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Features, segments and syllables in Radical CV Phonology

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Abstract

The original goal of Radical cv Phonology (van der Hulst, 1990; 1991; 1994a, b; 1995a) was to derive a set of phonological features and feature classes from general categorization principles, instead of simply stipulate them. The resulting theory offers a specific "feature geometry" without arbitrary or domain-specific properties (see Den Dikken & van der Hulst, 1988). In this article, section 2 presents a summary of the current state of the theory in the segmental domain. Van der Hulst (1996) extended Radical cv Phonology to the domain of syllable structure, showing how it establishes an explicit formal relation between the representation of the relevant segmental properties (i.e. stricture properties) and syllable structure itself (discussed in section 3.1).

Section 3.2 develops the syllable module further discussing the consequences of assuming syllable structure to be an inherent property of lexical representations, rather than derived through syllabification. Golston & van der Hulst (to appear) argue for two important consequences of this position. Firstly, if syllable structure is inherent, information about linear order can be suppressed. Secondly, given the correlation between the position of terminals in the syllabic structure and the stricture properties of segments in these terminals, we can suppress the formal distinction between syllabic structure and stricture properties. This idea is briefly explored within Radical cv Phonology. In doing so I incorporate the "strict CV approach" (to syllabic structure), proposed in Lowenstamm (1996).

1. *Phonological categories in* Radical CV *phonology*

1.1. *Introduction*

Since Radical cv Phonology (RcvP) is a rather abstract theory, I will first discuss the question of how phonological categories and phonological structure in general, relate to phonetic "reality". The SPE theory (Chomsky & Halle, 1968) embodies a view that, according to Carr & Burton-Roberts (1996), is fundamentally flawed because it assumes that phonological derivations map phonological representations into the phonetic reality. The "phonetic reality" is, given the articulatory bias of SPE, a set of instructions (i.e. motor commands) to the articulators. In line with this view, input or lexical representations are referred to as "phonological" whereas surface or output representations are called "phonetic". The phonological and the phonetic level forms the beginning and end point of a continuum that is bridged by the application of phonological rules.

Carr & Burton-Roberts argue that this view is untenable if phonological representations are taken as cognitive in nature and phonetic representations as physical events in the world (movements of the articulatory devices or noises) because phonological rules or generalizations cannot change the ontological status of their input. Thus phonological representations that form the input to rules must somehow be already intrinsically phonetic. But it is difficult to understand how cognitive categories can be intrinsically phonetic.

The RcvP position on the relation between phonology and phonetics is closely related to the views of Hjemslev and Firth. Fischer-Jorgensen (1975) and Anderson (1985) provide introductions to these views and contain references to the original works. The objects that the theory defines have no intrinsic phonetic properties. Yet, part of our knowledge of language is the ability to relate phonological categories to collections of phonological events. Along Firthian lines I will refer to these events as the exponents of phonological categories. As Ogden (1993) writes, "the idea of exponents embodies the view on what today would be called 'phonetic interpretation'".

At this point, various questions arise. The first question is whether the set of phonological categories is in some sense universal. Firthians claim that this is not the case. The set of categories that is used in this approach is fully determined by what is convenient in analysing a specific set of data. In short, no specific hypothesis is put forward concerning the set of phonological categories. This means that Firthian phonology aims at description only. Firthians distinguish certain **types** of categories, such as paradigmatic (or phonematic) units and syntagmatic (or prosodic) units. But they do not believe that sensible things can be said about, for example, the number of

such units. This is something I would like to dispute. A central claim of RcvP is that there are interesting things to say about the set of phonological categories. The claim is that, corresponding to the various phonetic dimensions that are relevant to speech, a definable set of phonological categories appears to exist. Thus, instead of postulating a list of phonetically defined features as part of the human language ability ("UG"), RcvP proposes a universal procedure to produce phonological categories.

The second question concerns mentalism. As will be clear from the discussion so far, Firthians do not claim that the analysis of a specific set of data in terms of categories and their exponents constitutes a hypothesis about the knowledge that underlies the production and perception of these data. A Firthian analysis makes no claim to psychological reality. It is not clear to me whether this is a point of principle or merely a sceptical attitude based on the idea that, at present, we have no way of testing whether an analysis is psychologically real. Perhaps the latter. My own perspective is different. If it turns out that the set of phonological categories reveals a systematic structure, the question arises where this structure comes from.

Several explanations are possible. One is that the people that devote their careers to studying the sound side of languages (phonologists) are somehow designed to come up with a systematic kind of categorization. A second explanation is that language-learning children necessarily learn the phonological structure of their language in terms of a systematic set of categories and that the phonological analysis reveals this structure. These two explanations do not exclude each other, neither is one necessarily less or more interesting than the other. In both cases the categorization in some sense comes from the human cognitive system.

There is of course another explanation as well, which is that the structure that our set of categories seems to have is a direct reflection of the structure of the phonetic dimensions that are relevant to speech. Stevens' quantal theory is presumably the best example of this line of reasoning (Stevens, 1972). But if it appears that generalizations can be made over sets of phonological categories that correspond to different phonetic dimensions, it seems plausible to think that these generalizations, at least in part, do not reflect a structure in the phonetic substance (or as Hjemslev would say: purport), but rather reflect a categorization strategy, i.e. a cognitive capacity or bias to categorize the physical world in a certain way. I will try to show that the set of phonological categories needed for phonological analysis reflects a structure which is unlikely to be fully determined by the phonetics of speech and which I will therefore interpret as a reflection of a cognitive capacity to parse continua into a set of discrete categories. In addition, I will claim that this cognitive capacity exists not only in the mind of the phonologist, but also in the mind of the language learner. Whether this capacity is part of a language-oriented ability or part of a more general cognitive ability cannot be determined before we have examined the relevant literature bearing on other human activities.

1.2. *Phonological categorization*

By saying that the relation between phonological categories and exponents is arbitrary we do not deny or exclude that the latter are always maximally dispersed within their phonetic space. The motivation for dispersion is clear enough. The function of phonetic forms is to keep apart morphemes or words. Hence, it makes no sense to do this with phonetic forms that are very much alike, both from a production and a perception point of view. Liljencrants & Lindblom (1972) have stressed the important role of disper-sion, but perhaps they overstressed it. Dispersion theory cannot explain why we end up with an identical set of categories for each phonetic space.

In the simplest case, then, a phonetic space gives rise to **two** phonolog-ical categories, which we could label (arbitrarily) A and B (or yin and yang). These categories take as their prototypical exponents dispersed phonetic events. I will refer to these categories as polar categories; for simplicity's sake I represent the phonetics in terms of simple linear scales, as in (1).

(1)
```
      A          B          Polar categories
|----------|----------|
```

Below we will see that there are several phonetic scales, such as manner of articulation (stricture), place of articulation and so on. Thus the phonetic substance is not atomic or holistic. Phonological categorization, so it seems, takes place with reference to each of these scales. The isolation of these scales, then, is itself an act of categorization. Let us call these scales c-categories ("c" standing for feature class). The formation of polar catego-ries takes place within each c-category.

(2)
```
      A          B          (e.g. stricture)
|----------|----------|
      C          D          (e.g. stricture)
|----------|----------|
      E          F          (e.g. place)
|----------|----------|
     etc.
```

I would now like to argue that the total set of polar categories {A, B, C, D, E, F, ...} is divided into two natural classes. The basis for this classification lies

in the fact that the speech signal is organized rhythmically. Different nota-tions, shown in (3), have been proposed to represent the basic rhythmic structure of speech.

(3) a. ... W S W S W S W S W S ...
b. ... V C V C V C V C V C ...
c. ... R O R O R O R O R O ...

S, V or R represent points of "high prominence" and W, C or O represent points of low prominence. I take "prominence" to refer to perceptual sali-ence.

The relation between rhythm and phonetic scales is that for each scale one polar category contributes to high prominence whereas the other contributes to low prominence. Thus, such diverse properties as lack of stricture, voicing and pharyngeal place produce a high prominence effect, a peak. To express the functional unity of these exponents RcvP sees them as exponents of polar categories of the same type, i.e. V. Likewise, sets of phonetic events that contribute to troughs in the rhythmic organization are regarded as exponents of the category C.

Since the original conception of RcvP was biased toward spoken lan-guage, the polar categories are labelled "V" and "C", referring to V positions in the rhythmic structure (which are preferably provided with V-type polar categories) and C-positions (which are preferably provided with C-type polar categories).

We will see that exponents of V do not necessarily contribute to salience. Sometimes V exponents represent the default option (like low tone, which is a V exponent).

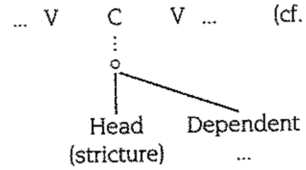
It turns out that scales can be 'parsed' into more than two categories. A maximal number of four categories seems quite typical, as we will see. I will derive this four-way categorization by assuming that the polar categories can enter into a head-dependent relation, which I represent as in (4a), for which I use (4b) as a shorthand.

(4)
```
a.  C    C    V    V
         |    |
         V    C
b.  C    Cv   Vc   V
```

Within the set of four categories, C and C_v are referred as C-headed, V and V_c as V-headed.

Some feature classes are more instrumental in producing the promi-nence alternation than others. In particular, properties that involve degree of stricture play a key role in this respect. To express this, I represent the stricture polar categories as heads and other polar categories as dependents.

(5) (cf. (4b))



Stricture properties represent the so-called major classes. Hence the claim I am making here is related to the proposal of McCarthy (1988) to regard major class features as head features.

Below, I will argue that the major head–dependent distinction corresponds to the distinction between stricture (or more generally: manner) and place. Within each of these major feature classes I will distinguish subclasses, also in terms of head–dependent relations. This implies that we replace the phonetic names of all feature classes by the formal notions head and dependent. Every class can be uniquely identified as the head or dependent at some level in the structure.

With the above concepts we can now define a set of unary phonological features.

(6) a. Phonological Feature = [Scale Type, Scale Category]
Scale Types: {STRICTURE, PLACE,...}
Scale Categories: {C, C_v, V_c, V}

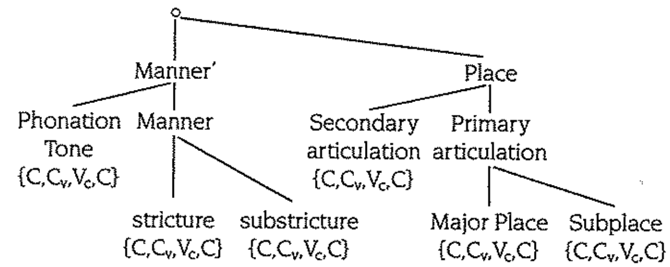
b.

Features		*Exponents*
[Stricture, C]	→	stop
[Stricture, C_v]	→	fricative
[Stricture, V_c]	→	sonorant consonant
[Stricture, V]	→	vowel
[Place, C]	→	coronal
[Place, C_v]	→	labial
[Place, V_c]	→	high
[Place, V]	→	low
...		

Although the categories C, C_v, V_c and V themselves are neutral with respect to specific phonetic properties, they have phonetic 'meanings' or 'exponents' in their specific instances, which I will indicate in articulatory terms, although each unit is supposed to correspond to an identifiable

acoustic event. For ease of exposition I indicate, where possible, traditional labels to the categories. A look at what several decades of phonological research has taught us reveals that eight features is presumably not enough. I extend the set of features by postulating the following feature geometry in (7).

(7)



This geometry makes use of a double X-bar organization. Within each class we have a four-way distinction. The system proposed so far generates 24 features. My claim is that this is **exactly** all that is required for phonological analysis.

The table in (8) summarizes the exponents of the 24 unary features that RcvP allows.

(8) *Phonological Features and their exponents*

	HEAD (Manner)			DEP (Place)		
	Spec (Phon)	Head (Strict)	Compl (SubStr)	Spec (SecPla)	Head (MajPla)	Compl (SubPla)
C	high / constr.	stop	lateral	palatal	coronal	front
C_v	hi-mi / creaky	fric.	stri/rho	labial	labial	round
V_c	lo-mi / aspir.	son. cns.	nasal	dorsal	high	laminal
V	low / breathy	vowel	voiced	pharyng.	low	posterior

Note that the exponents that are listed for each of the four scale categories correspond to traditional features that in a number of cases are known to be 'related', relations usually being expressed in the form of redundancy rules.

Below I will provide more details about certain aspects of this chart. I conclude this section by arguing why phonological features must be abstract, in the sense that they are not intrinsically phonetic.

The first argument involves the acquisition of language by deaf people. Today, there can be no doubt that deaf people acquiring a sign language acquire phonological knowledge. The form side of sign languages has an autonomous organization of which the units and smallest buildings blocks do not necessarily bear meaning, i.e. sign languages have a phonological organization. Those who claim that humans are endowed with certain capacities to set up this phonological knowledge of a language cannot seriously believe that these capacities make something available that is intrinsically connected to the properties of the human vocal tract and ear, i.e. a set of 'actual features'. Rather, it would seem that language learners are equipped with a capacity to set up a system of abstract categories which lend themselves to being externally represented by a system of perceptual events and the appropriate corresponding articulatory gestures.

The precise physical properties of the perceptual events and articulatory gestures **must** be largely irrelevant to the nature of this abstract system because it would otherwise not be possible for hearing and deaf language learners to approach their task on the basis of a single human capacity. The hypothesis that deaf human beings appeal to other capabilities to construct their phonological system than hearing people is both unlikely and theoretically less interesting (cf. van der Hulst, 1993; 1995b for ideas on the representation of signs which were inspired by RcvP).

The necessary abstractness of phonological categories follows not only from the modality argument, however. In fact, before I ever considered the relevance of sign language to this debate, I had already concluded that the system must be abstract, based on the argument that the various feature classes for spoken languages that the tradition hands to us seem to be structured in a specific way. RcvP makes this structure, which I outlined above, explicit.

1.3. *Segmental categories*

1.3.1. *Manner*

In this section I focus on distinctions that are traditionally referred to as 'manner distinctions' (see van der Hulst, 1995a for a more extensive treatment). I will argue that there are two types of manner properties, those that involve **degree of stricture** and those that involve modifications of the relevant **resonating cavities**. We will see that the elements that express stricture express so-called major class distinctions at the same time. Our system therefore does not recognize major class features or elements as a distinct class. Categories for resonating cavities express activation or expansion of the nasal and pharyngeal cavities as well as modifications of the oral cavity. The relevant distinctions in both classes can be expressed in terms of the same set of four elements (C, C_v, V_c, V), occurring as heads or dependents, respectively. I am also assuming that the laryngeal class is

added as a specifier to the manner node, as shown in (9). Head features (expression stricture distinctions) are immobile, i.e. non-spreading and local, whereas dependent features (expressing substricture and laryngeal distinctions) are, or can be, mobile in terms of spreading or non-local interaction. Such differences in behaviour are in line with general characteristic properties of heads and dependents.

(9)

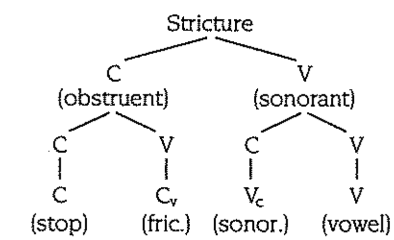
Manner

Manner

	tone	*phonation*	*stricture*	*substricture*
C	high	constricted	stop	lateral
C_v	high-mid	creaky voice	fricative	strident/rhotic
V_c	low-mid	aspirated	sonorant	nasal
V	low	breathy voice	vowel	voice

The traditional notion of stricture is represented here in terms of four categories (cf. (4b)).

(10)



This four-way distinction is also adopted in van de Weijer (1994) and in Humbert (1995).

C-headed stricture involves a relatively high degree of stricture (as in obstruents), while V-headed stricture involves a low degree of stricture (as in sonorants).

(11) *Stricture*

- C = absolute stricture (as in stops)
- C_v = very close approximation creating turbulence (as in fricatives)
- V_c = stricture that does not impede the airflow because there is an 'escape route' (as in sonorant consonants)
- V = absence of stricture (as in vowels)

This four-way division corresponds to the four-way stricture division proposed in Ladefoged & Maddieson (1995: 370–371).

In (10) and (11) we express directly that stops and oral vowels are unmarked with respect to their manner or, more narrowly speaking, stricture: stops are unmarked onsets (as opposed to fricatives) and oral vowels are unmarked nuclei. This is in accordance with the fact that the prototypical and least marked syllable consists of a stop followed by an oral vowel, two segments that are maximally opposed in terms of their stricture properties (cf. Jakobson, 1941; Jakobson, Fant & Halle, 1952).

Let us now discuss the interpretation of the four scale categories in dependent (complement) position.

(12) *Substricture*

- C = lateral modulation of oral cavity (lateral)
- C_v = central modulation of oral cavity (strident, rhotic)
- V_c = activation of nasal cavity (nasal)
- V = activation of pharyngeal cavity (voice)

It appears that the interpretation of the substricture features varies somewhat depending on what the (head) stricture is. In (13) I provide the specific interpretations for the four primary strictures with their subcategories.

(13)

stricture	*substricture*		*resulting segment type*
C (stop)	C (lateral)	→	lateral affricate
	C_v (strident)	→	affricate
	V_c (nasal)	→	prenasalized stop
	V (voice)	→	voiced stop
C_v (fric)	C (lateral)	→	lateral fricative
	C_v (strident)	→	strident fricative
	V_c (nasal)	→	prenasalized affricate
	V (voice)	→	voiced fricative
V_c (son)	C (lateral)	→	lateral liquid
	C_v (rhotic)	→	rhotic liquid
	V_c (nasal)	→	nasal consonant
	V (voice)	→	approximant?
V (vowel)	C (lateral)	→	tap/flap?
	C_v (rhotic)	→	rhotic vowel
	V_c (nasal)	→	nasalized vowel
	V (voice)	→	ATR/tense?

In a number of cases the resulting representations come close to the representations that Anderson & Ewen (1987) propose in terms of their phonatory gesture. A specific problem concerns the fact that voicing can be attributed to sonorant consonants and vowels, suggesting a phonemic distinction that does not seem to exist. (So-called voiceless sonorants and vowels will be interpreted as being aspirated – see below.) Vowels in general seem sensitive only to the nasal attribute. In §2.2 below I will consider the possibility of using the structures in (13) for complex onsets and complex nuclei, suggesting that such complex syllabic constituents are phonologically identical to complex segments which are claimed to occupy non-complex syllabic positions. This may fill some of the gaps for the V-headed structures. A complement V, for example, could be used to represent the tense-lax opposition in sonorants.

1.3.2. *Laryngeal categories*

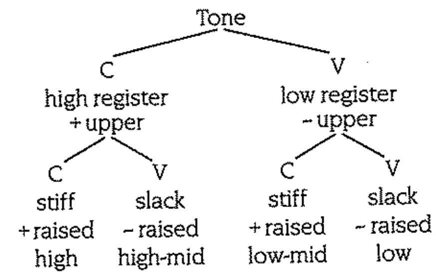
In the preceding section we discussed distinctions involving supralaryngeal stricture and concomitant activation of certain cavities. We now turn to the distinctions involving laryngeal activity, which play a role in phonation and tone.

Some of the basic ideas that I will explore in this section go back to Halle & Stevens (1971), who propose that the features for phonation, tone and airstream are, at least partly, the same. Within feature geometry, correlations between tone and phonation have been explored in Yip (1989; 1993) and, more explicitly in Bao (1991) and Duanmu (1991).

The idea behind seeing tone and phonation exponents as complementary is that it can perhaps be maintained that the tonal interpretation arises in nuclear position, while phonation interpretations arise in onset position. This issue needs further investigation.

RcvP proposes the categorization in (14) for tonal and phonation categories. In both cases I simply reconstruct well-known categorizations. To make this clear I have again added traditional feature labels to the category distinctions (cf. especially Yip, 1980) and van der Hulst & Snider, 1993).

(14) a.



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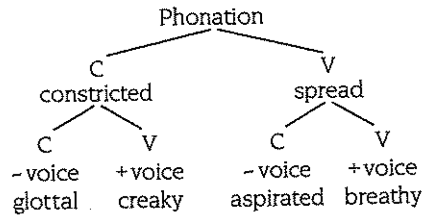


The two C-headed phonation features presumably have a wide range of phonetic interpretations.

(15) C = ejective, glottalized, voiceless implosive, voiceless
C_v = (voiced) implosive, creaky voice, laryngealized, preglottalized

I assume that glottalized obstruents and ejectives fall into the same phonological category (cf. Kenstowicz, 1994). This follows from the survey in Ladefoged & Maddieson (1995: 369), which tells us that these phonation types never contrast in a single language. Lombardi (1991; 1995) draws the same conclusion.

To regard implosivity (like ejectivity) as a phonation type is desirable, especially if we follow the proposal in Sagey (1986) to regard clicks as complex segments. These proposals, then, make it unnecessary to assume separate "airstream features". To eliminate such a category was also the goal of Halle & Stevens (1971), and the present proposal shares some characteristics with their feature system. I assume, then, that there are no airstream features like [± ingressive] or [± velaric suction].

C_v represents the more sonorous type of glottalization which may also take various forms, as indicated. Following Ladefoged (1971; 1973), Lombardi (1991; 1995) proposes placing implosives in the same phonological category as consonants which are preglottalized or laryngealized (cf. Greenberg, 1970). I follow this idea, including creaky voice. In languages that have a

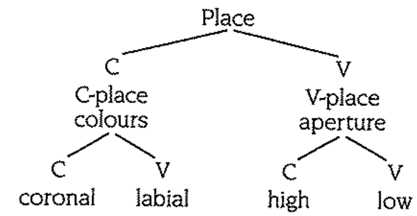
contrast between voiceless and voiced implosives, I assume that the former category has C phonation, while the second has C_v.

V is taken to represent aspiration. So-called "voiceless" sonorants are interpreted as being aspirated, i.e. as having the same phonological property as aspirated obstruents. This claim is also made in Anderson & Ewen (1987), who use |O| (aspiration) to represent voiceless sonorants. Cho (1991a,b) and Lombardi (1991; 1995) make the same claim in different models and provide a number of relevant examples.

1.3.3. *Place categories*

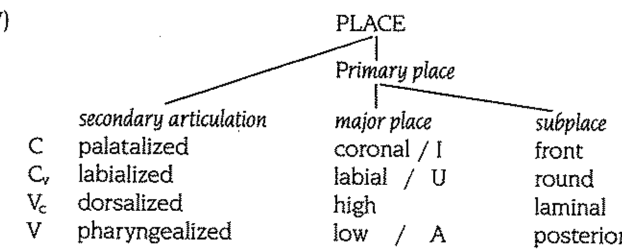
Place features within RcvP were treated in van der Hulst (1994b). The primary categories in the place domain are those in (16) (cf. (6b)).

(16)



In the place class as a whole, RcvP postulates three subclasses. To a large extent we reconstruct traditional and widely accepted distinctions in this case, too. I repeat in (17) the full set of place features with its geometrical structure.

(17)



Note that the major places contain one option that most versions of so-called IUA-theories (Dependency Phonology (Anderson & Ewen, 1987), Government Phonology (Kaye, Lowenstamm & Vergnaud, 1985), Particle Phonology (Schane, 1984)) have excluded, namely high.

In (18) I spell out the structures that receive a primary place interpretation. In this case, we only need the complement categories that have an opposite category type as their head, i.e. front and round apply to V-headed place, while laminal and posterior apply to C-headed place. Of course, it is always better if a proposed system is fully instantiated, but at least the observed restriction is not random. Also, we observe that labials are not subcategorized. This is presumably because the subplace features V_c and V refer to tongue body positions.

(18)

stricture	*substricture*
C (coronal)	C (...)
	C_v (...)
	V_c (laminal)
	V (posterior)
C_v (labial)	
V_c (high V)	C (front)
	C_v (round)
	V_c (...)
	V (...)
V (low V)	C (front)
	C_v (round)
	V_c (...)
	V (...)

The secondary articulations are relevant to both vowel and consonantal place. This implies, for example, that we can make a distinction between "round" and labialized vowels, which has been argued for by Clements (1992) in order to represent inrounded vs. outrounded vowels, as in Norwegian.

The distinction between the secondary articulation dorsalization and pharyngealization has been called into question. This may be related to the marginal status of the V_c feature.

The distinction between subplace features and secondary articulations produces a large set of places. It could be argued, given the gaps noted, that the subplace class expresses both place subcategories and secondary articulations. This matter needs further investigation.

1.3.4. *Cooccurrence restrictions*

When considering the full set of features that RcvP allows, it would seem that the theory specifies a set of possible segments that is far too large. It seems obvious that RcvP cannot do without cooccurrence restrictions. In the preceding section I mentioned one type of restriction holding for place features: head and complement features must be opposite with respect to headedness.

To constrain the inventory of possible segments further, I postulate an agreement relation between the manner and the place class.

(19)

Manner	→	*Place*
V		V-headed
others		C-headed

Thus vowels only take V-headed place structures, while all manners that include a C element (as head or dependent) take C-headed places.

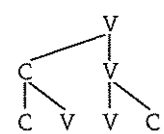
The restrictions mentioned here are presumably universal. We will also need language-specific restrictions which will tell us precisely which segment set a language has.

2. *Syllable structure in RcvP*

2.1. *The segment–syllable connection*

In this section I show how an RcvP treatment of syllable structure can establish a direct and formally non-arbitrary relation between the labelling of syllabic terminal nodes and the representation of manner (specifically stricture) properties of segments (cf. van der Hulst, 1996). Starting from the syllabic organization in (20b), (20a) seems the obvious CV coding of syllable structure.

(20) a.



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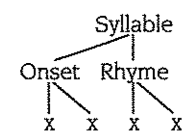
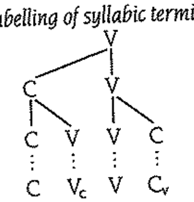


I will now show how we can derive information from the syllabic CV-labelling regarding the types of segments that ideally appear in each syllabic position. If any relation exists at all, we expect that the onset head favours C-type segments, i.e. segments with a simple C-manner (stops), whereas rhyme heads favour V-manner (vowels). This is obviously and uncontroversially the case. What about the two dependent positions? We know that sonorant consonants (liquids in particular) are preferred onset dependents. This suggests that we read the syllabic label "bottom up", namely: V (terminal label) + C (onset label) = V_c.

(21) *CV-labelling of syllabic terminals*

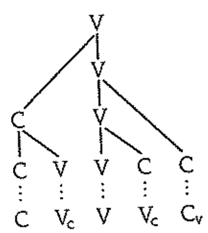


This means that we predict (22) to be true.

(22) a. Stops are ideal onset heads.
b. Sonorant consonants are ideal onset dependents.
c. Vowels are ideal rhyme heads.
d. Fricatives are ideal rhyme dependents.

These predictions seem correct except for (22d). A solution to this problem may lie in allowing a nucleus constituent. We can accommodate a nucleus by assuming that the rhyme has a complement–head–specifier structure, which is exactly what we expect given the generality of this particular constituent type. The specifier position can be labelled "coda".

(23)



To arrive at the desired manner categories, bottom-up construction of the category labels has to reckon with the principle in (24) (cf. Anderson & Jones, 1974; Anderson & Ewen, 1987).

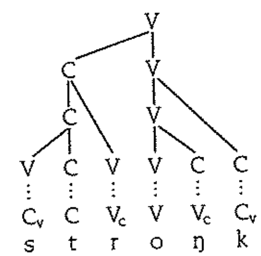
(24) *Head Switch Principle* (HSP)
$A_b + B = B_a$ (i.e. $C_v + V = V_c$)

This principle gives us sonorants in the dependent nuclear position, which is what we want, of course. We predict that V_c sonorants are optimal nuclear dependents. With the exclusion of the second half of long vowels, this is

probably correct. We now predict that fricatives are preferred over stops in the 'coda' position. There is some evidence for the claim that fricatives (and, more generally, obstruents) are preferred rhyme specifiers. Fikkert (1994) shows that Dutch children have fricative codas in their first CVC words. Her analysis is that at this stage the nucleus is not yet a branching constituent. This finding receives a natural interpretation within the current proposal. I follow Government Phonology in ruling out syllables that have both a branching nucleus and a branching rhyme (cf. Kaye, Lowenstamm & Vergnaud, 1990). The relevant principle may be that a head cannot have two dependents on the same side.

We might expect that the onset also has a complement–head–specifier structure, which according to the bottom-up algorithm and principle (17) has fricatives as preferred complement.

(25)



'trunk'

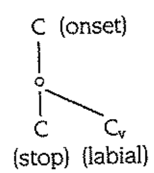
As is well known, many languages allow an 'extra' fricative syllable-initially (usually an /s/, the optimal fricative). Therefore the structure in (25) gives us exactly what we want.

2.2. *Integrating syllabic structure and manner*

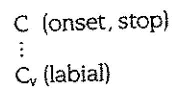
A further development of the model outlined here (first suggested to me by Marc Oostendorp) would be to "lift" the manner properties out of the segmental structure and attribute them directly to the syllable terminals. In this case we would have a different syllable structure for /pa/ and /fa/, for example. In the former case the onset head would be labelled with bare C, whereas in the latter case this label would be C_v. The properties of syllabic terminals would then be partly determined by the higher syllabic organization and partly free, i.e. subject to choices with phonemic consequences. The advantage of this approach is that we do not have to duplicate information in the form of (near) identical specification of syllabic terminals and manner properties. The characterization of the syllabic terminals would directly determine the manner of articulation of the place-of-articulation properties that they dominate. Thus, the dependence of place of articulation on manner would also be directly encoded. Similar ideas have been developed by Chris Golston (cf. Golston & van der Hulst, to appear) and in work in progress by Sean Jensen (in Government Phonology), who also replaces subsegmental manner elements by elaborations of the syllabic organization. This approach entails the view that syllabic organization is "underlying" or inherent (cf. Golston & van der Hulst, to appear). An immediate advantage of underlying syllable structure is that we can suppress information about linearization, as was first pointed out in Anderson (1987). Golston & van der Hulst (to appear) discuss internal and external, psycholinguistic evidence supporting underlying presence of syllable structure.

Here I wish to briefly consider the consequences that this claim has for the representation of stricture properties. In §2.1 we noted that a model in which syllable structure and stricture properties are regarded as independent involves a certain amount of redundancy: the syllabic structure encodes the same kinds of broad categories that we encode in terms of stricture properties. Instead of coding, for example, a /p/ as [stricture: C, place: C_v] and subjoining this structure to a syllabic head position which is coded C, as in (26a). We could also subjoin (and hence associate) the place feature directly to the syllable node, as in (26b).

(26) a.

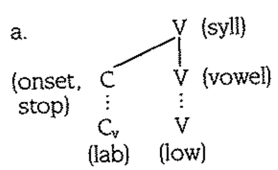


b.

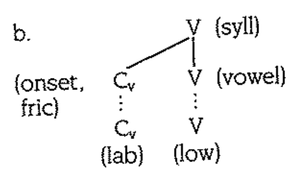


The distinction between stops and fricatives can be made by further specifying the syllabic node with a v subscript. In (27), the syllables /pa/ and /fa/ are represented.

(27) a.



b.

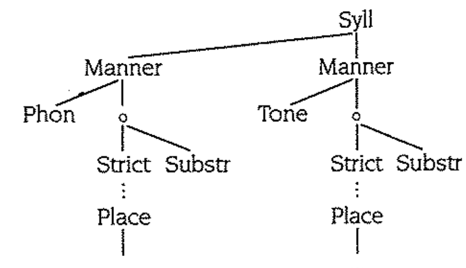


We arrive at a situation in which the only real features are place features. The rest is syllable structure. Chris Golston aptly refers to this view as: "stricture is structure".

I wish to end this section with a suggestion that will allow a further compression of the system. Lowenstamm (1996) proposed that syllables in all

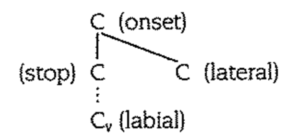
languages are strictly CV. In that framework, complex onsets and nuclei require a disyllabic representation. Within Government Phonology, convincing cases have been presented in which such disyllabic representations are indeed called for, for example to make a distinction between 'true' onsets (usually obstruent–liquid sequences) and 'fake' onsets (which involve two onsets separated by an empty nucleus). Lowenstamm's theory no longer allows this distinction, unless we choose to represent 'true branching onsets' as arising from specific feature combinations which associate to a single syllabic C-position. A proposal along these lines would associate the syllabic C and V position with a manner node which, if complex, may spell out as a linearized phonetic event.

(28)



To simplify matters, I have assumed here that phonation and tone are represented as complementary (cf. §1.3.2). A "branching" onset /pl/ would be represented as in (29).

(29)



The dependent C encodes laterality. This approach entails that complex onsets like /pl/ and lateral stops do not differ in terms of their representations, because in laterals, too, we combine stophood with laterality. A consequence that emerges is that the distinction between complex onsets and complex segments collapses from a phonological point of view. This in fact has also been proposed in Hirst (1985; 1995), who introduces the term 'macro-segment'. See also Golston & van der Hulst (to appear) for a tentative set of representations along the lines in (29). This line would require a reconsideration of our treatment of voice as an exponent of a substricture class feature. To represent the contrast between /pl/ and /bl/, we would have to locate voice in the phonation class (as the exponent of V), since the substricture slot in (29) is taken by the category for lateral. These and other consequences will be explored elsewhere.

3. *Concluding remarks*

In many respects, RcvP, which takes most of its inspiration from Dependency Phonology (Anderson & Ewen, 1987), is quite similar to models within the field of feature geometry. The specific notation that I have used throughout this article may conceal this fact. As I pointed out in §1, the grouping of features into laryngeal, stricture and place classes can also be found in Clements (1985). The grouping of stricture features under one node has since been abandoned by most phonologists, but recently the grouping of at least the manner features for sonorants has been reintroduced (cf. Rice & Avery, 1989; Piggott, 1990). The point that manner and major class distinctions are expressed hand in hand comes directly from Anderson & Ewen (1987). Geometrical models do not unify these distinctions, although it has been acknowledged that major class features and (some of the) manner features are "head features" (McCarthy, 1988). In the model proposed here, such ideas are incorporated and generalized. My approach to the laryngeal gesture perhaps finds its closest analogues in current geometrical models, even though there is no other proposal which is as much in the spirit of Halle & Stevens (1971) as mine, which pushes their program even further. Finally, the proposal for the place class pushes to the extreme that one feature set is shared by vowels and consonants. In my approach, however, the set does not have to be duplicated for vowels and consonants. My consistent use of the CV notation allows us to develop a unified theory of syllabic and segmental structure.

One could narrow down the goal of a phonological theory to stipulating a list of segmental and syllabic categories and the various compatibility and solidarity effects that hold among these categories. One could, however, also ask, **why** we have the set of phonological categories that we seem to need and **why** the compatibility and solidarity effects hold. Some assume, right from the start, that all the answers to these questions can be found by studying phonetics. RcvP is an attempt to draw at least some of the explanation from the realm of phonology.

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