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ON 'ADJACENCY' IN PHONOLOGY AND SYNTAX

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0. A preamble*

It is possible to distinguish two versions of the autonomy hypothesis:

- (1) The external autonomy hypothesis: the grammar as a whole represents an autonomous cognitive component which in interaction with other cognitive components determines linguistic behavior.
- (2) The internal autonomy hypothesis: within the grammar several components can be distinguished which are largely autonomous with respect to each other.

The internal autonomy hypothesis, while very plausible, is likely to give rise to a certain amount of confusion. What it means is that rules in one component cannot have access to information from another component except at the interface. For example, in the (T-)model of Chomsky & Lasnik (1977) the operation of a rule of 'logical form' (LF) to a structure cannot be determined by some property of the phonetic representation (PR) of that structure and vice-versa (cf. Van Riemsdijk & Williams (to appear) for discussion). However, the internal autonomy hypothesis does not imply that the components or modules of the grammar must be formally of a quite different nature. Whether they are formally similar or dissimilar is an empirical question, but attempts at answering this

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question have been scarce. While there have been some suggestions in the recent literature to the effect that the transformational and LF-modules share some fundamental formal characteristics, there has hardly been any serious discussion of the formal (dis-)similarity of the syntactic and phonological modules (but see Aoun (1980)). And even where a connection immediately suggests itself, the comparison goes undiscussed (cf. Wilkins (1980)). The present article represents a modest attempt to show that the assumption that phonology and syntax share a number of fundamental formal properties is a heuristically fruitful one which may provide new insight into the nature of both modules. In particular, I will argue that the notions of adjacency and projection, as used in generative phonology, provide a revealing account of certain locality phenomena (cf. Koster (1978)) in the syntax of an extremely word-order-free language, Warlpiri.

1. A program

It is a well-known fact that there are 'unbounded' phenomena, both in phonology and in syntax:

- (3) Phonology: vowel harmony, alternating stress, etc.
- (4) Syntax: 'move wh', PRO-control, etc.

The two types of unboundedness are comparable if we make the following assumption.

- (5) The characteristic domain of phonology is the word; the characteristic domain of syntax is the sentence.

(5) may turn out to be incorrect in view of the fact that there exist such notions as 'sentence phonology' and 'word syntax'. Nevertheless, (5) will be assumed to be correct without discussion here. One might reject the legitimacy of the comparison on other grounds, however, viz. that sentences are potentially infinite in length, while words are not because the lexicon must be finite given finite memory. The objection seems to me to be without force, however. In syntax it is only possible to talk about infinitely long sentences under the tacit idealization that memory is potentially infinite. While we know that memory is finite, this finiteness has nothing to do with the essence of recursion in syntax. Similarly, the lexicon is only finite in so far as the set of idiosyncratic words is concerned which must be individually stored. Productive parts of the lexicon, such as certain types of compounding for example, can give rise to words of potentially infinite length. General rule schemata for affixation and compounding have the same fundamental property of recursion as phrase structure rules. Therefore, morphology is just as potentially infinite as syntax. Hence the comparison of unbounded phenomena in phonology and syntax appears to be legitimate.

Consider a representative example of an unbounded process in phonology, like Turkish vowel harmony (from Jensen (1974)).

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- (6) a. (*) kol + ler + in + iz + den ('from your arms')
 b. kollar+n+zdan
 c. * kollarin+zdan
 d. * koller+n+zden

All suffixes must take on the value of the feature [α back] of the stem. The stem kol is [+back], hence (6a) must become (6b) by the vowel harmony rule. (6c) and (6d) are ungrammatical because not all suffix vowels have changed to [+back]. The process is unbounded because the harmonizing feature spreads over the whole word, regardless of the number of suffixes. Furthermore, the process observes some form of locality, because none of the intervening vowels may fail to undergo the rule.

Generative phonology has known a variety of proposals to characterize unbounded phenomena of this type. Chomsky & Halle (1968) use infinite schemata of the form (7).

- (7) $A \rightarrow B / Z (X)^* W \underline{\quad}$

The context is expanded to ZW, ZXW, ZXXW, ZXXXW, ..., and the rule is applied simultaneously in all successful factorizations

The rule of Turkish vowel harmony would roughly be formulated as in (8) according to this theory.

- (8) $V \rightarrow [\alpha\text{back}] / \# C_0 \left[\begin{array}{c} V \\ \alpha\text{back} \end{array} \right] (C_0 V)^* C_0 \underline{\quad}$

The major criticism of this approach, which we will not review in detail here, has been based on the excessive power of the type of variables that are used (the zero subscript variable and the *-variable). It would be easy, given this formalism, to formulate a rule such that only every second vowel undergoes vowel harmony, for example, a situation never found in natural language. Consequently, the incipient interest in locality principles in syntax in the early seventies led to questions about the nature of the locality of such unbounded processes in phonology. Jensen (1974), for example, offers the relevancy condition.

- (9) In a phonological rule of the form $A \rightarrow B / C X \underline{\quad}$ (focus \rightarrow change / determinant variable focus), only irrelevant segments may intervene between the focus and the determinant. The class of segments which is defined by the features which are shared by the focus and the determinant is the class of segments which are relevant for the rule in question. When focus and determinant do not share any features, all segments are relevant.

This condition accounts for the fact that no vowels may be omitted in a vowel harmony process like (6). However, the proposal is still based on the use of the same type of variables in phonological rules.

In a radical departure from this way of thinking about unbounded phenomena and locality effects in phonology, Vergnaud (1977, 1978) has proposed a new theory which is rooted in the following fundamental insight.

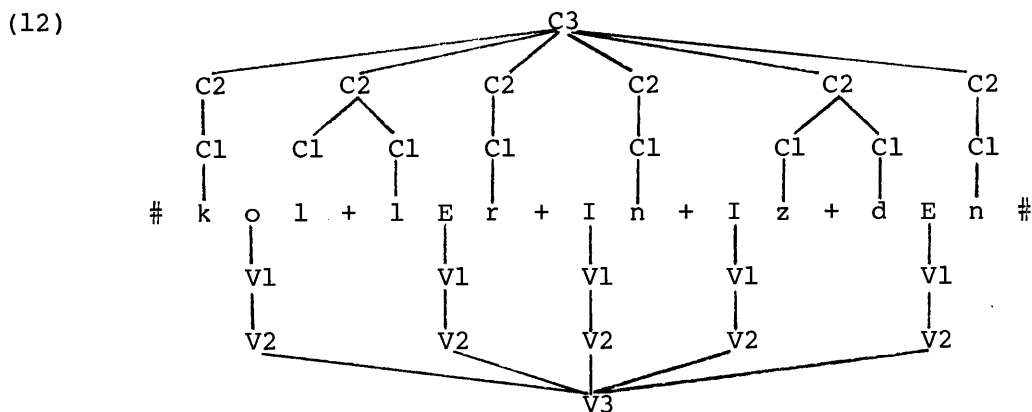
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- (10) Processes like vowel harmony are simultaneously unbounded and local, not because a locality principle like (9) governs the application of a rule to a linear sequence of segments, but because the set of segments relevant to that rule within a given word constitutes a single abstract formal object in the phonological representation of that word.

Thereby we leave the principle of one-dimensional representation of phonological structures. In the representation of (6a) there is a node which dominates all vowels of that word but no other segments; the node is the consequence of the projection of the relevant features, say [+voc,-cons]. The projection proceeds in three steps.

- (11) a. Each segment is assigned to nodes of the type N1 (=N̄) whose category (label) consists of a characteristic feature or subset of features of that segment.
 b. Maximal sequences of N1-nodes of the same category which are adjacent in the string of segments are assigned to a single node N2 (=N̄) of that category.
 c. All N2-nodes of the same category in a given domain (sc. the word) are assigned to a single node N3 (=N̄) of that category.

Accordingly, (6a) would be represented in the following way, where C = [-voc,+cons], V = [+voc, -cons], and E,I = vowels for which the value for [αback] is not specified.



Of course, (12) shows only two of the relevant dimensions of the phonological representation of the word. The main conceptual advantage of Vergnaud's proposal is that locality has now become, in some sense, an intrinsic property of phonological representation and need not be postulated as a separate principle. Processes like vowel harmony can now be formalized in a very simple variable-free way:

- (13) Project the stem value of the feature [αback] onto V3.

Typically bounded processes such as most assimilation phenomena, which we can regard as analogous to local transformations in syntax

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(cf. Emonds (1976)), are defined as affecting N2-nodes.

Let us now turn to syntax. In syntax the treatment of locality phenomena is comparable to a theory as illustrated in (7) through (9), Rules such as 'move wh' operate on one-dimensional representations, and its locality, in this case its successive-cyclic application, is forced by a separate principle, i.e. the subjacency condition or one of the alternative locality principles. The parallelism is clearest with Wilkins' theory (Wilkins (1980)), whose central principle, the variable interpretation convention, is roughly defined as in (14).

- (14) When a rule of the form $X - A - Y - B - Z$ is applied to a syntactic structure, the 'gross constituent analysis' of the portion of the syntactic structure which corresponds to the variable factor Y may not contain A or B. (The 'gross constituent analysis' gives a formal definition of which segments of the type A or B which intervene are relevant and which ones are not, in the sense of (9), to the rule.)

In addition, Wilkins proposes that, given (14), the variable Y can be eliminated from the rule, yielding $X - A - B - Y$. Thus the two constant factors are now adjacent in the rule, though not in the syntactic representation.

Wilkins' approach shows how close the conceptualization of the locality ideas in phonology and syntax are. Yet Vergnaud has introduced a radical innovation in phonology which has not been attempted in syntax thus far. Schematically:

(15)	Phonology	Syntax
	<hr/> one-dimensional representations + locality principles ↓	<hr/> one-dimensional representations + locality principles ↓↓
	multi-dimensional representations with inherent locality	? ? ? ? ?

2. A proposal

A tacit assumption accompanying the development of the X-bar theory of phrase structure has been that languages are all describable in terms of this theory. Ken Hale and others have argued, however, that there are languages whose syntactic structure is not readily amenable to an enlightening representation in terms of X-bar theory. Hale proposes to describe such languages, which are characterized by extremely free word order, by means of a single rule, (16), where E = Expression, W = Word.

- (16) $E \rightarrow W^*$

It is the syntactic and semantic rules which build up the relationships among words from this non-configurational base. In some sense,

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what Hale proposes, then, is the mirror image of a grammar which starts out with X-bar structures that are subsequently messed up by a very powerful scrambling rule. Hale (1979) and Nash (1980) have argued convincingly that the adoption of (16) does more justice to such languages than an X-bar base. The language which fulfills a model role in these arguments is Warlpiri, a central Australian language.

Word order in Warlpiri is very free. The auxiliary is always in second position in the sentence, but other words are not subject to any obvious ordering limitations. The most salient feature to the configurationalist's eye or ear, then, is that parts of phrases such as subject noun phrases and the like can be freely scattered throughout the sentence. For example:

- (17) Wita-ngku ka yalumpu-rlu maliki wajilipi-nyi kurdu- ngku
 small-ERG AUX:PRES that-ERG dog-(ABS) chase-NONPAST child-ERG
 'that small child is chasing the dog'

When parts of a phrase stand next to each other, they can form a syntactic unit, as can be ascertained on the basis of inflection and the position of the auxiliary element. In units of this type the inflection may be absent from all but the last word of the unit. When such a unit occupies the first position of a sentence, the auxiliary element follows it.

- (18) a. [Kurdu wita-jarra-rlu] ka-pala maliki wajilipi-nyi
 child small-DUAL-ERG AUX:DUAL dog-ABS chase-NONPAST
 'the two small children are chasing the dog'
 b. [Wita kurdu-jarra-rlu] ka-pala maliki wajilipi-nyi

The main questions that must be asked about such sentences, of course, are the following.

- (19) a. How are syntactic units like those in (18) built up from the non-configurational string of words?
 b. How are phrasal argument units built up from discontinuous sets of words in the string such that subcategorization rules and the like can function properly?

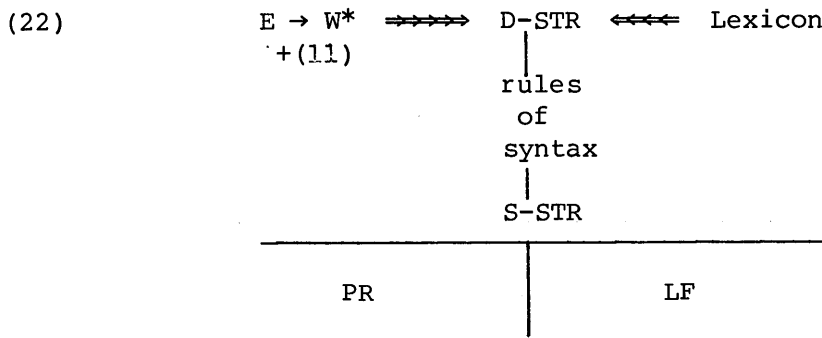
In the Hale/Nash theory these two questions receive separate answers. Syntactic units are built up by means of syntactic rules called 'labelling rules' which assign adjacent words that agree in the relevant morphological features (number, case, etc.) to higher nodes. The discontinuous semantic phrases are built up by semantic 'merger rules'. What we have referred to loosely as the relevant features, Hale calls the categorial signature (CS) of a word. In the following rough formulation of labelling and merger, the subscripts stand for CSs.

- (20) LABELLING (in syntax) (from Hale (1979), Nash (1980))
 In a structure $X W_i, W_j, \dots, W_k Y$ it is possible to assign W_i, W_j, \dots, W_k to a new syntactic node N_m , if $i=j=k=m$ and if W_i, W_j, \dots, W_k are all adjacent in the string.

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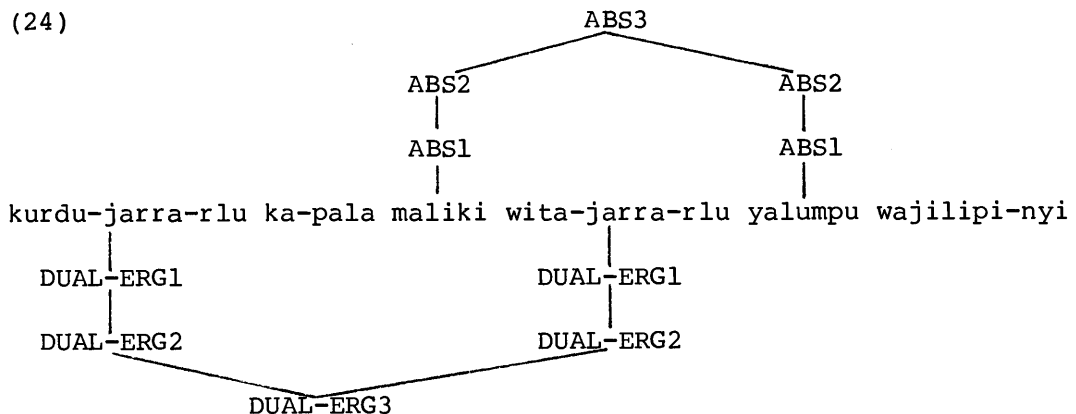
- (21) MERGER (in LF) (from Hale (1979), Nash (1980))
 In a structure $X W_i Y W_j Z \dots U W_k V$ it is possible to assign W_i, W_j, \dots, W_k to a new semantic unit S_n , if $i=j=k=n$.

What is noticeable about these rules is that despite their formal similarity they operate in completely different components of the grammar. Furthermore it is striking that these two rules are highly similar to the phonological projection conventions (11b) and (11c) respectively. In both cases the identity of the characteristic features is required, and the adjacency condition in (20) is parallel to that of (11b). I therefore propose to tentatively fill the empty slot in (15) with the syntactic analogue of the phonological projection convention. In other words, I propose that the syntactic representation of Warlpiri sentences consists of (multi-dimensional) sets of projections of CSs of their words. Hence a fairly minimal modification of the T-model will suffice:



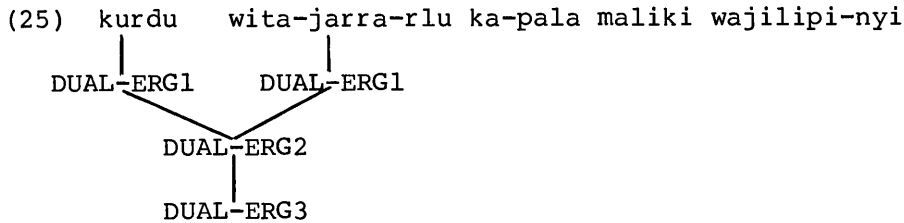
In this model, a sentence like (23) would thus be (partially) represented as (24).

- (23) Kurdu-jarra-rlu ka-pala maliki wita-jarra-rlu yalumpu
 child-DUAL-ERG AUX:DUAL dog-ABS small-DUAL-ERG that-ABS
 wajilipi-nyi 'two small children are chasing that dog'
 chase-NONPAST



And a sentence like (18a) will be represented as in (25).

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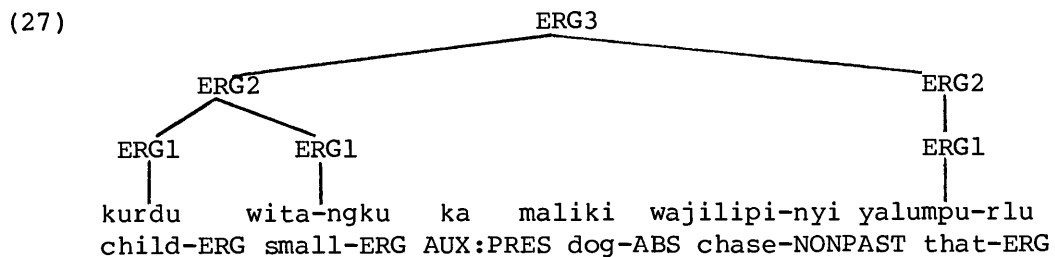


The rules for the morphological reduction in syntactic units and for the positioning of the auxiliary can now be formulated in a simple and straightforward way.

(26) a. In a phrase CS2, the morphological expression of CS is optional on all CS1's except for the last one, where it is obligatorily realized.

b. AUX is placed directly after the first CS2 of the sentence.

An interesting, and correct, consequence of this interpretation is that the CS2 adjacency projection defines subphrases that do not have any obvious correspondence to semantic phrases, as in (27).



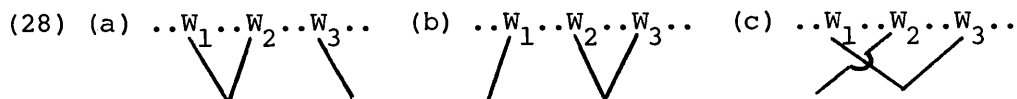
Needless to say, we have only sketched the barest fundamentals of Warlpiri syntax here, simplifying even the main rules, but it appears that the more detailed analyses in the works of Hale and Nash can be translated without difficulty into the formalism proposed here. The main motivation for the proposed alternative is, as was pointed out above, a conceptual one: the theory of universal grammar is greatly simplified if the labelling and merger rules are eliminated and if the independently motivated phonological projection convention is used for syntax as well as phonology. Interestingly, however, the conceptual change offers empirical perspectives as well.

3. A prediction

The Hale/Nash theory and the projection theory are nearly, but not completely, notational variants of each other, they are empirically distinguishable. On the basis of this difference, a potential argument for the projection theory can be constructed. A caveat is in order here, however: the facts as presented here have been confirmed by the world's leading Warlpiriologists (see the *-footnote), but more field work would be required to check out the prediction more solidly.

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The projection convention (11) must be taken to be optional, at least for syntax, because a sentence can contain more than one phrase with the same categorial signature. Note that we are assuming that the projection convention serves to build up phrases, corresponding mostly to NP, but no higher order units which would correspond to VP or S, for example. We will say that the projection convention operates at the subphrasal level, while the supraphrasal assembly rules are of a somewhat different nature (see section 5 below for some speculations). When more than one phrase with the same categorial signature must be built up in order to derive an interpretable proposition, the following situation can arise.



The merger rule does not distinguish in such cases: all three construals are possible. Under the projection theory, however, (28c) is excluded for principled reasons: since the projections take place in the same dimension, the branches of the trees in that dimension may not cross. If construals as in (28c) are indeed impossible, this fact would require the introduction of some locality principle à la Wilkins into Warlpiri syntax under the Hale/Nash theory. Under the projection theory, however, this fact is an automatic consequence of the syntactic representation of sentences.

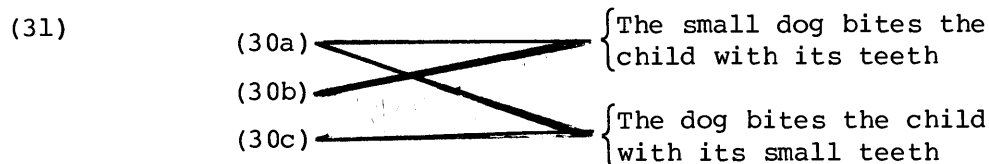
There are indications, in fact, that locality is observed in such situations. The relevant construction is one in which body parts agree in case with the possessor of the body part. An example of this construction is given in (29).

- (29) Maliki-rli ka kurdu yarlki-rni kartirdi-rli rdaka
 dog-ERG AUX:PRES child-ABS bite-NONPAST teeth-ERG hand-ABS
 'the dog bites the child in the hand with its teeth'

Recall that the agreement rule applies at the supraphrasal level. Consider now a case like (30).

- (30) a. Maliki-rli ka wita-ngku kurdu yarlki-rni kartirdi-rli
 dog-ERG AUX:PRES small-ERG child-ABS bite-NONPAST teeth-ERG
 b. Wita-ngku ka maliki-rli kurdu yarlki-rni kartirdi-rli
 c. Maliki-rli ka kurdu kartirdi-rli yarlki-rni wita-ngku

The interpretations are as given in (31).



(30a) is ambiguous, as expected, but (30b) and (30c) are unambiguous as predicted by the projection theory: the adjective can only be construed with the nearest noun. More complex examples involving N A A N, for example, observe locality as well:

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- (32) Maliki-rli ka-ju wiri-ngki nya-nyi wita-ngku milpa-ngku
 dog-ERG AUX:OBJ1 big-ERG see-NONPAST small-ERG eye-ERG
 'the big dog saw me with its little eyes'
 (not: the little dog saw me with its big eyes)

There is a second construction in which the locality effect can be observed. Certain infinitival constructions take a dative subject. When the infinitive takes either an indirect object (33) or a dative direct object (34), ambiguity could in principle arise and would not be excluded if the merger rule is assumed. But in fact such sentences appear to be non-ambiguous, as predicted by the projection analysis.

- (33) Ngaju-lpa-rna karli jarntu-rnu kurdu-ku karnta-ku
 I - AUX:SUL boomerang-ABS trim-PAST child-DAT woman-DAT
 kuyu wita-ku yi-nja-rlarni
 meat-ABS small-DAT give-INF-OBVCOMP
 'I was trimming a boomerang while the child gave some food to the small woman'
 (not: ...while the small child gave some food to the woman)

- (34) Ngaju-lpa-rna karli jarntu-rnu karnta-ku kurdu-ku
 I - AUX:SUL boomerang-ABS trim-PAST woman-DAT child-DAT
 wita-ku warri-rni-nja-rlarni
 small-DAT seek- INF-OBVCOMP
 'I am trimming a boomerang while the woman is looking for the small child'
 (not: ...while the small woman was looking for the child)

From such examples we may - modulo the aforementioned caveat - conclude that there is evidence that locality effects obtain in Warlpiri syntax, as predicted by the projection theory.

4. A problem

There is a construction in which two phrases occur in the same case, dative, but locality is not observed. This is when a verb takes a dative direct object but the sentence also contains a benefactive phrase in the dative. (35) is an example.

- (35) Karli-ki ka-rna-rla-jinta ngajukupirdangka-ku warri-rni
 boom.-DAT AUX:SUL-DAT-DAT my-brother-DAT seek-NONPAST
 kiriparnta-ku
 fluted/hoarse-DAT

In tensed clauses datives are 'cross-referenced' on the auxiliary, and in this case both datives are marked (by -rla- and -jinta), although it cannot, apparently, be determined which marker goes with which dative. The word kiriparnta is ambiguous; it can either mean 'fluted' or 'having a sore throat'. Locality predicts that the adjective should be construed with 'brother', and consequently that it

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should be interpreted as 'having a sore throat'. In actual fact (35) may have both of the following readings.

- (36) a. I am looking for a boomerang for my brother who has a
sore throat
- b. I am looking for the fluted boomerang for my brother

A similar problem, which we will not review in detail here, arises in yet another situation where one case paradigm serves two clearly distinct functions. The ergative case paradigm also serves for the instrumental case. And here the crossing construal appears to be available as well.

A tentative solution in both cases would be the assumption that the two case paradigms which in Warlpiri have coalesced into one syncretized case paradigm have a distinct underlying representation in terms of their morpho-syntactic features. Circumstantial evidence comes from the fact that the ergative and the instrumental have distinct case paradigms in many languages, including many Australian ones (cf. Dixon (1976), Blake (1977)). Similarly, though much more rarely, benefactive datives or datives of the 'beneficiary' can be distinct from grammatical datives (e.g. Kapampangan (cf. Mirikitani (1972)), Quechua (cf. Muysken (1977))); though quite rare, such a distinction is also found in a few Australian languages: Gidabal and Wangga-Yudjuru (cf. Blake (1977))). But note that in a great number of languages the case split may be such that the grammatical dative is expressed by the dative case while the beneficiary is expressed by a prepositional phrase. (For some discussion of the underlying representation of case categories see Van Riemsdijk (to appear), which also contains evidence that there are two distinct accusative cases in German.) We will not pursue the implications of this potential problem and its tentative solution beyond the sketchy suggestions offered here in the present context.

5. A prospect

The primary motivation for the argument presented in this article is that the effect of labelling and merger rules in the syntax of extremely non-configurational languages can be obtained 'for free' if it is assumed that Vergnaud's projection convention is not limited to phonology but is equally applicable in syntax. This conceptual argument receives support from the fact that certain locality phenomena in languages like Warlpiri are correctly predicted. We must now ask what are the implications of the proposed analysis for universal grammar.

Hale's (1979) proposal that languages like Warlpiri lack an X-bar component has been received with a certain amount of scepticism. The main reason for this hesitant reception of Hale's idea is probably that it implies a binary parameter that has an enormous impact that exceeds the impact of existing and well-established parameters by many orders of magnitude. Observe that the rejection of such a parameter could not be based on considerations of learnabi-

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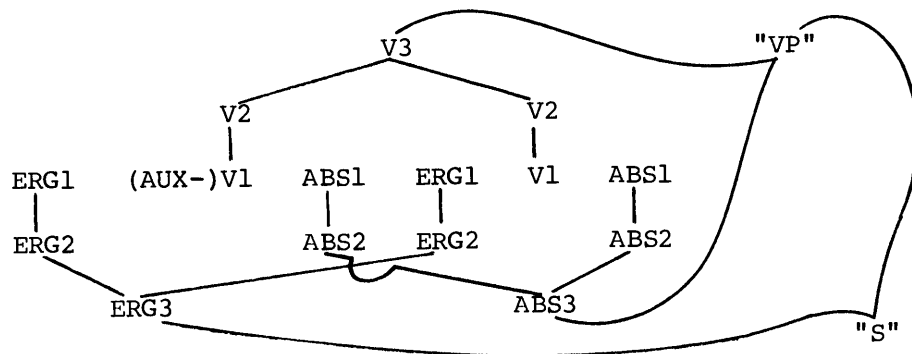
lity, since primary data are abundantly available, in a language like Warlpiri, to fix its value. However, there is another consideration, speculative but valid in my opinion, which has a bearing on the matter. If the mind is equipped with such abstract principles of syntactic organization as X-bar theory and the concomitant applicability of 'move α ', it would be highly surprising if there existed languages which did not make any use of this central element in the human mental faculty. A much more attractive perspective, from this point of view, would be to assume that configurational and non-configurational syntaxes are manifestations of the same abstract organizational principles.

My present proposal only goes a very short way in that direction, but I believe it opens some further avenues for research which may eventually give rise to an abstract theory of syntactic organization which is more pleasing to the mind. We do not need to say, now, that universal grammar offers two modes of syntactic organization, X-bar theory on the one hand and labelling plus merger on the other, and that languages choose among these two. We can now say that all languages make use of the the same two types of representation, X-bar theory and projection, but that the two modes of representation may differ from language to language in terms of their division of labor. Further integration may then also become possible (cf. Bouchard (n.d.) for some suggestions aiming at the same goal but differing in execution). Some of the adjacency facts which follow from X-bar theory, for example, may be the result of the fact that certain grammatical principles such as subcategorization, case-marking, etc. refer to CS2-nodes rather than CS3-nodes. Another way of looking at this question would be to say that some languages impose an additional condition on the application of the projection convention. In particular, convention (11c) might be required to be bi-unique in some languages. This would mean that CS3-nodes would not be branching in such languages. This would force strict adjacency onto the syntactic organization at the subphrasal level.

A second speculation, much in the same spirit, concerns the supraphrasal level. Recall that the CS3-nodes which are the result of the projection convention correspond directly to the nodes which are defined as maximal projection nodes in X-bar theory (NP, PP, etc.). From there it is only a small step to the assumption that CS3-type phrases may be organized with respect to each other in ways which correspond closely to X-bar theory, except that the connections would not be linearly representable. In particular, we can assume that the verb and its complement phrases project to a "VP", and that such a "VP" projects to an "S" together with the subject NP. Graphically:

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(37)



While the formal definition of such categories as VP and S may not be of any direct consequence to the syntax of a language like Warlpiri, it allows us to extend the definition of grammatical functions such as [NP,VP], [NP,S] to such a language (cf. Chomsky (1981a,b) for a somewhat different interpretation and Vergnaud & Zubizarreta (1980) for discussion along lines similar to those pursued here). In other words, the choice of formalism for the syntactic representation of languages like Warlpiri has immediate consequences for the universal applicability of certain fundamental principles of universal grammar, again a desirable perspective.

As a final plea in favor of this way of interpreting Warlpiri syntax, consider the fact that implicit forms of projection devices are already being proposed and used in the syntax of the usual configurational languages. Notions such as Grammatical Function chain (GF-chain) or (Non-)Argument chain (A-chain and \bar{A} -chain) are directly storable in terms of projections. Similarly, the idea that θ -roles are assigned to indices rather than to positions becomes quite natural from this point of view.

Needless to say, all of the above speculations imply that there is an intricate interaction between syntactic projections and X-bar principles which we remain completely ignorant of. Nevertheless it may have been useful to scratch at its surface.

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Footnotes

- * I wish to thank Ken Hale, Mary Laughren, and David Nash for having provided the factual and intellectual basis on which this essay rests. All Warlpiri examples discussed in the text are either taken from their writings as listed in the references or have been supplied by them in private. Obviously they are not to be blamed for my (mis-)treatment of the material. A somewhat different version of the present article is appearing as Van Riemsdijk (1981).

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