it is not entirely surprising that this element would also be subject to the head-final constraint. Alternatively, we could posit an LP-constraint for Japanese that would require phrasal elements to precede lexical elements. Then, the phrasal elements *Hanako ni*, *hon o* and so forth would be required to precede the lexical elements *age* and *sase*, and the example in (13) would be ruled out in terms of this constraint. I leave formalization of this notion for a future study.

[21] A brief discussion of this particular instance of over-generation is provided in the next section.

4 Suggestions for Further Research

So far, we have seen how our linearization model can be used to account for various word order possibilities, all the while assuming that the order of non-head elements of a given verb may appear in relatively free linear variation. In this first part of this section, I will discuss some cases in which the order of non-head elements is more constrained, and will demonstrate how our model can be (possibly) extended to account for these data. In the latter half of the section, I will make explicit the conclusions of the current work.

4.1 L-S-Exist Constructions: Attachment

In Japanese sentences involving the intransitive verb *aru* ('to exist'), Kuno (1973) notes that a locative NP usually precedes the subject NP, and that in many cases, linear variation among these two elements is impossible. The examples in (14) illustrate.

(14) a. yama ni ki ga aru
mountain LOC tree NOM exist
'Trees are on the mountain.'

b. ?*ki ga yama ni aru

What appears to be going on here is that the subject NP and the verb *aru* must remain adjacent in the phenogrammar. This is evidenced by sentences like (14b) above, and also by the fact that a time adverbial cannot (very easily) appear between the subject and *aru*, as in (15).

(15) a. kyonen yama ni ki ga aru
last year mountain LOC trees NOM exist
'Trees existed on the mountain last year.

b. ??yama ni ki ga kyonen aru

This restriction can be formalized in a number of ways, and certainly the way in which "attachment" relations such as this are captured in linearization models in general is a subject for future research. What I envision is for the verb *aru* (since the phenomena seems to be associated with the verb) to simply specify that the NODE of its subject complement must remain strictly adjacent to its own NODE, in any DOM in which they appear together, by way of some feature.

Such a move, along with the head-final constraint, would correctly rule out sentences like (15b) and (14b), since presumably nothing would be allowed to come between *aru* and its *ga*-marked complement, just as nothing is allowed to appear between the causative morpheme *sase* and the verb that attaches to it (in the examples above, *age*).[22]

[22]Whether *age* attaches to *sase* by the same mechanism as *ki ga* attaches to *aru* is, however, a matter for further research. I suspect not.

4.2 Constraints on Scrambling: A Problem

We have noted already that, while complements of the embedded VP in the causative construction can intermingle with complements of the matrix verb, it is not the case that this intermingling is totally free. For example, in the last section we saw that a *ni*- marked element of the lower clause cannot "cross over" a *ni*-marked element of the matrix clause, with the example repeated here in (16).

(16) *Ayako ni Haruka wa Hanako ni hon o agesaseta.

So far, nothing in the system outlined in this paper can capture this sort of constraint, and the alternatives seem to be few.

One possibility would be to "filter out" the *ni*-marked elements from the DOM of the matrix clause when domain union takes place. That is, domain union would be redefined to allow only "compatible" elements, or, in the case of the example in (16), the Domain Principle (somehow) would specify that *Ayako ni* not be involved in the domain unioning of the complements of *age* with the complements of *sase*.

If we adopt this approach, however, we are left without a way to explain cases like (17) where elements of the higher clause appear after the *ni*-marked element of the lower clause,

(17) Hanako ni hon o Ayako ni Haruka wa agesaseta

This sentence is not entirely perfect, but not entirely out either. Another tactic, of course, would be to explain this phenomena in terms of processing. After all, the sentence in (16) is actually quite grammatical, if *Ayako* is interpreted as the causee. The question, of course, would then be why *Ayako* **must** be interpreted in this way. Again, this issue warrants further study.

4.3 Markers

As one last illustration of the problems that lie ahead, recall that in the account above, I chose to ignore the case markers *ni*, *ga*, *o*, etc. This was not entirely by accident. That is, because markers are not analyzed here as heads, and because they in fact appear **after** the heads that they mark, these particles constitute an entire class of counterexamples to our (very strong) head final constraint. It may be possible, however, to account for these apparent violations by treating case markers like these as clitics, subject to different set of word order constraints; alternatively, we could just make markers the heads, following Gunji (1987). We could also stipulate in our LP constraints that heads follow nonmarkers and precede markers, or, more radically, we could envision a set of "weighted" rules, with markers being most strongly preferred to appear last, followed by heads, and so forth.

4.4 Concluding Remarks

As is evident, this paper should by no means be taken to provide an exhaustive account of word order variation in Japanese. Certainly, extending the "toy" model I have presented here to more complex examples will involve numerous combinations of new ideas, revisions and retractions. That is, there is a lot of linguistics left to be done, and this paper is only meant to serve as a starting point.

In sum, we have accomplished the following: (1) proposed a basic means by which word order variation in Japanese (and hopefully all languages) can be handled in terms of a linearization model, in which tectogrammatic and phenogrammatic information occupy two distinct, yet related, levels of description; (2) accounted for the previously problematic interspersal of adjuncts among complements in terms of this model; (3) posited a general principle to capture the relationship between tectogrammar and phenogrammar by appealing to the feature UNION; (4) moved towards an account of "scrambling" (in the traditional sense), in which co-dependents of one head intermingle with those of a (lower) head; and (5) identified areas of future research and suggested (albeit briefly) some avenues that this research might take.

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