17. Dependency Relations in Phonology

COLIN J. EWEN

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0 Introduction

The concept of dependency has been utilized in liguistic theory to characterize the claim that elements within a particular domain may be asymmetrically related. Within the syntactic domain, the introduction of dependency can be associated with the claim that the two constituents of a constitute display a head-modifier relation, rather than being simply sisters. The incorporation of the dependency relation into phonological representations, in particular those characterizing the internal structure of the segment, has been primarily associated with the theory of phonological structure referred to as *dependency phonology* (Anderson and Jones 1974, 1977; Durand 1986; Anderson and Ewen 1987; den Dikken and van der Hulst 1988; van der Hulst 1989). However, something closely approximating to the dependency relation of dependency phonology is utilized in various other approaches to phonological structure, although generally only in the suprasegmental domain, for example with respect to syllable structure. Furthermore, a number of writers have proposed introducing a segmental relation termed “dependency” into theories of representation other than that of dependency phonology. On closer inspection, though, we find that the term is typically used to denote different kinds of relation, especially with respect to segment-internal structure.

Although this contribution is primarily concerned with the role of dependency within the segment, I devote some space in section 1 to a discussion of suprasegmental structure, in particular to the relationship between dependency in the sense of dependency phonology and other kinds of relations which have been proposed. In sections 2-3, after a brief introduction to the character of dependency within the segment, I consider the way in which the relation has been developed within dependency phonology (sec. 2), and how notions of dependency have been utilized in other frameworks (sec. 3).Finally, in section 4, I consider very briefly how proposals within dependency phonology for the representation of the internal structure of the segment relate to those within feature geometry approaches to segmental structure.

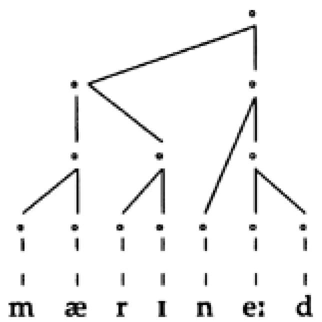
1 Dependency above the Segment

The dependency relation is a binary asymmetric relation in which one element in a construction is the *governor or head*, and the other the *dependent or modifier*. The head-modifier relation was initially more familiar from syntactic work, and its interpretation as dependency is indeed first found in syntax (e.g., Hays 1964; Robinson 1970), in particular in the framework of Case and Dependency Grammar (Anderson 1971, 1977). The application of the relation to phonological sequences incorporates the claim that such sequences are headed. Thus a syllable is a construction which is headed by a syllabic segment, a foot by a stressed syllabic segment, and so on.

Such claims, which received their first formal statement in the dependency model, have now become commonplace, especially in the light of developments within metrical phonology (see chaps. 10 and 11, this volume), where the relational interpretation of strong-weak is functionally more or less identical to the dependency relation. Thus it is generally accepted that sequences are headed, and furthermore that this formal relation has a physical correlate, relative prominence.[1] Stressed syllabic segments are inherently more prominent than unstressed syllabic segments, and syllabic segments are more prominent than nonsyllabic segments (chap. 6, this volume). In addition, within the syllable, sonorant consonants are inherently more prominent than nonsonorant consonants (simply by virtue of their greater sonority), so that the dependency relation also holds between the elements of a consonant cluster.[2]

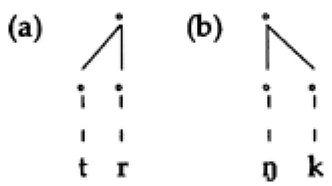
In view of these observations, it is clear that dependency phonology, like metrical and autosegmental approaches, can properly be reckoned as belonging to the general theory of phonology and phonological representation now referred to as nonlinear phonology. It is obvious, too, that the differences among the various nonlinear approaches to suprasegmental structure, at least insofar as these are crucial to the individual models, are no longer sufficiently great as to warrant, in the context of this overview, a detailed account of the formalism used in dependency phonology for the representation of phonological sequences. However, it is interesting to observe that recent notational proposals, both within syntax and phonology, adopt some of the formal conventions of dependency grammars, in the sense that an element which is head of more than one projection is characterized as a projection on a vertical line. Thus, in (1), the representation for the English word *marinade*, the line associated to the vowel /e:/ is a projection which indicates that the vowel is simultaneously head of the rhyme /e:d/, the syllable /ne:d/, and the larger construction formed by the whole word (I ignore here the question of the representation of the length of the vowel):

(1)



As noted above, similar considerations apply to the structure of subsyllabic constructions such as the onset and the coda, in which the more sonorant consonant is the governor, as in (2a, b):

(2)



Dependency phonology as such is strictly agnostic with respect to the issue of whether particular suprasegmental constructions are required in phonological representation. Thus Anderson and Ewen (1987) adopt a view of sequential structure compatible with (1) and (2); however, the particular structures proposed there are independent of the more general question of whether dependency relations are appropriate to the representation of units such as syllable, foot, or coda. The content of the claim made by dependency phonology is that any such structure is headed, and that this asymmetric relation is best represented in terms of dependency; (1) and (2) are particular interpretations of this claim.[3]

2 Dependency within the Segment

As we have seen, the relation of dependency applied to suprasegmental representations is largely equivalent to other proposals involving asymmetric relations. What distinguishes dependency phonology from other nonlinear approaches is the fact that segment-internal structure is also considered to involve headedness, and therefore that the dependency relation also plays a role within this domain. As in the case of suprasegmental structure, it is important to realize that there various aspects of the proposals made within dependency phonology concerning the internal structure of the segment which are independent of this basic property of the theory, and which therefore can, and should, be assessed independently.

In this respect, we should observe that the set of features commonly used within dependency phonology is not, as such, crucial to the model. However, the nature of the features – in particular, the fact that they are all *unary*, i.e., single-valued – is determined by the fact that these features can interact in terms of relative prominence, as we shall see. Unary features, or *components*, as they are commonly referred to in dependency phonology, have been proposed elsewhere, especially with respect to the characterization of vowel systems (e.g., Schane 1984 and chap. 18, this volume; Goldsmith 1985; Rennison 1986), and more recently as single-valued, or monovalent, nodes in a feature geometry (e.g., Sagey 1986; Avery and Rice 1989).

2.1 Vowel Representations

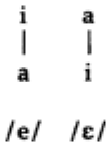
The motivation for incorporating dependency in vowel representations comes from vowels in which more than one single-valued feature is present. Thus, assuming a standard set of monovalent features [front], [round], and [sonorant] (or [open]), represented in dependency phonology as |i|,|u|, and |a|, respectively, there is clearly only a limited set of representations in which two or more of the features simply co-occur, viz.,|i, u|, |i, a|, |u, a|, and |i, u, a|, the representations for the vowels /y/, /e/, /o/, and /ø/, respectively (the order of the features in the representation of the vowels here is not significant). In common with other single-valued systems, such a system of representation incorporates an inherent evaluation metric: the more complex the vowel, the more features are required in its representation. This is argued to be appropriate to the extent that it reflects notation-independent interpretations of the notion of phonological complexity and also insofar it accords with the "quantal" theory of speech, in this case as applied to the vowel space (Stevens 1989).[4]

Theories which do not incorporate an asymmetric relation holding between features cannot, without introducing one or more new features or incorporating reiteration of the existing features, characterize a vowel system containing more than the seven vowels already mentioned. In particular, systems with more than one mid front vowel, say /e/ and /ɛ/, require a feature such as [tense] or [ATR] to distinguish between these two vowels. Thus a single-valued system incorporating a feature |ATR| might characterize the distinction between /e/ and /ɛ/ as |i, a, ATR| vs. |i, a|.

It can be argued that such representations are appropriate for familiar systems where ATR is the feature involved in dividing the set of vowels of a language into two distinct subsets involved in harmony processes, for example. Ewen and van der Hulst (forthcoming) suggest moreover that while some systems involve an ATR opposition, others may also be organized in terms of [tense] vs. [lax]. RP (British "Received Pronunciation") English is such a case. In the absence of other types of systems, then, it would not be immediately clear that there is any call for more complex structures involving dependency in the characterization of the vowel space.

There is, however, a third type of system, in which, it is claimed, the relationship between /i/ and /e/ is not different from that between /e/ and /ɛ/, nor from that between /ɛ/ and /a/ (assuming a system with all four of these unrounded vowels). Such systems are typically involved in apparently scalar processes such as vowel raising or lowering affecting, say, all of /i e ɛ a/ in the same way. Thus the English Great Vowel Shift is such a process, involving raising of all long vowels,[5] as is the lowering process of the Scanian dialect of Swedish, discussed by Lindau (1978). Given the correctness of the analysis of these systems as involving vowels arranged along some type of scale, it seems inappropriate to appeal to an extra feature such as |ÃR| to distinguish between *individual* members of the scale (this, of course, is also the motivation for a multivalent scalar feature of vowel height of the type proposed by Ladefoged (1971)). Rather, dependency phonologists argue, in a system containing two mid vowels /e/ and /ε/ in which the relationship between the vowels is scalar in this sense, both vowels contain only the features | i | and | a |. They differ in the relative prominence of the two features: for /ε/, | i | governs | a |; for /ε/, | i | is dependent on | a |. This can be represented as in (3):

(3)



As in (1) and (2), dependency is represented on the vertical axis. As the two elements are simultaneous, they are nondistinct on the horizontal axis, so that the line linking them is vertical. Whereas the vertical line dominating the vowel / e

/ in (1) is a projection of the vowel in question, with the unlabeled nodes characterizing the various headships of the vowel, the lines in (3) link labelled "content" nodes in terms of the dependency relation.[6]

As in the suprasegmental domain, dependency in segment-internal representations is the formal characterization of relative prominence. Thus /e/ is characterized as being a vowel in which frontness is more prominent and sonority less prominent than for /ε/. This allows vowel height to be characterized as a scale involving relative prominence of two interacting components, in the case of unrounded vowels frontness and sonority, as in (4):

(4)

Further advantages are claimed for the characterization of the dimension of vowel height in (4) over other univalent systems which do not utilize dependency. It is typically claimed by the proponents of univalent systems that the treatment of front rounded and mid vowels as complex is given support by their behavior in monophthongization and diphthonization processes - in Schanés (1984) terms, *fusion* and *fission*, respectively (see chap. 18, this volume). Schane suggests that such changes typically involve sequential reordering, with no alteration in the features involved, so that a change from / ai / to / e /, for example, consists of the fusion of the two vowels into one, with realization as the mid vowel corresponding to the combination of the two features involved. Similarly, the fusion of / au / gives / o / and the fission of / y / gives / iu / (or / ju /), as we would expect, given the representations |a, u| for / o / and |i, u| for / y /.[7]

Dependency phonology, however, makes a stronger claim, in particular with respect to monophthongization. In systems in which the dependency relation is invoked in the representation of mid vowels (e.g., those with both /e/ and /ε/), the claim is made that fusion will not only maintain the identity of the features involved, but also the dependency relation holding between them. Thus Anderson and Ewen (1987, p. 129) claim that the monophthongization of the Middle English diphthongs / aI / and / aʊ/to/ϵ

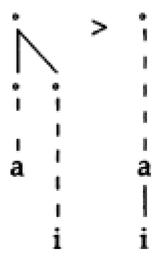
/ and /ɔː/ in late Middle English, as illustrated in (5), shows the expected development:

(5)

Early Middle English /daɪ/ > late Middle English /dɛː/ "day"
Early Middle English /klaʊ/ > late Middle English /klɔː/ "claw"

The input to the change is a falling dipthong, in which the first element (containing only |a|) is more prominent than the second element (|i| or |u|), and therefore governs it. The dependency relation is maintained after fusion, which gives a low mid vowel rather than a high mid vowel, as shown in (6) for the front vowels involved (for illustration, I assume that the representation of the vowel is linked to some kind of segmental node):

(6)



For processes involving diphthongs in which the element containing either |i| or |u| is the governor, we expect interaction with the high mid vowels, i.e., those in which |i| or |u| governs |a|, so that the dependency relations are maintained.

To the extent that they can be substantiated, these claims provide strong evidence in favor of positing a dependency relation in the representation of the mid vowels. However, as Anderson and Ewen point out, only those systems in which the dependency relation is required (because there is more than one mid vowel) provide the evidence required. In a system with only one mid vowel, no dependency relation is required, and therefore fusion will not maintain the asymmetrical relation which holds in the suprasegmental domain between the two elements of the original diphthong.

2.2 Major Class and Manner Representations

Dependency phonology shares with feature geometry the notion that features display grouping (see chap. 7, this volume). We have already examined one such group, the vowel features, which would be dominated by a single (class) node in the context of feature geometry. It is not immediately obvious how the formalism of dependency phonology is compatible with that of feature geometry, given the claim of dependency phonology that features do not simply co-occur, and given that appeals to "dependency" within feature geometry involve different types of relation, to which I return in section 3.[8] However, this does not affect the basic insight involved, that groups of features may operate in phonological processes as units independent of other features.

One area more than any other has proved controversial within feature geometry, namely the organization of features characterizing major class and manner (see van der Hulst and Ewen 1991 for some discussion). Which, if any, of these features should be dominated by a single class node, and what the character of that node should be, are issues of great debate, as is illustrated by the different geometries proposed by Clements (1985), Sagey (1986, 1988) and McCarthy (1988), for example. This controversy is largely due to the fact that the set of major class and manner features does not seem to meet any of the criteria proposed by McCarthy (1988) for membership of a group: they do not spread as a group, they are not implicated as a group in delinking, and they are not subject to Obligatory Contour Principle effects.

One criterion for the grouping of features which is appealed to in dependency phonology, but which has been largely ignored in feature geometry, is that a set of features which takes part in hierarchy-based processes should be considered to be part of the same group, or, in geometrical terms, to be dominated by a single node. This applies particularly to the set of features under consideration, the manner and major class features, which are involved in sonority hierarchy-based processes such as weakening and relations such as syllabification, as already noted above.

The question of whether sonority should be encoded – either directly or indirectly – in segmental representations is a familiar one, and various strategies have been adopted for allowing sonority to be read off the representations in some way. Recent proposals have involved the suggestion that sonority can be related to the amount of structure in the geometry of a segment, although without much agreement about the details. Thus Dogil (1988) argues that sonority "is inversely proportional to the number of nodes that have to be consulted on the way to the first articulator node," and suggests that the more sonorous a segment is, the less geometric structure it has. Rice (1992) proposes something similar: in her feature geometry "greater sonority involves … less structure." Within a government-based model of phonological representation, Harris (1990) takes the reverse standpoint: the least sonorous segments, voiceless stops, are composed of the greatest number of "elements." It is not my concern here to discuss the relative merits of these approaches, but rather to observe that there is a significant body of opinion which holds that sonority must be derivable from the representations, and also that some appeal is often made to the notion of complexity in this area.

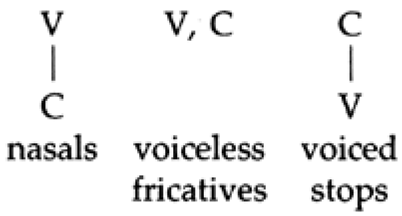
These two points of view – that the major class and manner features from a group, and that relative sonority is relevant to the organization of phonological representations, and hence must be computable in some way – are given an interpretation in dependency phonology in terms of the same types of representations as proposed for the analysis of the vowel space. The major class or *categorial* features which have usually been proposed are the familiar [sonorant] and [consonantal], represented as |V| and |C|, respectively. (These should not be confused with the timing units of the CV tier in the Clements and Keyser (1983) approach; |V| and |C| are simply labels for unary features.) Like the vowel features, they may occur alone in the representation of a segment, or in simple combination, or related by dependency, again according to the same basic criteria: segments with governing |V| are more sonorous than otherwise identical segments with dependent |V|.

Just as different writers have put forward different proposals for feature geometries in this and other areas, so there have been various suggestions within dependency phonology for the appropriate characterization of the major class categories. The most familiar proposal is that of Anderson and Ewen (1987), the basic elements of which can be found in one of the earliest publications in the framework, Anderson and Jones (1977). Den Dikken and van der Hulst (1988) offer an alternative to this proposal, and the most recent statement is that of van der Hulst and Ewen (1991). I will not devote space here to an extensive comparison of the various proposals (see van der Hulst and Ewen 1991 for a brief discussion), but will instead consider those aspects which are common to all three, and indeed to other suggestions within dependency phonology.

Common to these approaches, then, is the claim that the major class categories are characterized by various combinations of |V| and |C|. However, although |V| is primarily associated with sonorancy, and |C| with consonantality, they also subsume the other major class and manner properties, such as continuancy, stridency and "approximation" (in terms of the feature system proposed by Clements 1987), as well as the source feature [voice]. All these features are involved in sonority-based processes, and are therefore viewed as contributing to the relative sonority and consonantality of the various segment-types. Thus the sonority of a segment at the consonantal end of the scale can be increased by various means, e.g., by the addition of voicing, or by reduction of the degree of stricture. In both cases, this involves the representation becoming more "mid;V|-like," either by addition of |V |, or, as we shall see, by increase in its relative prominence.

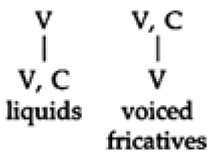
To illustrate the principles involved in the representation of the major class and manner segments, I consider here the system proposed by Anderson and Ewen (1987). As in the representation of vowels, the extremes of the sonority scale have the simplest representations. Thus, vowels as a major class are represented with |V| alone, corresponding to the fact that they constitute the maximally sonorous class, and voiceless stops, the optimal consonant class, are |C| alone. All other major classes contain combinations of the two components, with the representations of nasals, voiceless fricatives, and voiced stops all involving different relations:

(7)



The voicing of a stop thus involves the addition of |V| in dependent position, while, in comparison with vowels, the representation of nasals shows a dependent |C|, corresponding to the oral closure. The continuancy of the fricative as opposed to the stop involves addition of |V| at the same hierarchical level; the resulting node |V, C| is the formal representation of continuancy. The association of particular configurations with particular phonetic properties leads to an interpretation of the concept of natural class, as well as to other representations of major classes, shown in (8):

(8)



In the context of this survey of dependency phonology it is not appropriate to consider the motivation for the individual representations. We should, however, note certain aspects of the system. In the first place, |V| may occur more than once in a representation, as in the case of voiced fricatives, which involve both voicing and continuancy. This is a property not found in the vowel representations in section 2.1.

Second, it is clear that relative sonority can be straightforwardly derived from the representations: in (8), the representation of the more sonorant category, liquids, shows a greater “preponderance” of |V| than that of the voiced fricatives. Application of this property to the analysis of phenomena such as lenition and syllable structure can be found in various publications, to which the reader is referred for discussion.[9]

Third, given that the “vowel” feature |a| and the “major class” feature |V| are both defined in terms of sonority, it has been suggested that these are in fact the same feature, occurring within different domains, in much the same way that Clements and Hume propose in chapter 7, within a feature geometry model, that the set of vocalic and consonantal place features is the same, but occur twice in the feature geometry, dominated by different class nodes.[10]

The fourth point involves the relationship between relative sonority and complexity of structure, mentioned above. We have seen that phonologists have argued that complexity of structure can be associated with degree of sonority, in such a way that more sonorous segments have less structure (Harris 1990), or the reverse (Rice 1992).Dependency phonology, as represented by Anderson and Ewen (1987), takes a different standpoint: structural complexity is associated with phonological complexity in rather traditinal Jakobsonian terms, akin to concepts of markedness. Less marked segments are structurally less complex (fewer features, and/ or no utilization of the dependency relation) than more marked segments. Crucially, the notion of structural complexity, as we saw above with respect to vowel representations, has its basis in factors independent of the notation; like any system based on unary features, dependency phonology claims that the features which appear in the representation of a particular segment are those which are salient to its production. As such, the claims which Rice (1992) makes, i.e., that "the model of representation proposed here provides a learning path based on increasing complexity," would also be claimed to hold of dependency phonology. This approach leads to a very different interpretation of lenition from that of Harris, who notes (1990, p. 265): "under an element-based analysis, lenition is defined quite simply as any process which involves a reduction in the complexity of a segment." Such an analysis is not available to dependency phonology, in which intervocalic (i,e., sonority-increasing) lenition can involve increase in complexity (e.g., stop becoming fricative) or decrease in complexity (fricative or liquid becoming nonsyllabic vowel).

A further characteristic of the theory is that the set of major class representations proposed in Anderson and Ewen (1987) allows the sequence of segments within onsets and rhymes to be read off from the representations themselves. The segments within these constructions do not require to be underlyingly ordered, given that the canonical ordering of segments within the syllable is determined by relative sonority (see Anderson 1987).

3 Other Interpretations of the Dependency Relation

As I have already noted, the concept of dependency was originally introduced into phonological representations within the model of dependency phonology. In recent years, however, the notion has been appealed to within other approaches, two of which I consider in the following subsections.

Let us first, however, consider rather more closely what is meant by the dependency relation of dependency phonology, with respect to segment-internal structure. It is a relation holding between two elements - features - which characterizes the relative contribution of each element to the segment. Thus, as we have seen, in a vowel in which the frontness feature governs the sonority feature, the frontness feature contributes more to the segment than on in which the reverse dependency relation holds.

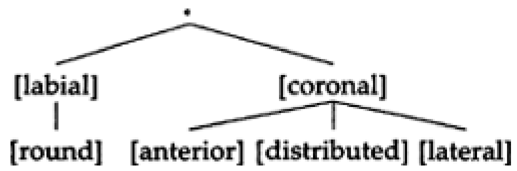
Much the same can be said of the characterization of secondary articulations. Although we have not here considered the characterization of place of articulation in dependency phonology,[11] it is clear that dependency can be used to characterize the relationship between the primary articulation and the secondary articulation in, say, the velarized alveolar lateral [ɫ]. The primary (alveolar) articulation, which, by definition, is of a greater degree of stricture than the secondary (velar), contributes more to the segment, and thus the representation of the primary articulation will govern that of the secondary articulation. Again, the motivation for the dependency relation is derived from the "content" of the segment. In what follows, then, I will refer to the relation of dependency phonology as *inherent dependency*.

3.1 Structural Dependency

Other theories of phonological representation make use of the term "dependency," in particular various recent versions of feature geometry. Given the title of McCarthy (1988), "Feature geometry and dependency," we might expect the concept to play a central role in this theory. And this is indeed the case: the dependency relation of feature geometry is a relation holding between features on different tiers, and is thus referred to as feature dependency, or dependent tier ordering. Paradis and Prunet (1991, p. 5) observe that "a node or feature X immediately dominated by a node Y is said to be a dependent of node Y." Thus, as pointed out by van der Hulst (1989, p. 258)," immediately dominate" and "depend" are used as complementaries.

McCarthy (1988, p. 98) notes that "by the logic of the dependency relation, the presence of a subordinate or dependent feature entails the presence of the superordinate or dominating feature" (see also McCarthy and Taub 1992). This claim can be illustrated by reference to (9), from McCarthy (1988, p. 103):

(9)



Here, [anterior] is said to be a *dependent* of [coronal], [round] a dependent of [labial], and so on. The interpretation of this dependency relation is thus that a dependent feature can only occur if the feature on which it is dependent is also present. As both [labial] and [coronal] are unary in McCarthy's approach, consonants which are neither labial nor coronal lack these features, and therefore also their dependents.

This relation is clearly of a different type from that of dependency phonology, although there too it is true to say that the presence of a dependent implies the presence of the governor (but see van der Hulst 1990 for a proposal that segments may have "empty heads" in dependency phonology). In feature geometry, we are not dealing with inherent dependency, but with what we might refer to as "dependency of occurrence" or *structural dependency*. There is no claim that the *content* of the features involved is in any way affected by the dependency relation: the dependent feature is in no sense less prominent than the "dominating" feature. Rather, the interpretation of the dependency relations represents an attempt to formalize the constraints holding on the human articulators. To that extent, it leads to a universal feature geometry.

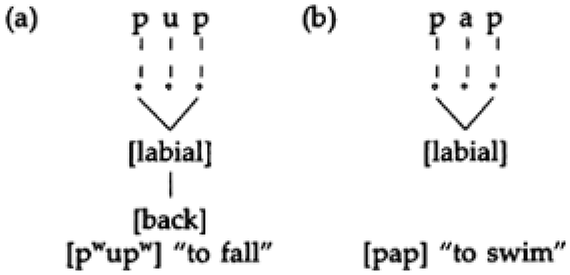
3.2 Parametric Dependency

The notion of dependent tier ordering is sometimes given a less rigorous interpretation than in McCarthy's account. Mester (1988, p. 127), for example, notes that "dependent tier ordering means that a hierarchical organization is imposed on the set of features," as in (10). (Here and in what follows I adapt Mester's formalism so that it more closely approximates that used above.)

(10)

In (10), "individual features, while occupying separate tiers, are not entirely autonomous and are dependent on other tiers which have a more central location" (ibid.). Thus [back] is dependent on [high]. These features are binary in Mester's approach, so that the crucial notion here is that the behavior of a dependent feature may be determined by the feature immediately dominating it. Mester's arguments are primarily concerned with Obligatory Contour Principle effects, such as those involving [labial] in Ponapean, a language in which all labials within a morpheme must agree in their specification for velarization. He assumes that velarization involves the presence of a feature [back], which is dependent on [labial]. The OCP determines that there will be only a single specification for [labial] for each morpheme. As [back] is dependent on [labial], it is affected by the same constraint; that is, an OCP effect on any feature automatically carries through to its dependent, as in (11), which shows the only two possibilities involved:

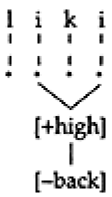
(11)



In (11a) the whole morpheme is velarized; in (11b) it is not.

Although the details of Mester's model differ from those of McCarthy, it is clear that we are dealing with largely the same kind of dependency here, which I have labeled structural. However, Mester goes further, by introducing the possibility of parametric tier ordering, or *parametric dependency*. His example concerns the relative ordering of the features [back] and [high] in the two languages Ngbaka and Ainu, both of which display vowel co-occurrence restrictions. In Ngbaka, vowels of the same height must agree in backness, a situation which Mester represents by the use of dependent tier ordering and the extension of the OCP to dependent features in the way described above. Thus (12) is well-formed in Ngbaka:

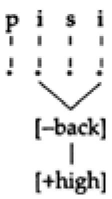
(12)



A morpheme with vowels which are [+high] but which differ in backness is thus correctly characterized as nonoccurring.

In Ainu, however, we find a situation in which vowels with the same value for [back] must agree in height. Thus two front vowels occurring in a morpheme must be identical (there are no front rounded vowels in Ainu). This situation can be characterized in the same way as in the Ngbaka case, but only if the dependency relation between the two features is reversed, as in (13):

(13)



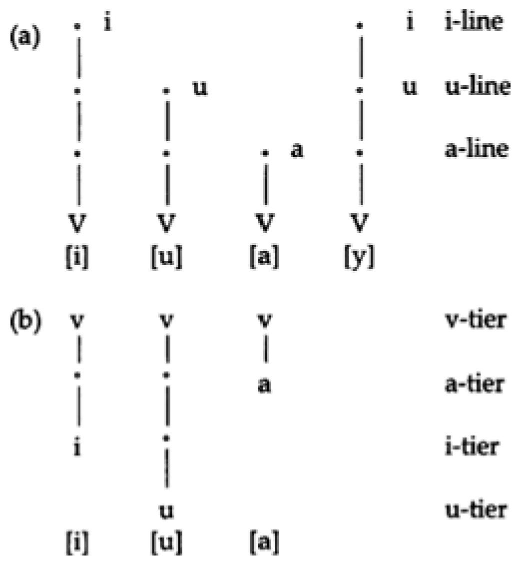
This type of parametric dependency is even further from inherent dependency than is the structural dependency more commonly found in feature geometry.

4 The Place of Dependency Phonology in Nonlinear Phonology

It will be clear from the above that this writer considers dependency phonology to fall squarely within the research program of nonlinear phonology. However, as noted above, the relationship between the formalisms of dependency phonology and feature geometry is not straightforward: the two models propose fundamentally different types of structural relation. Nevertheless, various attempts have been made to incorporate inherent dependency representations into a feature geometry, and I conclude this contribution by briefly discussing a few of these.

One approach involves the organization of the | i u a | components on tiers or "lines," reminiscent of those proposed in government phonology (Kaye, Lowenstamm, and Vergnaud et al. 1985). (14a, b) show the structures proposed by Durand (1990, p. 301) and van der Hulst (1989, p. 267), respectively:

(14)



The space available here does not permit me to discuss these models. However, both proposals involve the introduction into the dependency phonology model of "structural dependency" as found in feature geometry. Durand notes that the vertical lines in (14a) "no longer indicate dependency but geometrical anchorage," while for van der Hulst the tiers are in a "dominance" relation. The reader is referred to the sources for a defense of the two different feature hierarchies proposed in (14).[12]

In a similar vein, van der Hulst and Ewen (1991) suggest that the major class and manner features |V| and |C| can be assigned a geometry incorporating structural relations other than simple dependency.

It is clear that much remains to be done in reconciling the formalisms of dependency phonology and feature geometry. Nevertheless, I hope to have shown that the differences between them are not such that dependency phonology is incompatible with other non-linear approaches, and, indeed, that interaction between the various models can lead to a better understanding of phonological structure.

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1 I ignore here the question of how prominence is to be measured.

2 The claim that sonorant consonants are inherently more prominent than nonsonorant consonants requires more detailed phonetic justification than is possible here.

3 Furthermore, factors other than relative prominence may be invoked in characterizing dependency. Anderson (1986, sec. 6), for example, proposes that the head of clusters like those in (2) should not be the consonant with the greatest inherent sonority, but rather the most "consonantal" segment, so that in (2a) /t/ would govern /r/, and in (2b) /k/ would govern /ŋ/.

4 But see Lass (1984, pp. 278–279) for the view that complexity should *not* be encoded in phonological representations, and the conclusion that the feature of dependency phonology should be replaced by the

features |ɯ| ([velarity]) and |ω| ([labiality]/[roundness]).

5 I assume that high vowels also acted as input to the process, but that they did not undergo raising because of their height specification.

6 I ignore here the question of the precise way in which segmental representations such as those in (3) are incorporated into the suprasegmental representations in (1) and (2).

7 Here, and in what follows, I ignore the problem of the representation of length; I am merely concerned with the content of the features and segments involved.

8 See section 4 below for a brief consideration of the relation between feature geometry and dependency phonology.

9 E.g., Anderson and Ewen (1987, chap. 4).

10 In work in progress, Harry van der Hulst makes the further claim that |C| in the major class gesture can be equated with |i| in the articulatory gesture.

11 But see, e.g., Anderson and Ewen (1987, chap. 6). Smith (1988) proposes a dependency interpretation of place of articulation utilizing the components | i u a |.

12 Van der Hulst's hierarchization of the vowel features forms part of a more general approach to dependency phonology (see van der Hulst 1988, 1989), in which he incorporates the proposal that the phonetic interpretation of a particular component differs according to whether it is a head or a dependent feature. Thus |i| has a different interpretation (palatal constriction) in governing position than in dependent position (ATR). See both works for discussion.

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