



LANGUAGE
SOUND
STRUCTURE

Studies in Phonology
Presented to
Morris Halle by
His Teacher and Students

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if + *in* is present in order for R2 to copy its phonemic melody, it is not clear how a prosodic account incorporating the M-tier solution will avoid generating **li:misn-li:nis + in*.

11. If infixes are first prefixed and later metathesized into the stem, as I have argued (see note 9), this argument is invalid.

Chapter 14

Continuant Spreading in Basque, Catalan, and Spanish Joan Mascaró

At the level of descriptive adequacy, the choice of the pertinent generalization does not depend on the observational level alone. Just as facts at the observational level are selected under the influence of descriptive bias, choices at the descriptive level rely heavily on the theoretical framework in which they are embedded, as well as on thematic commitments of different sorts.¹

Consider, for example, the stop-fricative alternations [b] ~ [β], [d] ~ [ð], [g] ~ [γ] of Catalan. The standard analysis assumes the following:

(1)

There exists a single phenomenon, *spirantization*, characterized by the structural change [–son, +voice] → [+cont].

Once this assumption is made, the next step is to solve the problems involved in determining the context.

Another set of alternations, [ʒ] ~ [dʒ] (the latter always turning to [ʃ] due to word-final devoicing: [bɔʒɛ] 'mad-fem.' ~ [bɔʃɛ] 'mad-masc.'), is treated as a separate generalization since, even though the structural change presents some similarities, once the context of the first rule is established, it cannot be adequately modified to accommodate the context of the second process.

Factors that perhaps can be considered "external" might also lead to a different approach. Spirantization phenomena similar to the Catalan process seem to exist in several languages, whereas word-final ʒ-affrication is of a more particular character. Of the three languages considered in this paper—Basque, Catalan, and Spanish—only Catalan has the latter; and even within Catalan, Spirantization is an old rule (it goes back, in one form or another, to Vulgar Latin), but ʒ-affrication is probably much more recent (see Guisoy (1977)). Yet a standard treatment of these processes

expresses no difference in terms of naturalness between them. We can therefore try to extract from the spirantization data a general, simple rule and deal afterward with the cases not accounted for, a strategy different from, but parallel to, (1).

Following in this direction, I will propose a rule of Spirantization identical for the three languages. For Catalan it will cover part of the traditional spirantization phenomenon, which, I will claim, is the surface result of the interaction of two rules. The other part of spirantization will be handled by a separate rule that will account at the same time for 3-affrication. This analysis has three advantages. First, it yields rules of a very general sort compatible with a rule typology like the one that has emerged in recent years within the frameworks of autosegmental and metrical phonology. This typological classification facilitates the reduction of the class of possible phonological rules. Second, it overcomes some of the difficulties that arise in determining the environment in which Spirantization applies. Finally, it treats the 3-affrication phenomenon in Catalan as an instance of a more general process of stop formation subject to syllabic structure.

1. Stop ~ Spirant Alternations

Basque, Catalan, and Spanish are among the languages that have both continuant and noncontinuant voiced obstruents {β, ð, γ; b, d, g}. The contexts that determine their distribution are similar, though not identical. Basque and Spanish have the stop after pause and nasal, and for [d], after [j].² The fricative appears after vowel, glide, and nonnasal consonants (except, as noted, after [j] in the case of [d]). Catalan presents stops after pause, nasal, obstruent stop, and for [d] only, after [j] and [ŋ], as well as in a series of contexts that can best be characterized as syllable-final and word-final.³ The fricative appears whenever the voiced obstruent is syllable-initial and follows a vowel, glide, or fricative consonant.

I list some pertinent examples in (2). (2a-e) have the voiced obstruent exclusively in syllable-initial position; in (2f-i) the first example corresponds to syllable-initial, the second example to syllable-final position.

(2)

	<i>Context</i>	<i>Basque</i>	<i>Catalan</i>	<i>Spanish</i>
a.	_____	[be̞so]	[bo̞]	[bwe̞no]
		'arm' ⁴	'good'	'good'

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	b.	[+nas] _____	[sango]	[gãŋo]	[gãŋo]
		'will be'	'cheat'	'cheat'	'cheat'
	c.	ld	[saldi]	[mãdɾe]	[kãldo]
		'fear'	'fear'	'to grind'	'broth'
	d.	ɔd	_____	[ɛk diw]	_____
				'he says'	
	e.	[-son -cont] _____	_____	[subdi]	_____
				'subject'	
	f.	[-cons]	[eyo]	[kãβeɔ]	[kãβeɔ]
			'south'	'hair'	'hair'
			[guy yeren]	[ãdika]	[ãdika]
			'we-erg. our'	'the abdicates'	'the abdicates'
			[e̞ŋi]	[kõrβe]	[kõrβe]
			'hare'	'curve'	'curve'
			_____	[kõrβ ne̞yɾe]	_____
				'black raven'	
	g.	{f f}	_____	_____	_____
	h.	{f A} {b g}	[alβoal]	[bãlβa]	[kãlβo]
			'the side'	'numb-fem.'	'bald'
			_____	[bãlb da mãns]	_____
				'hand numb'	
	i.	[-son +cont] _____	[ezβai]	[diɾyusl]	[diɾyusl]
			'doubt'	'trouble'	'trouble'
			_____	[biɾz βe]	_____
				'I live well'	

2. Segmental Analysis

The standard treatment of these data has been to posit an underlying stop and a rule of Spirantization (Harris (1969), Wheeler (1979), Tillardegi (1980, 301). The same structural change seems to occur in a number of phonologically conditioned environments—a situation that points to the existence of a significant generalization that should be expressed by a single rule. It must be kept clear, however, that formal similarity is an indication, not a proof, nor even a strong argument in favor of the existence of a single phenomenon. In this case, as well as in many others, the coined categorization of a set of facts ("spirantization," "passive," etc.) in a previous theoretical framework has influenced the choice of the generalization to be expressed.

As mentioned earlier, the context of the stop-to-spirant (or spirant-to-stop) rule presents some problems. Consider the simpler case, Spanish (Basque is similar to Spanish in this respect). Harris (1969, 40) proposes the environment in (3a) covering all the cases of (3b), for which I have listed the corresponding contexts and examples of (2).

$$(3) \quad \begin{cases} \text{a. } \left\{ \begin{array}{l} [+obs] \\ [+cont] \\ \langle [-acor] \rangle \end{array} \right\} \left[\langle \text{acor} \rangle \right] \\ \text{b. } \left\{ \begin{array}{l} [-round] \\ [-obstr] \\ [-cont] \\ \text{xp. art.} \\ \$ C \end{array} \right\} \left[\text{xp. art.} \right] \end{cases}$$

(3a) covers correctly the cases in which spirantization occurs. But it also predicts spirantization in other cases that, as a result of the peculiarities of the sound pattern of the language, do not arise. Compare (3a) with a different environment having this same property:

$$(4) \quad \begin{cases} \text{a. } \left\{ \begin{array}{l} [+obs] \\ [+cont] \\ [+lat] \\ [+dist] \end{array} \right\} \text{---} \\ \text{b. } \left\{ \begin{array}{l} [-round] \\ [-obstr] \\ [-cont] \\ \text{xp. art.} \\ \$ C \end{array} \right\} \left[\text{xp. art.} \right] \end{cases}$$

(3a) and (4a) differ in the last expansion. Since the first two expansions cover all segments but nasals and laterals (assuming *r*s to be fricatives),⁵ the last expansion must exclude nasals (cf. (2b)) and [d] after [j] (cf. (2c)). (3a) does this, since nasals and following obstruents, as well as the sequence [ld], are always homorganic. (4a) excludes nasals by not mentioning them, and [ld] because [l] becomes dental before [d] (Harris (1969, 18–19)).

The analysis put forward by Lozano (1979, 100–108) is different in that the rule fills unspecified values for [cont] and also handles [w] ~ [gʷ], [y] ~ [ʎ] alternations, but Lozano also uses homorganicity as pertinent for the generalization. In fact, she requires *total* homorganic clusters, since her rule (23) for Castilian Spanish reads as follows:

$$(5) \quad \left\{ \begin{array}{l} [+obstr] \\ [+voice] \end{array} \right\} \rightarrow \left\{ \begin{array}{l} [-cont] / \\ [+cont] \end{array} \right\} \left\{ \begin{array}{l} \left[\begin{array}{l} \text{---} \\ \text{---} \\ \text{---} \\ \text{xp. art.} \\ \$ C \end{array} \right] \\ \left[\begin{array}{l} \text{---} \\ \text{---} \\ \text{---} \\ \text{xp. art.} \\ \$ C \end{array} \right] \end{array} \right\} \left(\# \right) \left[\text{xp. art.} \right]$$

|| = pause; p. art. = point-of-articulation features; \$ = syllable boundary

How are we to choose among (3a), (4a), (5), and other equivalent options? Notice that they are not only notationally different. They are in fact empirically different, but the set of empirical predictions that distinguishes them is canceled out by other phonological properties of the language. This means that, under normal conditions, (3a) and (4a) are empirically equivalent for language X (= Spanish). We will then say that they are *L-empirically equivalent*. In the cases given, (3a) and (5) star *[ɲb] and *[ɲg] (nonhomorganic) and allow instead [ɲβ] and [ɲy], whereas (4a) predicts exactly the opposite. But nasal and lateral assimilation preclude the existence of these clusters.

Cases of L-empirical equivalence are fairly common, but can be distinguished in two ways. Since they are not empirically equivalent in the general sense, there might be external arguments to differentiate them. For instance, behavior of borrowings from other languages, slips of the tongue, or historical change might be relevant—that is, situations in which the conditions that cancel out the crucial empirical predictions disappear.⁶ But there can also be more “theory-internal” arguments, when a given approach is either consistent or conflicts with some empirically supported universal principle. Sometimes this universal principle, or some supposed universal feature of language, may have a less firm basis, and the argument turns in this case into a guiding theme or principle.⁷

3. Continuant Spreading

Pursuing the lines sketched in the first section, we may try to reduce Spirantization to a simpler rule that can be included in some general class of phonological rules. Suppose that the rule in fact reads as follows:

$$(6) \quad \left[\begin{array}{l} \text{---} \\ \text{---} \\ \text{---} \\ \text{xp. art.} \\ \$ C \end{array} \right] \rightarrow \left[\begin{array}{l} \text{---} \\ \text{---} \\ \text{---} \\ \text{xp. art.} \\ \$ C \end{array} \right]$$

Its environment is thus reduced to the second expansion of (3a) or (4a). Now it can be considered to be a case of local rightward spreading of the feature [+cont] from a continuant segment to a sequence of voiced obstruents. Since, as far as I know, and as argued extensively for Spanish in Lozano (1979), there is no compelling argument for having underlying stops or underlying fricatives in any of the three languages, we can assume that the feature [cont] is unspecified for voiced (nonstrident) obstruents. We might suppose that a rule copies an [xcont] autosegment after another [xcont] autosegment whenever the latter is linked to a segment in the phonological core or skeleton followed by one or more unlinked segments. Thus, the Spanish and Basque representations in (7a) turn to (7b) and, by familiar conventions, to (7c):

- (7)
- a. +CT +CT -CT +CT +CT +CT +CT -CT +CT
 | | | | | |
 a b d i k a i s a n g o
- b. +CT +CT +CT +CT -CT +CT +CT +CT +CT -CT -CT +CT +CT
 | | | | | | | | | |
 a b d i k a i s a n g o
- c. +CT +CT +CT +CT -CT +CT +CT +CT +CT +CT -CT -CT +CT +CT
 | | | | | | | | | |
 a b d i k a i s a n g o

Or we can construct a metrical left-branching tree starting at any segment in the core that is specified for CT and copy this feature onto the root of the tree, whence it will percolate to all the terminal nodes:

- (8)
-

I will not analyze further the choice between (7) and (8). See Halle and Vergnaud (1980) and Steriade (1981) for relevant discussion.

Returning to the simplified rule (6), note that it partially covers the context (3). The second expansion of (3), [+cont] _____, is identical to

the context of (6). But notice that the first expansion—namely, [+obstr] _____ will also be covered as a consequence of the formalism. Any obstruent to the left of *h, d, g* either will be attached to a [+cont] ([ezpa]j, [dizyisto]j; see (2i)), which will then spread to *h, d, or g*, or will be another unspecified *h, d, or g* (like [guy yerel], [aβōkka] in (2)). The latter case does not require two different applications of the rule, one after vowel, the other after obstruent; the [+cont] feature will spread from the vowel to the whole voiced obstruent sequence.

The cases in which the stop appears (the environments of (5a, b, c)) are also handled correctly, assuming nasals to be [-cont] and *rs* to be [+cont]. The only problem left is the initial position after pause, as well as the [ld] (and [kdl] for Catalan) as opposed to the [β], [ly] ([kβ], [ky] for Catalan) cases.

The first case, absolute initial position, probably must be treated in an ad hoc fashion, as Lozano (1979) does. It is the most variable case ([β, δ, γ] are also heard in this position, as noted by Malmberg (1971)).⁸

Consider next the [ld], [kdl] sequences. Although the system of features as it stands treats them as a peculiarity with respect to spirantization, this does not seem correct. First, the phenomenon seems to have persisted for a long time involving sequences of lateral and *b, g*, but not lateral and *d*. Though differing in other respects in the spirantization environments, all dialects of the three languages considered invariably show the stop [d] after a lateral.⁹ But it also seems that the articulatory correlate of the feature [continuant] can easily accommodate the behavior of *d* after a lateral. The defining property of [-cont] is blockage of the airflow in the vocal tract. The assignment of this property has caused some problems in the characterization of sonorants (Chomsky and Halle (1968, 317–318)). Some of them can probably be solved if the value of such a feature is considered relative. In relation to the following spirantizing obstruent, nasals count as stops, since for an oral obstruent the airflow passes only through the mouth, and the oral part of a nasal corresponds to an oral stop. Nasals are therefore stops for nonnasals. For laterals there is unimpeded passage of the air through the vocal tract except for the alveopalatal region where there is a (partial) blocking. One might suggest that laterals are stops with respect to some segments (dentals, alveolars, palatals), but fricatives with respect to other segments (labials, velars). The homorganicity condition in previous formulations of the rule partially captured this property. Catalan shows that total homorganicity is not required ([kdl] for laterals and is wrong for nasals.¹⁰ Although I am not in a position to propose a formal refinement of the feature system in this respect, I think that it should

incorporate this property – namely, that the narrowing of the vocal tract characteristic of laterals counts as blocking for the region where laterals are articulated, but as unblocked for other regions, just as nasals are fricatives in the nasal cavity but stops in the oral cavity.¹¹

4. The Catalan Case

I now turn to the Catalan case, which, as I pointed out before, is somewhat more complicated. Even if nasals are treated as stops, /r/ as fricatives, and [l, ʎ] as stops only for /d/, there are examples with noncontinuant [b, d, g] after continuants:

- (9)
- | | |
|-----------------------------|-----------------------------|
| a. [kəbdéʎ] 'wool/ball' | b. [kəβré] 'I'll fit in' |
| [kájə dənún] 'I fall on' | [kájij] 'fall-he-subj.' |
| [səg grán] 'I am big' | [sijij] 'be-he-subj.' |
| [kóʀb nəyʀe] 'black raven' | [ʒəryi/ʎiŋk] 'hieroglyphic' |
| [bəlg məs] 'I'm worth more' | [kurβáɾe] 'tie' |
| [askəb lu] 'spit it!' | [uβiðə] 'he forgets' |

Mascaro (1972: 32) and, in a more adequate analysis, Wheeler (1979: 316–332) have proposed a single rule to account for the spirantization phenomena. If the simpler rule (6) is to be part of the grammar of Catalan, the form of the examples in (9a), which seem to violate (6), will have to be attributed to some other process. It is necessary only to account for the noncontinuant character of the first member of the cluster, since once this is warranted, the second member will follow a stop and will receive the feature [–cont] accounting to rule (6) or any of the other solutions explored in section 3.

The distinction between (9a) and (9b) is clear: within a syllable, after a continuant, [b, d, g] occur in the rime and [β, ð, ɣ] in the onset. Applying (6) or its variants to the examples in (10a) results in (10b), instead of the correct (10c), in some cases (irrelevant structure is omitted):

- (10)
- | | | | | |
|----------|---------|---------|-------|----------|
| a. +CT | +CT | +CT | +CT | +CT |
| [kəbdéʎ] | [kəbré] | [pudij] | [pud] | [dóbbɫə] |
| * +CT | +CT | +CT | * +CT | +CT |
| [kəbdéʎ] | [kəbré] | [pudij] | [pud] | [dóbbɫə] |

- c. +CT –CT
- | | | | |
|----------|-------|----------|--------|
| [kəbdéʎ] | [pud] | [dóbbɫə] | [puds] |
|----------|-------|----------|--------|

The correct result is achieved by assigning the feature [–cont] to voiced obstruents in the syllable rime, as follows:

(11)

$$\left[\begin{array}{l} \text{–son} \\ \text{+voice} \end{array} \right] \rightarrow \text{[–cont]} / \text{---}$$

R

Applying (11) to (10a) results in (12a), to which Continuant Spreading applies to derive, correctly now, (12b):

- (12)
- | | | | | | |
|------------|---------|---------|---------|----------|---------|
| a. +CT –CT | +CT | +CT +CT | –CT +CT | –CT | +CT –CT |
| [kəbdéʎ] | [kəbré] | [pudij] | [pud] | [dóbbɫə] | [puds] |
| b. +CT –CT | +CT +CT | +CT +CT | –CT +CT | –CT | +CT –CT |
| [kəbdéʎ] | [kəbré] | [pudij] | [pud] | [dóbbɫə] | [puds] |

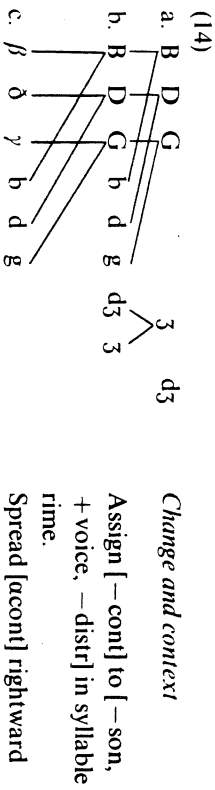
The different surface distribution of Catalan voiced obstruents, as compared to those of Spanish and Basque, can thus be attributed to an independent process of quite a different nature, and not to a different context of application of the Spirantization rule itself.¹²

The proposed rule for [–cont] assignment (11) can now account for another phenomenon of Catalan that had been treated in previous analyses by a separate, unrelated rule (Wheeler (1979: 309–310), Mascaro (1978: 105–106)), [dʒ] and [ʒ] alternate in most contexts, but word-finally only [dʒ] occurs, devoiced to [ʃ]:¹³

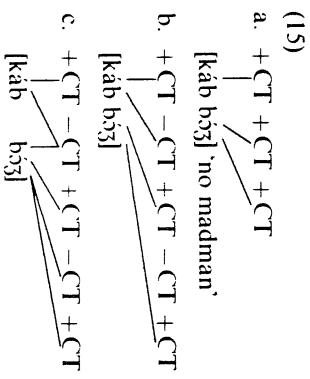
- (13)
- | | | |
|--------------|-------------|------------|
| a. [ɛβpúðʒu] | [ɛβjúʃ] | ← /ɛβpúðʒ/ |
| 'I reject' | 'rejection' | |
| b. [fúʒu] | [fúʃ] | ← /fúðʒ/ |
| 'I flee' | 'the flees' | |

Although the [dʒ] ~ [ʒ] and [b, d, g] ~ [β, ð, ɣ] alternations seem to have something in common, previous analyses have been unable to relate them, since the contrast /r/[dʒ]V ~ /r/[ʒ]V arises, but never *r/[b]V ~ r/[β]V, etc. But once two rules have been posited to account for [b, d, g] ~ [β, ð, ɣ] alternations, the word-final [dʒ] is a natural extension of the second rule.

Recall that rule (9) assigns to voiced obstruents the feature [-cont] in the syllable rime. But all the cases in which underlying \int appears as [dʒ] are either word-final or before word-final *s* (see note 13), and [ʒ] (or [dʒ]) never appears syllable-finally in other positions. (11) therefore covers all the cases of [ʒ] ~ [dʒ] alternation. On the other hand, *dʒs* that are in a spirantizing environment do not become [ʒ] because Continuant Spreading is restricted to nonstrident obstruents. (14) illustrates the surface reflexes of underlying (14a) *B.D.G* (which are unspecified for [cont]), [ʒ], and [dʒ].



Notice that although (11) can just change the [cont] value of \int from \pm to $-$, yielding an affricate (thus not affecting [-del rel] through mechanisms equivalent to "linking"; Chomsky and Halle (1968, 419-435)), a [-cont] might be attached to *b,d,g,s*, to the left of another associated [cont] if any, yielding, for example, (15c) from (15a):



(The [-CT] + CT] contour attached to a single segment in the core is to be interpreted as an affricate.)

Notes

1. Both Halle and Freud have warned against what might be termed "the danger of being seduced by facts": "One must not be a slave of data" (Halle (personal com-

munication): "Keine noch so verführerische Wahrscheinlichkeit schütze vom Irrtum ... man muß daran denken, daß das Wahrscheinliche nicht notwendig das Wahre sei und die Wahrheit nicht immer wahrscheinlich" (Freud (1974, 468)).

2. For Basque, see Navarro Tomás (1925, 605-609), from whose description of Gipuzkoan I have taken the data. Other dialects show similar distribution; see Moutard (1975).

For (Castilian) Spanish, I follow Navarro Tomás (1971, 84-86, 98-100, 138-140), as well as my own observations. I will omit from consideration emphatic or hypercareful styles. See Lozano (1979) for analysis of such cases and of other dialects.

3. I use for (Central) Catalan my own speech and Wheeler (1979). Other dialects present the same distribution, except Valencian, which is similar to Spanish in some respects, Agueres, and other dialects that conserve [v], in which [b] tends to remain a stop in all contexts.

The Catalan data in Lozano (1979, 123) are from an unreliable source; see Coromines (1971, 246-248) for some pertinent corrections.

4. For Basque, [ʃ] represents an apical, more retracted [ʃ], similar to Catalan and Spanish (in some dialects); [s] is dorsal and more advanced, similar to English [s].

5. It is interesting to note that Catalan, which always has [f] (a fricative as argued in Mascaro (1978, 46-49, 53-54)), presents without exception the fricative obstruent after the liquid, Spanish, which has [ʎ], normally presents the fricative obstruent, but there are reported cases of stop ("Thabitude dialectale et individuelle—de prononcer une occlusive après [ʎ]" (Malmberg (1971, 405)). Portuguese, according to Lozano (1979, 120-122), has [ʎ] systematically followed by stop.

6. In Castilian Spanish, when cases of final [ŋ] occur and do not undergo—exceptionally—assimilation in point of articulation, the following voiced obstruent is always noncontinuant. This happens, for instance, in onomatopoeic words such as [banbãŋ], [dindõŋ]. These cases might not be usual, but the style is not slow or careful, as in examples like [mbjerno] examined by Lozano (1979, 117).

7. For some general remarks pertinent to this matter, see Chomsky (1981, 1-16, 47).

8. I do not totally agree, however, with Malmberg's characterization, at least for Castilian Spanish (and Central Catalan). He states: "En dehors de la place après nasale, où l'occlusion est de règle, le choix de l'une ou de l'autre de ces deux variantes est en réalité une question d'emphase ou de force articulatoire ... on peut aller jusqu'à l'introduction d'une occlusive même à l'intervocallique ... le phonème initial lui-même peut se rééliser comme spirant" (1971, 405). According to my observations, the fricative is possible, though unusual, in absolute initial position, and in some cases the stop can be found after laterals and *rs*. But stops after vowels are much more rare (unless a pause is introduced) and rather on a par with fricatives after nasal, also an extremely deviant and unusual case. This shows that the most regular positions for the process to apply are those for which the triggering element is most clearly defined for the feature [cont], a fact that supports the present analysis.

9. This is true of all dialects of Catalan and of all the Spanish dialects examined by

- Lozano (1979) that show the alternation, as well as of the Basque dialects about which I have been able to obtain sufficient information.
10. All Catalan dialects (except those like Balearic that have total assimilation of nasals in point of articulation) always present nasal-stop sequences regardless of point of articulation: [sòm dós] 'we are two', [sòm gràns] 'we are big', [sɪŋ bɪns] 'five wines', [sɪŋ dɪs] 'five fingers'.
11. Malmberg (1971, 412) has already observed, in part, this correlation: "La nasale ... est elle-même une occlusive du point de vue de son articulation buccale ... C'est donc une assimilation de fermeture."
12. The differences found in different dialects of Spanish and analyzed in detail by Lozano (1979) can be treated in much the same way. The basic differences are: (a) the presence in Porteno of a rule similar to the Catalan (11) but restricted to the occurrence of certain consonants after *h, d, g*; (b) a rule of final obstruent devoicing in Mexican and Castilian; and (c) the existence in Porteno and Mexican of underlying preconsonantal *p, t, k* beside the voiced *b, d, g*.
13. This process occurs in only one context that is not word-final—namely, in syllable-final position before the word-final *s* of the plural. After *ʒ* has become [dʒ], it assimilates in voicing to devoiced [s], and then the affricate-fricative sequence merges into a single [ʃ]: *ʔəbiʒ + s* → *ʔəbiʒs + s* → *ʔəbiʃ + s* → [ʔəbiʃ].

Chapter 15

Prosodic Organization in John J. McCarthy Morphology

Paralleling developments in phonology, recent research in morphology (McCarthy (1979, 1981, 1982a,b), Halle and Vergnaud (1980, forthcoming), Harris (1980), Marantz (1982), Yip (1982)) has led to a significant enrichment of the representational system for words and morphemes. This enrichment has been largely in the direction of incorporating autosegmental or nonlinear formalism into the theory of morphology, eschewing the conventional segment-and-boundary notation. Specifically, this new theory provides minimally that utterances are represented on two (and possibly more) isochronous formal levels, called *tiers*: a skeleton or template characterizing canonical pattern in terms of the units C (consonant or glide) and V (vowel), and a melody of segment types, describing point and manner of articulation. Morphology is organized on at least these two levels, and sometimes more. Gestures on different levels are orchestrated with respect to one another by autosegmental conventions and rules of association.

This theory was originally devised to account for morphological regularities of the sort obtaining in the Semitic languages. An example from Classical Arabic shows the basic properties of the system. The formal analysis of the stem *kattab* 'caused to write' is illustrated in (1):

- (1)
- Vowel melody tier
- CV-template tier
- Consonantal root tier
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Peculiar to Semitic morphology is the recognition of two separate segmental tiers, one for vowel melodies and the other for consonantal roots.