

Feature Geometry of Dependency Phonology

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0. Introduction

In SPE a segment was assumed to be the representation of an unordered set of distinctive features. However, following researches show that distinctive features of a segment are not simply present but hierarchically organized autosegmentally. Since segment itself is a highly abstract entity, the internal structure of it cannot be concrete. We only guess the internal structure of a segment by the superficial observations of phonological processes. It is due to this property of abstractness that there are so many versions of feature geometry, which defines the hierarchical structure of features.

At first, the idea that features are autosegmental and hierarchically ordered was motivated by the study of tones, called suprasegmentals. Then the idea spread over the other features and the first the feature [syllabic] split itself from the others, forming CV tier (Clements and Keyser 1983), which is also called skeletal. Later versions of feature geometry (FG) (Clements 1985, Sagey 1986) assume that not only [syllabic] but also all of the features have their own tier and are hierarchically organized.

On the other hand, the other line of autosegmental framework is found in Dependency Phonology (DP) (Anderson and Ewen 1987), in which a segment is composed of components, the property of which is different from that of features. The form and content of components are different from those of features in that the former is unary-value system while the latter binary (+, -) one.

Moreover, components are represented in bars and brackets (i.e. $\{\{ \}\}$) while binary features are in square brackets. These superficial differences make DP framework look much different from FG. However, if we look into them closer, we can find that

they are not so much different as we think they are.

The purpose of this paper is to show their similarities as well as differences by suggesting the feature geometrical version of DP framework. In the following sections, I will compare components of each subgestures of DP with features of FG and in the final section FG version of DP will be suggested.

1. Categorical Gesture

In DP, a segment is represented by two major gestures, categorial and articulatory. Each major category consists of two minor subgestures. First, categorial gesture is divided into phonatory and initiatory subgesture. Two components ($|C|$ and $|V|$) are in the phonatory subgesture and the major categories of segments are represented by the dependency relation of the two as follows.¹

¹ In DP framework, following notational conventions are used.

$\alpha ; \beta$	α	' α governs β '
	β	

$\alpha : \beta$	' α and β mutually govern each other'
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α , β	combination of α and β '
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(1)	C	C:V	V;C	V;C:V	V
	stops	fricatives	nasals	liquids	vowels

According to Anderson and Ewen (1987:151), |V| component is defined as 'relatively periodic' and |C| as 'periodic energy reduction' in acoustic terms.

In FG, on the other hand, major categories of segments are distinguished by the features like [consonantal], [continuant], [sonorant], and [nasal] as shown below.

(2)					
	stops	fricatives	nasal	liquids	vowels
[cons]	+	+	+	+	-
[conti]	-	+	-	+	+
[son]	-	-	+	+	+
[nas]	-	-	+	-	-

By comparing (1) and (2), we can find that |C| component is similar to [consonantal] in that if a segment has |C| component, it is [+consonantal], natural class of which is represented as {C} in DP. However, [consonantal] alone cannot replace |C| component, because the latter has more functions than feature systems as we can expect from the quantitative difference between two systems.

First, in DP |C| component alone represents a glottal stop, which in FG is supposed to have only one feature [c.g.] ([constricted glottis]) under laryngeal node. Thus in this respect |C| can be comparable to [constricted glottis].

Moreover, glottalization is also interpreted as the spreading of [C] while in FG as that of [c.g.] (Kang 1991).

Second, [V] component also functions as the replacement of several features. Considering that voiced obstruents are represented by [V] in dependent positions as in (3), we can say that [V] is like [voiced] in Clements (1985) or [slack vocal cords] in Sagey (1986).

(3)	C	C:V
	v	v
	voiced stops	voiced fricatives

Besides, [V] is equivalent to [continuant] in that fricatives are represented as {[C:V]} and fricativization is as the addition of [V] component. Or as Dikken and Hulst (1988) put it, we may say that [C:V] is equal to [continuant]. Anyway since both voicing and fricativization are weakening processes and they are all expressed by the appending of [V], we can say that [V] plays the role of [continuant]

Third, in DP sonorants are represented as {[V]=> } (Anderson and Ewen 1987:158) and thus the feature [sonorant] belongs to phonatory sub-gesture.

Finally, there is no CV-tier (i.e. skeletal tier) in DP framework and the terminal point of syllable is categorial gesture. In other words, the internal structure of syllable is said to be predictable from the sonority hierarchy in categorial gesture which is in proportion to V-ness. Thus it can be said that the feature [syllabic] is reflected in categorial gesture.

2. Initiatory Gesture

There are three components in initiatory subgesture. They are |O| (Opening glottis), |G| (Glottalicness), and |K| (Velaric suction). The corresponding features of latter two components are [implosion], [ejection] for |G| and [velaric suction] for |K| and those features are not reflected in FG of Clements or Sagey. For this reason, they will not be discussed in this paper.

The component |O| is to represent three-way contrasting consonants of a language like Icelandic and Korean. For instance, in Korean obstruents are differentiated not by voicing but by the degree of aspiration in the following way.²

(4)	O	C : O	C
	C		O
	aspirated	lax	tense (glottalized)

In (4) dependency relation between phonatory component (|C|) and initiatory component (|O|) determines three categories. On the other hand, in FG glottalization and aspiration are represented by two features [constricted glottis] and [spread glottis] respectively under the intermediate laryngeal node. However, we cannot say that initiatory subgesture corresponds to the laryngeal node in FG. The reasons are: first, in DP there is nothing like an intermediate node. In short, subgestures in DP framework does not have hierarchical relation with gestures. A segment like /a/ is usually represented by two gestures in the following way.

² Here the presence of a component does not necessarily mean the influence of that component. For instance, in tense obstruents |O| component is just a dependent of |C| and no 'glottal opening' process is involved here.

- (5) {|V|} Categorial gesture
- {|a|} Articulatory gesture

Two gestures in (5) are related by Universal Association Convention and of course do not have dependency relation between them. Second, in laryngeal node is another feature [voiced] which is equivalent to |V| component in phonatory subgesture. Davenport and Staun (1986) have suggested that the component |O| be moved to phonatory subgesture so that voicing and glottalization would belong to the same subgesture. For both processes involve the glottis. At any rate, these differences make it impossible to identify initiatory subgesture with laryngeal node. Categorial gesture cannot be equated to laryngeal node either since it includes more properties (i.e. features) as shown above.

3. Articulatory Gesture

Articulatory gesture is divided into two subgestures: oro-nasal and locational. Oro-nasal subgesture has only one component |n| and this is for nasalized segments. In Clements (1985) the feature [nasal] is shown under the manner node while Sagey (1986) proposes the soft palate node which governs only one feature [nasal]. In the later version of Sagey (1988) it is promoted to the root node. In Kim, K.-H. (1987), nasalization is performed not by the spreading of [nasal] but by that of [sonorant]. Anyway, there is no doubt that oro-nasal component |n| is equal to [nasal].

Locational subgesture has following main components. (Anderson and Ewen 1987:28)

- (6) |i| 'frontness' (or 'acuteness' and 'sharpness')
 |a| 'lowness' (or 'compactness')
 |u| 'roundness' (or 'gravity' and 'flatness')

These are referred to as resonance or vowel components. However, as we see in (7), it is also used to define the place of articulation for consonants. Thus it is not surprising to find that a component can be equalized to two different features which were used for defining vowels and consonants respectively.

- (7) labials alveolars palato-alveolars velars
 {|u|} {|l|} {|l,i|} {|l,u|}

In (7) || means 'linguality' and the segments displaying this component in their representation are produced with the blade or body of the tongue as an active articulator. This component does not have equivalent features in SPE or FG of Clements (1985). The coronal node of Sagey (1986) may be compared with this component in that they both represent alveolar consonants.

Now let's turn to vowel components in (6) to compare them with binary features in FG. First, |i| component is equal to [-back] and [+high]. As (6) shows, it means frontness which is [-back] in featural terms. It also implies [+high] not only because /i/ is a high vowel but because palatalization, which is a spreading of |i| (Kang 1991), involves [+high] too. (Cf. Sohn 1987). In FG which adopts SPE feature system, alveolars and palato-alveolars are differentiated by the value of [anterior] as shown in (8). Thus palatalization is a phonological process which changes [+anterior] to [-anterior]. So |i| can be said to play the role of [anterior] as well.

(8)

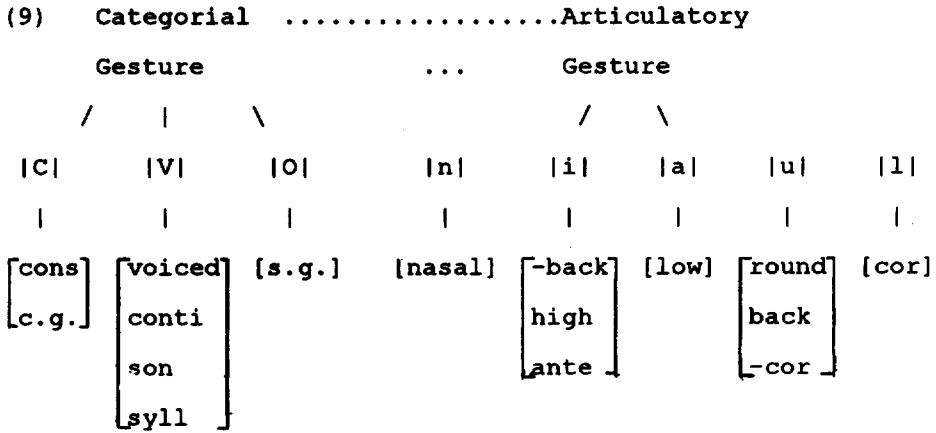
	labials	alveolars	palato-alveolars	velars
[ant]	+	+	-	-
[cor]	-	+	+	-

Second, |a| is analogous to [+low]. Thus Vowel Harmony process which is a spreading of [+low] is understood as an operation of |a| component. Lowering is also an influence of |a| component which would be represented as that of [+low] in feature terms. There doesn't seem to be any consonant features equivalent to |a| for this is not used for the representation of place of articulation.

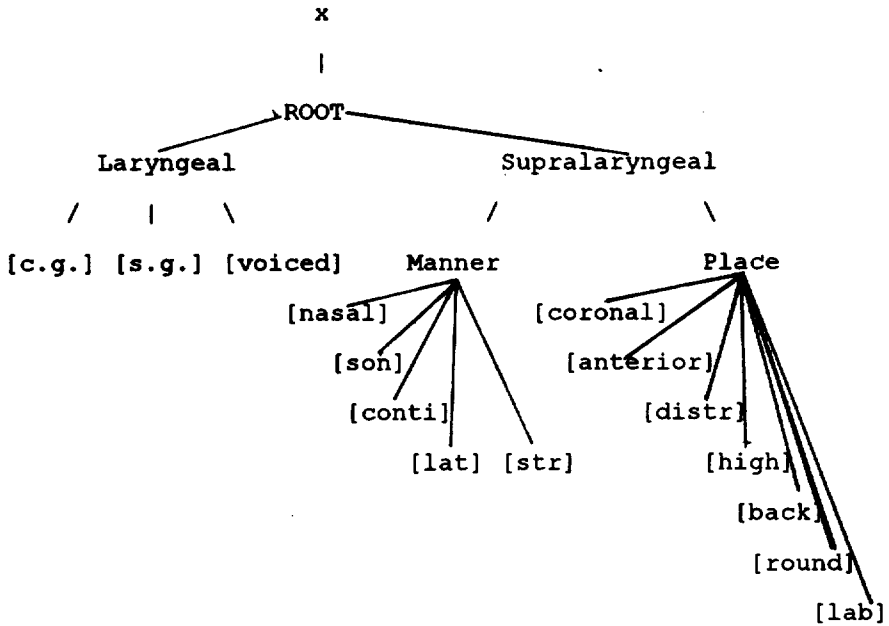
Third, |u| is equivalent to several features unlike |a|. As articulatory gloss in (6) shows, |u| is identical with [+round] and so spreading of |u| causes rounding of lips or vowel labialization (Kang 1991). In Sagey's FG, labial node under place node can be regarded as having the same function. For it also can show that labial consonants as well as round vowel cause rounding of the following vowels. In acoustic terms, however, the function of |u| goes further to the extent that labials and velars can form a natural class, which was first proposed in Jakobson, Fant & Halle (1951) by the feature [grave]. In SPE this idea was not reflected and palatals were defined as [-coronal] like labials and velars. Later Odden (1978) suggested more evidences for the feature [grave]. If we modify SPE model a little bit so that palatals are classified as [+coronal] as was done by Halle and Stevens (Keating 1988), then we can say that the presence of |u| is equal to [-coronal].

4. Summary and theoretical implications

In the above, I compared the components of DP with features of FG under the assumption that they show more similarities than differences in figuring out the internal structure of a segment. The consequence can be diagrammed as in (9).



(10) Clements (1985)



When we compare (9) with (10), a couple of similarities are found. First, main division between articulatory and categorial corresponds to that of supralaryngeal and laryngeal. Second, it seems that there should be a place node which comprises all the place of articulation. In fact, these are only what many versions of FG agree. As for the structure of other features in FG, there is no agreement yet. In DP, since they claim that there is neither root node nor skeletal tier, all the roles played by these are accomplished by Categorical gesture. As a result, most of manner features, which are now assumed to be directly dominated by root (Sagey 1988), and [syllabic] belong to Categorical gesture.³

The discussion on the internal structure of segments is not settled yet. However, it does not mean that there is no consensus at all. As we see in this paper, even the extremely different versions show some similarities. I believe that further researches will reveal the correct internal structure of segment in the near future.

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³ It is interesting to note that in Kim, H.-S. (1990) there was a proposal to incorporate [continuant] with laryngeal node (LC node in his terms) and to identify two features, [consonantal] and [sonorant], with root node on the basis of some phonological processes. This approach seems near to DP model shown here.

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