1. Introduction*

In this paper I describe the rough outlines of a theory of segmental structure, with particular attention to the representation of phonological complexity within such a theory. Examples of segments which have been traditionally referred to as 'complex' in the literature are consonants with secondary articulation, like /pʰ/ or /kʷ/, affricates (/pf/, /ts/), segments which contain two simultaneous articulations such as labial-velars (/kp/, /w/), and pre- or post-nasalised stops (/d̪/, /b̪/). Vowel segments can also be complex, as will be seen below. Finally, /s/ plus stop onset clusters have at times been regarded as a type of complex units (Ewen 1982). All these categories will fall into place in the model that I will propose.

This paper is organised as follows: in section 2 I lay out the basic assumptions that underlie the model that I argue for. In section 3 I propose a general definition of complexity in phonology, and point out that the model proposed allows for three types of complexity. I will call these types plane doubling, colour mixing, and multiple stricture; these terms will be explained and illustrated below. Here I also propose a general definition of simplicity in phonology. Section 4 briefly sums up the results.

2. Assumptions

I assume that linguistic structure in general is organised into planes. For instance, there is increasing evidence that syntactic and phonological information are arrayed on co-existing planes, which can refer to each other (cf. Inkelas & Zec 1990). In the same spirit, there is evidence that the planar organisation in phonology is roughly as follows (cf. Sagey 1986:19 and references cited there):

The x's in (1) represent some kind of skeletal units, for which various interpretations have been proposed in the literature. In this paper I will focus on the segmental plane and its internal structure, where I use the word 'plane' to refer to the subtrees by way of which vowels and consonants are represented.

In a number of recent studies evidence is presented for a further subdivision of the segmental plane into separate consonantal and vocalic planes (cf. Archangeli 1983, 1984, 1985, Smith 1985, McCarthy 1989, Clements 1989, etc.). That is, in these follows consonants and vowels are also represented on co-existing planes. At the same time, however, there is growing agreement that the same phonological primitives should be used for the representation of Place in vowels and consonants (cf. Smith 1988, Clements 1989, Pulleyblank 1989, etc.). Of course, the two issues are separate: the division into consonantal and vowel planes may be correct without it being true that the same Place primitives must be used on both planes, or vice versa. In this paper I assume that both assumptions are correct, and I will attempt to show that using the same primitives for Place in consonants and vowels can in fact be derived from using planes.

Both assumptions are also implicit in the model for segmental structure advanced by Clements (1989). This model is given in (2):
As can be seen in (2), approximately the same sets of features appear under the C-place node and under the V-place node. However, that these sets should be roughly identical is a stipulation in this model, and I will make an alternative proposal below. To see that the Clements model also defines separate planes for consonants and vowels, consider the fact that the node labelled 'supralaryngeal' in (2) is neither necessary nor well-motivated, as has been pointed out by McCarthy (1988) and Iverson (1989). If we omit this node, the model in (2) can be schematically rewritten as (3) (cf. Gussenhoven & van de Weijer 1990):

(3)  

\[
\begin{align*}
\text{L/T} & \rightarrow \text{root} \\
& \rightarrow \text{segmental primitives : \{x y z\}} \\
& \rightarrow \text{Place} \\
& \rightarrow 'C\text{-plane}' \\
& \rightarrow \text{root tier} \\
& \rightarrow \text{Place} \\
& \rightarrow 'V\text{-plane}' \\
& \rightarrow \text{segmental primitives : \{x y z\}} \\
\text{L/T} : \text{Laryngeal and/or Tone features}
\end{align*}
\]

In the model in (3), the sets \{x y z\} on C- and V-plane indicate identical segmental primitives, of whatever type. Below I propose that the features representing Place are not binary features, as in (2), but the unary features or 'elements' \{A I U\} of Dependency Phonology (DP). This permits a restrictive statement of segmental complexity.

In a model with separate planes for consonants and vowels, vowels constitute a single event on the V-plane, and consonants a single event on the C-plane. This raises the question what it means when a segment consists of events on both planes. Before answering this question in section 3, I wish to point out that in such a case a head-dependent relation holds between the two planes. The head-dependent relation is independently motivated: it holds between any two categories of the same type that are gathered into a single construct (see Anderson & Ewen (1987) for extensive discussion). I propose that in a segment with both C- and V-plane, the plane which is head determines the major class status of the segment as a whole. That is, a segment with both planes in which the C-plane is head is a type of consonant, and a segment with both planes in which the V-plane is head is a type of vowel.

Although the C-plane and the V-plane in (3) would seem to be mirror images of each other, it is important to observe that they have different structural properties. These concern the place of operation of certain groups of features. The laryngeal features, for instance, appear appropriately placed on the C-plane, because laryngeal contrasts are typically — though certainly not exclusively — contrasts between consonants. Tone features, on the other hand, are traditionally used for vocalic segments, i.e. belong to the V-plane. I will say that a feature or group of features operates on a plane if it is able to induce attested phonemic contrasts on it.

Manner features (like [continuant] and [strident]) operate on the C-plane, because these features only have a contrastive function for consonants. The one feature for which this is not so clear is [nasal], which would seem to distinguish oral from nasal stops, as well as oral from nasal vowels. It is possible, however, that a nasalised vowel also consists of representations on
two planes: its Place features would then be on the V-plane, and its feature [nasal] would be on the C-plane. Because nasalised vowels diachronically always seem to derive from oral vowels followed by nasal consonants, this biplanar representation seems to be well-motivated. Note, however, that this would be the only case of a Manner feature being realised on a vowel.

To introduce some more terminology, I will say that laryngeal and Manner features are inherent properties of the C-plane. Inherent features are fundamentally different from projected ones, which a segment is assigned in underlying representation. Projection may take place either onto the C- or onto the V-plane. I propose that Place features are projected features. For instance, if the element U is projected onto the C-plane it will (possibly together with other features) define a labial consonant. If projected onto the V-plane, it will (possibly together with other features) define a rounded vowel.

Some evidence for the division of the feature set into inherent and projected features can be found in the analysis of disharmonic roots in Turkish, but it would go beyond the scope of this article to review this evidence in detail (the reader is referred to van de Weijer (1991a) for a fuller discussion). Consider furthermore the fact that in underspecification theory (Archangeli 1984, Kiparsky 1982, 1985, and others), segments are also provided with segmental content (usually Place features) in the course of the derivation by means of redundancy rules. My proposal is to push this idea to its extreme: all Place features are projected onto segment positions, both within the lexical representation and in the course of the derivation. By projecting Place features onto either the consonant or the vowel plane (or both, as was noted above), I derive the fact that the representation of Place in consonants and vowels is achieved with the same set of primitives.

One other aspect of the model in (3) must be pointed out. Nodes like those labelled 'Place' must be well-motivated, because their presence entails the possibility of branching beneath it. In the course of this paper it will become clear that there is no need to take recourse to such Place nodes for the adequate representation of phonological segments, so that on grounds of restrictiveness they, too, should be left out. I claim that it should not be necessary to introduce extra devices into a theory which is adequate for segmental representation. The result is that when segmental primitives are projected, they attach directly to the root node. The model in (3) can thus be re-written as (4):

\[
\begin{tikzpicture}
  \node[link] (4) at (0,0) {\text{Manner features operate on the C-plane}};
  \node[link] (m) at (0,1) {\text{the Place primitives \{I A U\} are projected features}};
  \node[link] (c) at (-1,2) {\text{Ma}};
  \node[link] (a) at (0,2) {\text{Ma}};
  \node[link] (u) at (1,2) {\text{Ma}};
  \node[link] (r) at (-2,3) {\text{root}};
  \node[link] (v) at (2,3) {\text{root}};
  \node[link] (l) at (0,3) {\text{root}};
  \node[link] (w) at (1,3) {\text{root}};
  \draw[link] (r) -- (c);
  \draw[link] (a) -- (l);
  \draw[link] (u) -- (w);
  \draw[link] (c) -- (v);
  \draw[link] (l) -- (m);
  \draw[link] (w) -- (m);
  \draw[link] (v) -- (m);
  \draw[link] (c) -- (l);
  \draw[link] (l) -- (v);
  \draw[link] (v) -- (w);
\end{tikzpicture}
\]

The model in (4) is the proposal for segmental structure that I will take as a starting-point for the investigation of complexity that is the major concern of this paper.

3. Complexity as branching

I propose that complexity in phonology in general is the result of branching. All types of complex segments mentioned in the introduction involve some type of it. Branching is formally defined as the presence of more than one entity under a single node, and may be depicted as follows:

\[
\begin{tikzpicture}
  \node[link] (5) at (0,0) {\text{\(\alpha\)}};
  \node[link] (b) at (1,0) {\text{\(\beta\)}};
  \draw[link] (\alpha) -- (\beta);
\end{tikzpicture}
\]

In the model in (4) above, branching can only take place at the level of the
root node. I regard this as an advantage, because the fewer possibilities for branching there are, the more restrictive the model will be. In this respect, the model compares favourably with that of Clements (1989), given in (2) above, where branching can take place under a much larger number of nodes. This causes overgeneration in the model, because it allows the representation of a great many more segments than are actually attested. Extra stipulations are required to rule these out.

If (5) is applied to the model in (4), \( \alpha \) and \( \beta \) will either be Manner or Place features. Recall that in a group of two phonological entities organised under the same node a head-dependent relation holds. This relation may be contrastive, that is, if two segments both consist of \( \alpha \) and \( \beta \), the segment in which \( \alpha \) is head is a different segment than that in which \( \beta \) is head.

I should also point out that there is no \textit{a priori} reason why \( \alpha \) could not be identical to \( \beta \) in (5). That is, two segmental primitives I could be projected onto the same plane (cf. (9) below). While there is no reason why a head-dependent relation could not hold between the two primitives in such a case, this relation could not be contrastive. I will leave for further contemplation the question if an interpretation can be assigned to the presence of two identical Manner features in a single segment, parallel to the projection of two identical Place elements.

We can now be specific about what kinds of branching the model in (4) allows. I have already pointed out that both C- and V-plane may be present in the underlying representation of a segment. I will refer to this possibility as \textit{plane doubling}. I propose that plane doubling results in secondary articulation on consonants, e.g. /p\( \grave{\text{j}} \)/ or /k\( \grave{\text{w}} \)/ (namely when the C-plane is head), or in (short) diphthongs (when the V-plane is head).

Two other types of branching take place within a segmental plane. The second type of complexity results when two or more segmental primitives are projected onto the same plane. Following nomenclature in Dependency and Natural Phonology, I will refer to this as \textit{colour mixing}. For vowels, colour mixing results in vowels other than /a i u/, such as /\text{y} e \text{ø}/. Colour mixing on the C-plane results in consonants other than /p t k/, such as palatals and labial-velars, but also uvulars and retroflex consonants.

Thirdly, a segment is complex when it has more than one Manner feature in underlying representation. This is what I will call \textit{multiple stricture}. As Manner features operate only on the C-plane, multiple stricture is only an option for consonants. Among other things, it gives rise to affricates and pre-nasalised stops. The three types of complexity are illustrated in (6):

\[
\text{(6) } \quad \begin{array}{c}
\text{root} \\
\text{plane doubling}
\end{array} \quad \begin{array}{c}
\text{root} \\
\text{colour mixing}
\end{array} \quad \begin{array}{c}
\text{root} \\
\text{multiple stricture}
\end{array}
\]

In (6) and below, daughter nodes are represented at the same height only for presentational convenience. Of course, different phonological primitives occur on different, autosegmental tiers.

\text{A priori, combinations of different types of complexity are not ruled out, so that we expect that affricates with secondary articulation occur, pre-nasalised palatals, pre-nasalised stops with secondary articulation, and so on. This requires a more detailed study (cf. van de Weijer 1991b). I will now discuss the three types of complexity in some more detail.}

\subsection{3.1 Plane doubling}

In this section I investigate some issues associated with the first kind of complexity, that is, the presence of both planes in the underlying representation of a segment. If the C-plane is head, this results in secondary articulation. Examples are given in (7):

\[
\begin{array}{c}
\text{root} \\
\text{[cont]} \\
\text{[stop]}
\end{array}
\]

\text{In (6) and below, daughter nodes are represented at the same height only for presentational convenience. Of course, different phonological primitives occur on different, autosegmental tiers.}

\text{A priori, combinations of different types of complexity are not ruled out, so that we expect that affricates with secondary articulation occur, pre-nasalised palatals, pre-nasalised stops with secondary articulation, and so on. This requires a more detailed study (cf. van de Weijer 1991b). I will now discuss the three types of complexity in some more detail.}

\subsection{3.1 Plane doubling}

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There appear to be four major types of secondary articulation, namely labialisation, palatalisation, velarisation, and pharyngealisation (Ladefoged 1982, Maddieson 1984). These four types correspond straightforwardly to the three primitives U, I and A, in that order, of Dependency Phonology, if velarisation and pharyngealisation can both be phonologically expressed as the presence of A. This is what is assumed here. It makes the prediction that the two kinds of secondary articulation cannot contrast, which is borne out for the languages surveyed in Maddieson (1984).

The theory proposed requires us to search for an interpretation of the same construct as that which characterises consonants with secondary articulation, but which has the V-plane as its head. I propose that this structure may represent short diphthongs. Recall that the head plane determines the major class status of the segment as a whole. Hence, the segmental element assigned to the C-plane (most usually I or U, parallel to predominant palatalisation and labialisation in secondary articulation) has no effect on the interpretation of the whole segment as a vowel. Vowels occurring by themselves are of course also manifestations on the vowel plane. Secondary articulation is thus identified with vowel features, and historically secondary articulation in fact almost always derives from earlier full vowels. Also, secondary articulation on consonants often interacts with vowels in terms of processes and constraints. In Gussenhoven & van de Weijer (1990) an investigation is presented of interaction between vowels and secondary Place features of consonants in the historical phonology of English.

Finally, it has become quite standard in nonlinear phonology to assume that glides (or semivowels) are vowels in non-peak syllable position. Thus, in our framework they are V-plane events, and it is predicted that these segments cannot have a second V-plane, and hence cannot bear contrastive secondary articulation. This prediction is correct (Maddieson 1984).

3.2 Colour mixing

Colour mixing refers to the presence of more than one Place primitive on one plane, whether this is the V- or the C-plane. As far as the V-plane is concerned, I refer to DP sources for arguments that vowels like /e o ø/ are composed of two or three of the elements {I A U}. In this sense, vowels like /e/ or /ø/ are complex segments:

\begin{equation}
\begin{array}{c}
\text{/e/} \\
\text{ root } A \\
\text{ I } \\
\text{ V-plane }
\end{array}
\end{equation}

\begin{equation}
\begin{array}{c}
\text{/o/} \\
\text{ root } A \\
\text{ U } \\
\text{ V-plane }
\end{array}
\end{equation}

If two elements are assigned to the V-plane, a head-dependent relation will hold between them, either by default, or to create phonemic contrasts, as in languages which have a four-height vowel system.

The question arises what interpretation must be given to the following contrast:

\begin{equation}
\begin{array}{c}
\text{root } I \\
\text{ I } \\
\text{ V-plane }
\end{array}
\end{equation}

Following van der Hulst (1988), I assume that a dependent I element signifies an ATR-distinction. That is, the representation in (9) with single I may characterise /l/, and the representation with two I elements may characterise
In languages which have both vowels, /i/, this vowel is adequately represented as just I. Interpretations for vowels with two U or two A elements are harder to find, however, and I have no suggestions to make at this point.

With regard to colour mixing on the C-plane, it is not hard to find evidence that projection of I, A, and U, gives coronal, dorsal, and labial consonants, respectively (cf. Pulleyblank 1989, Clements 1990). Palatal consonants are complexes of coronal and dorsal articulations, as Keating (1988) and Jacobs (1989) have shown on phonetic and phonological grounds. That is, these segments consist of the elements A and I. If a language has both palatal and palato-alveolar sounds, the head-dependent relation may be invoked to distinguish between the two: in palatals the element A would be head, in palato-alveolars it would be I.

I propose that the presence of the elements A and U results in labial-velar articulations like the labial-velar stop /kp/, which occurs in African languages, and the more familiar labial-velar approximant /w/. A head-dependent contrast between A and U in such a case could be used to distinguish labial-velars from labial clicks (with the element A head). However, more research on clicks produced at other places of articulation is necessary before any definite proposals can be made.

For the third combination, of the elements U and I, a number of interpretations are possible. One is that it represents labiodental sounds in languages which have both bilabial and labiodental fricatives, such as Irish or Twi (Maddieson 1984). However, it is also possible that this contrast should be expressed differently, for example as the projection of a single U element vs. two U elements, or as a stridency difference. Another interpretation of the combination of U and I is that it represents retroflex consonants, which are coronal, but also induce rounding in Dravidian languages (Clements 1990).

The presence of two elements A will result in uvular or pharyngeal consonants in languages which have a contrast between velars and uvulars or pharyngeals. Further study of languages which have velars, uvulars and pharyngeals, such as Kabardian (Maddieson 1984), is necessary to evaluate this proposal. The presence of two I elements, finally, may be used to represent dentals in languages which have dentals as well as coronals.

These are only tentative proposals, and many questions remain unanswered or have not even been thought of. Nevertheless, the framework seems powerful enough to generate a considerable variety of sounds, while at the same time it is clearly more restrictive than previous models.

### 3.3 Multiple stricture

I will now examine the last type of branching, namely multiple stricture. Let us consider affricates and pre-nasalised stops, both of which will be seen to fall under this heading. In Sagey (1986), both are analysed as contour segments, i.e. segments in which there is sequencing of opposite feature values. The feature involved is [+continuant] for affricates, and [+nasal] for pre-nasalised stops:

\[
\begin{array}{c}
\text{affricates} \\
[-\text{cont}] \quad [+\text{cont}] \\
\quad [+\text{nasal}] \quad [-\text{nasal}] \\
\text{pre-nasalised sounds}
\end{array}
\]

However, theoretical considerations and empirical evidence suggests that the representations in (10) cannot stand. The presence of contrary feature specifications within a single segment in this proposal seems limited to the features [+continuant] and [+nasal]. Apart from the fact that these features are both Manner features, they seem to have little in common, and the skewing of the feature set into two groups, the first of which contains [+continuant] and [+nasal], and the second all other features, is not motivated by Sagey. The two values of a feature like [+voice] or [+low] do not occur within a single segment; at least, Sagey does not consider this possibility.

There are more arguments against the representations in (10). One is provided by underspecification theory. This would presumably frown on the
presence of both feature values within one underlying system, and therefore also within a single segment. The representations in (10) are therefore anomalous even within the binary theory Sagey embraces. To this can be added that the sequencing of the two values of [±continuant] is completely predictable (the [−cont] part of the affricate invariably appears before the [+cont] part in phonetic realisation), so the information that these features are ordered should arguably not be present in the underlying representation (Kaye 1985). The same arguments hold for the feature [±nasal].

The representation of affricates in (10) has also been criticised on empirical grounds, most specifically by Hualde (1987, 1988, 1991) and Lombardi (1990) and their work provides the key to the solution for the problems that contour segments pose for both binary and unary feature theories. Hualde and Lombardi show that the [−cont] and [+cont] parts of an affricate cannot be ordered in underlying representation. In the process of Basque pre-stop stop deletion for instance, stops are deleted before other stops (where nasals and /l/ also count as stops, i.e. are [−cont]). The stop part of an affricate is also deleted before a stop. If analysed as an OCP effect, the [−cont] parts of trigger and target should be adjacent. Hence, the [+cont] and [−cont] parts of the affricate cannot be on the same tier (as they were in (10)), and hence the features [−continuant] and [+continuant] are best re-analysed as single-valued features [stop] and [cont], respectively. The revised representation of affricates is given in (11):

(11)

```
[stop]  [cont]
```

The representation in (11) conforms to the general definition of complexity, and I will adopt it. It predicts that [stop] and [cont] are not ordered in underlying representation, and therefore that phonological rules cannot refer to the 'edges' of an affricate. This accounts for the Basque 'anti-edge effects'. At some point, however, the features [stop] and [cont] must be ordered to allow for phonetic realisation, and after this the edges can be referred to.

An interesting issue is whether a head-dependent relation can hold contrastively between the two Manner features in (11). I would like to suggest that the head Manner feature determines, or is more closely related to, the Place features in a segment which is complex for Manner. In Basque affricates, for instance, the place of articulation of affricates corresponds to the place of articulation of (coronal) fricatives. Basque has apico-alveolar, prendorsal-alveolar and prepalatal fricatives (Hualde 1991), and affricates at the same places. In every affricate the stop part is the unmarked coronal /t/. Hence, the [cont] part of a Basque affricate is more closely related to its Place specification than its [stop] part.

We can speculate about the question arises what it means for [stop] to be head in a constellation like (11). A suggestion that I would like to make is that this is a way of representing /s/ plus stop clusters in languages in which these behave phonologically like unitary segments. For example, these clusters are not split up in languages that do not normally allow initial clusters (as in Turkish, according to van der Hulst & van de Weijer 1991, and dialects of Arabic, according to McCarthy & Prince 1989 AIO course class notes). They also behave like units in syllabification and alliteration (cf. Ewen 1982, and references cited there). In these complex units, then, the Place specification is more closely related to the [stop] part, and the continuant part is the unmarked coronal /t/. The phonetic sequencing of the two features is the same as for affricates, with the head feature coming last.

The elimination of affricates as contour segments raises the question whether the category is valid at all, i.e. whether p-nasalised segments cannot be similarly re-analysed. Sagey (1986) goes to great lengths to show that these are unitary segments, so approaches like those taken by Feinstein (1979) or Herbert (1986), who derive pre-nasalised stops from underlying sequences, seem unlikely to be correct. I would like to propose that p-nasalised stops differ from normal stops and normal nasals in that they are underlingly specified for both [stop] and [nasal]. Thus, the following underlying
representation is proposed:

(12)

```
root
\[nasal\] [stop]
```

p-nasalised stop

Again, the two features making up the complex segment are predicted to be unordered in underlying representation. Evidence bearing on this is hard to come by, but Mester (1986:45) argues that in Ngbaka \([-\text{nasal}]\) and \([+\text{nasal}]\) are not ordered underlyingly in a pre-nasalised stop. For the moment, I will assume that his argument can be extended to the \([\text{stop}]\) plus \([\text{nasal}]\) representation in (12), but remain on the look-out for further evidence. At some point, the two features must be ordered to allow for phonetic representation, in parallel fashion to affricates.

The representations in (11) and (12) utilise the unary features \([\text{stop}]\), \([\text{cont}]\), and \([\text{nasal}]\). When these features occur alone on a consonant, they define the natural classes of plosives, fricatives, and nasals, respectively. This is shown in (13), where the label 'Place' refers to one of the primitives A, I or U, and not to a node.

(13)

```
root
\[\text{Place}\] [stop] [cont] [nasal]
```

plosives fricatives nasals

These natural classes are represented by a one-to-one relation between Manner and Place features. In simple consonants, one stricture feature is mapped onto one Place primitive A, I or U. I propose that this one-to-one relation is the formal expression of simplicity in phonology. Increasing divergence from the one-to-one relation causes increasing complexity. Combination of two Manner features results in a two-to-one relation, and thus in a more complex segment. A combination of the three \([\text{nasal}, \text{stop}, \text{cont}]\), represents a pre-nasalised affricate, which also occurs in the world's languages, e.g. in the Amerindian language Mazatec (Maddieson 1984).

At the same time it should be pointed out that there are no constraints on the combination of these Manner features, in the same way as it is possible to combine all Place primitives. I regard the fact that free combination of all primitives produces attested segments as an advantage of the model proposed. Recall that the main disadvantage of previous models was that they massively overgenerated, that is, it was possible to represent segments that were not attested.

Let us, finally, return briefly to the Basque rule of pre-stop stop deletion. It provides interesting questions for the present theory (as well as for all theories taking underspecification seriously). In (13), nasals are represented as being just \([\text{nasal}]\) underlyingly, and not also as \([\text{stop}]\). The question therefore is how nasals and stops form a natural class, as in the Basque process. One possibility is that at some point \([\text{stop}]\) is assigned to simple nasals by a default rule, and that Basque pre-stop stop deletion takes place after the default rule. Another possibility is that both \([\text{nasal}]\) and \([\text{stop}]\) are instantiations of a higher-category primitive which we might call 'Closure'. The Basque rule would be sensitive to this node, rather than to the feature \([\text{stop}]\). I will not explore here the consequences that this might have for the organisation of the Manner node, if any (cf. van der Hulst & Ewen (1990), van der Hulst (1991) for discussion).

5. Conclusions

In this paper I have proposed a model for segmental structure which incorporates aspects of feature geometry models like that of Clements (1989), particularly planar representation, but which uses Dependency Phonology primitives \{A I U\} for its Place features. I hope this conjunction turns out
to be a felicitous one. If we assume that A, I and U are projected rather than inherent features, the idea that the same primitives are used for the representation of consonants and vowels follows without further stipulation.

Complexity in phonology was proposed to be a function of branching. The model proposed allows for three types. Simplicity is expressed as a one-to-one relation between Manner features and Place features. Increasingly complex segments increasingly diverge from this unmarked relation. In the course of events, the anomalous class of 'contour segments' (Sagey 1986) was abolished.

Footnotes

* Some ideas presented here were first explored in the AIO course *Segmental Phonology*, taught by Colin Ewen at the University of Leiden from 5 to 9 November, 1990. I would like to thank the lecturer and the other participants for stimulating lectures and discussion. I would also like to thank Wim de Haas, Harry van der Hulst, Grażyna Rowicka, Leo Wetzels and an anonymous LIN-reviewer for comments on a preliminary version of this article. The usual disclaimers are in effect.

1. If the laryngeal and tone features can be unified, as has been argued for on the basis of phonological phenomena like tonogenesis as well as articulatory phonetics (cf. Halle & Stevens 1971, Fromkin 1978, Sagey 1986, among others), its place as intermediate between the two planes (or connected, as a separate plane, to both) is well expressed in (3). My main concern in this paper is Manner and Place features.

2. The sense in which the term feature projection is used here is completely different from the sense in which Clements (1989) uses it. In Clements (1989), feature projection refers to an operation which copies a feature from one plane to another.

3. Note that it is not necessary to stipulate the possibility of two planes underlyingly: if planes are genuine phonological entities, it follows from the general expression of complexity in phonology, to be discussed below, that it is possible to have two under the root node.

4. Of course branching has always been used in metrical phonology as a determining factor for labelling certain syllables as 'heavy'. This heaviness is therefore the metrical parallel of complexity in segmental phonology.

5. In Sagey (1986), the feature [±continuant] is located under the root node, and [±nasal] under a 'soft palate' node. Figure (10) abstracts away from this.

6. The monovalent features [stop] and [cont] represent the two values of the formerly binary feature [±continuant]. Both these values define recurrent classes of sounds, namely stops and fricatives. The case is totally unlike that of features like [±nasal] or [±round], where there is large phonological skewing in favour of the perceptually salient pole, i.e. [+nasal] and [+round]. I therefore assume that having these two monovalent features is not contrary to the spirit of Dependency Phonology, in which primitives are monovalent.

7. The categories pre- and post-nasalised segment do not contrast in languages. A generic term to cover both suggested to me by Harry van der Hulst is 'p-nasalised' segment.

References


Hulst, H.G. van der (1988). The Dual Interpretation of \(|i|, |u| \) and \(|a|\). NELS 18, 208-22.


