John Anderson
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# Dependency Phonology

# Introduction to dependency phonology

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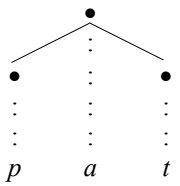
What follows is an attempt to initiate the reader into the central tenets of a particular approach to phonology, specifically to phonological structure, namely dependency phonology (henceforth DP), and to describe some of the consequences of these tenets for other aspects of phonology. The presentation will also endeavour, as it proceeds, to make comparisons with other approaches (with which, indeed, the reader may be more familiar) to whatever phenomena are under consideration at that point. These comparisons are distinguished from the main exposition by smaller type on a grey background. Unfortunately, such comparisons, as well as being brief, are limited for the most part to recent approaches, and then only a selection of those; but to look carefully at antecedents would overburden what is intended as an introductory exposition. Some previous introductory treatments of DP are Anderson & Ewen 1980, Lass 1984: ch.11, Anderson & Durand 1986, 1987, Clark & Yallop 1990: §10.15, Durand 1990: ch.8, Carr 1993: §11.3, Ewen 1995, 1996; the fullest expositions are Ewen 1980, Anderson & Ewen 1987.

## 1 Dependency, constructions and structural analogy

Central to the research tradition that has been characterised as 'dependency phonology' (DP) is a conjunction of assumptions concerning the representation of phonological phenomena. Most obvious is the assumption that gives the framework its name: the assumption that fundamental to phonological structure is the **dependency**, or **head/dependent**, relation. This means, in the first place, that phonological structure involves constructions, and that, secondly, each of these constructions has a determinate head. The head is also **atomic**; it is a single **segment**, or minimal unit. And it is associated with some substantive property that distinguishes it from other members of the construction; in phonology this is **perceptual salience**. The head is **characteristic** of the construction: the presence of the head distinguishes the construction type from other constructions. Thus we might say, as a first approximation, that the head of the **syllable** written as *pat* in English is the vowel represented in writing as *a*: it is salient by virtue of inherent sonority and its place at the energy peak in the articulation of the syllable, and it identifies the construction as a syllable. The initial cluster orthographically represented *spr* in English *sprat* does not contain a syllable head, and is not a syllable, though it is arguably a construction, a syllable onset, with strict restrictions internal to the construction (thus *spl-* and *str-* but no **stl-* in English) – to which we return in §3.

In dependency representations constituency is not a primitive: constructions are constituted by a head and all its ultimate dependents. The graph in (1) represents the syllable spelled *pat* as a (conventionally inverted) dependency tree rooted in the head element, with dependents as branches:

(1)




Each **arc** (or asymmetric line) in (1) and the like originates in a head node, which is conventionally distinguished by being superior in the tree to the node it is linked to, and terminates at the other end of the continuous line in a dependent. Each node in the tree is associated with a **categorial** representation, for the moment abbreviated by the orthographic symbol(s) that most commonly represent the category. This simple symmetric relation of **association** is represented by the discontinuous lines in diagrams like (1).

As the construction corresponding to (1) is defined by its head, there is no recourse in dependency representations to labels for constructions, which (as observed above) are not primitive; there are no 'pre-terminal' categories, such as 'syllable' or 'foot': a syllable, for instance, is a construction headed by a syllabic.

> In this respect DP differs from much work on 'prosodic structure', which is constituency-based, and invokes a hierarchy of constituent-types: cf. e.g. Selkirk (1984). 'Bracketed grid' representations, however, as in Halle & Vergnaud (1987), may approximate to dependency representations.

There are also no 'relational' labels associated with dependency trees. The relative strength of some property attributed to the various elements is not represented by labelling as, say, 'strong' vs. 'weak'. The salience associated with the syllabic is directly represented relationally, by the dependency arcs.

> 'Relational labelling' is associated with constituency tree representations in the tradition of 'metrical phonology' initiated by Liberman & Prince (1977).

In early work in DP the dependency relation was introduced as an analogy from the syntax, where the notion had been familiar for some time (cf. Anderson & Jones 1972/1974, Anderson & Ewen 1987: §3.1, Anderson 1992a: ch.2). Such analogies between levels have had an important part to play in the development of DP (cf. e.g. Anderson 1985, 1986a), and of dependency morphology (see e.g. Anderson 1980a, 1992a: §2.3, Colman 1985, 1994, 1996). Linguistic objects can be represented on different **levels**, where these different levels display distinct principles of organisation or have different domains. Thus we might recognise on either

(or both) of these grounds a distinction between a 'lexical' level and an 'utterance' level within the phonology (see below). A major distinction between levels of representation, a difference in **plane**, is occasioned by distinctiveness of the **substantive alphabets** out of which representations are built. These alphabets define in the first place the basic **elements**, words or segments, out of which structures are built; in syntax the alphabet is conceptually- or semantically-based, on the view taken within **notional grammar**, in phonology it is perceptually- or phonetically-based. Syntactic and phonological representations thus belong on different planes. Differences between levels are constrained by the **structural analogy assumption** (henceforth SAA), which has been adopted in work on DP: see e.g., apart from Anderson (1985), discussions in Anderson (1992a: particularly chs. 2 & 6), Anderson & Durand (1986), Anderson & Ewen (1987: §8.1) and Durand (1990: §8.2, 1995: §6), Staun (1996). This assumption is informally rendered as:

> **structural analogy assumption**
> The same structural properties are to be associated with different levels of representation except for differences which can be attributed to the different character of the alphabet involved (as in the case of planes) or to the relationship between the two levels (as may be the case with any pair of levels), including their domains.

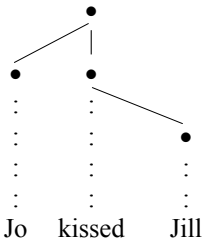
The alphabets of syntax and phonology differ in various ways, apart from being semantically as opposed to phonetically based. For instance, the categories of the syntax are very finely differentiable, on syntactic grounds; the categories that are appropriate to the phonology are much more limited. There is also usually considered to be an asymmetrical relation between the two planes; one way of formulating this is to take the phonology to be interpretive of the syntax. The SAA recognises only such bases for exception to the expectation that the same structural properties recur throughout linguistic representations.

> Such a view is not universally explicitly, or even implicitly, espoused, and it may be denied, at least as concerns transplanar analogy (cf. e.g. Bromberger & Halle (1989), who argue that 'syntax and phonology are essentially different' (1989: 69); also Carr (2000)); but see e.g. Anderson (1987a) on something of the history of 'structural analogy'.

Analogy works both transplanarly and, within planes, across levels. And the analogies can be quite detailed. Thus, phonology shares with syntax not just the appropriateness of invoking the dependency relation, but also motivations for distinguishing between dependency as **adjunction** and dependency as **subjunction**. It might be assumed that the dependency relation is always accompanied by a distinction in **linear precedence**, as in (1): the head is distinct in precedence from both its dependents, it occurs in a distinct position, it has them adjoined to it. But say head and dependent coincide in position. This is an appropriate representation, involving subjunction, when we want to say that an element is head of two successively more

inclusive constructions, as in the syntactic tree in (2), which assumes that we should distinguish in this way between 'sentence' and 'verb phrase' in English:

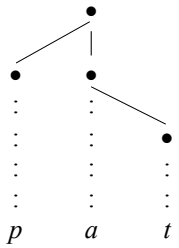
(2)




By virtue of a representation in which it is associated with a node which is subjoined to another, *kissed* is both head of the 'verb phrase' *kissed Jill* and of the whole sentence. This might seem to be difficult to reconcile with the characteristic, distinguishing role of the head. But notice, on the one hand, that the two constructions, sentence and 'verb phrase', remain distinct in other terms: *Jo* is a left-dependent and *Jill* is a right-dependent. Moreover, on the other hand, there are good reasons for regarding sentence and 'verb phrase' as variants of the same construction type, with the same head. In particular, *kissed* is subcategorised for both the 'subject', dependent on the head of the sentence, and the 'object', dependent on the head of the 'verb phrase'.

There are likewise motivations, the traditional ones associated with the **rhyme** as a constituent, for attributing a representation involving subjunction to our phonological example, spelled *pat*, and to modify (1) as in (3):

(3)



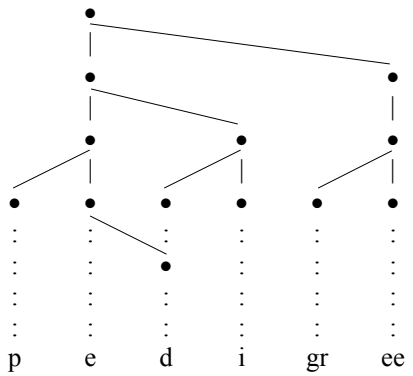

That is, the element spelled *a* is both the head of the syllable and the head of the rhyme, the **nucleus**. A final consonant is a necessary part of this particular rhyme. The nucleus represented by *a* is a checked, or 'transitive', vowel, whereas that in *pea*, *peat* is free; it need not be accompanied by a consonantal dependent. The structural properties shared here by the syntax and phonology go rather beyond simply sharing the dependency relation.

Carstairs-McCarthy, indeed, argues for 'the syllable as a model for sentence structure' (1999: 143) in evolutionary terms.

Both the adjunction vs. subjunction distinction and the 'transitivity' relation seem to be appropriate to both planes.

The vowel represented by *a* is successively head of the rhyme and the syllable. And headhood can extend to yet more inclusive constructions, as shown in (4):

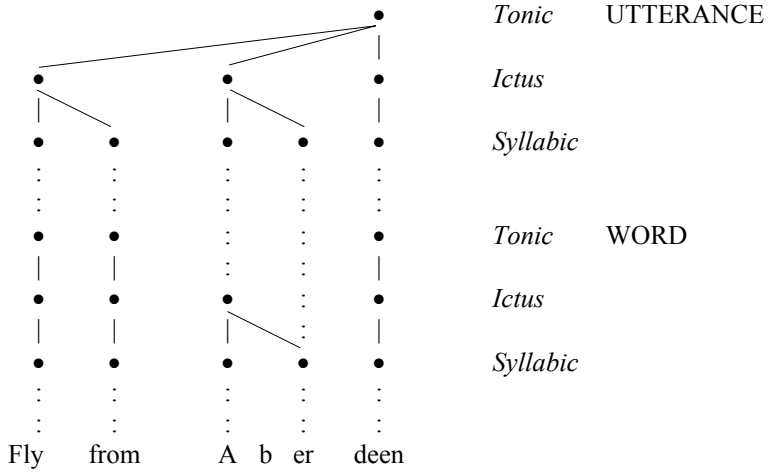
(4)




The first and the final vowels are both **foot**- as well as syllable-heads and rhyme-heads, and the initial vowel is also the **phonological head of the word**, the site of the **word-accent**. (This representation is somewhat simplified: see Anderson 1986a: §13. And it does not provide the internal structure of clusters.)

The representations in (2) through (4) instantiate quite detailed transplanar analogies involving the dependency relation. There are also obvious intraplanar analogies holding within the phonology between **lexical structure**, or word structure, as alluded above, and the structure of **utterances**. The same constructional hierarchy seems to be appropriate in both domains, as illustrated in the representation for *Fly from Aberdeen* given in (5):

(5)




Each level has, within its particular domain, the word or the utterance, the same successive constructions: syllable, with syllabic head, or **peak**; foot, with foot-head, or **ictus**; and word or tone group, with **tonic** head (word accent or group tonic). (Subsyllabic structure is omitted.) Not all word accents (word tonics) receive an utterance tonic or even an ictus. English suprasegmental word structure is non-contrastive, and may be projected from the segmental content of the lexical entry for the word. The status of utterance structure in this respect is a lot more controversial. We return to matters to do with contrastivity in §3.

Dependency has also been invoked in relation to the representation of the internal structure of segments, their intra-categorial structure, as well as to the representation of sequences, as in (1, 3 & 4). And this is again in accord with the structural analogy assumption. But before we consider this we must bring into the discussion a further, connected DP assumption concerning the representation of phonological structure. This is the assumption of **unarism** of the atoms of phonological representation.

## 2 Unarism, segmental structure and componentiality

Like many other recent approaches to phonological representation, DP analyses minimal sequential units, or segments, into component properties, generally known as **features**. The features of DP, often referred to as **components**, are atomic; they are thus single-valued, **unary**. These constitute the alphabet of the plane, and their combinations define categories.

> Many feature-based phonologies, however, regard the feature as having two values (represented [± F]), and some regard it as multi-valued. This assumption of binarism is central to the core tradition within 'generative phonology', from the adoption of the Jakobsonian features (Jakobson, Fant and Halle 1952, Jakobson &

Halle 1956) through the period of *The sound pattern of English* (Chomsky & Halle 1968: see particularly, ch.4) and the 'non-linear' reaction to it (as represented in e.g. the collections by van der Hulst & Smith 1982a, 1985, 1988) into many recent discussions, despite outbreaks of unarism in the representation of phonological or syntactic elements (e.g. Sanders 1972).

From the beginning work in DP has maintained a unarism analogical with the representation of syntactic features adopted in the 'case grammar' tradition that leads to recent work in 'notional grammar' (cf. already Anderson 1971).

The DP representation of minimal sequential units involves the combination of unary features, so that the 'classical' five-vowel system found in many languages (such as Greek) can be represented as to the relative location of the vowels in the perceptual vowel space as in (6):

(6)

| | | | |
|---|---|---|---|
| {\|i\|} | (= [i]) | {\|u\|} | (= [u]) |
| {i,a} | (= [e]) | {u,a} | (= [o]) |
| | {\|a\|} (= [a]) | | |

The 'phonetic values' given in square brackets are approximations only, and serve merely to indicate the rough differences in 'phonetic value' involved: for instance, in (6) '[e]' indicates a vowel that is not high and not low. The five vowels are differentiated by presence vs. absence of the unary **perceptually-based** features **i**, **u** and **a** (introduced in Anderson & Jones 1972/1974), which we can roughly associate respectively with a predominance of acoustic energy high in the spectrum, a predominance low in the spectrum and a concentration of energy centrally in the spectrum. What is traditionally described as a 'high front unround' vowel is characterised as invoking the presence of only the **i** feature, where 'only' is indicated by the **verticals** in the representation in (6); whereas the 'mid back round' vowel requires the presence of two such components. The peripheral vowels are represented as more 'basic'. This also embodies the claim that the simplex, or 'basic', vowels form a **triangular** system. **i** and **u** are sometimes distinguished as 'chromatic' or **tonality** components, as opposed to the **sonority** feature **a** with which they combine in (6) (Anderson & Ewen 1987: §6.1). Combination between the tonality components themselves is perceptually less optimal, but not uncommon, giving {i,u}, i.e. a front round vowel, [y].

Ewen and van der Hulst (1988) suggest a formal recognition of the grouping **i**, **u** vs. **a**. And we come back to this below. Adoption of unarism, and in particular the adoption of **i**, **u** and **a** as the 'basic vowels', is also associated with a number of other approaches to phonology, such as 'particle phonology' (e.g. Schane 1985, 1994), 'government phonology' (e.g. Kaye, Lowenstamm & Vergnaud 1985) and 'radical CV phonology' (e.g. van der Hulst 1989, 1994, 1995). These differ, however, in how the components may be combined, as well as in the identity of the components and other aspects of their organisation. 'Particle' phonology is

perhaps most distinctive in respect to the representation of vowels, in allowing only simple combinations of the particles but reiteration of the 'aperture' particle, **a**. The other frameworks, including DP, countenance asymmetric relations between components.

Within DP further distinctions are provided for by recognising that the components may be combined asymmetrically; one component is more **salient** than the other. This is appropriately represented as a dependency relation between the two components, as shown in (7), where the notation allows us to characterise systems with mid vowels:

(7)

| | | | |
|---|---|---|---|
| {\|i\|} | (= [i]) | {\|u\|} | (= [u]) |
| {i} | (= [e]) | {u} | (= [o]) |
| \| | | \| | |
| {a} | | {a} | |
| {a} | (= [ɛ]) | {a} | (= [ɔ]} |
| \| | | \| | |
| {i} | | {u} | |

{|a|} (= [a])

In the representation of the high-mid vowel [e], now distinctively high in relation to another mid vowel, '[ɛ]', the **i** component is more salient than the **a**, and it determines that the vowel belongs to the set of high vowels, vowels with predominant **i** or **u**, i.e. predominant tonality. Mid vowels are those represented by a combination of the sonority feature with a tonality one, as shown in (6) and (7). The notation thus allows for the representation of **natural classes**, classes whose members share a phonetic property and which recur in phonological formulations; it is intended to satisfy the **componentiality assumption** (Anderson & Ewen 1987: 8):

> **componentiality assumption**
> The representation of the internal structure of segments optimises the expression of phonological relationships ('classes', 'regularities') that are (a) recurrent and (b) natural

Thus the representation of the class of vowels containing **i** is simpler than the representation for any of the members of the class: the class is {i}; the members are {|i|}, {i;a}, {a;i}. If we denote a tonality feature as ¬**a** ('not-**a**'), where ¬ counts as a 'complexity-reducer', then we can represent the class of mid vowels in (6) as {a,¬a}, or simply as {a,}, any combination with **a**. The set of close, or 'absolutely high' vowels, [i] and [u], is {|¬a|}. The set of high vowels in (7), [i], [u], [e], [o], is {¬a;}, where ';' means 'preponderates', and which specification covers both a ¬**a**

that has a dependent and one that doesn't – they are both heads. The ';' notation is thus often used to represent dependency, so that alternative representations for the mid vowels of system (7) are as in (8):

(8) {i;a} (= [e]) {u;a} (= [o])
{a;i} (= [ɛ]) {a;u} (= [ɔ]}

An opposition involving a unary component is inherently **privative**, involving presence vs. absence of some property; but introduction of the ¬ operator to characterise tonality renders, exceptionally, the tonality/sonority opposition **equipollent** (cf. Harris & Lindsay 1995: note 2), an opposition between two properties. Privative oppositions make a more restrictive claim, in so far as reference to one member of the opposition is ruled out by its absence. The operator can be avoided in terms of e.g. Ewen & van der Hulst's (1988) proposal for a sub-gesture including just **i** and **u**, though this further extends the set of asymmetrical relations (dependencies) between gestures. Again, we return to this.

Lass (1984: §11.2) and Anderson & Ewen (1987: §6.2) discuss motivations for recognising a centrality, or **neutral** component, **ə**, which characterises central vowels in systems where the central vowel is not simply as 'reduction' vowel, representable as lacking a positive articulatory component (see §3.1).

This component roughly corresponds to the 'cold' vowel of Kaye *et al*. (1985).

And Lass further proposes replacing **u** with separate components for 'velarity' and 'labiality'/'roundness' – somewhat contrary to the spirit of system-relativity and the complexity measure, to both of which concepts we now turn.

Some representations are inherently more complex than others: the mid vowels are, as noted above, more complex than the peripheral ones. The most complex simple (non-dependency) combination is {i,u,a}, representing a mid front round vowel, [ø]. The representations thus directly reflect **markedness**, which is basically the 'accessibility' of a particular segment type or class of segments. This is manifested in its degree of recurrence in different languages and its relative earliness in first language acquisition (cf. e.g. Anderson 1997, Heijkoop 1998); but this cannot be measured cross-linguistically in a gross fashion (say, by counts of phonetic types), given that, within DP, the representation of phonetically the same segment will differ in systems with different membership, as might be the case with (6) and (7). It could be that these systems are associated with two different languages which have a phonetically very similar vowel represented as respectively {i,a} and {i;a} or as respectively {i,a} and {a;i}, given that {i,a} can be realised as anything in the general area of [e,ɛ]. Representations are system-dependent, or **system-relative**.

In recognising markedness, the feature notation of traditional generative phonology necessitates recourse to an extrinsic, stipulative apparatus of 'marking conventions' (see Chomsky & Halle 1968: ch.9; and, for some (not necessarily con

sensual) criticisms, Lass & Anderson 1975: app.IV, Lass 1975, 1980: ch. 2, Anderson & Ewen 1987: §§1.3.2-3). Allan & Bauer (1991) attempt to defend this apparatus and criticise the DP approach on the basis of a dubious notion of 'markedness inversion' and a misunderstanding of system-relativity.

Markedness reveals itself in various other ways. For instance, in perceptually problematical circumstances marked elements may be eliminated. We have **system-reduction**. This is exemplified by 'nasal influence' in the development of Old English. Old English is usually considered to have inherited from Germanic a maximal monophthongal vowel system of five short vowels and five corresponding long, of the familiar pattern of (6) above. To this was added a contrast between the low vowels and elements between them and the front mid ones, giving a pattern for the short vowels like (9) – though the new contrast in their case remains rather marginal (cf. Colman 1983):

(9)

| | | | |
|---|---|---|---|
| {\|i\|} (wið, 'against') | | {\|u\|} (buc, 'buck') | |
| {i;a} (hel(l)) | | | |
| | | {u,a} (God) | |
| {a;i} (æt, 'at') | | | |
| | {\|a\|} (ac, 'but') | | |

Further distinctions of varying lifespans were added by processes like *i*-umlaut. However, there is in Old English and other Germanic languages a persistent, though not consistently implemented (cf. Campbell 1959: §116), tendency for the system to be reduced before nasals, where Lass & Anderson suggest (1975: 73, n.1) that perhaps 'the extra formants in the transition to a nasal have an analogous effect' to low stress, also associated with system reduction (cf. e.g. Anderson 1996), where in the latter case 'the speed of articulation and relative lack of sonority function effectively as channel noise' (Lass & Anderson 1975: ibid.). This tendency results in elimination of non-unary combinations of elements; only the least marked vowels at the angles of the vowel triangle survive. The effects can be observed in a comparison of the partial paradigms of two strong verbs from the same class given in (10):

(10)

| | | |
|---|---|---|
| bregdan, 'brandish', *infin.* | brægd, *pret. 1* | brogden, *2nd part.* |
| bindan, 'bind', *infin.* | band, *pret. 1* | bunden, *2nd part* |

(*Infin.* = 'infinitive'; *pret. 1* = 'singular preterite indicative, 1st and 3rd person'; *2nd part.* = 'second participle'.) The 'expected' more marked vowels in the forms of the first verb are 'replaced' in those of the second, with post-vocalic nasal, by members of the unmarked set {|i|}, {|u|} and {|a|}.

The notation also allows rather transparently for the expression of the **gradience** of certain phenomena.

> This is the third of those of Trubetzkoy's (1939) opposition types that are based on the relationship between the terms of the opposition; recall privative and equipollent from above.

It is apparent from the representations of [i], [e], [ɛ] and [a] in (7/8) that in them the proportion of **a** present gradually increases, from absence through non-salience and salience to unique presence. Such gradience relates in an obvious way to the characterisation of 'chain-shift' phenomena, such as the English Great Vowel Shift (Anderson 1980b, 1992b – pace Stockwell & Minkova 1988), as well as to processes of 'weakening' and 'strengthening'. But in order to consider these latter we must introduce another aspect of segmental structure, neglected so far.

The vowel representations we have been concerned with so far are incomplete in so far as they do not characterise what these segments share as vowels, what distinguish them from consonants. Indeed, the components invoked in (6), (7) and (8) are not in themselves distinctive of vowels, but also enter into the characterisation of various consonant types (so that e.g. palatal consonants share the **i** component with front unround vowels). (6)-(8) constitute representations of only the **articulatory** gesture, which embodies the 'resonator' properties of the vocal tract. A **gesture** is a systematic grouping of features which interact by directly combining with one another, symmetrically or asymmetrically. Features from different gestures do not combine in this way; rather, there are associations between gestures as a whole.

> This notion was initially developed by Lass & Anderson (1975: Ch.6 & app.II) and Lass (1976: ch.6) with respect to binary features. A variety of proposals concerning 'feature geometry' that have been elaborated within frameworks based (like Lass 1976) on binary features (see e.g. Clements 1985, Hayes 1986, Sagey 1986, Clements & Hume 1995) can be seen as developments of this notion. Such groupings are not envisaged in Anderson & Jones 1972/1974. The components in this early work are more like the primes proposed by Foley (1977) and particularly those envisaged by Donegan (1978) and Kaye *et al*. (1985), which 'have autonomous phonetic identities which they can display without requiring support from other primes' (Harris & Lindsey 1995: 34). The 'gestures' of articulatory phonology (e.g. Browman & Goldstein 1985, 1989, 1992) are rather differently conceived, and are, of course, articulatorily based.

In DP vowels and different consonant types are differentiated within the **categorial** gesture, which we turn to now.

We can differentiate the various categories associated with 'manner of articulation', including voice, in terms of combinations of the two components, **V**, correlating with periodicity, presence of a well-defined formant structure, and **C**, involving reduction in periodic energy.

These features derive ultimately from Jakobson, Fant & Halle's 'fundamental source features' (1969: 18-9), [± vocalic] and [± consonantal], but the binarism of the latter is of course rejected, resulting in rather different claims being made concerning phonological categories.

Some basic representations are given in (9), wherein it can be seen that the proportion of **V** decreases from left to right:

| (11) | {V} | {V;(V:C)} | {V;C} | {(V:C);V} | {V:C} | {(V:C);(V:C)} | {(V:C);C} | {C;V} | {C} |
|---|---|---|---|---|---|---|---|---|---|
| | vowel | liquid | nasal | vd sibilant | vless sib | vd fricative | vless fric | vd pl | vl pl |
| e.g. | [a] | [l] | [n] | [z] | [s] | [D] | [T] | [d] | [t] |

vd = voiced
vl(ess) = voiceless
pl(os) = plosive

(Here and subsequently I suppress the verticals in segment representations where no ambiguity arises.) For a precise formulation of how 'proportionality' is to be calculated, i.e. of the appropriate complexity measure, see Anderson (1992a: ch.6 & §7.4). The representations in (11) are approximately as proposed in Anderson & Ewen (1987: §4.1); elsewhere in the literature, sibilant and non-sibilant fricatives are not necessarily distinguished in this way. (11) introduces a relationship of mutual dependency, notated as ':', where 'x:y' = 'x;y & y;x'. And (11) also contains second-order dependencies, as in the representation for the liquid, where the mutually dependent **V** and **C** are dependent on a further **V**. The sibilant fricative vs. non-sibilant fricative distinction is typically non-contrastive, being associated with a difference in place, an articulatory distinction; and we can generally refer to all fricatives in a particular system as having contrastively a non-dependent **V:C**: contrastively, we can generalise the sibilant specification. As noted, we look at contrastivity in §3.

Thus, as well as allowing the expression of natural classes and reflecting markedness, these representations define a hierarchy, the **sonority hierarchy**, manifested in processes of lenition, or **weakening**, approximation to **V**, and fortition, or **strengthening**, approximation to **C**. (12) gives a couple of examples of diachronic weakening:

(12) a. Latin *aqua* → Spanish *agua*

-k- → -g- → -ɣ-

{|C|} → {|C;V|} → {(V:C);V}

b. Old English *dragan* → Middle English *drawe* → Modern English *draw*

-ɣ- → -w- → -u- (→ *monophthong*)

{(V:C);V} → {V;(V:C)} → {|V|}

These show progressive approximation to a vowel intervocalically, i.e. in a highly vowelly environment. For more detailed exemplification of lenition processes in such terms see e.g. Ó Dochartaigh 1979,1980, Ewen 1982a.

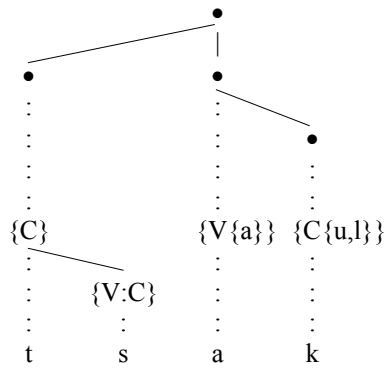
The representation of a segment thus involves both a categorial and an articulatory specification: so {V{i;a}} for [e]. I shall not illustrate here the components attributed to consonant articulation, which overlap with those we have discussed in relation to vowels; but see for various views e.g. Anderson & Jones 1977, Lodge 1981, Anderson & Ewen 1987: ch.6. In this last work too there is a discussion of further elaboration of the system of gestures, including in particular the division of the categorial gesture into **phonatory** (1987: ch.4) and **initiatory** (ch.5) **sub-gestures**. The former corresponds to what has been presented here as the categorial gesture. The latter contains components concerned with the differentiation of **air-stream mechanisms** and degrees of **glottal stricture**. Anderson & Ewen suggest too that gestures may be related asymmetrically. For alternative views of gesture organisation see Davenport & Staun 1986, Lodge 1986, Staun 1987, van der Hulst 1995: §3. We neglect here also the status of nasality and the proposed **oro-nasal sub-gesture** (Anderson & Ewen 1987: §6.9, Davenport 1993). Anderson & Ewen (1987: §7.5) add a **tonological** gesture, whose components are again **i** and **u**, corresponding to 'high' and 'low' tone. The attribution of at least some of the same features to different gestures (which is an interesting extension of the structural analogy assumption), also involved in Anderson & Ewen's suggestion that **a** is the articulatory equivalent of **V** (1987: §6.1.2), is pursued most radically by van der Hulst (1988a,b) and in subsequent work leading to 'radical CV phonology' (cf. above). Much else remains to be explored in the area of gesture organisation, however. It may be, for instance, given observations made above, that we should recognise a sub-gesture containing **i** and **u** and excluding **a**.

The distinction between categorial and articulatory, at least, again has its analogue in the syntax in the form of a distinction between **primary** and **secondary categories**, the former determining the distribution of an item, including its 'part of speech' (Anderson 1992a: ch.6), just like the phonological categorial gesture. In this case the distinction was explicitly drawn first in the phonology (cf. Anderson 1991a, 1992a: ch.5). The same kinds of combinations are available at all of these various grammatical levels, though the system of secondary grammatical categories remains under-explored. See on this, however, Böhm (1993) for a proposal that the secondary functor categories (distinguishing e.g. different cases or prepositions) may combine asymmetrically, just as the articulatory components can. Representations at the syntactic and phonological levels allow in the same ways for relations of

classification, markedness and gradience. Thus, for instance, the sonority hierarchy in phonology, involving decreasing **consonant-ness** in the examples in (12), is paralleled by a hierarchy of nouniness in the syntax: Ross (1973), in particular, has documented in some detail the hierarchisation of various categories – nouns, verbal nouns, action nominals, gerunds, infinitives, finites – with respect to their participation in various grammatical phenomena and how this correlates with degree of **nouniness**, where nouniness has an obvious semantic basis.

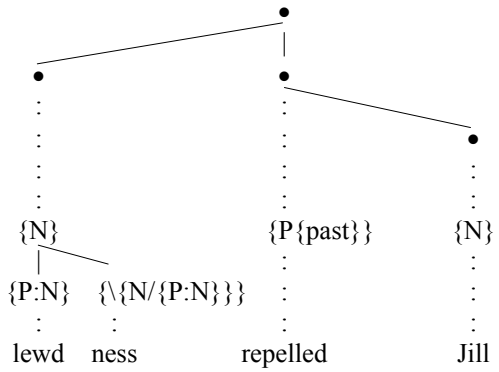
Elements on the two planes also share the property of including adjunctions as well as the subjunctions we have encountered thus far, paralleling the use made of the distinction in syntactic and suprasegmental structure: recall (2) and (3). **Element-internal adjunction** is appropriate for the representation of complex segments, such as affricates. So that we might represent the initial affricate in German *Zack* as in (13):

(13)




Alveolars are typically distinguished from other obstruents, as here, by the absence of an articulatory feature; {u,l}, 'grave' tonality + 'linguality' (Anderson & Ewen 1987: §6.6), is the specification for a velar. Compare with the **complex segment** in (13) the **complex word** in the sentence *Lewdness repelled Jill*, as represented in (14), which again simplifies the categorial characterisations involved, in the interests of aiming at a more transparent exposition of the analogy:

(14)




As indicated, the categorial details in (14) need not concern us; the specification for *-ness* tells us that it seeks to modify (= '\') a noun {'{N}', for present purposes) which is based on, has dependent on it (= '/') an adjective ('{P:N}'). In more traditional terms, *-ness* is a suffix which converts an adjective into a noun. (In a language like English, the unmarked affix is a suffix, just as the sequence of subelements within the affricate in (13) is determinate; so this need not be specified in the categorisation given in (14).) Categorial relationships get more complicated in the syntax, unsurprisingly; but we find in both planes an appeal to intra-element adjunctions, as well as the subjunctive dependencies described above. See e.g. Ewen (1982b) and Davenport & Staun (1986) for discussion of the characterisation of such complex segments in the phonology.

**3 Contrastivity**

Unary representations are inherently 'unevenly specified', in so far as elements and gestures consist of combinations of varying numbers of features rather than selections of feature-values for an omnipresent set of features, and some combinations will be simpler than others, thus defining markedness relations, as described above. Further, in DP a particular gesture within an element, and indeed a particular element, may contain contrastively no features at all; it is **unspecified**. Such an element may be selected as such on a fully general basis. Thus we can interpret Lass's (1976: ch.6) proposals concerning the glottal stop and the glottal fricative as involving respectively a stop and a fricative with unspecified articulatory gesture. Likewise, the neutralisation associated with a 'reduction vowel' can be represented as non-specification of articulation. Absence of features may reflect markedness, as with the treatment of alveolars embodied in the categorial representation in (13), if this is indeed universally appropriate (which is a controversial issue). However, in certain circumstances, selection of segments unspecified for a particular gesture may be system-relative. This is not necessarily to say that the selection is fully language-particular, in that it can be argued that in many cases the selection still follows from general principles.

### *3.1 Non-specification*

Ewen & van der Hulst (1985), Anderson (1988a, 1992b, 1994) and Anderson & Durand (1988a,b, 1993) have proposed that selection of an unspecified vowel is associated with asymmetries in the system, and that the non-specification resolves apparent asymmetries in the regularities, such as vowel harmony relationships, associated with the particular vowel system. Anderson & Durand (1988a: §5), for instance, suggest that the asymmetrical vowel system of Latvian, like other such systems, obeys certain **geometrical** principles. The vowel system, represented in terms of the articulatory components of DP, is as in (15):

(15) {i} (= [i]) {u} (= [u])
{i,a} (= [e])
{a} (= [a])

There are four vowels (though see Anderson & Durand 1988a: §5.4, for reservations which do not affect the analysis), distributed asymmetrically, in showing a gap at {u,a}. A geometric principle selects the vowel isolated by this asymmetry as unspecified; this is evidently {u}, whose sole component doesn't interact with the other components:

(16)

| *System geometry* | *Minimally specified element* |
|---|---|
| {X}, (X,a}, {a}, *{Y,a}, {Y} | {Y} |

'X' and 'Y' here are variables over the chromatic/tonal vowel components, and in the case of Latvian Y = **u**. So that, contrastively, the Latvian vowel system is as in (17):

(17) {i} { }
{i,a}
{a}

Morphophonological relationships that appear to be asymmetrical are regularised if they are conceived of as interpreting the system with unspecified vowel. This is the case with so-called Latvian accusative raising. In Latvian, noun stems can end with any of the four vowels in (15/17), but with feminine stems only three of them are found finally in the stem and with masculines likewise only a non-identical set of three, as exemplified by the locative and dative singular forms in (18) and (19) respectively:

| (18) | | 'sister' | 'mother' | 'fish' |
|---|---|---|---|---|
| | *sg. loc.* | maasa-a | maate-e | zivi-i |
| | *sg. dat.* | maasa-y | maate-y | zivi-y |
| | *sg. acc.* | maasu | maati | zivi |

| (19) | | 'horse' | 'market' | 'swan' |
|---|---|---|---|---|
| | *sg. loc.* | zirga-a | tirgu-u | gulbi-i |
| | *sg. dat.* | zirga-m | tirgu-m | gulbi-m |
| | *sg. acc.* | zirgu | tirgu | gulbi |

If we compare these *forms* with the accusative singular forms given last in (18) and (19), the stem final vowel in some of the latter seems to have undergone a rather strange 'mutation', if we represent the vowels as fully specified, i.e. as in (15). This is diagrammed for the feminines in (20) and the masculines in (21), where at least the 'mutations' in the two sets are not inconsistent with each other:

| (20) | {a}/[a] | → | {u}/[u] |
|---|---|---|---|
| | {i,a}/[e] | → | {i}/[i] |
| | {i}/[i] | → | {i}/[i] |

| (21) | {a}/[a] | → | {u}/[u] |
|---|---|---|---|
| | {u}/[u] | → | {u}/[u] |
| | {i}/[i] | → | {i}/[i] |

Say, however, we consider this morphophonological relationship to be holding between sub-systems in which the duly selected vowel is unspecified. Then the simple generalisation given in (22) covers all the cases in which the stem-final accusative vowel system differs from the general one:

(22) **Latvian accusative raising**: Suppress any **a** present

Application of his gives the results for feminine and masculine stems in Latvian shown in (23) and (24) respectively:

| (23) | {a} | → | { } |
|---|---|---|---|
| | {i,a} | → | {i} |
| | {i} | → | {i} |

| (24) | {a} | → | { } |
|---|---|---|---|
| | { } | → | { } |
| | {i} | → | {i} |

All the elements left unspecified on the right of (23/24) are realised as {u}/[u].

The works cited at the beginning of this section provide more extensive illustration of the principles involved in non-specification of both gestures and individual features. Anderson (1994), for instance, provides an analysis of English with **minimal substantive specification** of elements and relations which invokes non-specification based on both markedness and system geometry, as well as polysystemicity, to which we turn below.

> Compare here proposals within binary-feature systems concerning 'underspecification' (such as Archangeli 1984, Archangeli & Pulleyblank 1989 – and see Steriade 1995, for a critical survey), proposals that the contrastive representations in a language should contain the minimal feature-value specification sufficient to maintain the contrasts of the language, and in particular suggestions that segments in such representations typically contain certain features with an unspecified value. Contrastivity is maximised, with non-contrastive values being given by redundancy or default, but these are determined on a language-particular basis, where not constrained by marking conventions.

Non-specification is part of the pursuit of **contrastivity** which has characterised DP from its origins. Those properties which are lexically distinctive are to be discriminated from the **redundant**. Again, one can associate a similar need for such discrimination with respect to syntactic structure (cf. Anderson 1991b, 1992a: ch.3), in accordance with the structural analogy assumption: a major motivation for the development of 'case grammar', for instance, was the recognition that grammatical relations like 'subject' are not primitive but defined on the basis of the semantic relations in terms of which the subcategorisation, or argument-structure, of verbs are formulated (for discussion and references, see e.g. Anderson 1977). Both phonology and syntax are governed by the **maximal contrastivity assumption**:

> **maximal contrastivity assumption**
> The optimal grammar minimises redundancy

Satisfaction of this assumption tests the appropriateness of the notations of the grammar.

### *3.2 Polysystemicity*

Another consequence of the insistence in DP on contrastivity is the recognition that phonology is **polysystemic**.

> Thus, DP shares with Firthian phonology (cf. e.g. the collection by Palmer (1970) and the discussion by Sommerstein (1977: ch.3)) a rejection of the 'phoneme' – in so far as this notion is associated with the cross-identification (as allophones of the same phoneme) of (phonetically similar) members of systems at different positions even when the membership of the systems is not the same. It is significant

that Pike's influential *Phonemics* is sub-titled *A technique for reducing languages to writing*: this acknowledges that 'phonemics' is based not on a coherent theory of phonological representation but on putatively theoretical assumptions which in fact constitute a (not entirely determinate) bundle of guidelines for devising writing systems.

Thus, none of the elements in the English initial cluster spelled *spr* belongs to a 'phoneme' which is manifested elsewhere in the structure of words. A sound that is very similar to that spelled *s*- here – and is indeed usually spelled *s* – occurs in other positions in the structure of English words. But in these other positions, what is represented by *s* is in opposition with a number of other sounds, from which it has to be distinguished in its representation; thus we must assign something like the contrastive representation in (25) to the *s*- in *sip*:

(25) {V:C}

This element is a sibilant, distinguished as such from plosives and **sonorants** (liquids and nasals), which can also occur in this position (*lip*, *nip*, etc.) by the mutual preponderance of **V** and **C** (recall (11) above), and distinguished from the other voiceless fricatives (*ship*), which also can occur in this position, again as in (11), where compared to them it lacks an additional dependent **C**, and distinguished from its voiced congener, which can also occur in this position (*zip*), by absence of a dependent **V**. The segment concerned is also alveolar, which (as above) is taken to be unmarked, in lacking the articulatory components present with labials and velars, etc. Compare the representation for the voiceless labial in (26), which need not be specified as a non-sibilant, since sibilant status is incompatible in English with the chromatic feature **u**:

(26) {V:C{u}}

The dental [θ], on the other hand, might be represented as in (27), as a voiceless non-labial, non-velar non-sibilant fricative:

(27) {(V:C);C}

These details are unimportant in the present context, however; and different interpretations are given in e.g. Anderson (1994). The important thing is that, unlike in *sip*, the first element in, say, *sprat* is not in contrast with anything (except its absence). It need be represented as at most '{C}', a segment which is again articulatorily unspecified and categorially is specified only as a consonant, and therefore distinct in its contrastive representation from the first segment in *sip*.

Consider, too, the elements that can appear in second position in such three-member initial clusters, spelled *spr*, *spl*, *str*, *skr*, *skl*. (As observed in §1, in most varieties an alveolar is excluded before the lateral in such a position.) There are, of

course, segments spelled *p*, *t, k* occurring in other positions. But elsewhere the three segments involved are in contrast with a range of other consonants. Here, the segments contrast only among themselves, and there is not even a contrast between a fortis voiceless plosive and a lax voiced one of the same articulation. There are only these three possibilities, which we can differentiate as in (28):

(28) {C{u}} (= [P]) {C} (= [T]) {C{l}} (= [K])

**u** is again associated with the labial, and **l** with the velar (now interpreted as only redundantly also **u**, following Anderson & Ewen 1987 – cf. the partially redundant specification in (13)). I use the capitals in the informal representation in (28) to indicate that the realisation in each case is a 'compromise' between a fortis voiceless and a lenis voiced plosive: we have here lenis voiceless plosives. Elsewhere, the plosives would have to be distinguished as in (29), respectively 'voiceless/fortis' *vs*. 'voiced/lenis':

(29) {|C|{u}} (= [p]) {|C|} (= [t]) {|C|{l}} (= [k])

{|C;V|{u}} (= [b]) {|C;V|} (= [d]) {|C|{l}} (= [g])

Recall that the '|X|' notation means that the segment '{|X|}' contains categorially only the feature(s) (and relations) enclosed within the verticals; '{X}' is any segment containing 'X' – as in (28). Again, these contrastive units are not to be identified at a contrastive level with similar segments occurring at other positions.

The membership of the third-position class is rather more controversial: with the limitation given above, the third member can be what is spelled *r* and what is spelled *l*, but we also find examples like *square* and *skew*. The [s – w] of the former doesn't allow second position to the other plosives, and is not well-represented in the lexicon; the second involves the well-known contentious semi-vowel + vowel sequence whose distribution in different varieties is rather different (involving 'yod-dropping' etc.). I shall omit consideration of these for the purposes of the present discussion (for some discussion see again Anderson 1994). Thus, laying aside these minor complications (minor from the point of view of our theme here), again the two liquids are not in contrast with other consonants in this position, as they are not in general when following obstruents (with the usual caveats: *bwana*, *dwarf*, *beauty*, *cutey*, etc.), except after the voiceless sibilant (*sphere*, *small*, *snow*). They are contrastively '{C}' for the 'r-sound' and '{C,C}' for the lateral, on the assumption that the latter is when fully specified more complex and more consonantal in the way suggested by Anderson & Ewen (1987: §4.1.3). We can thus represent the initial cluster in *sprat* as in (30), which indeed provides a full contrastive representation for the segments in the word:

(30) {C} {C{u}} {C} {V{a}} {|C|}

The pre-vocalic consonants in (30) require varyingly more detailed specifications in other phonological environments. And polysystemicity is prevalent in English. Recognition of this is demanded by the maximal contrastivity assumption.

### *3.3 Prosodies*

Certain gestures or features may not be associated contrastively with one particular minimal position or segment. And some of these may not be so associated even non-contrastively. Let us look at the latter first.

> These include the tonal phenomena and the articulatory-harmony phenomena that is most familiarly associated with the development of the Firthian notion of 'prosody' (see again Sommerstein 1977: ch.3, where there is also discussed the 'long components' approach of e.g. Harris 1945, Hockett 1947) and of the notion of 'autosegment' in a later tradition (for surveys of the latter see e.g. van der Hulst & Smith 1982b, Goldsmith 1990, and much of the discussion in Goldsmith 1995).

A simple example is provided by obstruents clusters in English, which are either uniformly voiceless (*a<u>f</u>t*, *a<u>c</u>t*) or, less commonly, uniformly voiced (*a<u>dz</u>e*). Voicing is a property of the cluster, contrastively and realisationally; and we might represent this as in (31):

(31) {V{a}} + {C} + {V:C}
. .
. .
.
;V

Anderson, Ewen & Staun (1985) label such an aspect of structure as is instantiated by ';V' in (31), associated with no single position, as **extrasegmental**, which approximates to the **prosodies** of the Firthian tradition.

More complicated are cases of **vowel harmony**; and what follows ignores a number of important issues. In Finnish, for example, the vowels in any word must be all front or all back, as in (32.a) vs. (b), with the exception of [i] and [e], which can appear in both 'front words' (32.c) and 'back words' (d) (examples from van der Hulst & van de Weijer 1995):

(32) a. pöytä 'table'
b. tuhma-sta 'naughty'-*illative*
c. värttinä-llä 'with spinning-wheel'
d. tuoli-lla 'on the chair'

(32.b-d) show that the harmony extends to suffixes. The vowel inventory of Finnish is usually given as (33):

(33)

| | | |
|---|---|---|
| [i] | [y] | [u] |
| [e] | [ø] | [o] |
| | [æ] | [a] |

([ø] and [æ] are spelled *ö* and *ä* respectively.) Column one contains the neutral front vowels which can appear in both 'front words' (32.c) and 'back words' (32.d), column two the front vowels that appear only in 'front words' such as (32.a & c), and column three has the back vowels that are found only in 'back words' such as (32.b & d). Given the set of vowel components discussed in §2, the following analysis seems to be appropriate:

(34) **Finnish harmony**

a. a word may or may not be associated with an extrasegmental component **i**.

b. [y], [ø] and [æ] segmentally lack **i** – i.e. are segmentally identical to [u], [o] and [a].

The contrastive segmental vowel system consists of only columns one and three in (33); i.e. in terms of vowel components we have the segmental system in (35):

(35)

| | |
|---|---|
| {i}/[i] | {u}/[u] |
| {i,a}/[e] | {u,a}/[o] |
| | {a}/[a] |

Column one contains the only vowels with segmental **i**. The words in (32) are thus represented as in (36) (which ignores the content of consonants other than **C**):

(36) a.

| {C} | {V{u,a}} | {V{u} | {C} | {V{a}} |
|---|---|---|---|---|
| i | | | | |
| p | ö | y | t | ä |

b.

| {C} | {V{u} | {C} | {C} | {V{a}} | {C} | {C} | {V{a}} |
|---|---|---|---|---|---|---|---|
| t | u | h | m | a | s | t | a |

c.

| {C} | {V{a}} | {C} | {C} | {C} | {V{i}} | {C} | {V{a}} | {C} | {C} | {V{a}} |
|---|---|---|---|---|---|---|---|---|---|---|
| i | | | | | | | | | | |
| v | ä | r | t | t | i | n | ä | l | l | ä |

d.

| {C} | {V{u}} | {V{u,a}} | {C} | {V{i}} | {C} | {C} | {V{a}} |
|---|---|---|---|---|---|---|---|
| t | u | o | l | i | l | l | a |

The **i** of 'front words' is not associated with any segment(s) contrastively, and, on the erection of suprasegmental structure, it is associated with the head of the word (cf. Anderson 1986c: §1). This analysis recognises that none of the segments in Finnish words is associated contrastively with a prosodic **i**, which is a property of the word, and indeed that a prosody may never come to be associated with individual segments rather than a suprasegmental node.

> Insistence on association with individual segments would be a residue of the concerns of phonemics described above.

Some properties that are realised in a particular segmental position may nevertheless be associated contrastively with a more extensive sequence, including whole constructions.

> Again, this is an idea familiar from the prosodies of the Firthian tradition (see once more Sommerstein 1977: §3.2.1).

Anderson (1986b, 2001) argues that this is the case with the English glottal fricative. The [h] occurs in syllable onsets, but which onset in the word it will appear in seems to be predictable from the structure of the word. Anderson (2001: §2) offers the following formulation, on the assumptions that the glottal fricative is, like extrasegmental **i** in Finnish, not associated contrastively with a particular position, and that it is realised in an 'empty' onset of the word in whose lexical entry it appears (but is not given a phonological position in), i.e. an onset which otherwise lacks a consonant:

(37) **English *h*-sequencing**
Serialise [h] in an empty onset in accordance with the hierarchy:
a. in a syllable bearing secondary stress
b. in an accented syllable
c. in a word-initial syllable

The hierarchy is illustrated by (38):

(38) a. hiatus, Ahab
b. ahoy, jojoba
c. hysterical, jojoba

In (38.a) the onset in the syllable with secondary stress is preferred as the location for the [h] to that in the syllable with the word accent; in *ahoy* in (b) the accented syllable is preferred as the location to the unaccented, and in *jojoba* (what comes to be) the second [h] is localised by (b) in the sequencing rule; whereas in (38.c), in the absence of either a secondarily accented or a primarily accented syllable with no consonant in the onset, the [h] is assigned to the unaccented syllable, including the

other [h] in *jojoba*, which word lexically has two unattached [h]s. This analysis of what we might call a **demarcative prosody** again seeks to maximise contrastivity.

The prosody notion has been pursued as an analogy in the syntax: see e.g. Anderson (1997: §§2.7.5, 3.4) for some preliminary suggestions. A somewhat premature proposal for 'prosodic syntax' is indeed made in Anderson (1965), which built on some ideas of John Sinclair in ways he had no responsibility for.

### *3.4 Linearisation*

Let us note finally here, in considering the consequences of the maximal contrastivity assumption, an area where paradoxically contrastivity has not been thoroughly pursued by many proposals for a 'non-linear' phonology, namely in the treatment of **linearisation**. In this respect, the term 'multi-linear', suggested by Iggy Roca, would be rather more appropriate as a characterisation of such approaches. The brief discussion of the English glottal fricative illustrates, however, persistent concern within DP with the contrastive status of linear sequences. This is discussed in more detail in Anderson (1986c, 1994), in particular. Consider again here our example *sprat*, which was used to illustrate polysystemicity and in particular the redundancy of much of the substantive content of the initial three consonants. The contrastive content was given above as (30), repeated here for ease of reference:

(30) {C} {C{u}} {C} {V{a}} {|C|}

We should note now that not just this content but also the serialisation of the consonants is predictable; it is invariant. And the position of consonants relative to the syllable peak is very largely predictable, either in terms of universals, such as in particular the sonority hierarchy discussed in §2, or in terms of language-particular stipulations, many of which can be regarded as 'fine-tuning' the hierarchy. In general, consonants closer to the peak are no less vowelly than those further away on the same side and they are likely to be more so, where vowelliness is measured in terms of, say, the representations in (11). So, in *sprat* the liquid is closer to the peak than the plosive, as it is in the coda in *belt*. Initial *s*-clusters represent a major exception to sequencing in accordance with sonority, in English and in many other languages, but the positioning remains invariant. This means that contrastively the onset of *sprat* can be represented as in (39), without linearity stipulations with respect in the onset, indicated graphically by the vertical placement:

(39) {C}
{C}
{C{u}}

We know that a three-consonant onset has an initial sibilant, [s], and a final liquid, [l] or [r], here [r]. Given that neither the sibilant nor the liquid can be specified for

**u**, the {C{u}} must be the medial plosive that we also expect, in this case [P], and both the other consonant are specified for only {C}, whereas [l] would be {C,C}.

Further, though consonants, for the most part in English, contrast in the position they adopt with respect to the syllable peak – they may occur in the onset or the coda – we need to stipulate only one of these positional possibilities contrastively. It is generally assumed that the unmarked position for a consonant relative to the syllabic peak is before it, in the onset. In that case we need not specify lexically that the consonants in (39) precede the peak: that is the default position. What we need to specify is that the [t] in *sprat* follows the peak, since this is the marked possibility. We need to specify *sprat* lexically as no more than (40):

(40) {C}
{C}
{C{u}}
{V{a}} + {C}

Only the one linearity relation requires to be included. Even the association of **u** with a particular {C} need not be stipulated, given that only one of the unserialised (onset) consonants can he a host for it, namely that which comes to be fleshed out as the medial plosive:

(41) {u}
{C}
{C}
{C}
{V{a}} + {C}

Syllable peaks need to be linearised contrastively with each other, of course, and in many languages the position of the word accent must be stipulated, but, just as we saw initially that most of the suprasegmental structure is invariant, non-contrastive, so most of the relations of sequencing between segments are redundant.

Such analyses as that embodied in (41) have been criticised as 'abstract'. But it is important to note that this 'abstractness' does not involve structural mutations in the relation between the lexical representations and their realisations; this relation involves only the filling in of redundant material. The distinction between the lexical representation and its realisation is only what is required by the maximal contrastivity assumption. This is why Anderson (1988b), for instance, maintains as its subtitle 'the essentially concrete character of dependency phonology'. One consequence of adoption of the minimally specified analysis of English given in Anderson (1994) is the elimination of appeal to such mutative, derivational processes as the vowel-shift rule, originally formulated as a synchronic rule in terms of binary features in Chomsky & Halle (1968). Problems with this 'rule' and its diachronic

counterpart have been a focus for some of the main developments associated with DP: recall e.g. Anderson & Jones 1974, 1977, Anderson 1980b, 1992b. This should be unsurprising given the various assumptions (concerning componentiality, contrastivity and even analogy) I have outlined here.

**Envoi**

This brief account is intended to provide an introduction to the crucial assumptions concerning the unary character of the features of DP and their natural basis, and concerning the pervasive role of dependency relations in DP. The conjunction of these assumptions provides a richly expressive notation for phonological structure. And I briefly illustrated its role in the expression of natural classes, markedness and gradient or hierarchical phenomena as well as in the characterisation of suprasegmental constructions. This expressiveness has to be tested for failures to provide appropriate expression or to provide expression which is unnecessary – in brief, for failures of componentiality. But the structural analogy assumption also provides, amongst other things, one control on a notation: it immediately calls into question, for instance, the vast discrepancies between phonological and syntactic notations characteristic of much of the field of linguistics. A related but rather different kind of control on the expressivity of the phonology as a whole (rather than simply the notation) is provided indirectly by the maximal contrastivity assumption: as alluded to at the end of §3 (and cf. e.g. Anderson (1998) for an illustration), pursuit of contrastivity leads to the minimisation, and possible elimination, of appeals to mutative derivational devices and to arbitrary ordering of realisational rules. The 'abstractness problem' associated with derivational theories of phonology may reflect after all a notational failure.

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