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Within traditional descriptions of the order of grammatical constituents, a distinction is often made between unmarked (or basic) orders and alternate orders. To take one example of this view, Gleason (1961) has stated:

> It is sometimes said that because of the highly developed inflectional system of Latin, word order was unimportant. This is a gross overstatement. In every language, word order had important syntactic functions... Every language has some definable instances of rigidly fixed order and some definable freedom of word order.
>
> (Gleason 1961, p. 163)

Working within the framework elaborated by Chomsky (1965; henceforth, *Aspects*), Ross (1967) offered an analysis for capturing this traditional distinction within standard transformational theory. It was generally assumed in the *Aspects* framework that in fixed order languages like English the unmarked constituent order is defined by the phrase structure (PS) rules of the base component, with variations in order being determined by transformational rule. Ross suggested that the same should be true of languages like Latin which exhibit much wider variations in constituent orders; he proposed that the unmarked orders of such languages be generated by PS rules in the usual way with the freely varying orders being accounted for in terms of a rule of Scrambling which interchanges any two adjacent constituents and can apply any number of times in a single derivation.

There are several peculiarities with this sort of approach which ultimately make it an unsatisfying account of unrestricted alternate orders. First, as Ross himself noted, Scrambling exhibits properties which distinguish it from the standard sorts of transformations; in attempting to account for this fact, Ross suggested that this rule be considered part of the separate component of stylistic rules which apply after the set of cyclic transformations. Unfortunately, since it seems that the stylistic component also contains various transformations of the standard sort in addition to Scrambling,[1] that rule will also have to occupy a special place within the stylistic component.

The relation between Scrambling and the standard transformations therefore remains obscure regardless of whether or not Scrambling is segregated into the stylistic component. Second, if one assumes the existence of Scrambling, one will have to worry about various technical issues concerning either the derived constituent structures produced or the direction in which constituents are moved by these rules. However, as we will see below, these technical issues are really beside the point since constituents in languages with freely varying alternate orders can simply appear in any order with respect to other constituents in a sentence. The third, and perhaps most important, problem with the Scrambling approach is that it permits potentially infinitely many derivations for each single surface sentence, since Scrambling can undo and redo whatever order relations have already been defined by the PS rules and regular transformations of the grammar without restriction. This possibility seriously compromises a generative grammar's ability to describe structural ambiguity or the lack thereof, and there is no obvious way to constrain Scrambling sufficiently to regain this lost ability.

There is of course another device included in generative grammars which defines constituent orders -- namely, the set of PS rules of the base component. If these could somehow be made to define freely varying alternate orders as well as fixed unmarked orders, we might be able to avoid the problems inherent in the Scrambling approach while still being able to accomodate the traditional distinction between unmarked and alternate orders within a generative theory. The present paper represents a preliminary investigation into the structure of such a theory. After reviewing the approach to traditional order description presented in Lapointe (1980a) in section 1, an analysis will be given for the alternate orders in two free order languages which exhibit different order properties. In section 3 the free order characteristics of these and several other languages will be brought to bear on the formulation of a theory of free order S-expansion rules. In section 4 the unmarked order/free order distinction will be explored in greater detail within the proposed theory and will be shown to play an important role in the acquisition of constituent orders.

1. An Analysis of Traditional Order Descriptions.

Traditional descriptions of constituent orders can be viewed as generally consisting of two parts: structural statements indicating the actual order of the constituents and relational statements indicating the relations which hold between the constituents. In recent work (Lapointe 1980a; henceforth, TGA), I have pointed out that it is natural to assume that the facts described by such structural statements are to be handled by $\bar{X}$ PS rules (Chomsky 1970, Jackendoff 1977) with the following properties: (i) lexically-defined syntactic categories are marked [± maj], where the [+maj] categories (N,A,V, and P) participate in forming phrases, and [-maj] categories (Det, Aux, Quant, etc.) do not; (ii) the maximum phrase level for [+maj] phrases is assumed for convenience to be 2, while the maximal level for [-maj] categories is 0, the level of words; and (iii) S-type categories form a distinct class of [+maj] phrases which, unlike the other major categories, are not formed by the projection of lexical categories through a series of higher phrase levels and are governed by a separate set of PS rule conditions from the other [+maj] categories.[2] Little was said about rules for expanding S in TGA but I will have occasion to specify some of the details of these rules below.

In formulating a theory of morphological agreement in TGA, it was necessary to make various assumptions about the semantic representations of words and phrases. An important part of the assumptions made there involves the system of argument-type determining procedures (ADPs) which specify the argument in the semantic translation of a verb (represented $\tau(V)$) that a NP-translation ($\tau(NP_i)$) can logically bind. Semantic translations can be assumed to pair syntactic cetegories with expressions in a suitable logical form, the details of which are largely irrelevant for present purposes.[3] ADPs can be defined as having the following form.

(1) Form of ADPs

ADPs are of the form, "If $\mathcal{C}$, then $\mathcal{M}$," where $\mathcal{C}$ is a structural condition consisting of

a. a description of the local syntactic context in which an NP appears, and/or
b. a description of the morphological form of the lexical head N of the NP,

and is a manipulation of the variables appearing in the translation of the NP mentioned.

Since the actual manipulations of the NP-translations performed by ADPs are not of interest here, $\mathcal{M}$ will simply be given as an instruction of the form " $\tau(NP_i)$ binds the j^{th} argument of $\tau(V)$" (there is obviously more going on in these variable manipulations; see fn. 3). The local syntactic context around a category C in a syntactic tree is assumed to include the category D which immediately dominates C plus any of the categories $C_1 \ldots C_n$ which are the sisters to C; the morphological form of a noun is assumed to be represented in terms of arbitrary morphological features which specify gender class, morphophonemic inflectional class, etc. The relational statements of traditional order descriptions, to the extent that these specify relations holding between NPs and Vs, were assumed in TGA to be accounted for in terms of ADPs.

This approach to the analysis of traditional order descriptions can be illustrated by the PS rules and ADPs given in (3) and (4) to account for the statements in (2) about the order of constituents in simple declarative sentences of English.

(2) Traditional description for English. The order of elements in simple declarative sentences consists of various presubject modifiers, the subject, and the predicate. The predicate consists of various auxiliary verbs and pre-

verbal modifiers, the verb, an optional direct object, and various post-verbal modifiers.

(3) Structural statements (PS rules)

a. $S \rightarrow \ldots \underline{NP}$ (Aux) VP
b. $\underline{VP} \rightarrow \ldots \bar{V} \ldots$
c. $\bar{V} \rightarrow V$ (NP) ...

(4) Relational statements (ADPs)

a. If $NP_i/[X\_\_\_(Aux)\ VP]_S$, then $\tau(NP_i)$ binds the 1st argument of $\tau(V)$.

b. If $NP_i/[V\_\_\_X]_{\bar{V}}$, then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

Further investigations into the constituent structure of English sentences will lead to the postulation of Aux categories in various further positions and to the filling in of the dotted gaps in the PS rules of (3).

The ADPs in (4) state that the semantic translation of the NP traditionally termed the subject (SUBJ), which in English appears in the local context $[X\_\_\_(Aux)\ VP]_S$, binds the first argument in a V's translation, and the direct object NP (DO NP), which in English occurs in the context $[V\_\_\_X]_{\bar{V}}$ binds the second argument.[4] As was pointed out in TGA, it is natural within this type of theory to identify the traditional grammatical relations such as SUBJ, DO, and the like with the relation obtaining between a NP-translation and the argument which that NP-translation binds. The structural conditions of the ADPs in (4) only involve syntactic information since this is all that is required in determining which argument of a V-translation is bound by a NP-translation in simple declarative sentences in English. However, languages differ exactly in that some use only local syntactic information, some use only morphological information, and still others use a combination of the two in specifying the argument that an NP-translation can bind. Furthermore, given the above association of the grammatical relations with the binding of particular arguments in V-translations by NP-translations and the assumption that the argument structure of V-translations is essentially the same across languages, it becomes possible within the present theory to associate classes of NPs across different languages which would traditionally be described as bearing the same grammatical relation in sentences of their respective languages. That is, this sort of approach allows us to make formal sense out of the characterization of NPs with certain properties in a language like English and NPs with certain other properties in Sanskrit, say, both as "subjects".

Having briefly considered an example of a grammar whose ADPs only refer to syntactic information, we now turn to two cases which involve reference to morphological information.

2. Two Free Order Languages

In this section we will look at some facts from two free order languages, Latin and Dyirbal, which present different types of order behavior both in their unmarked orders and in their alternate orders, and we will attempt to analyze these within the system outlined above.

2.1 Latin. A traditional description of the unmarked order of a language like classical Latin might say the following.[5]

(5) Traditional description of Latin unmarked order:

a. The subject precedes the predicate.
b. The order of elements in the predicate is, Modifiers - IO - DO - Advs - V

If we concern ourselves just with the positions of SUBJ and DO NPs and the V, we can analyze this description in terms of the following PS rules and ADPs.

(6) Unmarked Latin PS Rules

a. $S \rightarrow (NP)\ VP$
b. $VP \rightarrow \ldots \bar{V}$
c. $\bar{V} \rightarrow \ldots (NP)\ V$

(7) Unmarked Latin ADPs

a. If $N_i \in [NOM]$ and $NP_i/[\_\_\_ VP]_S$, then $\tau(NP_i)$ binds the 1st argument of $\tau(V)$.

b. If $N_i \in [ACC]$ and $NP_i/[\_\_\_ V]_{\bar{V}}$, then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

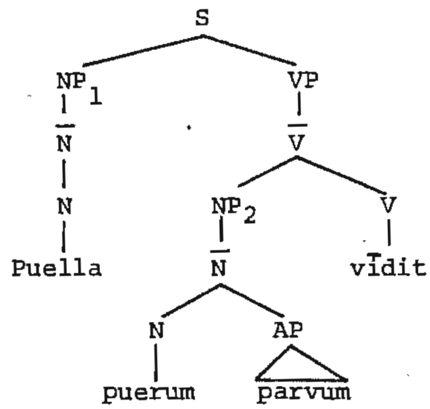
Here NOM and ACC represent the traditional morphological cases nominative and accusative. There is obviously much more going on in the language than is captured by the rules stated in (6) and (7), but these will serve our purposes (for more details, see Chapter 3 of TGA). The PS rules of (6) state that the unmarked constituent structure in Latin is V-final, and the ADPs in (7) specify that in unmarked order SUBJ NPs appear before the NP and have nominatively-marked lexical heads while DO NPs appear (nearly) immediately before the V and have accusatively-marked lexical heads. An example of a Latin sentence conforming to (6) and (7) is (8).

(8) a.

Puella	puerum	parvum	vīdit.
girl	boy	small	see
NOM	ACC	ACC	PERF

'The girl saw the small boy'

b.



In addition to examples of such unmarked orders however, Latin also shows a considerable amount of freedom in the order in which constituents may appear. The sentence in (8) can therefore be realized in any of the following orders with the same basic sense (although, as Latin grammar books are quick to point out, with differences in emphasis).

(9) a. Puella vīdit puerum parvum.
b. Puerum puella vīdit parvum.
c. Parvum puerum puella vīdit.

⋮

In order to account for such alternate orders, we can add the extra S-expansion rule in (10) to those in (6), where X^{max} is defined as in (11).

(10) $S \rightarrow (X^{max})*$

(11) $X^{max} =_{def} \begin{cases} X^2, \text{ if } X \text{ is } [+maj] \\ X^0, \text{ is } X \text{ is } [-maj] \end{cases}$

Let us refer to rules of the sort in (10) as <u>free order</u> S rules and to those in (3a) and (6a) as <u>fixed order</u> S rules; let us further define a term appearing on the righthand side of a PS rule such as X^{max} as a variable term and to a term like $(X^{max})*$ as a starred variable term. Rules such as (10) are to be interpreted as saying that an unlimited number of constituents of any category can appear in any order immediately dominated by S, and under convention (11) the phrase-level of a given category generated by such a rule is the maximal one for that category (i.e., 2 if the category is [+maj] and 0 if the category is [-maj]). Such a rule will of course overgenerate wildly; however, as shown in <u>TGA</u>, a reasonable system of verb argument structure and logical forms will eliminate as ill-formed all of the unwanted structures.

Having made the above change in the set of PS rules that we have posited for Latin, we must now make concomitant changes in the ADPs in (7) since we now want NPs with NOM and ACC head Ns to act as SUBJs and DOs even though they may not appear in the syntactic environments specified in (7). One option open to us at this point would simply be to eliminate those syntactic contexts from the ADPs and hence claim that the ADPs of Latin operate solely on the basis of morphological information. If we adopt this approach, however, we will no longer have the information about the unmarked order of the language represented in its grammar. Assuming that there are good reasons for wanting to be able to recover unmarked order information,[6] we would prefer to optionalize the syntactic contexts in ADPs like those in (7) rather than eliminate them entirely. Using parentheses in their customary role to indicate optionality, the final version of the ADPs in (7) would be those in (12).

(12) Final Latin ADPs

a. If $N_i \in$ [NOM] (& NP_i/[___VP]$_S$), then $\tau(NP_i)$ binds the 1st argument of $\tau(V)$.

b. If $N_i \in$ [ACC] (& NP_i/[___V]$_{\overline{V}}$), then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

Under these assumptions then, the following procedure can be used for determining the unmarked order of a language given the PS rules and ADPs of its grammar; the structural statements concerning the unmarked order are determined by the whole set of PS rules excluding any free order S rules which may be present, and the relational statements are determined by the longest expansion of all of the ADPs. Thus, (6) and (7) continue to define the unmarked constituent order of Latin despite the changes in its grammar which have just been adopted.

2.2 Dyirbal*. If the theory of argument structure and ADPs defined in TGA is truly universal, then it should be able to do some work in a non-Indoeuropean language like Dyirbal, described by Dixon (1972). One of the interesting aspects of this language is that it employs an ergative case marking system involving a complex interaction between grammatical relations, topic marking, and various construal and control rules. Part of this system is explored in some detail in TGA. Since we are interested here in the free order properties of this language rather than in the problems encountered in describing its case marking system, we will simplify the discussion by focusing on a subset of the language, Dyirbal*, which contains only transitive sentences. The unmarked order of Dyirbal* would, following Dixon's description, be that in (13).

(13) Description of Dyirbal* unmarked order:

a. An absolutive (ABS) NP precedes the predicate.
b. The predicate consists of an ergative (ERG) NP followed by a V.

In the transitive sentences of such languages, ERG NPs function as SUBJs and ABS NPs function as DOs. The description in (13) can therefore be represented in terms of the following PS rules and ADPs.

(14) Unmarked Dyirbal* PS Rules

a. S → NP $\overline{VP}$
b. $\overline{VP}$ → ...$\bar{V}$ ...
c. $\bar{V}$ → ... NP V

(15) Unmarked Dyirbal* ADPs

a. If $N_i \in$ [ABS] & $NP_i/[\_\_\overline{VP}]_S$, then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

b. If $N_i \in$ [ERG] & $NP_i/[X\_\_V]_{\bar{V}}$, then $\tau(NP_i)$ binds the 1st argument of $\tau(V)$.

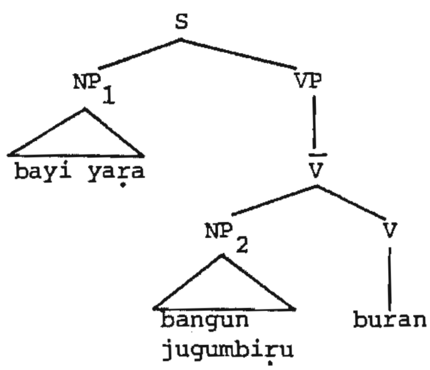
An example of a sentence and structure conforming to (14) and (15) is given in (16).

(16) a.

bayi	yaṛa	bangun	jugumbiṛu	buran
ClassI	man	ClassII	woman	watch
ABS	ABS	ERG	ERG	NONFUT

'The woman is watching the man'

b.



As was the case with classical Latin, Dyirbal (and Dyirbal*) exhibits considerable freedom of order among sentential elements. However, where Latin shows freely varying alternate constituent orders in declarative sentence (i.e. scrambled maximal phrases), Dyirbal shows freely alternate word worders. One of the most vivid examples of this phenomenon is the sentence in (17a) which Dixon (1972, p. 107) notes can also be realized equally grammatically as (17b). (Lines have been added in (17b) to make it easier to connect the separated constituents of (17a)).

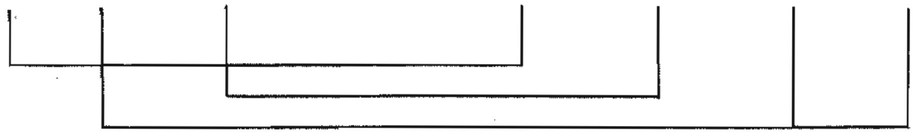
(17) a.

bayi	waŋal	baŋal	yaṛaŋu	bulgani	baŋgun	jugumbiṛu	buran
C.I	boomerang	C.I	man	big	C.II	woman	see
ABS	ABS	GEN	GEN	GEN	ERG	ERG	NONFUT

'The woman sees the big man's boomerang.'

b.

bayi	yaṛaŋu	jugumbiṛu	buran	waŋal	baŋgun	baŋul	bulganu
C.I	man	woman	see	boomerang	C.II	C.I	big
ABS	GEN	ERG		ABS	ERG	GEN	GEN



Many further examples of this sort can be found in the texts which Dixon presents at the end of his book. As before, we can account for this sort of behavior by positing a free order S rule, except that now we want the righthand side of the rule to allow only an unlimited number of words rather than phrases (cf. (18) and (10)).

(18) $S \rightarrow (X^0)^*$

Again, the ADPs in (15) must be changed to accomodate the possibility that sentences like (17b) can be produced by (18).

(19) Final Dyirbal* ADPs

a. If $N_i \in$ [ABS] (& $NP_i/[\_\_\_VP]_S$), then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

b. If $N_i \in$ [ERG] (& $NP_i/[X\_\_\_V]_{\bar{V}}$), then $\tau(NP_i)$ binds the 1st argument of $\tau(V)$.

As above, (14) and (15) will still define the unmarked orders of the language.

3. Toward a Theory of S-expansion Rules

Having considered two languages which exhibit different alternate order properties, we must now try to construct a general theory of free order S rules which will allow both types of languages as well as several others. Although it is logically possible that rules expanding categories other than S can introduce free orders, there are two reasons for assuming that this ability is restricted to S-expansion rules. First, this is a kind of minimal assumption to make since, on the basis of our investigations so far, there is no need to assume that any other category introduces free orders, and second, it is a fairly natural assumption to make within the present theory of $\bar{X}$ PS rules, since S rules are assumed to have special properties distinguishing them from the rules expanding the lexically-headed phrases, the ability to introduce free orders presumably being among these distinguishing properties.

Before continuing, we will find it useful to define the notation in (20).

(20). $X^\alpha =_{def} X^{max}$ or X^0

X^{α} will be used as a metatheoretical variable in universal PS schemas to indicate that grammars of particular languages may have free order S rules with either X^{max} or X^{o} in the indicated position.

On the basis of the above discussions of Latin and Dyirbal*, we would want Universal Grammar (henceforth, UG) to include the following schema defining free order rules.

(21) Universal Free Order Schema I (to be revised)

$$S \quad (X^{\alpha})*$$

Under the notational convention just introduced, this schema is to be interpreted as saying that a free order S rule appearing in the grammar of a particular language can be of one of the forms in (22).

(22) a. $S \rightarrow (X^{max})*$
b. $S \rightarrow (X^{o})*$

Is (21) the only free order S rule schema? Apparently not, since there is at least one well-documented language, Walbiri (Hale 1979), which has free word order like Dyirbal but requires that an Aux element appear in second position.[7] Within the present analysis, simple declarative sentences in this language would be described by the following free order rule which does not conform to (21).

(23) Walbiri Free Order Rule

$$S \rightarrow X^{0} \quad Aux \quad (Y^{0})*$$

There are other languages which seem to exhibit free order behavior but whose free order S rules do not conform to (21). Thus German (Curme 1952) might be described as being a free constituent order language which requires a tensed V to appear in second position in matrix clauses and in final position in embedded clauses, as given by the PS rules in (24).[8]

(24) a. German Matrix Free Order Rule

$$S \rightarrow X^{max} \quad V \quad (Y^{max})*$$

b. German Embedded Free Order Rule

$$S \rightarrow (X^{max})* \quad V$$

Similarly, Japanese (Martin 1975) might be describable as having the same free order rules as in (24b) for both matrix and embedded clauses. Finally, there are languages like Biblical Hebrew (Weingreen 1959) and Irish (Thurneysen 1946) which might be described to a first approximation as having a free order rule of the sort in (25).

(25) Biblical Hebrew and Irish Free Order Rule

$$S \rightarrow V \quad (X^{max})*$$

At this point it is appropriate to try to draw some generalizations from (21), (23), (24) and (25). The first observation to be made is that (23) and (24) appear to be reflexes of the same general type of PS rule since main Vs and auxiliaries share the feature [+V] within the system of syntactic features assumed in TGA (i.e., V = $[+V, +maj]^0$ and Aux = $[+V, -maj]^0$). We might therefore posit the general rule schema in (26).

(26) Universal Free Order Schema II

$$S \rightarrow X^{\alpha}\ [+V]^0\ (Y^{\alpha})*$$

The next observation to be made is that single phrases can appear to the left of the V in Biblical Hebrew (and possibly also Irish, although the situation here is less clear). According to Greenberg (1963), it is generally the case that V-initial languages have alternate orders in which SUBJ NPs are initial, and it is likely that S-initial position is a general "topicalized" position for phrases of any category in such languages. If this is the case, then these languages can be assimilated under (26) as instances where the X^{α} term is optional. This possibility can be accomodated through the following convention.

(27) Convention on parentheses

> A nonhead term appearing on the righthand side of a universal PS schema can appear in a language-specific rule either as it is stated or enclosed in parentheses.

Let us say that the head of S is the V^{α} term in the PS rule expanding S, if such a term exists; if no such term exists, the head of S will simply be left undefined. There are ways of defining this property in cases where no [+V]- type category is explicitly mentioned in an S-expansion rule, but these involve some fairly complex technical problems which shed little light on the issues under discussion here, and hence the simpler assumption, that rules like those in (22) do not define heads, will be adopted for present purposes.

The final observation to be made is that languages exhibiting PS rules like (24b) can be accomodated by generalizing the schema in (21) to the following.

(28) Universal Free Order Schema I (final version)

$$S \rightarrow (X^{\alpha})*\ \{[+V]^0\}$$

'{, }' are being used here to indicate metatheoretical optionality; hence (28) says that the constituent $[+V]^0$ may or may not appear as the rightmost term in a free order S rule of some particular grammar. Furthermore, if that term does appear in such a rule, under convention (27) it may appear in that rule either with or without regular parentheses.

We now take the two schema (26) and (28) as defining the set of universally possible free order S rules. Table 1 lists all of these possibilities along with languages which exemplify these rules.

<u>Universal Schema Type I</u>:	$S \rightarrow (X^{\alpha})^* \{[+V]^{o}\}$	
a.	$S \rightarrow (X^{max})^* \quad [+V]^{o}$	German embedded, Japanese
b.	$S \rightarrow (X^{max})^* \quad ([+V]^{o})$	?
c.	$S \rightarrow (X^{max})^*$	Latin, Papago
d.	$S \rightarrow (X^{o})^* \quad [+V]^{o}$	?
e.	$S \rightarrow (X^{o})^*$	Dyirbal
<u>Universal Schema Type II</u>:	$S \rightarrow X^{\alpha} \; [+V]^{o} \quad (Y^{\alpha})^*$	
a.	$S \rightarrow X^{max} \quad [+V]^{o} \quad (Y^{max})^*$	German matrix
b.	$S \rightarrow (X^{max}) \; [+V]^{o} \quad (Y^{max})^*$	Biblical Hebrew (Irish?)
c.	$S \rightarrow X^{o} \quad [+V]^{o} \quad (Y^{o})^*$	Walbiri
d.	$S \rightarrow (X^{o}) \quad [+V]^{o} \quad (Y^{o})^*$	?

Table 1. Universal free order S rule schemas and the major rule types which they define

In addition to the languages which have already been discussed, Papago has been tentatively included since this language appears to have free order properties similar to those exhibited by Latin.[9] Notice also that there are actually six more PS rules than are listed in the table under Type I and eight more than are listed under Type II because individual grammars can further specify the $[+V]^{o}$ term in a free order rule as [+maj] (i.e., a main verb) or as [-maj] (i.e., auxiliary verb). Finally, schema (28) actually allows a sixth type of S rule, namely, the one in (29).

(29) $S \rightarrow (X^{o})^* \quad ([+V]^{o})$

However, since the effects of (29) are identical to those of the simpler rule Ie of table 1, it is reasonable to assume that universal restrictions on the appearance of X* terms in PS rules only permit rules like Ie and <u>not</u> those like (29) to occur in the grammars of particular languages.

As can be seen from the table, schemas (26) and (28) make several fairly clear predictions about the possible free order rules which can appear in individual grammars. First, they claim that there are at most only the 9 possible free order rules shown in the table (plus the additional variations arising from the specifications of [±maj] just mentioned). Second, there are only a small number of dimensions along which these rules can differ from one another: they can be V-final (types Ia, b, d), V-medial (IIa-d), or without explicit V (Ic, e). Third, every free order S rule must contain a starred variable term and in addition, at most one $[+V]^{o}$ term and at most one unstarred variable term. Furthermore, the appearance of a starred variable term in type II free order rules is governed by the following constraint: the initial and final variable terms in type II rules must introduce constituents of the same phrase-level; i.e., within a single rule, α = max for both variable terms or α = 0 for both terms. There are several other generalizations of these sorts which (26) and (28) capture; for comparison, (30) lists some of the logically possible rules containing starred and unstarred variable terms which are not possible free order S rules under the above schemas.

(30) Impermissible free order rules under (26), (28)

a.	$S \rightarrow X^{o}\ [+V]^{o}\ (Y^{max})*$	(variable terms introduce different phrase-levels)
b.	$S \rightarrow X^{max}\ [+V]^{o}\ (Y^{o})*$	
c.	$S \rightarrow (X^{max})*\ [+V]^{o}\ (Y^{max})$	(starred variable term to the left of $[+V]^{o}$)
d.	$S \rightarrow (X^{max})*\ [+V]^{o}\ (Y^{max})*$	(two starred variable terms)
e.	$S \rightarrow (X^{max})\ [+V]^{o}\ (Y^{max})$	(no starred variable terms)

⋮

In addition these schemas claim that there are several types of free order rules beyond those that have already been discussed which should appear in the grammars of some languages, namely, types Ib, d, and IId. Given the generality and relative simplicity of schemas (26) and (28), it is to be hoped that future research will bear out these predictions by furnishing appropriate examples of these types to replace the question marks in Table 1. However, this research may also find that certain rule types are simply unattested. Depending on the particular results obtained, various modifications could be made in the above analysis. If, for instance, it turned out that types Ib, d actually do not exist, and if it were also shown that German embedded Ss and Japanese Ss are best analyzed in terms of fixed order S rules (defined below) and V-final VP rules rather than the free order rule Ia, then we could eliminate all of the rules Ia, b, d. This would leave just the schema originally given in (21) which could now be collapsed with schema (26) into the single schema $S \rightarrow \{X\ [+V]^{o}\}\ (Y^{\alpha})*$. Alternatively, it may be discovered that certain rule types not listed in Table I are attested. Thus, if convincing cases of languages with absolute V-final Ss can be found, i.e., languages that would require a free order rule like $S \rightarrow [+V]^{o}\ (Y^{max})*$ for example, schema (26) could be amended by placing '{, }' around the X term. Various other possibilities may arise, but there is no need to pursue all of these here since the issue is presently an open empirical matter. Nevertheless, there is one important point to be derived from the above discussion. Based on the preliminary results reported here, it seems reasonable to believe that only a small number of universal schemas are required to adequately define the set of possible free order S rules and that those schemas define a fairly restricted range of possibilities for such rules.[10, 11]

There is one small problem in the above analysis remaining to be addressed. We may assume that a variable term Y^{max} can introduce S along with the lexically projected maximal categories NP, VP, etc. and hence that the rules in Table 1 with α = max automatically permit the generation of embedded sentences. As things currently stand, however, no allowance has been made for generating embedded Ss in rules Id,e and IIc,d which only introduce word-level categories. One way to solve this problem would be to posit the following universal condition.

(31) Introduction of S in Free Order Rules

If grammar G contains a free order S rule R in which α = 0 in the variable term(s), then G must allow for the generation of S among the categories introduced by the starred variable term of R.

This constraint can be accomodated quite easily if we assume that PS rules of individual grammars can make use of the notation $X \longrightarrow \{A_1,...,A_n\}$, interpreted as a collapsing of the *n*! rules resulting from all possible permutations of the A_i terms on the righthand side. Similarly, we may define $X \longrightarrow \{A, Y^*\}$ as an infinite schema permitting A to appear interspersed among any of the categories defined by the variable Y. The intent of (31) then is to force individual grammars to contain the more complex rules in (32) rather than those given in Table 1, Id,e and IIc,d.[12]

(32) Id. $S \rightarrow \{(S), (X^o)^*\}$ $[+V^o]$

Ie. $S \rightarrow \{(S), (X^o)^*\}$

IIc. $S \longrightarrow X^o$ $[+V]^o$ $\{(S), (Y^o)^*\}$

IId. $S \longrightarrow (X^o)$ $[+V]^o$ $\{(S), (Y^o)^*\}$

The effect of (31) is to insure that embedded Ss are introduced in the starred variable position in rules where α = 0 which corresponds to the same starred variable position where embedded Ss are introduced in rules where α = max. The only difference between these two types of rules then is that a single embedded S can appear S-initially in types IIa,b but not in IIc,d; otherwise, embedded Ss are generated in the same positions in free order S rules regardless of whether α = max or α = 0.[13]

To summarize briefly, the theory of free order S rules proposed here consists of two universal schemas (26) and (28) which define the rules in Table 1, plus the universal conditions and conventions (20), (27), and (31). However, there is more to the story of S-expansion rules than this system of free order rules; in particular there also appears to be a fixed order S rule schema of the sort in (33).

(33) Universal Fixed Order S Rule Schema

$S \rightarrow C_1 \ldots C_i$ NP $C_{i+1} \ldots C_j$ VP $C_{j+1} \ldots C_k$, where each of the C_h's is a category of maximal phrase level fixed by individual grammars.

Since (33) is a universal schema, it comes under the provenance of condition (27), which in this case stipulates that any of the terms except the VP in a fixed order S rule appearing in an individual grammar can be optional. The complete theory of S-expansion rules governing the expansion of higher-level S-type categories (e.g. $\bar{S}$) which have not been considered at all in the present study. The relation between fixed order rules defined by (33) and free order rules defined by (26) and (28) as they appear in particular grammars plays a central role in the explication of the relation between unmarked and alternate orders, to which we now return.

4. The Role of the Unmarked Order/Free Order Distinction

Let us now consider the issue raised in section 2.1 when we were considering the changes that needed to be made in the ADPs of Latin as a result of the inclusion of the free order rule (10) in its grammar. Aside from the fact that most native speakers seem to have intuitions about which orders count as the unmarked or basic ones for declarative Ss in their languages, what other reasons can be offered for retaining information about the relational aspects of unmarked order descriptions in grammars which define free alternative orders? This question appears not to be answerable solely in terms of grammatical factors, but rather in terms of the functions of unmarked orders, a topic whose domain lies beyond the scope of the theory of grammar per se. In the present section a plausible theory of the way in which the language acquisition mechanism learns constituent orders will be outlined in which unmarked orders are acquired first, unrestricted alternate orders are learned next, and unmarked orders are eliminated from grammars for languages with free orders only under certain specific conditions; in all other cases, unmarked orders remain in adult grammars as a residue of the acquisition process.

4.1 Some proposals concerning the acquisition of constituent orders.

To begin, there are several reasons for supposing that the language acquisition mechanism is arranged in such a way that it learns unmarked orders before it attempts to tackle alternate orders. If constituent orders were learned in the opposite order, a child that was learning a language exhibiting just fixed orders presumable would (incorrectly) posit one of the free order rules in Table 1 as its first guess about the PS rules in its language; however, it would then need negative evidence to determine that the myriad of nonexistent alternative orders allowed by the posited free order rules do not appear in the fixed order language the child is trying to learn. Since it appears that such evidence is not available as a direct influence on the child's acquisition decisions,[14] it is reasonable to suppose that the acquisition mechanism is not set up to learn alternate orders first. Furthermore, if it turned out that other acquisition principles require that the child have available to it information about the order in which categories are introduced by PS rules, having just a free order S rule would not help the child to learn the structures acquired by these principles. One such principle has already been proposed in Lapointe (1980c) to aid in the process of learning whether a language contains the syntactic category Aux. A second potential principle of this type involves the markedness relations mentioned in the preceding section. Since type 1 free order rules are essentially the free order counterparts to the family of fixed order rules which define V-final clauses, and type II rules are the counterparts to the family of fixed order rules defining V-medial clauses, it is reasonable to assume that type I free order rules are unmarked for grammars with V-final VPs and type II rules are unmarked for grammars with V-initial VPs. As Lapointe and Feinstein (1980) argue, it is also reasonable to assume that markedness conditions of this sort actually form a part of the language acquisition mechanism itself. It is likely that other acquisition principles dependent on fixed order will be discovered, and the more that such principles are unearthed, the less likely it will be that free order rules are acquired before fixed order rules. Finally, Slobin (1966) reports some empirical evidence which suggests that children do in fact learn unmarked orders before alternate orders.

The next step is to construct a plausible account of the way that constituent orders are acquired in which unmarked orders are learned before alternate orders. Let us assume that the unmarked order of a language is defined in terms of a fixed order S rule conforming to (33), the $\bar{X}$ PS rules of the language, and two of the following universally unmarked ADPs.[15]

(34) Universally Unmarked ADPs

A grammar containing the ADP in (a) and one of the ADPs in (b) contains the minimal unmarked set of ADPs.

(a) If $NP_i/[\ldots \_\_ \ldots VP \ldots]_S$, then $\tau(NP_i)$ binds the 1st argument of $\tau(V)$.

(b) (i) If $NP_i/[V \_\_ \ldots]_{\bar{V}}$, then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

or (ii) If $NP_i/[\ldots \_\_ V]_{\bar{V}}$, then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

An ADP will be said to contain an unmarked syntactic condition (with respect to variable manipulation $\mathcal{M}$) if it contains one of the pairs of syntactic conditions and variable manipulations in (34) and possibly an additional morphological condition. Those ADPs containing other sorts of syntactic conditions will be said to contain a marked syntactic condition (with respect to variable manipulation $\mathcal{M}$). The acquisition of order can now be viewed as a two-stage process. In the first stage, the child posits a minimal fixed order S rule of the form S → NP VP (perhaps with the NP in parentheses), either a V-initial or a V-final $\bar{V}$ rule, and two unmarked ADPs, (34a) and whichever of the ADPs in (34b) is appropriate for the $\bar{V}$ rule which has been posited. In the second stage, the child tries to determine whether any morphological conditions are required in the ADPs that have been posited and the extent to which these correlate with syntactic conditions of the ADPs. As a result of this determination, the child might decide to add a free order S rule to its grammar and to modify its ADPs in various ways, including the possible elimination of some syntactic conditions.

More specifically, we can assume that the second stage operates in the following way. As soon as the child posits a morphological condition M_1 in an ADP A_1 containing syntactic condition S_1, it begins to use the PS rules it has already constructed to help find instances of Ns in different syntactic contexts S_2, S_3, etc. appearing in the same morphological forms specified in M_1. When it has determined the appropriate manipulations which have been performed on the variables in the semantic representations in each case, it adds a new ADP with the same morphological condition M_1 but with different syntactic conditions (S_2, S_3, etc.), and it keeps track of the number of times it comes across cases conforming to each of these ADPs. The system then makes the following decisions based on the given criteria.

(35) For a given ADP A_i,

a. if the count for A_i is considerably less than a fixed threshold frequency f_o (in symbols, $\#(A_i) \ll f_o$), then eliminate A_i;

b. if $\#(A_i) \approx f_o$, do not change A_i but recheck its count after a fixed amount of time;

c. if $\#(A_i) \gg f_o$, retain A_i as it is.

(36) Let $A_1,\ldots,A_n$ be a set of ADPs such that (35c) holds of each A_i, and each contains the same morphological condition M and the same variable manipulation $\mathcal{M}$ but distinct syntactic conditions $S_1,\ldots,S_n$. That is, the set of ADPs has the following form:

A_1 = If M and S_1, then $\mathcal{M}$.

A_2 = If M and S_2, then $\mathcal{M}$.

⋮

A_n = If M and S_n, then $\mathcal{M}$.

(a) If the S_i's specify a sufficiently large percentage of the possible NP positions generated by the PS rules currently under construction, then add a free order S rule.

(b) Let the condition in step (a) be met and let A_j be an ADP containing an unmarked syntactic condition S_j. If for every $i \neq j$, $\#(A_j) > \#(A_i)$, then eliminate every A_i for $i \neq j$ and put parentheses around S_j in A_j (i.e. eliminate all but the ADP containing the unmarked syntactic condition with count greater than that for all the other ADPs and optionalize that syntactic condition).

(c) Let the condition in (a) hold and the condition in (b) fail, and let A_k be an ADP containing a marked syntactic condition S_k. If for every $i \neq k$ $\#(A_k) > \#(A_i)$, eliminate every A_i for $i \neq k$ and put parentheses arounf S_k in A_k.

(d) Let the condition in (a) hold but those in (b,c) fail. If a sufficiently large percentage of the A_i's have maximal and approximately equal counts, then eliminate all but one of the ADPs, A_h, eliminate the syntactic condition S_h from A_h, and eliminate the fixed order S rule from the grammar.

(e) Let the condition in (a) be met but those in (b-d) fail; then there are several A_i's with maximal and approximately equal counts, but not a sufficiently large number for condition (d) to be met. If this is the case, do not change the grammar, and after a fixed amount of time, go back to step (a).

These decision criteria are oversimplified in at least the following ways. First, the frequency count for the ADPs is actually a time varying function $\#(A_i, t)$. Next, the frequency functions should probably be compared not to a single threshold frequency f_o, but rather to a range of frequencies $f_o \pm \varepsilon$.[16] Third, the values for the constants f_o, ε, the "fixed times" in (35b) and (36e), and the "sufficiently large percentages" of (36a,d) need to be determined. Fourth, further procedures must be added which state what happens if $\#(A_i)$ is still $\approx f_o$ after it has been rechecked in (35b) and set criteria beyond the already mentioned markedness principles for determining which of the free order S rules listed in Table 1 are to be added to the grammar under (36a). Fifth, (35) and (36) are based on the assumption that the only unmarked ADPs are those in (34) and that there is no substantial interaction between morphological and syntactic conditions in ADPs; if such dependencies actually exist, they will have to be taken into account in reformulations of these procedures. Finally, it is likely that conditions which check whether V's can appear "out of place" (i.e., in S-initial and medial positions in languages with V-final VP rules and S-finally in languages with V-initial VP rules) must also be incorporated somehow into (36).[17]

Despite these caveats, this partial alogirthm nevertheless presents a reasonable first approximation to the procedure which the child's acquisition mechanism actually uses in learning constituent orders. The two stages are arranged in such a way that the unmarked orders of a language are learned first, with alternate orders being acquired later under the guidance of the decision procedure outlined in (36). That procedure is arranged in such a way that an ADP containing an unmarked syntactic condition wins out over other ADPs with the same morphological condition if it can; otherwise, an ADP with a marked syntactic condition wins out if it is found sufficiently frequently in the child's data corpus. Furthermore, unmarked order information is eliminated from a child's grammar only if (36b,c) fail, i.e., only if no single ADP with an unmarked or marked syntactic condition wins out, and then only if there is a sufficient number of ADPs with maximal count. Moreover, while the addition of a free order S rule in step (36a) is not contingent on the elimination of the grammar's fixed order S rule, the elimination of a fixed order S rule (36d) is dependent on the prior addition of a free order rule; (36) thus insures that the output grammar will have at least one S rule.

The proposal about the acquisition of constituent orders just presented makes a number of claims which will be evaluated in the following subsection. Before turning to these predictions however, it would be worthwhile to compare what happens when the above acquisition procedures are confronted with data from a fixed order language and from a free order language. Consider first the sequences of events that occur during the acquisition of English constituent order. Assuming that the child's data contains a reasonable amount of simple transitive and intransitive Ss, after the first stage the child will have learned the following PS rules and ADPs.

(37) English constituent order -- stage 1

a. PS rules

$S \rightarrow \underline{NP}\ VP$
$\underline{VP} \rightarrow \overline{V}$
$\overline{V} \rightarrow V\ \ (NP)$

b. ADPs

If $NP_i/[\_\_\_ VP]_S$, then $\tau(NP_i)$ binds the 1st argument of $\tau(V)$.
If $NP_i/[V \_\_\_]_{\overline{V}}$, then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

In the second stage, the child learns that Ns in English do not appear in distinctive morphological shapes which have a bearing on the manipulation of semantic variables carried out by ADPs. Procedure (36) therefore cannot be implemented and the result of stage 2 is again (37). The child thus retains the universally determined unmarked fixed order system, carrying it along into later stages of acquisition where further details of the PS rules and ADP syntactic conditions will be filled in.

Consider now what happens when a child attempts to learn Latin. After the first stage, the child's grammar will look just like the one in (37) except in its $\overline{V}$ expansion rule and its DO NP ADP (assuming once again that the child's data corpus contains a sufficient number of simple declarative sentences in unmarked order).

(38) Latin constituent order -- stage 1

a. PS rules

⋮

$\bar{V} \rightarrow$ (NP) V

b. ADPs

⋮

If $NP_i/[\_\_\_V]_{\bar{V}}$, then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

In the second stage, the child presumable learns that Latin Ns come in various morphological shapes, that Ns with NOM endings appearing in both possible NP positions allowed by the child's present grammar bind the 1st arguments of V-translations, and that Ns with ACC endings appearing in both NP positions bind the 2nd arguments of V-translations. The child's set of ADPs now looks like (39).

(39)

a. If $N_i \in$ [NOM] & $NP_i/[\_\_\_VP]_S$, then $\tau(NP_i)$ binds the 1st argument of $\tau(V)$.
b. If $N_i \in$ [NOM] & $NP_i/[\_\_\_V]_{\bar{V}}$, then $\tau(NP_i)$ binds the 1st argument of $\tau(V)$.
c. If $N_i \in$ [ACC] & $NP_i/[\_\_\_VP]_S$, then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.
d. If $N_i \in$ [ACC] & $NP_i/[\_\_\_V]_{\bar{V}}$, then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

The child now starts counting instances of these ADPs. There are five possibilities for the frequencies that it will arrive at: (i) (39a,d) are more frequent than (39b,c), respectively, (ii) (39b,c) are more frequent than (39a,d), respectively, (iii) (39a) is more frequent than (39b), but (39c) is more frequent than (39d), (iv) the opposite case from (iii), or (v) (39a,b) are approximately equal in count and (39c,d) are approximately equal. If (i) is the case, then according to (36a) a free order S rule is added to the grammar, and according to (36b), (39b,c) are deleted from the grammar, and the syntactic conditions of (39a,d) are made optional. Assuming that further acquisition procedures have directed the child to the correct free order rule,[18] it will now be left with the free order system in (40) which is a reasonable first approximation to the order system of the language.

(40) Latin constituent order - stage 2

a. PS rules

as before, plus S $\rightarrow$ $(X^{max})^*$

b. ADPs

same as in (12) above

If on the other hand the relative frequencies turned out as described in (ii)-(v), then according to (36), various other modifications in (39a-d) would be implemented. However, even if one of these other frequency distributions obtains during the child's first pass through (36), as suggested in fn. 17, the ADPs containing unmarked syntactic conditions (39a,d) can be added back to the grammar at a later point, and since Latin is a free order language with unmarked SOV order, over time the frequencies of these ADPs will presumably surpass the frequencies in (39b,c). When this occurs, (36b) will dictate the elimination of (39b,c) and the optionalization of the syntactic conditions in (39a,d). Thus, because of the properties of the language being learned, regardless of the decision the child comes to after its first pass through (36), it will ultimately wind up with the partial grammar in (40) which will form the basis for the construction of the rest of its syntax. Thus, since the conditions of (36b) will always ultimately be met in the case of Latin, unmarked order information will be retained by the child learning that language, rather than being eliminated as it would in the case of a language like Walbiri which seems to exhibit no unmarked order.

4.2 Some predictions made by the acquisition proposals. The above acquisition system makes several qualitative predictions about the typology of fixed vs. free order languages. First, since fixed SOV and SVO orders are assumed to be the universally unmarked types which the language acquisition mechanism uses in establishing the child's stage 1 order hypotheses, and since it requires extra evidence and extra work for the child to posit an order system allowing free orders, it should be the case that these are the most frequently occurring order types among the world's languages. This is apparently the case. In the classic survey conducted by Greenberg (1963), 80% of the 30 languages studied were either SOV or SVO; in a more recent study by Hawkins (1976) 83% of the 217 languages reported on were of these order types.

Next, the acquisition model makes several predictions about languages with both fixed basic orders and free alternate orders. The implementation of (36b) and (36c) should lead to the existence of two types of such languages: (a) those exhibiting fixed orders in which SUBJ and DO NPs appear in syntactic positions determined by the universally unmarked syntactic conditions of (34) and (b) those exhibiting fixed orders in which SUBJ and/or DO NPs appear in syntactic positions determined by marked syntactic conditions. Furthermore, given the fact that ADPs with unmarked syntactic conditions are given precedence in (36) over ADPs with marked syntactic conditions, we would expect that (a) type free order languages should be more widespread than the (b) type languages; i.e., languages like Latin should be more frequent than those like Dyirbal.[19] Unfortunately, at present there is very little data on the distributional relations between fixed and free orders across the world's languages. Hopefully, future research will be able to uncover evidence to support these predictions.

Finally, languages with no basic orders, i.e., languages whose grammars have no fixed order S rules and no ADPs containing universally unmarked syntactic conditions, should be relatively rare according to the above acquisition system, since the only way that a child can posit such a grammar is to try steps (36b,c) and fail. This prediction appears in general to be true, the only fairly convincing case of a language of this type at the moment being Walbiri (Hale 1979).

There is, however, more that has to be said about the treatment of the elimination of fixed order S rules by step (36d) since there is a problem with accounting for the existence of fixed order VSO languages in the above system. The problem here is that no set of PS rules which includes just a fixed order S rule defined by (33) can generate V-initial clauses. An obvious way of handling such cases would be to say that VSO languages like Biblical Hebrew discussed briefly above have a free order S rule like IIb of Table 1 in their grammars along with the two ADPs in (41) containing obligatory syntactic conditions, but with no fixed order S rule.[20]

(41) Fixed VSO ADPs

a. If $NP_i/[V\_\_\_X]_S$, then $\tau(NP_i)$ binds the 1st argument of $\tau(V)$.

b. If $NP_i/[V\ NP\_\_\_X]_S$, then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

The problem with this analysis is that it cannot be learned with algorithm (36) stated as it is. What we would like to be able to do is to have the algorithm eliminate any fixed order S rule just in case the child is learning a language which has the constituent relations given in (41). To do this, the following changes can be made in the above acquisition system.

(42) a. Assume that the ADPs in (41) are also universally defined, but are marked.

b. Change (36a) to allow the child to posit either the free order S rule IIb or IId whenever the set of candidate ADPs include those containing both of the universally defined syntactic conditions in (41).

c. Change (36d) to allow (i) the elimination of a fixed order S rule if the grammar contains free order rule IIb or IId, and the ADPs containing the syntactic conditions in (41) have the highest frequency counts among those ADPs with the same morphological conditions, and (ii) the elimination of IIb and IId whenever both of the ADPs containing the syntactic conditions of (41) are eliminated.

Although step (42c) results in the elimination of fixed order S rules, it does so only on the basis of the establishment of the pair of universally defined ADPs in (41) which themselves guarantee a fixed position for SUBJ and DO NPs. We might therefore expect that VSO languages fall in between the free order types with fixed basic orders (a) and (b) discussed above and the languages without fixed orders; VSO languages ought to be more frequent than languages whose grammars contain no fixed order S rules and no syntactic conditions in their ADPs, but they ought to be less frequent than free order languages which have fixed basic orders and hence less frequent than fixed SOV and SVO languages. As far as can be determined at the moment, this appears to be the case.

The results obtained here involving the markedness relations among the various sorts of possible grammars as well as the relationship of these to the acquisition system posited above are summarized in Table 2.

Fixed and free order language types defined by the given grammatical properties	Acquisition stages and procedures
Fixed SOV and SVO languages (fixed order S rule, universally unmarked ADPs)	Stage 1
Type (a) free order languages (fixed order S rule, free order S rule, universally unmarked ADPs)	Stage 2: (36a,b)
Type (b) free order languages (fixed order S rule, free order S rule, marked ADPs)	(36a,c)
Fixed VSO languages (no fixed order S rule, free order S rule, universally defined but marked ADPs)	(42b,c)
Languages without unmarked orders (no fixed order S rule, free order S rule, no syntactic conditions in ADPs)	(36a,d)

Table 2. Markedness relations among various types of languages in terms of the proposed acquisition system

5. Conclusion

To review briefly, the foregoing analysis of free and fixed constituent orders consists of the following assumptions.

(43) a. The theory of PS rules given by (26), (28), (33), and by the conventions (20), (27), (31), which supplements the theory of regular $\bar{X}$ PS rules expanding lexically-headed phrases, defines a limited range of fixed and free constituent orders.

b. A system of argument-type determining procedures (ADPs) is used to permit the semantic representations of NPs to bind the appropriate arguments in the semantic representations of Vs.

c. The traditional notion "unmarked order of a language" is not determined by UG but rather by the language acquisition mechanism; in a given grammar it is defined by a fixed order S rule and several universally unmarked ADPs and is manifested as either rigid SOV or SVO order.

d. The traditional notion "free alternate orders of a language" is likewise determined by the operations of the acquisition mechanisms; in a given language free orders are defined by free order S rules and the optionality or nonexistence of syntactic conditions in the grammar's ADPs.

Let us close with some remarks concerning the role of PS rules within the above analysis. In particular, the following questions can be raised: Having presented an analysis for fixed VSO languages which involves only free order S rules, might it not be possible to analyze all languages, both fixed and free, in terms of grammars containing no fixed order PS rules, with all language-specific order constraints being determined by ADPs? A proposal along these lines but restricted just to free order languages has been suggested by Hale (1979);[22] likewise, this possibility is very much in the spirit of the system of context sensitive parsing rules (CSPRs) proposed by Gazdar (1979a,b). However, the problems with Hale's specific proposals, discussed in some detail in the Appendix, suggest that this is not the best approach to take in the analysis of free order languages. Furthermore, there are at least two important ways in which ADPs are more restrictive than CSPRs: ADPs can only refer to certain limited kinds of structural syntactic information while CSPRs are not limited in this way, and ADPs are defined in TGA to operate only on NP and AP translations since these are the only phrases whose translations require argument-type specification, whereas CSPRs can analyze any syntactic category of any phrase-level. This latter property of the ADP theory means that conditions on the structural distributions of VPs and PPs as well as on phrases with less than maximal levels must be defined by some device other than ADPs, and hence the theory of ADPs as defined in TGA cannot by itself be used in general to determine fixed orders in those languages exhibiting them.

The answer to the above question thus appears to be that PS rules defining fixed orders cannot be eliminated within the present analysis.

This is not to say of course that the above question can never be answered positively, since it may well turn out that the ADP theory is seriously defective, and other more adequate proposals which supplant the ADP theory may allow for the eventual elimination of fixed order PS rules. However, at the moment the proposals made above appear to represent just the sort of compromise between theoretical restrictiveness and the need to define a sufficiently wide range of free orders that is required here, and therefore for the present PS rules must remain an integral part of the analysis of fixed and free orders.

Appendix

The treatment of free order proposed by Hale (1979) is similar in many respects to the approach adopted here, although as noted in the text the two analyses differ in several important ways. The purpose of this appendix is to compare these two analyses and to point out several problems with Hale's approach which do not arise with the one presented above.

Hale proposes that there are two types of languages: "$\bar{X}$" languages, whose grammars contain PS rules conforming to the standard $\bar{X}$ conventions, and "W*" languages, whose grammars contain essentially the single PS rule in (A.1), plus some provisions for generating embedded sentences.

(A.1) $E \rightarrow W^*$

Here E is the category of expressions and W is the category of words. This rule is in effect Ie of Table 1 with E = S and W = X^o. Hale goes on to suggest that there are distinctive sets of properties associated with each type of language; these are outlined in (A.2) and (A.3).

(A.2) Properties of $\bar{X}$ languages

a. They have more complex PS rule systems.
b. They have simpler semantic translation rules since they can rely directly on the constituent structure defined by the PS rules in deriving semantic constituents.
c. They may have transformations since these are defined on the sorts of constituents produced by $\bar{X}$ phrase structure systems.
d. Precede and c-command restrictions on anaphora apply in them.

(A.3) Properties of W* languages

a. They have trivial PS systems
b. They have more complex semantic translation rules since they cannot rely on constituent structure; semantic constituents are put together by operations which refer solely to information about the morphological form of the Ws (Hale presents the beginnings of a theory for accomplishing this).
c. They do not have transformations, since they do not have the constituents over which transformations are defined.

d. C-command restrictions on anaphora do not apply since these are also defined over constituents.

As one might expect, Hale characterizes Walbiri as a W* language and English as an $\bar{X}$ language.

The fundamental difference between the W* approach of Hale and the approach proposed above, which we might for convenience refer to as the "X^{α}" approach, is that the W* theory accords no status to the traditional notion "unmarked order" nor to the distinction traditionally made between unmarked and alternate orders within free order languages, where the X^{α} theory has been constructed around this distinction. This fact in and of itself is not a defect of the W* approach, since the traditional distinction may be completely ill-founded. However, there appear to be at least three problems which arise in the W* theory as a result of the failure to make these distinctions. First, the W* theory has no explanation for the apparent fact that the majority of languages have identifiable unmarked orders. The objection may be raised at this point that there are many languages which linguists have never studied and a substantial proportion of these may have W* properties. This may well be true; however, at the present, the syntactic properties of a large number of non-Indoeuropean languages have been studied, and most of these appear to exhibit fixed orders either as the only order possibility or as the unmarked order. Second, in the W* theory there is no way to explain free constituent orders as opposed to free word orders in languages like Latin (and presumably also Papago, German, Russian, etc.). The only problem here is that the W* approach does not make provisions for the generation of phrases of any sorts, which nevertheless appears to be required by the facts of these languages, and, at least in the case of Latin, an unbridled Extraposition approach like the one given by Hale, Jeanne, and Platero (1977) for Papago simply will not work. Third, it is not at all clear how the categorization of a given language as belonging to the W* or the $\bar{X}$ type in the W* theory is actually supposed to follow from the properties summarized in (A.2) and (A.3). The problem here is that Hale uses one of the properties as the defining criterion for certain languages and another property as the defining criterion for other languages without explaining on what grounds the decision should be made. Thus, both Walbiri and Navaho are considered to be W* languages, the criterion used in the first case being extreme freedom of word orders (A.3a); the criterion in the second case however is the fact that c-command relations are violated in the interpretation of relative clauses in Navaho (A.3d), and the fact that this language exhibits very rigid constituent order constraints is for some reason ignored.

In the X^{α} theory proposed above, which does make the traditional distinction between unmarked and alternate orders, none of these problems arise. The fact that the majority of languages appear to have unmarked orders is predicted by the acquisition system as we have already seen. The two universal free order S rule schemas (26) and (28) allow a number of different kinds of free order rules, including those which introduce phrasal categories (i.e., those containing $(X^{max})*$ sorts of terms), and hence the existence of languages like Latin, Papago, and the like is to be expected on the X^{α} story developed above. Finally, there is no question about the characterization of languages into the various types in the present theory since this is based entirely on the order properties which the languages show. This fact of course requires the presentation of an alternative fixed order grammar approach to the interpretation of relative clauses in Navaho from the one that Hale argues against, but as he himself notes, that analysis is based on a number of assumptions, a change in any number of which would lead to a different conclusion from the one Hale reaches.

It may be too early to judge these two theories of order typology, especially since it is likely that at least as many, if not more, problems will be found with the present analysis as there are with the W* account. Nevertheless, there remains a common claim which both of these theories share and which both presume will turn out to be correct even if the particular details of the analyses are discovered to be hopelessly inadequate. If one is interested in trying to formulate a phrase structural analysis of free order, one only needs to posit a small number of universally-defined phrase structure schemas which will adequately characterize the total range of possible free order rules which can appear in natural language grammars, and these schemas will define a fairly restricted set of rule and language types.

Footnotes

[*]The following report is a considerably revised and expanded version of portions of Chapter III of Lapointe (1980a). I wish to thank two anonymous UMOP reviewers for their comments on an earlier version of this paper, parts of which were presented at the Graduate Linguistics Seminar, University of California, Irvine, and at the Department of Linguistics Colloquium Series, Stanford University in the spring of 1980. The research reported below was supported in part by Sloan Foundation Grant no. 78-2-10 and NIH grant no. NS 16155 to Johns Hopkins University.

[1]As seems to be the case within the organization of grammatical subsystems proposed by Chomsky and Lasnik (1977).

[2]There is in fact some evidence that the maximal level of major categories is 3; see Akmajian, Steele, and Wasow (1979), Jackendoff (1977), Lapointe (1980c). The question of whether there is a series of higher-level S-type categories as suggested by Chomsky (1977) will not be addressed here.

More traditional category labels will often be used in place of the "official" superscripted labels X^i; specifically, $XP = X^2$, $\bar{X} = X^1$, and $X = X^o$.

[3]The interested reader should consult TGA for further details about the sorts of logical forms that seem to be needed in accounting for agreement phenomena.

[4]Of course, in the case of intransitive verbs there will not be a second argument, and we will want instances in which DO NPs appear with intransitive Vs to be ruled out. This is accomplished in TGA by disallowing as ill-formed all logical expressions with vacuous quantifiers.

[5]See for instance Gildersleeve and Lodge (1895) pp. 429-430.

[6]That is, reasons which go beyond the fact that native speakers apparently retain intuitions about which constituent orders are the unmarked ones in their languages.

[7]There is a further order restriction operating in Walbiri to the effect that a DO complement of an infinitive must immediately precede the infinitive. Such a restriction can be handled straightforwardly by positing an ADP of the form in (i).

(i) If $N_i \in$ [ABS] & $NP_i/[\_\_\_ \overset{V}{[-fin]}]$, then $\tau(NP_i)$ binds the 2nd argument of $\tau(V)$.

An interesting fact about this language is that it appears not to have an unmarked order, as was argued by Hale (1979). The proposals made by Hale bear a close resemblance to those made here in a number of respects, although there are several distinctive differences between the two analyses. A comparison and evaluation of the two approaches is given in the Appendix.

[8]There are two points which need to be made about (24). First, these rules assume that there is a distinction made in UG between matrix and embedded Ss. Second, the fact that the V in these rules must be tensed (i.e., [+fin]) presumably follows from a more general formulation of the universal condition on the position of tensed auxiliaries presented in Lapointe (1980b).

[9]Hale, Jeanne, and Platero (1977) present an analysis of alternate orders in Papago which relies on the application of several extraposition transformations, although as the authors themselves point out (cf. their fn. 8), it is not at all clear how revealing a transformational account of this language really is. For present purposes, therefore, we may simply accept the suggestion made at the end of that footnote and assume that Papago is a free order language.

[10]Tom Wasow (personal communication) has pointed out to me that Luiseño may be a counterexample to the sorts of generalizations about the positions of $[+V]^o$ items captured by schema (26). Akmajian, Stelle, and Wasow (1979) point out that the auxiliary element in Luiseño can either appear immediately after the first phrase or immediately after the first word. It seems that free orders are defined in Luiseño by a rule like IIa in Table 1; however, when the Aux appears after the first word in a S, it appears after the first word within the first consti-

tuent of the S, regardless of what category that constituent may belong to. If this description of the language is correct, then Luiseño is not only a counterexample to the above proposals but also a counterexample to most of the assumptions usually made about constituency in generative grammar. The resolution of this issue must await considerable future research.

[11]It is likely that there are severe markedness relations of various sorts holding among the rules listed in Table 1. Some discussion of this point will be given in the following section.

[12]Presumably there are universal restrictions governing the use of such braces in PS rules. Their potential usefulness however lies in capturing free order generalizations for constituents in regular fixed order PS rules. Thus such braces can be used in stating the Latin $\bar{N}$ rule as $\bar{N} \rightarrow$ {AP, N} ..., since adjectives can appear both before and after an N in Latin, as discussed in TGA Chapter III, fn. 29.

[13]Several remarks need to be made about embedded Ss. First, while (31) prevents embedded Ss from appearing on the wrong side of $[+V]^o$ terms in free order S rules, there is nothing in this condition which prevents Ss from appearing to the right of a V in a set of fixed order rules in which V is $\bar{V}$-final (i.e., VP $\rightarrow$ $\bar{V}$ (S), $\bar{V} \rightarrow$ ...V). Second, (31) cannot be all there is to the story about the order of embedded Ss by any means. To see this, consider a language whose grammar contains the free order rule Ie of Table 1. Under (31) there is nothing stopping a structure of the following sort from being generated, where identity of subscript indicates constituents of the same clause.

(i) $[a_1\ b_1\ c_1[V_2\ a_2\ b_2\ c_2]_{S_2}\ V_1]_{S_1}$

Presumably, such a structure could be misinterpreted as in (ii).

(ii) $[a_1\ b_1\ c_1\ V_2]_{S_1}\ \ [a_2\ b_2\ c_2\ V_1]_{S_2}$

To the extent that such confusions can be shown to exist, it seems reasonable to suppose that parsing strategies are responsible for producing the misanalyses in such cases as these. One possible parsing strategy along these lines is the embedding constraint discussed by Dixon (1972) which stipulates that all of the constituents of a matrix clause have to appear before the V of the embedded clause. Interpreting this constraint as a parsing strategy, we would expect speakers of Dyirbal under the appropriate conditions to misinterpret (i) as (ii).

Finally, as stated, (31) allows only a single embedded S to be generated as a daughter to another S. The schema can be extended in obvious ways to allow for the possibility of more than one embedded S being generated per clause.

[14]See the discussion in Wexler and Culicover (1980) and Baker (1980).

15 V-initial clauses have not been mentioned here since these are assumed to be handled by free order S rules; see section 4.2 below.

There are probably other markedness relations holding among the free order S rules; thus it may turn out that rule Ia is less marked than Ib, which is less marked than Ic, that Id is less marked than Ie, and that IIa,b are less marked than IIc,d. Under such assumptions, the Latin and Dyirbal rules (Ic,e) are the most marked in type I. This would make sense if markedness among free order rules is based on the "distance" of those rules from orders defined by the fixed order rules.

16 These clarifications allow us to make the "$\ll$" and "$\approx$" relations in (35) more precise in the following ways; (35a) is replaced by (i), (35c) becomes (ii), and (35b) becomes the "elsewhere" condition (iii).

(i) if for every $\underline{t} > \underline{t}_1$, $\#(A_i, t) < f_o - \varepsilon$, then eliminate A_i;

(ii) if for every $\underline{t} > \underline{t}_1$, $\#(A_i, t) > f_o + \varepsilon$, then retain A_i as it is;

(iii) otherwise, recheck $\#(A_i, t)$ after a fixed amount of time.

Here, $\underline{t_1}$ is some fixed time after the ADP is added to the grammar after which the frequency remains above or below the threshold range $f_o \pm \varepsilon$.

Notice also that the count relations among the various ADPs in steps (b-d) of (36) also need to be relativized with respect to ε. Thus in (36b) $|\#(A_j) - \#(A_i)| > \varepsilon$, in (36c) $|\#(A_k) - \#(A_i)| > \varepsilon$, and in (36d) "approximately equal counts" means that for every A_p, A_q in the subset of ADPs, $|\#(A_p) - \#(A_q)| < \varepsilon$.

17 The adoption of this two-stage procedure does not necessarily imply that the child cannot go back and rearrange its PS rules or the conditions in its ADPs after it has gone through (36). On the contrary, depending on the frequency distribution of the constituent orders appearing in the data available to the child over time, the child might misanalyze that data in any number of ways and have to return to an earlier point in the algorithm to rectify its mistakes. For example, initially the child may have mistakenly posited a V-final $\bar{V}$ PS rule in the first stage only to discover the error while it was going through the second stage, at which point it would have to go back to the first stage procedures, change the $\bar{V}$ rule to be V-initial, and change the syntactic conditions in the ADPs for DO NPs. Alternatively, the child may discover data which causes it to reanalyze the morphological forms of some Ns in such a way that what was originally thought to be an ADP containing an unmarked syntactic condition with high frequency count no longer exists, forcing the child to go back through stage 2 to reanalyze the remaining ADPs, many of whose morphological conditions may also have been changed in the process. These sorts of cases suggest that there may be a more complex interaction between what has been called here the first and second stages than the simple serial ordering proposed in the text and that frequency counts taken after the child has already gone through (36) may have an effect on its earlier decisions. In particular, it appears likely that at least universally unmarked ADPs can be added back to the grammar if they show sufficiently high

frequency counts (i.e., > $f_o + \varepsilon$), which would force all of the other frequency-dependent decisions of (36) to be reinterpreted.

[18]One plausible procedure would act as follows. First, since the $\bar{V}$ rule in (38) is V-final, the child will try type I free order rules first, and among these rules it will test them in the order Ia, Ib, Ic, or Id, Ie. Finally, it must test to see if X^{max} constituents cohere in the various positions where X^o categories appear.

[19]It would be improper to conclude from this remark that the acquisition system proposed here predicts that accusative languages are in general more frequent than ergative languages. This may in fact be the case, but the above system does not predict it. Dyirbal appears to exhibit an unusual distribution of ABS vs. ERG marked NPs in unmarked orders. There is much more going on in ergative languages than there is space to discuss here. For some discussion of these issues, see Dixon (1979).

[20]This possibility for defining certain kinds of order restrictions was originally suggested by Hale (1979), although he did not propose it specifically in the context of defining V-initial orders.

[21]Presumably the VOS type of language is like the VSO type except that it has ADPs which are not defined universally. There are various ways in which one might try to amend the present analysis in order to account for the existence of the apperently very rare types OVS and OSV, but these will not be discussed here.

[22]There is a further peculiarity of Walbiri which I have not discussed here. Hale (1979) notes that when the "constituents" of a NP are scattered throughout a sentence, each one will appear with a distinctive morphological case/class marker, but when these words are all adjacent so they form what might otherwise look like a coherent NP constituent, only the last word in the sequence bears the case/class marker. Although such facts raise some serious questions about the present approach, it is not obvious that the problems are a matter of the way in which the PS system is set up; rather they seem to be problems for the account of agreement proposed in TGA. I am currently working on this and several related problems within a TGA type of framework.

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