

In Defence of Dependency Phonology

Jacques Durand

This paper offers a reply to a recent critique of Dependency Phonology (DP) by Michael Kenstowicz (this volume) who, in the main, concentrates on two areas which he sees as problematic for this framework. First of all, Kenstowicz questions the need for the notion of syllable overlap defended in much DP work and sees its formalization as leading to a violation of the 'no tangling' constraint otherwise accepted by DP. The second target of his critique is the assumption made in DP that features are unary (not binary) and that the vowel space should not be analyzed in terms of the features [high], [low], [back], [round] which are part of the standard generative tradition, but organized around primitives labelled *i*, *a*, *#* for convenience (more accurately, 'palatal'/'acute', 'low'/'compact' and 'round'/'grave'). Kenstowicz presents the well-known phenomenon of Italian metaphony as possible evidence that the DP set of primitives is too limited (or 'reductionist') since it does not offer a feature [high] seen as central to metaphony in various generative accounts. It is our contention that these criticisms, while showing that DP assumptions are desirably open to refutation (in Popper's sense), can be adequately answered.

1. Introduction

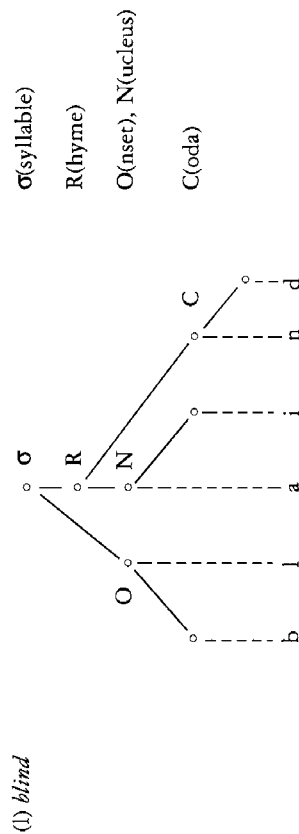
In a recent study, Michael Kenstowicz (1990) offers a thorough survey of stress in Generative Phonology and concludes his work by some reflections on the framework of Dependency Phonology (particularly, as outlined in Anderson & Ewen 1987 and Durand 1990: ch. 8). His assessment of Dependency Phonology (DP hereafter) is a sympathetic one and, as he points out, there are many similarities between DP and current accounts of phonological structures in frameworks which can be considered direct offshoots of the *Sound Pattern of English*. This is not surprising since DP is not a school of phonology outside the generative tradition (see Durand 1990). The first studies in DP (Anderson and Jones 1974 [1972], 1977, Durand 1976, Jones 1976), involved careful considerations of a number of problems which faced the phonologist operating within the *SPE* strictures and stressed that both the internal structure of segments and their external structure had to be more richly articulated than usually assumed, a conclusion now generally shared by phonologists of various persuasions. As in the *SPE* tradition, there has always been a commitment by DP phonologists to universalism and to the need for grammars (the mechanisms governing the building of representations and the relations between

levels of representation) to be fully explicit. What still separates DP from mainstream non-linear phonology is a different view of suprasegmental and infrasegmental structures. At the suprasegmental level, the key-concept of DP, as the name indicates, is that of dependency or head-modifier relation, claimed to span the syntactic, morphological and phonological domains. The notion of constituency, which is central to much modern work in theoretical linguistics, is claimed not to be primitive, but to be derivable from the dependency relation coupled with linear precedence and rules of association. A concomitant of this position is that the formal objects that the linguist manipulates are dependency trees (more properly, graphs) rather than standard phrase-structure trees augmented with the idea of headship (X-bar, s-w). From the infrasegmental point of view, features (called components) are, first of all, argued to be grouped into 'gestures' and, as stressed by Kenstowicz, "early DP can legitimately take credit for recognizing that the features composing phonological segments are partitioned in some fashion and that the determination of this organization should be an important research objective of any linguistic theory". A second assumption is that components are unary (and not binary as in SPE) and, as part of its programme, DP proposes somewhat different primitives from familiar sets such as that of SPE or Halle and Clements (1983), among others. A third assumption is that the relation of dependency (governor-dependant) is also available within the segment.

In his brief critique of DP, Kenstowicz concentrates on a few areas at the suprasegmental and the infrasegmental level which he sees as problematic for this framework. I will consider each of these in turn and attempt to show that there are indeed answers to the queries he raises.

2. Suprasegmental structures

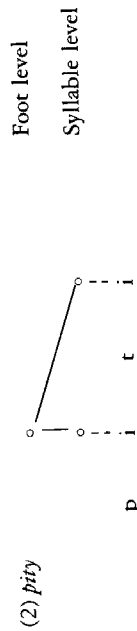
As mentioned above, the representation of units such as the syllable in DP is in the form of dependency trees such as the following one for the word *blind*:



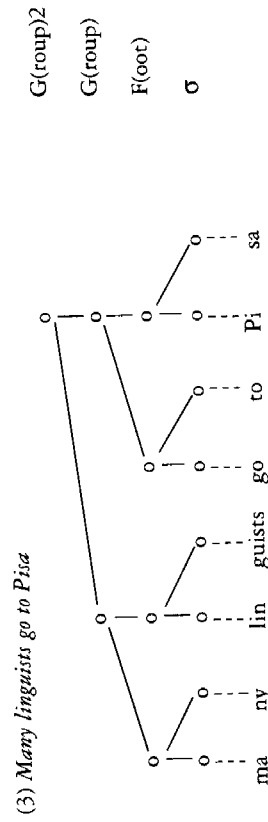
For reasons of space, the details of the formalism will be left aside here and we will content ourselves with an informal description of a representation such as (1). The relation between a head and a dependant is expressed by a node being higher than another node and connected to it by an arc. Order is

expressed by the left-to-right placing of the nodes on the page. Traditional dependency trees embody the assumption that a head is the head of only one (maximal) unit – an assumption which is rejected as empirically wrong: the first element /a/ of the diphthong /ai/ above is successively the head of the nucleus, the head of the rhyme and the head of the whole syllable. And if we added an inflection, as in *blinded*, /a/ would be projected as the head of the foot since -ed is unstressed. In this graph, therefore, beside nodes being *adjoined* to heads (e.g. the node corresponding to /i/ which hangs from the node corresponding to /a/), some nodes are *subjoined* to other nodes (cf. the nodes corresponding to the nucleus, the rhyme, and the syllable). It can be observed that constituency is expressible in a straightforward way: any node which has other nodes hanging from it can be said to form a constituent with these nodes. Criteria for constituency within the syllable are no different from that used in other frameworks but it is worth pointing out that headhood, which is determined by DP's own version of the sonority hierarchy, is directly expressed in (1): thus, the onset *bl* is made up of a /b/ which is a dependant of the more sonorous /l/. The labeling used in (1) is, in fact, unnecessary since the constituents of the syllable are uniquely reconstructable from the geometry of the graph. The nucleus is the root of the graph or, from another angle, the node which is a first-order projection of the syllabic. The rhyme is the second order projection of the syllabic and the syllable its third-order projection. A lack of labelling is not peculiar to DP but is a characteristic of much recent work on suprasegmental structure.

Now one important assumption made in DP, which separates it from many other frameworks, is that the same formalisation applies to syllable-internal and to syllable-external structure. Thus the word *pity* which forms a left-strong foot can be represented with the same apparatus (taking the internal structure of each of the two syllables for granted):



And a sequence such as *Many linguists go to Pisa* would be represented (in a simplified way) as follows:



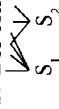
In effect, such representations combine the grid and the metrical tree (cf. Ewen 1986). The arcs connecting nodes give us the constituency information which is encoded in a metrical tree and is required for the statement of rules which have the syllable, the foot or the group as a domain. The presence of subjunction paths give us a representation analogous to columns of asterisks (or x's). In so far as it is claimed that both these types of information must be expressed – and Kenstowicz (1990) explicitly supports this thesis – the dependency representation would seem to be in principle superior, to say the use of the grid plus bracketing, since it does not separate syllable internal representations (standardly phrase-structure trees) from suprasegmental representation (columns of asterisks).

One other assumption has been made in DP work: namely, that in left-strong feet such as that in (2) ambisyllabicity is often observable and perhaps a universal feature of language (with slightly varying parochial manifestations but with an essential reference to the rules specifying onsets and codas in monosyllables). This would mean that the [ʃ] of *pity* would be simultaneously a member of the first and the second syllable: [pɪ [ʃ] tɪ]₂. The same assumption applied to a cluster such as [st] in *Boston* (which is permissible initially in *stop* and in finally in *past*) would yield the following bracketing: [bo [st] on]₂. Kenstowicz (1990) sees this assumption as unwarranted since he claims that it leads to a violation of the no-tangling condition which is elsewhere respected in DP and also because he feels that Anderson & Ewen (1987: 53-58 et passim) “only hint at the phonological evidence” in favour of this, thus making it difficult to reach a proper evaluation of this claim. Let first us examine the objection concerning the violation of the no-tangling condition. We are offered by Kenstowicz the following illustration of the problem (his example (48)):

(4) a. money

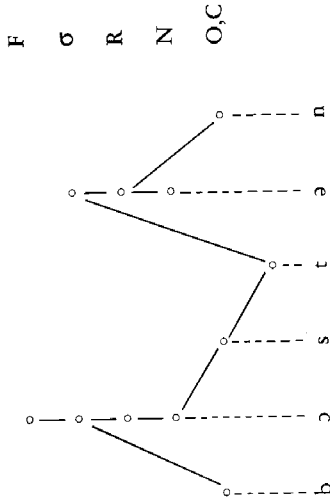


b. Bos ton



c. [Bo [st] on]₂

This way of representing the problem is one that is already found in Kahn (1976: 20) but the conclusion drawn is incorrect with respect to DP. The DP representation of (4c) is not the autosegmental one above (or its phrase-structure equivalent) but (5):



Since formally syllable-overlap in DP does not entail any violation of a major constraint on representations, what really needs to be established is whether ambisyllabicity is empirically motivated and whether it can be extended to whole clusters such as [st] in *Boston*. Ambisyllabicity in left-headed feet is far from universally accepted in phonology (see e.g. Selkirk 1982 for a contrary point of view), nevertheless DP practitioners have argued that there is a range of evidence supporting this assumption which can only be briefly summarised here.

Ambisyllabicity is the theoretical translation of the phenomenon of syllable-contact. From a phonetic point of view, if we consider, for instance, an English word like *petrol*, it has been often observed that the medial [t] has simultaneously syllable-initial and syllable-final characteristics. In particular, the [t] is voiceless as the result of the strong aspiration of the [l] in syllable-initial position, but there is also a glottal reinforcement of the [l] ([peʔtʀəl]). From a phonological point of view, by recognizing ambisyllabicity, we can directly relate the structure of polysyllabic morphemes and that of monosyllabic morphemes in English. In the latter, which are usually considered as lexically stressed, the short (or lax) vowels are not allowed unless a consonant follows. Compare (6a) and (6b):

- (6) a. [bɪp.] b. * [bɪ]
 [æk] * [æ]
 [nek] * [ne]

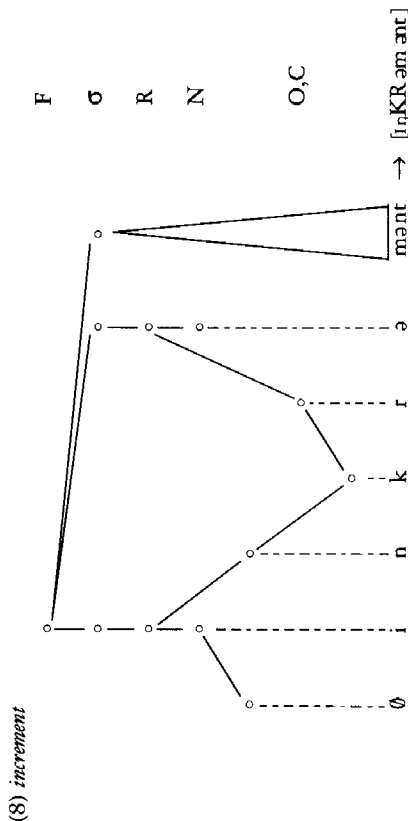
But, in polysyllables, if ambisyllabicity is not allowed, a stressed syllable can be open and yet contain a short vowel (cf. *petrol*, *city*, *wrecker* under this assumption). If, on the other hand, we accept that the medial consonant in such words is ambisyllabic, a single generalization holds: a short vowel cannot be the sole element of a stressed rhymer or, put another way, the rhyme of a stressed syllable must be complex.

A further example in favour of ambisyllabicity at the post-lexical level can be adduced from two phenomena described by Kiparsky (1979: 439) as evidence of *close contact* between adjacent segments in English which have the foot as a domain. His first example of this is the fact that in words like *ink* or

increment, the nasal is obligatorily assimilated to the following obstruent ([ŋk], [ŋkrəmənt]) whereas in words like *increase* (n) or *increase* (v) the assimilation is optional ([ŋkrijs] or [ŋkrijs]). This is referred to below as Nasal Place Assimilation (NPA). His second example involves the Mutual Assimilation (MA) of [k] and [r], which he writes [KR] in words like *crew*, *increase* ([KR]) vs. *back-rub*, *cock-roach* ([kr]). If we define the domain of obligatory NPA and MA as the foot an account becomes possible as is shown by the following examples (cf Nespor & Vogel 1986: 94):

- (7)
- | | | | | | |
|---|--------------|--|---|-------------------------|---------|
| a | ink | [ink] _F | → | i[ŋ]k | NPA |
| b | crew | [kru] _F | → | [KR] _{ew} | MA |
| c | increase (n) | [in] _F [krejs] _F | → | in [KR] _{ease} | MA |
| d | increase (v) | [in] _F [krejs] _F | → | in [KR] _{ease} | MA |
| e | increment | [inkrəmənt] _F | → | i[ŋKR]əmənt | NPA, MA |

Kiparsky (1979) rejects any explanation of the above in terms of syllable-structure, and Nespor & Vogel (1986), who follow his treatment, argue that in an example such as *increment* ambisyllabicity is not acceptable 'because such an analysis would require the entire sequence *kr* to be tautosyllabic, and this would violate the principles governing English syllable structure' (p. 94). But, again, if we assume standard dependency representations an example such as *increment* would receive the following structure (where we leave aside the structure of the third syllable and assign an unfilled onset node to the first syllable):



As should be obvious, (8) does not require any ill-formed onset or coda and, by adopting such representations, a better generalization emerges than the previous one: obligatory NPA and MA apply to tautosyllabic segments.

If we turn finally to the diachronic dimension, Jones (1976, 1989) argues that at various points of the history of English a wide range of sound-changes involving either deletion or insertion can be appropriately characterized if we assume that overlapping at syllable-interfaces is a preferred configuration.

Some examples of deletion from the 12-15th century period are provided below (Jones 1989: 188-189):

- (9) Some 12-15th century changes
- | | | | |
|--|---|---|--------------|
| [eɪn] ₁ [i ₂ bɔɪ ₂ a ₂] | → | [el ₁ b ₁ jɔɪ ₂ a ₂] | 'elbow' |
| [frɛnd] ₁ [l ₂ stɔp ₂] | → | [frɛn ₁ l ₂ s ₂ jɪp ₂] | 'friendship' |
| [gɔd] ₁ [l ₂ spɛl ₂] | → | [gɔ ₁ l ₂ s ₂ jɪpɛl ₂] | 'gospel' |
| [nɔrθ] ₁ [l ₂ fɔlk ₂] | → | [nɔr ₁ l ₂ f ₂ jɔlk ₂] | 'Norfolk' |

Given that the contexts under which deletion operates are quite disparate, Jones argues persuasively that it is more insightful to see it as a way of avoiding syllable interfaces whose initial/end points show unique domain reference (see examples on the left) thus maximizing syllable-overlap (see the examples on the right).

If the above is correct, it is by no means clear why the ambisyllabic [st] cluster in *Boston* should require special motivation. Various examples in (7) and (9) show that whole clusters (cf. [ɪk] and [kr] in (8)) can be either syllable-final or syllable-initial. If we assume that /st/ is a permissible syllable-initial and syllable-final cluster, then its ambisyllabicity is directly predictable. Evidence in favour of the ambivalent nature of [st] clusters does exist since it can be shown (variably according to languages) that sometimes the [st] cluster functions as a syllable-terminator and sometimes as a syllable-initiator. The reader is referred to Anderson & Ewen (1987: 66-69) for the relevance of the ambisyllabicity of [st] in the phenomenon of Middle English open syllable lengthening (see too Jones 1989: 98-127).

Many questions relating to ambisyllabicity remain (e.g. at which level within derivation does it start operating?). But, if this proposal is right, an important hypothesis emerges: i.e. that in left-strong feet we should normally see ambisyllabicity at work (see Durand 1986 for some evidence within the portions of French where left-strong feet can be postulated). Kenstowicz points out that DP has not paid sufficient attention to right-strong feet and to stress-systems of the world and rules regulating them. This seems to me a fair criticism. But what the above paragraphs stress is the asymmetry between left-strong and right-strong feet with respect to the medial consonants sandwiched between a head and a dependant and this needs to be taken care of whatever the framework.

3. Segment-internal structure

As mentioned earlier, one of the assumptions made by DP is that segments are not analyzed in terms of binary distinctive features but in terms of unary (or monovalent) components. The three basic components which define the vowel space are:

- (10) i 'palatality' (or 'acuteness')
 a 'lowness' (or 'compactness')
 u 'roundness' (or 'gravity')

which have been supplemented by a feature of centrality and ATR (see below). Vowel systems of the /i, a, u/ type, which are widely attested and constitute the simplest possible vowel systems are uniquely characterized by recourse to these primitives:

- (11) (i) /i/ {u} /u/ {a} /a/

where the symbols slanted brackets have no systematic import but abbreviate the set-description of the left. Because of the way the *i, a, u* components structure vowel systems, they are often referred to as 'tridirectional feature systems', in contrast with classical binary systems, which are then described as 'bidirectional'. Unlike binary or scalar features, unary features are not omnipresent via the attribution of a positive or negative value. Rather segments can be simply characterized by the absence as well as the presence of a given component. In other words, the segment informally called /u/ in (11) is not in any sense [-a, -i, +u] but is simply {a}, with the features *i* and *u* absent.

Since not all systems are as simple as (11), we obviously need to allow components to be combined and the simple association of two or more components is symbolized by a comma within the set brackets as in the system of (12):

- (12) (i) /i/ {i,u} /y/ {u} /u/ {u,a} /o/ {a} /a/

In (12), the vowels /y, ø, e, o/ are treated as 'mixed vowels', that is to say, as vowels which have two or more components of equal strength.

As noted by Kenstowicz, the adoption of unary features is quite controversial in current phonology. It is, however, worth observing that the monolithic approach to distinctive features which was characteristic of *The Sound Pattern of English* has been the subject of considerably reexamination in recent years. Some challenging research, often referred to a 'Radical Underspecification Theory', initiated by linguists such as Kiparsky, Archangeli and Pulleyblank in the first half of the eighties, has advocated a position in which distinctive features are initially one-valued, the other value being added during or at the end of derivations by a battery of redundancy rules – complement and default rules (see Durand 1990: ch. 5 for an overview and Archangeli 1988, for detailed discussion). Other phonologists (e.g. Goldsmith 1985, 1987, Steriade 1987) have defended a mixture of binary and unary features underlyingly and throughout derivations – a position which Kenstowicz mentions as an alternative to DP if it turns out that some features (such as [round]) are better viewed as monovalent. On the other hand, a few research programmes have been actively pursuing the idea of unary components or elements (cf. the Government-Based Phonology of Kaye, Lowenstamm & Vergnaud 1985, and the work of what might be referred to as the Dutch school of Dependency Phonology – cf. Ewen & van der Hulst 1988, van der Hulst 1988, 1989, Smith 1988, van der Hulst & Smith 1985b).

The idea that all features are unary throughout phonological derivations is a strong hypothesis and much more vulnerable than positions which posit a mix of unary and binary features. Moreover, unlike underspecification theory, DP assumes that it is always the same pole of a property (e.g. [roundness]) which represents the positive phonological property. By contrast, in Radical Underspecification, either the positive or the negative value of a feature can be selected as the underlying value for each system at a time. Clearly, to defend the unary hypothesis, problematic cases have to be faced (e.g. how to account for transparent and opaque segments) and much of this work is already available (van der Hulst 1988: 4-5). Here we will address only the problem raised by Kenstowicz in connection with the choice of *i a u* as primitives. Let us consider the examples from Northern Salentino in (13) discussed by Kenstowicz (based on Calabrese 1984):

- (13) fr'edda l'enta r'ossa b'ona fem.sg
fr'iddu l'entu r'ussu b'ue nu masc.sg
fr'iddi l'ienti r'ussi b'ueni masc.pl
'cold' 'slow' 'red' 'good'

Assuming that the mid vowels are differentiated in terms of [+tense] (e, o) vs. [-tense] (ɛ, ɔ), the change can be described as follows: /e/ and /o/ acquire by spreading the feature [+high] which is shared by the suffixes /i/ and /u/. As a result, /e/ and /o/ merge with /i/ and /u/ respectively. Moreover, if we assume with Calabrese that lax high vowels are missing from the Italian vocalic inventory, [+high] cannot be inherited by /ɛ, ɔ/ and different dialects exhibit different repair strategies. In Salentino, we observe a linearization of these incompatible values as [+high I -tense] i.e. [iɛ] and [uɔ] sequences (the latter being converted to [ue] by a late rule). The problem for DP is the following: if there is no feature [+high], how can we express metaphony phenomena such as the above?

Italian dialects offer a rich body of data for any theoretical framework and there is much disagreement about the data and its synchronic interpretation: compare Calabrese (1984), Maiden (1985, 1987, 1989, in press), Sluyters (1988) among others. Only a comprehensive study of these dialects can allow one to decide, for instance, to what extent the phenomena described here are morphologised or not. I will therefore address the above problem in general terms and see what solutions could be offered within DP to deal with data of this type leaving a dehisled DP treatment to further investigation.

In many DP writings vowel systems typical of Italian dialects such as the following:

- (14) i u
 e o
 ɛ ɔ
 a

would be argued to involve dependency in addition to the simple combination of components. That is, rather than classifying /a/ as a back vowel and fitting in the remaining vowels in the quadrangular space of SPE vowel

features it is argued that we should allow for the possibility of one component preponderating over another component. In its terms, this involves treating one component as a governor and another component as a dependant, as in the graphs of (15):

- (15) a. /e/ i governor
 |
 a dependant
 b. /ε/ a governor
 |
 i dependant

Where palatality is dominant, as in (15a), we get the high mid vowel (/e/), and, where lowness is dominant, as in (15b), we get the low mid vowel /ε/. As graphs can prove typographically cumbersome, the convention used in DP is to express infrasegmental government by a semi-colon: /e/ will be represented as {i;a} and /ε/ as {a;i}. As a result the system of (15) can be symbolized as in (16):

- (16) {i} /i/ /u/ /u/ /u/
 {i;a} /e/ {u} /u/ /u/
 {a;i} /ε/ {a;u} /o/ /o/
 {a} /a/ /a/

How can we express the Salentino metaphony rule? One important observation which lies behind various possible DP analyses is that in a framework with privative relations, "assimilation" can be achieved in two ways: either by the spreading of a feature from a target to a victim or by a loss of feature which one segment possesses and another one lacks. In the case of Salentino, if (16) is adopted, the suffixes /i/ and /u/ lack a feature *α* which characterizes the mid-vowels. Harmony in this case, involves reducing the difference between the mid vowels and the suffixes by a reduction in the *α*-ness of the stem vowel. Since /i/ and /u/ do not include the *α* component, they remain unaffected. The mid high vowels already contain *α* in dependent position and the only way to reduce *α*-ness is by deleting it. The low mid vowels, however, contain *α* in governing position. The preponderance of *α* can be reduced by making it dependent. In this case, this yields /e/ and /o/. This solution is chosen by some Italian dialects such as southern Umbro mentioned in Calabrese (1984). The mechanisms involved here have been argued in DP to be universally available (see Anderson & Ewen 1987). It is perhaps worth pointing out that metaphony is not an isolated process in Italian phonology since, for some dialects, there is also a related process of neutralization of vowel differences in unstressed position reducing the vocalic inventory to /i a u/. This is straightforwardly dealt with in DP by loss of *α* from all mid vowels.

What remains to be explored is the breaking process chosen by Salentino for the mid low vowels. In Calabrese's account this is justified by reference to an incompatibility of [+high] and [+lax] which is assumed to lead to a universal repair mechanism ('clean up') which triggers a linearisation of these

features later filled in by redundancy rules. This account is itself not above suspicion if conceived as involving a set of cost-free processes. It is, for instance, criticized by Sluyters (1988) on three counts (see too Maiden, in press). To quote this author: "In the first place, we observed earlier that metaphony is a cyclic rule. The SCC, because of structure preservations, prohibits the creation of the segments [i] and [u] in the cyclic component. Furthermore, we would expect the repair mechanism to be the expression of a universal format, a kind of automatic rule. This is certainly not the case. Even within this group of Italian dialects a large number of them do not resort to diphthongization. The format is dialect specific. Third, the ordering of the conflicting features within the diphthong ([+HIGH][−TENSE]) and not [−TENSE][+HIGH] is not explained" (p. 175). If, indeed, it is correct that the actual breaking process does not derive from universal principles, it has to be assumed that language-specific mechanisms may be involved. Sluyters suggests that the diphthongs /iε, uɔ/ are characterized by a second V slot which is contextually determined by stress and introduced by a rule of the following type:

- (17) [+stress]
 /o → V / V - - - -
 / /

This rule applies to /ε,ɔ/ and the epenthetic V slot is later filled in by general (but not necessarily universal) mechanisms. But it is arguable that these diphthongs should be interpreted as structurally light as Calabrese does. I shall follow Sluyters here but either interpretation can be accommodated along similar lines within DP.

Let us assume that the input to diphthongization is (18) where a new empty V gesture is now available:

- (18) V |
 a,i

If we do not decrease *α*-ness by simple dependency reversal, breaking can achieve a similar result by making the non-*α* component fill in another position of the sequence. Recent work in DP has assumed that the three features *i, a, #* should in fact be organised into gestures. One major split seems to be within *i #* on the one hand and *a* on the other. The following geometrical organisation is proposed in Ewen and van der Hulst (1988):



where government (dependency) operates in addition to the geometrical organisation. Given the proposal (18) would in fact have the fuller representation of (20):

seem to find their way into the writings of a variety of scholars and it is no longer clear what the 'standard' paradigm can and cannot incorporate. One of the merits of DP, in my eyes, is and has been to offer a novel framework which attempts to integrate various assumptions into a unified and coherent whole. Rather than setting the scene in terms of a 'standard' framework which DP should respond to, it is perhaps time that the 'standard' framework addressed squarely all the questions raised by the DP tradition.

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Address of the author:

Department of Modern Languages
University of Salford
Salford M5 4WT.

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