Dependency Phonology

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Abstract

Dependency Phonology is a theory of phonological representation which is different from other approaches in that it posits a head-dependency relation between any two units that enter into a combination. This principle, which may have a wider cognitive basis, applies in all linguistic modules, including phonology, morphology and syntax. This approach has consequences for the units phonological segments consist of, which are postulated to be monovalent features. Dependency also applies to syllable structure and higher prosodic units. We present different aspects of segmental representation (place, manner, and major class) and also present some variations on the Dependency theme which have been more recently pursued.

Key words: Dependency; Phonetics; Phonology; Segmental representation; Suprasegmental representation

Key points

- All linguistic units that are combined are subject to a head-dependency relation
- For the representation of segments, monovalent features are used
- Features form groups within the segment
- The head-dependency relation works in the same way at different phonological levels (segments, syllables, foot structure, prosodic structure)
- DP anticipated major developments in mainstream generative phonology

Introduction

Dependency Phonology (DP) is an approach to phonological representations. It is part of a wider program which seeks to establish the role of dependency, i.e., headedness, at all levels of linguistic structure. In syntax, phrases are usually assumed to have a head (a Verb Phrase is headed by a verb, an Adjective Phrase headed by an adjective, etc.). In morphology, affixes are said to 'head' a complex form if they determine word class (Hoekstra, Moortgat and van der Hulst 1980, Williams 1981). In foot structure, one syllable is typically weak (unstressed) and the other one strong (stressed). All these cases, which could be amplified by examples from semantics and other fields, involve combinations of units (words, morphemes, syllables) in which one of the units dominates the other in some way. All these cases also instantiate this relation in different ways: in terms of word class (or obligatoriness) in syntax and morphology, and in sonority in syllable structure, in terms of stress in the case of foot structure. The relation of domination is omnipresent in language, but the way it is interpreted differs depending on the module where it applies. Dependency Phonology explores whether this relation, referred to as dependency, also applies within segmental structure, as well within the syllable and higher prosodic units.

In the paradigmatic dimension of phonological representations ('segmental structure'), DP offers proposals for a set of ultimate primes or 'features' (i.e. the basic building blocks of phonological segments) and for their relationships within segments. In

the syntagmatic dimension, DP proposes a set of structures ranging from the syllabic to the utterance level. As such, DP covers the full range of phonological structure, both at the segmental and the suprasegmental level. DP originates from proposals developed in response to Chomsky and Halle (1968, henceforth SPE) and first set published in Anderson and Jones (1974), the goal being to lay the foundations for a dependency-based approach to phonology, which would form a counterpart to Anderson's dependency-based work in syntax and morphology (see **Dependency Grammar**). As such, DP adds a novel perspective in that varieties and applications of this type of grammar are or have been mostly (perhaps almost exclusively) limited to morpho-syntax (i.e. constructions with meaning). The idea that phonological and morpho-syntactic structure should both be analyzed in terms of a particular construal of dependency relations reflects what Anderson (1985, 1992, 2022a, b) has called the Structural Analogy Hypothesis or Assumption, viz. the idea that, all things being equal, both articulations of language make use of the same set of formal relations and principles.

The fullest statement of DP too date can be found in Anderson and Ewen (1987), a work that summarizes and elaborates more than a decade and a half of theoretical extensions and case studies of the original proposals. Although the number of DP researchers is relatively smaller than those in 'mainstream generative phonology', here interpreted as work that emerged from Chomsky and Halle (1968), insights in both frameworks can be fruitfully compared and have inspired a number of theoretical developments (see also van der Hulst and van de Weijer (2018)). DP also bears a close resemblance to a model that emerged in the mid eighties, viz. government phonology (*see* **Government Phonology**), which differs from it in two ways. First, DP, has not put as much emphasis as Government Phonology on developing a narrowly-defined, restrictive theory of primes and (segmental and suprasegmental) constellations; thus, DP is more open-ended, often considering alternatives. Second, in the treatment of phonological alternations, DP adopted the perspective of Chomsky and Halle's model in which language-specific (possibly extrinsically ordered) phonological rules map underlying representations into surface representations, whereas Government Phonology, while rejecting language-specific, extrinsically ordered rules, attempts to derive alternations

from the interplay between enriched underlying representations and universal principles and parameters.

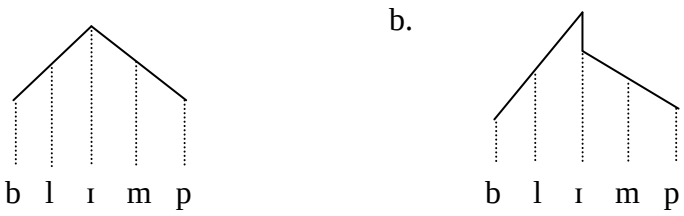
In what follows, we first discuss the evidence for and role played by the dependency relation. Then we discuss specific proposals for segmental structure and the relation between segmental and prosodic structure in the Dependency Phonology approach.

Dependency and Constituency

Linguistic units such as words and sentences have structure. Dependency approaches capture such structure in dependency graphs; see examples in (1) below. A feature that is shared by all dependency graphs is that all terminals depend on some other terminal, except for one terminal which does not depend on anything, the ultimate *head* of the structure.

Although Dependency Grammar formalisms were originally construed as an alternative to constituency-based grammars, thus effectively lacking the notion of constituent and only representing adjunction relations between terminal elements (cf. 1a), DP, by allowing a single terminal to be linked to more than one head (given that these heads dominate each other in terms of subjunction), effectively re-introduced a close equivalent to constituency (cf. 1b):

(1) a. b.

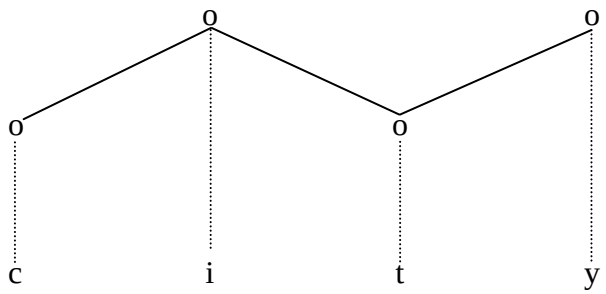


In the nonce syllable *blimp*, the segment /ɪ/ is the head of /m/ and of /l/ in both representations, since it attaches to the node that dominates all others. If we wish to characterize syllable structure more fully, making a distinction between units such as

onset and rhyme (*see* **Syllable Structure**) the graph in (1b) is more specific. Formally, the main difference is that the sequence /blɪ/ is not *directly* headed by /ɪ/ in (1b), whereas it is in (1a). Thus, (1b) creates a difference between the relationship between the vowel and prevocalic as opposed to postvocalic material. Most phonologists would agree that such a difference is real and reflected in the phonotactic constraints that hold within the onset and rhyme part of the syllable which the structure in (1b) expresses. As a result, DP structures can be interpreted as, or mapped into constituency structure, which creates a resemblance between DP structures and X-bar type phrase structures which also combine constituency and headedness (*see* **X-bar Theory**). Although the dependency relation allows several elements to depend on one head, DP tends to favor structures in which each head has only one dependent (thus favoring 'binary branching structures').

Unlike traditional constituent structures, dependency structures can also permit one daughter to be dependent on two heads, which, at the syllabic level, creates a structure that expresses the notion of **ambisyllabicity**, i.e. the linking of one consonant to two syllable nodes (like the *t* in English 'city'):

(2)



However, it would be possible to restrict dependency relations such that each dependent can have only one head, again bringing the dependency structures one step closer to constituent structure that are augmented with head-dependent labels. Anderson and Ewen (1987) give a detailed account of how dependency graphs can represent syllabic (including ambisyllabic and subsyllabic) structure and higher prosodic structure. Their work thus covers much the same ground as metrical phonology (*see* **Metrical Phonology**) and prosodic phonology (*see* **Prosodic Morphology**), fully compatible with,

but being less explicit on the cross-linguistic, parametric application to a wide variety of languages that we find in these mainstream approaches.

As at the suprasegmental level, DP also combines the notions of grouping ('constituency') and dependency intrasegmentally.. Anderson and Jones (1974) and Lass (1976) put forward a number of specific arguments for the view that the matrix characterizing the phonological segment must be partitioned into at least two submatrices, called gestures in DP. This subdivision reflects the fact that phonological processes can refer precisely to (e.g., delete or spread) specific gestures, leaving other gestures unaffected (cf. the so-called 'stability effects' of autosegmental phonology; *see* **Autosegmental Phonology**). Lass (1976) discussed cases of reduction of full consonants to the glottal fricative [h] and glottal stop [ʔ], as occurring for instance in many varieties of Scots, which show the independence of the laryngeal features *vis-à-vis* the oral (or supralaryngeal) features, a proposal also made in Thráinsson (1978) on the basis of Icelandic preaspiration data and subsequently in various versions of feature geometry (*see* **Feature Organization**). The DP arguments for subsegmental grouping of phonological primes are essentially analogous to the arguments that have been presented for feature classes in approaches of the latter type.

In the next section, we will discuss the approach to the internal structure of segments in more detail, focusing on (sub)gestures, phonological primes, major class and manner features, laryngeal and airstream distinctions, place features, and nasality, respectively. The final sections deal with suprasegmental structure and more recent developments in dependency-inspired approaches.

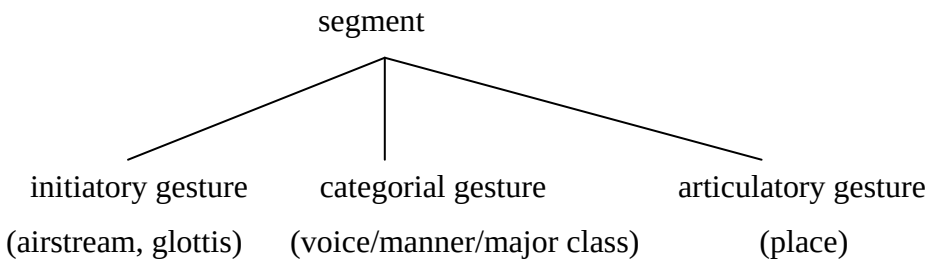
Subsegmental Structure in DP

Gestures and Subgestures

In early DP work, the bipartite division referred to above into a laryngeal gesture (covering voice and glottal states) and a broad oral gesture (covering major class, manner and place primes), was replaced by a proposal for a tripartite gestural organization

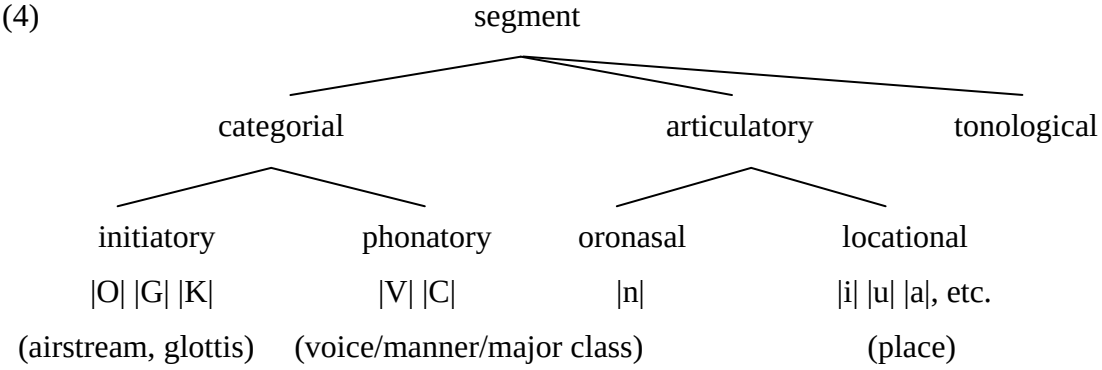
(Anderson and Ewen (1980), Ewen (1980), Lass (1984)), by splitting the oral gesture into a categorial gesture (for major class and manner-like distinctions), and an articulatory gesture (for place distinctions); the laryngeal distinctions were now incorporated into an initiatory gesture (representing laryngeal and airstream distinctions):

(3)



This three-way division is essentially parallel to the laryngeal, manner and place division proposed in Clements' (1985) feature geometry proposal. Ewen (1986: 205) proposed to elaborate the DP model as in (4), which is also used in Anderson and Ewen (1987). Below the subgestures, a number of elements that are associated with each gesture are listed; these will be discussed in more detail below.

(4)



The label 'categorial' dominates two subgestures: the initiatory subgesture (for laryngeal and airstream distinctions) and the (somewhat confusingly labeled) phonatory subgesture (for major class and manner distinctions). Under the articulatory gesture label, an oronasal subgesture (for nasality distinctions) and a locational subgesture (for place distinctions) are postulated. Nasality was formerly (i.e. in the structure in (3)) only

expressed in terms of the categorial gesture (as a particular combination of the components |C| and |V|; cf. below). In the new proposal, nasality is expressed both in the categorial-phonatory subgesture and as an independent component |n|. In addition, a tonological gesture is mentioned in later DP works but this proposal is not fully fleshed out (except for a tantalizing idea; cf. below).

The phonological primes, as is discussed below in more detail, enter into different kinds of dependency relations when combined within a subgesture. In a combination of some element A and some element B either A or B can be the head, where both options represent different phonological (thus potentially contrastive) expressions.

DP also explores the possibility of allowing the subgestures themselves to enter into different dependency relations. For example, to express the distinction between (egressive) glottalized and (ingressive) implosive consonants it is suggested that the former display an initiatory component |G| 'glottalicness' governing a phonatory component |C| 'consonantality', while the latter displays a reversed dependency relation. However, similar combinations for |K| 'velar suction' or |O| 'glottal opening' are not exploited. Anderson and Ewen (1987: 251) considered the possibility of allowing variable dependency between the two subgestures of the articulatory gesture to represent two distinctive degrees of nasalization, but no such scenario was posited for the two 'main' gestures, categorial and articulatory. From a formal point of view, it is not obvious what distinguishes the variable dependencies that appear (or are claimed) to be contrastive and those that do not so used. In this sense, the DP model could be said to suffer from overgeneration, or a lack of restrictiveness. To address this issue, Davenport and Staun (1986) proposed to dispense with inter-subgesture dependency. Van der Hulst (2005), based on a somewhat different gestural organization, proposed to limit the relations between gestures to fixed (rather than variable) dependency relations.

The Phonological Primes

In motivating its primes, their combinations, and the use of the dependency relation, DP's primary point of departure is the need to express existing or potential phonological

contrasts in the languages of the world, which leads to an implicit focus on phoneme inventories. The approach is not, however, exclusively focused on contrastivity and also aims at representing phonetic (cross-linguistically, cross-dialectally or stylistically non-contrastive) differences. Third, arguments for the adoption of primes are based on phonological processes.

The primes that DP adopts are not distinctive (binary-valued) features. Rather, DP adopts the view that the primes of segmental structure are (in an Aristotelian sense) 'substances' in themselves rather than 'properties of substances'. Whereas mainstream binary features are arguably properties of segments, DP-primes can function as segments themselves, an idea that is attributed to Foley (1977). Indeed, such primes can occur independently as fully pronounceable phonological segments (a view also found in government phonology). Independent occurrence is not a requirement that is consistently pursued, however. DP refers to the primes as components (or sometimes elements). In many ways, components function as the so-called unary features that were later proposed in various versions of mainstream generative phonology. Below we will discuss some of these components in more detail, in order of the gesture to which they belong.

Major class and manner distinctions The phonatory subgesture contains two components, |V| and |C| which are defined as follows: "|V|, a component which can be defined as 'relatively periodic', and |C|, a component of 'periodic energy reduction.' " (Anderson and Ewen 1987: 151). From its beginnings, DP has adopted the view that the primary interpretation of components is acoustic, a position that is found in government phonology as well. These two components are, formally, unary building blocks that can be present or absent in a segmental structure. Furthermore, although seemingly antagonistic, |C| and |V| can be combined into a single segment, characterizing a segmental type with major class/manner characteristics that lie somewhere between segments that have only |C| or only |V| (the formal option of a segment having neither has not been systematically explored in DP works). Anderson and Ewen continued (1987: 151): "|V| and |C| differ from the [Jakobsonian] vocalic and consonantal distinctive features in that the presence of, say, |V| in a segment does not necessarily imply that the

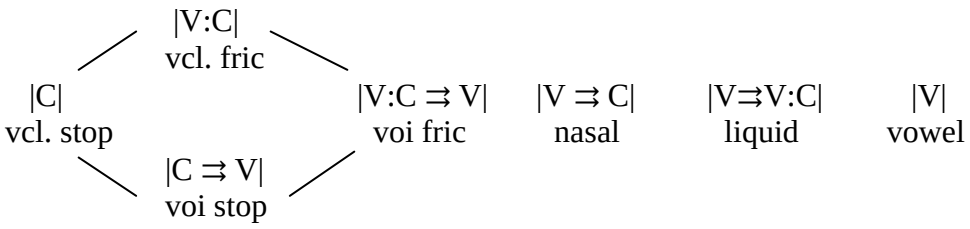
segment is in a simple binary opposition to an otherwise identical segment not containing |V|. Rather … the more prominent a particular … component … the greater the preponderance of the property characterized by that component." The key term here is 'prominence', which is expressed in terms of a head-dependent relation. If a component is prominent it can be present in a subgesture as a head (either by itself, or governing another component), the dependent role marking relative absence of prominence.

While a basic principle of DP is that components, when combined, enter into a relationship in which either component is more important, the other component being dependent on it, perhaps unexpectedly, Anderson and Ewen also allowed the possibility that two components can entertain a relation in which neither is dominant, a relationship which DP calls 'mutual/bilateral dependency'. Thus, we arrive at the set of dependency relationships in (5), which displays two different notations to express the head-dependency relation:

(5) a. |X;Y| or |X ⇉ Y| : Y is dependent on X.
b. |Y;X| or |Y⇉ X| : X is dependent on Y.
c. |X:Y| or |X ⇆ Y| : X and Y are mutually dependent.

These dependency relations provide the tools to express a number of major and manner segment classes in terms of combinations of |V| and |C|, as shown in (6) (vcl.=voiceless; voi=voiced, fric=fricative):

(6)



The terms beneath the actual representations indicate which classes of segments they represent. Anderson and Ewen argued that the representations appropriately reflect a sonority ranking in which the classes of voiceless fricatives and voiced stops are claimed

to have equal sonority. The primary motivation for including voicing in the phonatory gesture is the participation of this property in lenition and fortition processes alongside more obviously manner-like properties such as continuancy.

There are five advantages of the DP proposals which remain valid even if the details of the structures or their interpretations are modified:

1. By invoking dependency relations, DP can strike a balance between systems of phonological primes that allow (in principle unrestricted) use of multi-valued features and 'Jakobsonian' systems (Jakobson, Fant and Halle 1952) that only allow binary oppositions. The relations in (5) allow a relative (yet restricted) expression of the prominence of any given component and thus the expression of scalar processes (such as lenition or fortition processes). In fact, DP allows formal expression of all three kinds of oppositions as originally recognized by Trubetzkoy (1939 [1969]) (*see* **Prague School**). Privative oppositions involve the presence versus absence of a prime, equipollent oppositions involve the presence of a prime in one member of the opposition and the presence of another prime in the other member of the opposition and, thirdly, gradual oppositions, as shown in (6), emerge when a component, such as |V| occurs as a head or dependent, and even as a dependent of a head that contains this same element. This is reminiscent, albeit in a more constrained way, of the possibility of one element occurring multiple times in Schane's (1984) particle theory.
2. By replacing binary features with constellations of unary components varying in complexity, representations adequately reflect the relative markedness of phonological major class and manner categories. In (6), the categories vowel and voiceless stop are the least complex which reflects their indisputable relative unmarked status. Fricatives are more complex than stops and voiced obstruents are more complex than voiceless obstruents. This again reflects well-known and widely accepted claims regarding the relative markedness of these categories. Binary notations can only capture such distinctions by augmenting the basic apparatus with an ad hoc system of underspecification (*see* **Underspecification**).

3. If we assume (as most phonologists do) that phonological rules can only reflect phonetic events by manipulating phonological units, the structures in (6) express that languages can 'spread voicing' (as an assimilatory process) but not the absence thereof. If this is empirically correct, representations as in (6) are superior to binary feature systems in which [+voice] and [–voice] have the same status and are both available for phonological manipulation. Independent of the correctness of this specific prediction, unary systems beat binary systems in terms of restrictiveness (all other things being equal).
4. Given the addition of a head-dependency relation, an impressive reduction in the number of primes can be achieved. In order to characterize major classes and manner distinctions in the feature system of Chomsky and Halle (1968) (or its feature geometric descendants) one needs many features (such as [voice], [nasal], [lateral], [strident], [consonantal], [continuant], [sonorant], and so on) where DP uses just two single-valued primes, the components |C| and |V| and their interdependencies.
5. The CV-constellations are constructed in such a way that often-observed affinities between the phonological categories that they represent are formally expressed. For example, in the structures in (6), an ungoverned |V| can be glossed as [(+)sonorant], whereas a governed |V| forms the equivalent of [(+)voice]. This particular example reveals that DP manages to express distinct but clearly related phonological categories in terms of a single primitive appearing in different structural positions, where traditional feature systems must stipulate a relation in the form of ad hoc redundancy rules like [+sonorant] → [+voice]. In DP [+sonorant] and [+voice] are manifestations of one and the same component, viz. |V|. Thus the relation between these two categories is 'built into' the basic vocabulary.

Anderson and Ewen allowed various additional structures composed of the components |C| and |V| which are used to deal with more specific manner types (such as lateralized obstruents, fricative trills and the like), inviting the kind of criticism that was already mentioned above, viz. that the model seems to impose no principled limits on the complexity of such structure. In an attempt to push back overgeneration, van der Hulst

(1995, 2005) firstly proposed to disallow mutual dependency, while also developing an explicit and limited 'syntax' for component combinations. This gave rise to a variety of DP that is called Radical CV Phonology (RCVP), which owes its name to the further proposal that, given grouping of components, and the option of specific components occurring in more than one group, all potentially contrastive segmental representations can be represented in terms of just two components, |C| and |V|. These two components then receive phonetic interpretations depending on their intersegmental status as head or dependent and their occurrence in a syllabic onset of rhyme position. We will discuss RCVP below.

Laryngeal and airstream distinctions We now turn to the second subgesture of the categorial gesture, viz. the initiatory subgesture. DP advocates the idea that the traditional concept of phonation (involving glottal states and vocal fold vibration) is relevant to two different gestures. Vocal fold vibration (voicing) is, as seen in (6), expressed within the phonatory gesture. Glottal state distinctions are incorporated in the initiatory gesture. This subgesture contains the 'glottal opening' component |O| as well as two components used for the description of different types of airstream mechanisms, |G| (for glottalicness) and |K| (for velaric suction). Anderson and Ewen argued that the use of |O| is called for in three types of languages: languages that have more than two voicing distinctions (e.g., Indonesian, which has voiceless, 'lax voice' and 'tense voice'), languages that do not seem to use voice but rather aspiration (e.g., Icelandic), and languages that have an opposition between voiced and voiceless sonorants (e.g., Burmese which has this for nasals and laterals). |G| is introduced not only to accommodate glottalized segments, but also in conjunction with the phonatory component |C| for implosive and ejective consonants (see above). |K|, finally, is an *ad hoc* component for clicks.

Place distinctions Anderson and Ewen introduce the following place components: |i| 'palatality, acuteness/sharpness', |u| 'roundness, gravity/flatness', |a| 'lowness, sonority', |ə| 'centrality', |α| 'Advanced Tongue Root (ATR)', |l| 'linguality', |t| 'apicality', |d| 'dentality', |r| 'retracted tongue root' and |L| 'laterality'. Not all of these components play

an equally important role in the theory. The heart of the set of place components is formed by the familiar 'aiu' subset, which plays a key role in the representations of vowels and consonants. Two further components are added for vowels, |@| 'centrality' and |α| 'ATR', as well as a set of components which are mainly or exclusively used for consonants (the last five components).

Let us now have a closer look at DP's proposal for vowels. We note at the outset that the DP system differs from the SPE system not only in that they use unary rather than binary primes, but also in choosing different parameters for characterizing the vowel space. Whereas the SPE system is bidirectional in that it uses the high-low and the front-back dimensions in the description of vowels (lip-rounding being 'superimposed' on these two dimensions), the feature systems of DP—and other systems such as government phonology, Schane's (1984) particle phonology and the partly binary-valued theories of Goldsmith (1985) and Rennison (1987))—are tridirectional. From a phonetic point of view, the primes |a|, |i| and |u|, which on their own represent the vowels /a/, /i/ and /u/, are clearly basic. They constitute the so-called 'quantal' vowels (Stevens 1972)—that is, they are the acoustically most stable vowels, in that their acoustic effect can be produced with a fairly wide range of articulatory configurations. In addition, these three vowels are maximally different, both from an acoustic and an articulatory point of view. Moreover, /a/, /i/, and /u/ are also basic as far as phonology is concerned. They constitute the canonical three-vowel system, and they are also the first vowels that children acquire. Hence it turns out that the choice of |a|, |i| and |u| as basic vocalic features is well-motivated, both phonetically and phonologically. If we include the formal option of mutual dependency, these three components can occur in three singleton representations, six doublet representations and a rather large number of triplet combinations of which Anderson and Ewen use only three (mostly by assuming that |i| and |u| act as a 'virtual unit' without contrastive dependency relations):

(7) The maximal number of combinations of |a|, |i| and |u|:

|i|	/i/	|u:i|	/y/	|u|	/u/
|i;a|	/ɛ/	|u:i;a|	/ø/	|u;a|	/o/
|a:i|	/e/	|a:u:i|	/œ/	|a:u|	/ɔ/
|a;i|	/æ/	|a;u:i|/	/Œ/	|a;u|	/ɒ/
		|a|	/a/		

Lacking representations for central vowels, Anderson and Ewen introduced the component |ə|, which combines with the representation for the front rounded series to produce central vowels. This component can occur, as a dependent, with any other representation to represent laxness (centralization) as well. Back unrounded vowels (such as /ɯ/) are discussed at some length and concluded that their representation requires the components |i,u| in conjunction with |ə|. To represent the dimension of expanded/contracted pharynx (or Advanced Tongue Root), Anderson and Ewen introduced two additional components |r| 'retracted tongue root' (also used for pharyngeal consonants) and |α| 'advanced tongue root'. The two components are justified by arguing that languages may differ in terms of which pole in this dimension is dominant. Clearly, at this point the number of possible representations 'explodes' into a set that goes well beyond what would be necessary to represent only phonological contrasts. Anderson and Ewen defended their approach by claiming that non-contrastive phonetic or dialectal differences must be expressible too. Finally, a placeless vowel (having just the phonatory component |V|) is reserved for a reduction, schwa-like vowel.

We will now briefly turn to consonantal representations. Anderson and Ewen adopted a component |l| 'lingual', motivated by Lass (1976) to capture the natural class of high front vowels and tongue blade and tongue body consonants, which Lass claimed recurs in sixteen processes in the history of English. The |t| element is meant to capture the contrast between apical and laminal coronals, and |d| distinguishes dentals from alveolars. The element |r|, already mentioned, is introduced for pharyngeal consonants. |L| is introduced to capture laterality, despite the fact that laterals are also captured in the

phonatory gesture; this is similar to the dual treatment of nasality (cf. below). |L| is needed for lateralized segments such as lateral fricatives. Example (8) shows some representative consonantal place representations:

(8)	|u|	|l;t|	|t;l|	|l,i|	|l,u|	|l,u,a|
	labials	laminal coronals	retroflex	palatals	velars	uvulars

Noteworthy is the use of the 'aiu' set for consonantal place of articulation. The idea to use the same set of place primes for consonants and vowels can also be found in approaches within feature geometry and, of course, in earlier feature proposals by Roman Jakobson (*see* **Jakobson, Roman (1896–1982)**). As in the case of vowels, Anderson and Ewen were not concerned with allowing a minimal set of potentially contrastive representations. This means that their calculus of primes overgenerates from a phonological point of view, which does not take away that the proposed representations capture most of the recurrent natural classes of phonological segments.

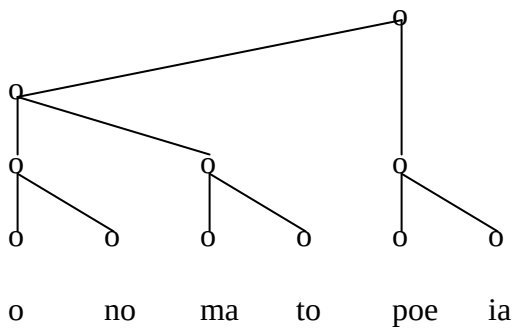
Nasality Finally, there is the oronasal subgesture, which contains precisely one component, |n|, for 'nasality'. Recall that there also is a phonatory characterization of nasals |V → C|. The question arises whether DP really needs a nasality component, or—if it turns out that such a component is necessary—whether this component should have a subgesture entirely for itself. With respect to the first question, Anderson and Ewen argued that nasal consonants not only form a natural class with other sonorant consonants by sharing certain characteristics in their categorial (particularly phonatory) representations, but that they also form a natural class with nasalized segments, which may have different specifications in the categorial gesture. In order for this latter natural class to be reflected by the DP representations of the segments in question, proponents of DP argue that we need a separate component, |n|. The question as to whether the nasality component should occupy a (sub)gesture of its own, is rather more difficult to answer. In DP, phonetic considerations have always played a central role in the justification and

motivation of its primitives and hierarchical organizations. Although Catford (1977) recognized only three functional aspects in the specification of speech (correlating with DP's phonatory, initiatory and locational subgestures), Ladefoged (1971) distinguished four aspects required in speech specification; he added the oronasal aspect. On the basis of Ladefoged's subclassification, Anderson and Ewen (1987: 148) concluded that "it seems possible, then, to account for the oronasal process as a distinct subgesture within the articulatory gesture", and that hence a subdivision into two subgestures, just as in the categorial gesture, "is perhaps not inappropriate for the articulatory gesture". Notice, though, that the motivation for a separate oronasal subgesture does not appear to be overwhelming.

Suprasegmental Structures

The idea to represent syllabic organization and stress in terms of dependency relations goes back to the earliest DP publications: "the syllable structure rules … and the stress rules are revealed as having … the common role of building successively more inclusive trees" (Anderson and Jones 1977: 118). At the syllabic level, headedness was first claimed to correlate with sonority peaks (making sonorants heads of onsets and vowels heads of rhymes), but Anderson (1986) proposed to regard obstruents (sonority minima) as heads of onsets, an idea that we later find in government phonology as well. At the suprasyllabic level, Anderson and Ewen proposed structures that capture foot organization and prosodic organization at higher levels. Noteworthy is their point that, given the notation that DP uses to express the head-dependent relation, trees embody the notion of grid structure (*see* **Word Stress**), a point that was later independently made by Hammond (1985) and Halle and Vergnaud (1987):

(9)



Anderson and Ewen also proposed a distinction between word level representations and utterance level representations, remarking that “any sequence of word structures may be associated with several distinct utterance structures” (Anderson and Ewen 1987: 122).

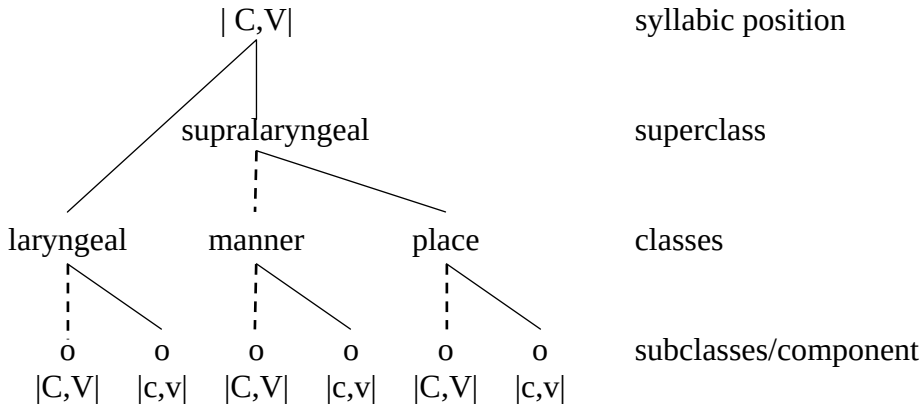
This distinction is reminiscent of the distinction between lexical phonology and post-lexical phonology, as proposed in work by Paul Kiparsky (e.g, Kiparsky 1982a, Kiparsky 1982b, 1985).

Reductionism and Radical CV Phonology

In their excursus on representations for tonal distinctions, Anderson and Ewen (1987: 273) made the intriguing suggestion that the components |i| and |u| could be employed for high and low tone, respectively, as part of the tonological gesture. What is most noticeable in this proposal is the idea to use the same components, viz. |i| and |u|, in two different gestures. To emphasize that this strategy is present in the DP proposals, we can also point out Anderson and Ewen’s suggestion concerning the identity of |a| and |V| (1987: 215). In short, in two places these authors suggested to employ the same components in different (sub)gestures, thus deriving similarities in phonetic interpretation, while attributing the differences to the fact that the (sub)gestural location of a component has a bearing on the phonetic interpretation. This shows that DP offers two possibilities for reducing the number of primes. First, fewer primes are needed thanks to the dependency relation. Two traditional features can be replaced by the dependent and head occurrence of a single prime, e.g., |V| for [voice] (as a dependent) and [sonorant] (as a head); see (6). Second, given that elements are grouped into gestures,

fewer primes are needed: one particular component may occur in various groups, each time with a different phonetic interpretation and thus replace two or more features (|V| for sonorant or vowel and for low, open place). These reduction possibilities are pushed to their extreme in Radical CV Phonology (RCVP), developed by van der Hulst (1988a, b, 1989, 1995, 2005, 2020). In these works, a variant of DP is developed that differs from standard DP by aiming at a precisely-defined, restricted set of structures, needed for the expression of potential phonological contrast only. RCVP advanced a restricted 'syntax' for C/V combinations (both intrasegmentally and at the syllabic level), which uses just two components (more or less arbitrarily labeled |C| and |V|) for the representation of all phonological contrasts that are attested in the languages of the world It then used the same two components for the representation of a limited set of syllabic structures. The structure in (10) expresses that the component C and V occur in the three classes Laryngeal, Manner and Place, where they can combined with each other in a head-subclass or in a dependent subclass:

(10) The 'geometry' of elements in RCVP



- Vertical broken lines dominate the head subclass
- Slant lines dominate the dependent subclass

Given the potential multiple occurrences of each component, an interpretation function is proposed that assigns a phonetic interpretation to each element in a specific position.

Here we show such interpretation functions for the components in the head subclass of segments that occur in either the head positions of the onset or of the rhyme:

(11) Phonetic Interpretation Functions in RCVP

PI (Man: C, head class, onset head) = ⟦stop⟧
PI (Man: C, head class, nucleus head) = ⟦high⟧

PI (Man: V, head class, onset head) = ⟦fricative⟧
PI (Man: V, head class, nucleus head) = ⟦low⟧

PI (Place: C, head class, onset head) = ⟦palatal⟧
PI (Place: C, head class, nucleus head) = ⟦front⟧

PI (Place: V, head class, onset head) = ⟦labial⟧
PI (Place: V, head class, nucleus head) = ⟦round⟧

PI (Lar: C, head class, onset head) = ⟦tense⟧
PI (Lar: C, head class, nucleus head) = ⟦high tone⟧

PI (Lar: V, head class, onset head) = ⟦voiced⟧
PI (Lar: V, head class, nucleus head) = ⟦low tone⟧

The phonetic details of interpretations are, to some extent, language-specific. Here we focus on articulatory interpretations, but there are also (psycho-)acoustic interpretations. The '⟦…⟧' indicate 'phonetic interpretation/implementation'. It cannot escape our attention that the labels for these phonetic interpretations look a lot like traditional binary feature labels, while the use of double brackets is borrowed from a common usage for the representation of meanings that are assigned to syntactic objects.

Developments in DP are not exclusively found in the early modifications that we have mentioned and the RCVP model. In Anderson (2011, 2022a, b), various modifications have been explored, in part inspired by RCVP and other proposals, and critical of some aspects of RCVP.

Conclusions

The preceding overview should have made it abundantly clear that DP never deserved the marginal position that it has occupied in the field of (generative) phonology. As of its development in the early 1970s onward, DP developed proposals that anticipated all many developments in mainstream generative phonology (such as, but limited to, Feature Geometry and Metrical Phonology). In its original conception, DP does not prescribe a specific restricted theory, nor did it aim to impose 'universal' limits on phonological structures. Anderson's point of view has always been that there is no 'universal grammar' that stipulates possible structures. Rather his view is that linguistic structures in general submit to general cognitive principles that 'cause' instances of structure analogy across both articulations of language and within these across levels of representation and modules In this light, RCVP can be seen as a refinement of the kinds of linguistic structures, ranging from more simple to more complex in principled steps, that fall within the range of general cognitive principles, which include foremost the head-dependency relation, but also binary of structure. From the outside DP has primarily focused on questions of representation, paying less attention to derivational relationship, but in that respect never favoring highly abstract derivations that were characteristic of classical generative phonology.

See also: Autosegmental Phonology; Dependency Grammar; Feature Organization; Government Phonology; Head Feature Principle and Feature Distribution Constraints; Head-Driven Phrase Structure Grammar; Jakobson, Roman (1897–1982); Metrical

Phonology; Prague School; Prosodic Morphology; Underspecification; Word Stress; X-Bar Theory

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