Joan Mascaró

Syllable-Final Processes in Catalan

It is a well-known fact that the right edge of the syllable is a linguistically significant unit. Why it is that rhyme phenomena seem to be more common than onset phenomena, or whether there is at all an answer to this question, is still open. In this paper I will focus on a set of these processes in Catalan and show that although apparently disparate in character, they are one and the same phenomenon. The research strategy I am adopting is thus to try to reduce a complex set of rules to a few simple rules. Of course we expect also to find complex rules, idiosyncracies, in natural languages, and the question whether a rule should be simple or complex is an empirical one. But it is the case that if phonology is an interesting part of grammar at all we also expect to find abstract principles interacting with parametric values (that is, simple rules) to produce a set of complex, possibly disparate, phenomena.

Generally speaking, we find in Catalan two different kinds of syllable-final phenomena (henceforth I will use "syllable-final" in the sense of postnuclear, i.e. not necessarily meaning absolute syllable-final position). One kind of syllable-final process has to do with regressive assimilation, which effects syllable-final consonants in different ways. Consonants lose their place of articulation, voicing, and other properties, and adopt those of the following consonant: compare [fɔ́n] 'melts' with [fɔ́m mə] 'melt me' and [fɔ́l lu] 'melt it'; [əskúp] 'spit' with [əskúb lu] 'spit it', etc.. I will not deal here with these cases.[1] I will rather concentrate on a set of "strengthening" processes that I will term, for convenience, **r-tensing**, **Stop Formation**, and **b,g-gemination**. A description of the first two will be given first. Then **b,g-gemination** will be examined in more detail, and this analysis will lead to a formulation that covers the rest of the phenomena as well, and distinguishes them in a principled way from the other

(assimilatory) syllable-final processes just mentioned.

The distribution of [r] and [r] is quite straightforward.[2] The tense, trilled variety is found in the following contexts: i) At the beginning of words, and word-internally, at the beginning of lexical morphemes, i.e. before prefixes or in compounds; ii) in syllable-initial position, after a heterosyllabic consonant; and iii) in syllable-final position. The flap [r] is found in syllable onsets after a tautosyllabic consonant (iv). Intervocalically, i.e. between two elements of the set vowel, glide, [r] and [r] are found in contrast (v). Some examples are given below.

(1)

i)	ii)
ríw 'river'	mártirs 'martyrs'
ə+rímmik 'arrhythmic)	ənrík 'Henry'
peŋɜə+róβəs 'hanger'	

iii)
əskríwrə 'to write'

iv)	v)
murál 'feedbag'	murál 'moral'
sɛ́rə 'saw'	sɛ́rə 'wax'
əmərá 'to moor'	əmərá 'to soak'

I follow standard analyses in considering /r/ the underlying source of [r] and of non-intervocalic [r], and in separating the processes responsible for syllable-initial and syllable-final cases.[3] Also following all standard analyses, the contrast between intervocalic [r] and [r] will be traced back to an underlying /rX-/rrX distinction.

Since here we are concentrating on syllable-final cases, we will only deal with syllable-final tensing. This process will have the following effect:

(2) **r-tensing:** Make all syllable-final rs [r].

Intervocalically a/rr/ sequence will turn also into [r]. Since we will have to refer to this process later, let's state it informally as (3):

(3) A/rr/sequence turns into [r].

The effect of (3) can be derived from (2) and independent processes. See Wheeler (1979: 191-194) and Mascaró (1978: 47-51) for more formal statements of these rules: I have avoided formalization since it is not central to the present discussion.

The process of **Stop Formation** is first introduced in Mascaró 81984). Standard analyses treated the well known stop-spirant alternations starting from underlying /b/, /d/, /g/, and deriving all the cases of [β], [ð], [ɣ] through a spirantization rule. If spirantization is viewed as a very general continuant spreading rule,[4] the cases that don't show spirantization in Catalan (but do, indicentally, in Spanish), have to be accounted for by a separate rule. In Mascaró (1984) it is shown that this rule is independently needed for the [ʒ]-[dʒ] alternation; to illustrate this analysis consider the following examples. In (4a) there is spirantization of the voiced obstruent because the preceding segment is continuant. In (4b) we get a stop since the preceding segment is noncontinuant. And in (4c), although the voiced obstruent is preceded by a continuant, it is syllable final, and Stop Formation applies, giving a stop. The same stop formation process is responsible for the final affricate of (4d).

(4) a.
nérβi 'nerve'
ruðá 'to roll'
dəzɣlás 'defrosting'

b.
kámbi 'change'
əŋglés 'English'
súbdit 'subject, vassal'

c.
subliminál 'subliminal'
əgzémplə 'example'
əd dík 'I say to you'

d.
bédʒ. βé 'I see (ind.) well'
but: béʒi βé 'I see (subj.) well'

Notice that in the third examples of (4b) and (4c) there is first stop formation in syllable-final position, and then spreading of [-cont] from the stop to the adjacent **d**. Again, without adhering to any particular formulation of the rule, let's state its effects as in (5). I assume, following Mascaró (1984), that **b**, **d**, **g** are underlyingly unmarked for

continuancy, and I use capital letters to represent the archisegments, although occasionally I will refer to them simply as b, d, g.

(5) **Stop Formation:** B, D, G, 3 acquire the feature [-cont] in syllable final position.

The third process to be discussed, **b,g-gemination**, can be illustrated with alternations like [pusíbblə]~[pusiβilitát] 'possible', 'possibility', or [réggla] - [rəγulár] 'rule', 'regular'. A few words should be said about the dialectal distribution of the process.[5] Some dialects, like Valencian, lack it ([posíβle]), in others the results is a nongeminate (Southern Central [pusíblə]), or a devoiced consonant of varying length (Barcelona [pusíplə], other Central varieties have [pusíp.lə] or [pusípplə]. Here I will be dealing with dialects with a voiced geminate, [bb] and [gg], which include some Central dialects on which I will base my data, and also Balearic.

Another problem should be mentioned. The only real alternations are allomorphic in nature, like the ones mentioned above. Here are some more examples:

(6)	diábblə 'devil'	diəβólik	'devilish'
	móbblə 'piece of furniture'	muβiljári	'furniture'
	nóbblə 'noble'	nuβiljári	'relative to nobility'
	bulúbblə 'voluble'	buluβilitát	'volubility'

This does not rule out the phonological character of the process. Even a strict formulation of the Alternation Condition (Kiparsky 1974) or any principle with equivalent effects, would not prohibit a rule of gemination, since the rule is not neutralizing.

To handle such cases, Wheeler (1974:209) proposes, "with no great commitment" however, a minor rule that makes voiced stops long between V and l. DeCaesaris (1981:26) has a similar rule which requires in addition that the vowel be stressed.[6] The examples in (7) show that the rule should be further restricted to apply only to b and g and before morpheme boundary. This is basically the structural description of the rule proposed in Mascaró (1978:24) for a devoicing dialect.

(7) a.

dóbbl+ə 'double'
púbbl+ik 'public)
réggl+ə 'rule'
pusíbbl+ə 'possible'

b.

éγluγ+ə 'eclogue'
bíβli+ə 'Bible'
púβli 'Publi' (proper noun)

c.

dubbl+əγ+á 'to fold'
pubbl+ik+á 'to publish'
ə+rəggl+á 'to regularize, fix'

d.

əpi+γlɔ́t+is 'epiglotis'
də+γlut+í 'to swallow'
ʒəru+γlíf+ik 'hieroglyph'
ʒuγlá 'minstrel'
ʒuγ lənd+ásj+ə+s 'Juglandaceae'
nəγliʒ+í 'to neglect'
uβlík 'oblique'
uβliγ+á 'to force'
uβlið+á 'to forget'
pɣuβlém+ə 'problem'
səγlá 'secular, lay'
suβlím 'sublime'

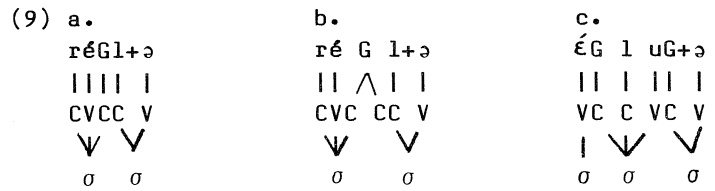
The data in (7) are drawn from Wheeler (1980), who examines all words transcribed in three different dictionaries with bl and gl groups that might undergo gemination. In (7a) we find [dóbblə] and [pusíbblə] with a stressed vowel followed by the bbl cluster and an epenthetic ə. The words [púbblik] and [réggłə] have also the structure XV{b,g}]+Y, Y being, respectively, a derivational and an inflectional suffix. In (7c) we have derivatives of (7a) where the stress has shifted to the right. It was argued in Mascaró (1978: 20-25) that underlying stress feeds the rule and is deleted later. All the examples with gemination in the list given by Wheeler (1980: 613-615) have the same structure. (7b) shows that the fact that the l is morpheme-final is crucial, since otherwise the rule would apply to these examples as well, (7b,d) contain practically all examples in Wheeler (1980) that have no gemination.

So far we can account for the data by a rule of the following form:

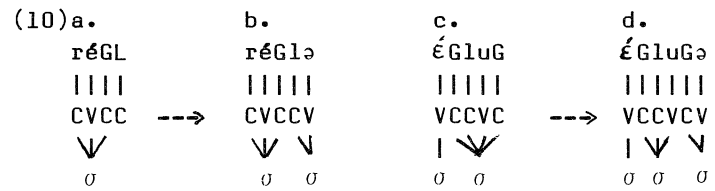
(8)

$$C \longrightarrow CC / V \_\_\_\_ \begin{matrix} \{ b \\ g \} \end{matrix} l \; C \; +$$

As indicated before, we will proceed by trying to simplify the formalized descriptive statement in (8). We will begin by examining the condition that there be a preceding stressed vowel. If we require that the morpheme boundary be present, stress is not needed, as a matter of fact. It just happens that all the examples have an underlying stressed vowel, because there are no examples with the structure WV́XV[B,G]l+YVZ.[7] We can thus remove the condition on stress from the rule. The other condition, namely that the l should be morpheme final, seems rather odd. In fact, it isn't needed either. Consider the representations before the rule applies, and after it has applied (a and b, respectively), and compare that to a case where the rule doesn't apply (c):



Crucially, g is syllable-final in cases that undergo the rule, but is syllabified with the following l in cases that don't. Rather than being an ad hoc stipulation, this particular sullabification follows from the fact that the l is morpheme-final. The root **régl** will have the syllabification shown in (10a), if syllabification is cyclic: in (10c), on the other hand, the domain of syllabification will include the vowel following the gl cluster and they will be syllabified together. After epenthesis (and in the case of **ègloga**, at the word-level cycle), syllabification will change the syllabic constituency of the last consonant, yielding the structures (10b) and (10d):



I will not go into the details of Catalan syllabification. I am making the minimal assumptions, namely that syllabification applies in a way to give the structures necessary for

assimilation to apply correctly: recall that assimilation is the other typical syllable-final process. Across words, where gemination does not apply, assimilation shows that structures like those in (10) are correct. Compare the syllable division of the phrases **trec l'aire** 'I take out the air' and **trec aire** 'I take out air', with voicing assimilation showing the correct division: [trɛ́g.láj.rə], [trɛ́.káj.rə], respectively.

The context of our **b,g-gemination** rule thus reduces to (11):

(11)
$$\begin{matrix} & B & \\ \{ & & \} \ l \\ & G & \\ & | \quad | & \\ V & \_\_ &] \ C \end{matrix}$$

The next question to ask is whether the l is necessary. What are the other possibilities? If we get a vowel after b or g, they will be resyllabified with it, and the rule will not apply. The second g in **ègloga** in (10) is an example. The other possibilities are that the b,g be final, that the following segment be an obstruent, a liquid or a glide. If we remove the l from the structural description of (11), a geminate will arise in all the cases. Let's consider them in turn.

In word final position, if the l in (11) is not mentioned, we will get two identical consonants by gemination (**bb#, gg#**). This is a phonetically impermissible final cluster in Catalan. The fate of such impermissible sequences is either ə epenthesis or deletion of one of the members. Alternations such as [áptə] - [əptitút] 'apt', 'aptitude', and [lén] - [ləntitút] 'slow', 'slowliness', are representative. Unfortunately, there exist no such alternations with double obstruents: morpheme-internally they are rare ([fubból] 'soccer', [óbbi] 'obvious'); I don't know of any example of morpheme-final geminate b or g.[8] On the other hand, the most recent treatment of these processes, Mascaró (1985), extends easily to such cases as the ones we are examining, predicting deletion, which in our case means simplification of the cluster. Basically, we get deletion when the second member of a cluster is a stop and is homorganic with the other member. No rule applies, and we get a surface cluster, if the second member is a stop, the first a sonorant, and they are not homorganic. Finally we get epenthesis if the

second member is a stop, the first a nonhomorganic obstruent, or when the second is a sonorant:[9]

(12)

	Homorganic			**Nonhomorganic**		
	Obst.-Obst.	Son.-Obst	Obst.-Son.	Obst.-Obst.	Son.-Obst.	Obst.-Son.
	GɾóGG	sáŋG	BíDr	ákt	BɛrB	DɔGm
Deletion	GɾóG	sáŋ	---	---	---	---
Epenthesis	---	---	BíDrə	áktə	---	DɔGmə
	'yellow'	'blood'	'glass'	'act'	'verb'	'dogma'

In case an obstruent follows the b or g, gemination will derive a BBC or GGC sequence. Unless the second member of the geminate cluster can be syllabified with the C, we will have the same situation as for final geminates that we just examined, and deletion will apply. And indeed syllabification with a following obstruent is impossible: there are no words with syllable initial **g,b-obstruent** sequences, and when those sequences are found word-internally or across words, assimilation shows that they are heterosyllabic ([sǒ.k ɔ.mík] 'I am fiend', [sǒg . nów] 'I am new').

Let's illustrate the proposed analysis with two examples, **groc** 'yellow'-masc. (fem.[gɾóγə]), and **exili** 'exile'.

(13)

	b,g gemination		Cluster Simplification		
GɾóG		GɾóG		GɾóG	
||||	----->	|||Λ	----->	||||	
CCVC		CCVCC		CCVC	
əGzili		əG zili		əGzili	
||||||	----->	|Λ||||	----->	||||||	
VCCVCV		VCCCVCV		VCCVCV	

We will now examine the cases in which b or g are followed by a liquid or a glide, i.e. by either λ, r, w, or j. There are no cases of **b,g** followed by λ so all the possibilities are illustrated by the examples that follow (I have been unable to find examples of the form $XV\{^{\beta w}_{\gamma j}\}+Y$:

(14) br: sɔ́βr+ə 'rest, excess'

gr: sɔ́γr+ə 'mother-in-law'

bj: sáβj+ə 'wise'-fem.

gw: əmbíγw+ə 'ambiguous'

Recall that we are trying to determine whether the l has to be mentioned or not in context (11) of the gemination rule. If not, we would expect, in principle, the geminated consonants to show up before other segments as well. Consider first the cases with **r**. I will assume that [r] is never syllable-initial, and that this disallows resyllabification with a following vowel.[10] Instead the whole cluster **br** or **gr** is resyllabified with the following vowel. Compare **pobre** 'poor'with **poble** 'people':

(15) a.

pɔ́Br+ə	pɔ́Bl+ə
|||| |	|||| |
CVCC V	CVCC V
⋁	⋁
σ	σ

b.

pɔ́Br+ə	pɔ́Bl+ə
|||| |	|||| |
CVCC V	CVCC V
⋁ ⋁	⋁ ⋁
σ σ	σ σ

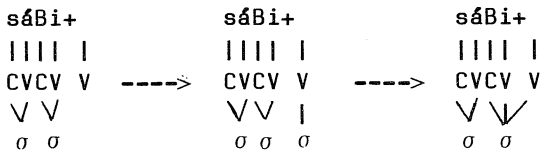
The b in **pobre** not being syllable-final, it will not geminate and will later spirantize, giving as a result [pɔ́βrə]. But the b in **poble** will be syllable-final, and will geminate as we have already seen.

When a glide appears after b or g, it can always be derived, as far as I know, from an underlying vowel, at least in the cases where it is at the end of the morpheme, and hence subject to gemination:

(16)	sáβjə 'wise'-fem.	sáβi (masc.)
	əmbíγwə 'ambiguous'-fem.	əmbíγu (masc.)
	tɛ́βjə 'lukewarm'-fem.	tɛ́βi (masc.)
	áβjə 'grandmother'	áβi 'grandfather'
	kuntíγwə 'contiguous'-fem.	kuntíγu (masc.)

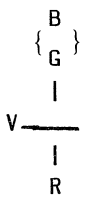
In these cases there is in fact no glide formation process in itself: syllabification takes two syllables with adjacent vowels one of which is high, and syllabifies them as a single syllabic unit. Hence there is no stage in the derivation at which the b or g is syllable-final:

(17)



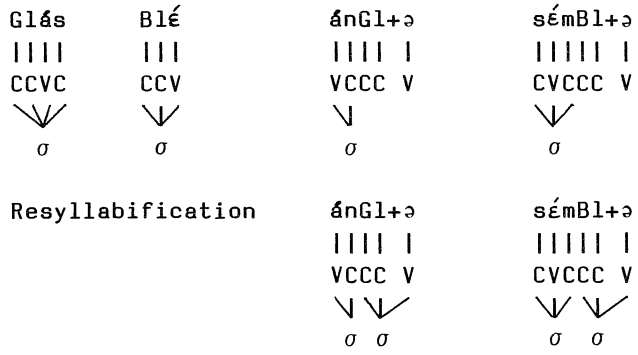
Having justified that the rule of gemination operates correctly even if no reference is made in it to the segment l, we can simplify the previous version (12) to the following context:[11]

(18)



Now notice that the condition that the geminating segment be syllable-final precludes the possibility that the element to the left be anything but a vowel. If the b or g is initial as in **glaç** 'ice sheet' or **ble** 'wick', it will be in the onset, and if it is preceded by a consonant, this will constitute the syllable-final consonant, and the b or g will be syllabified with the l,[12] as in **angle** 'angle', **sembla** 'it seems':

(19)



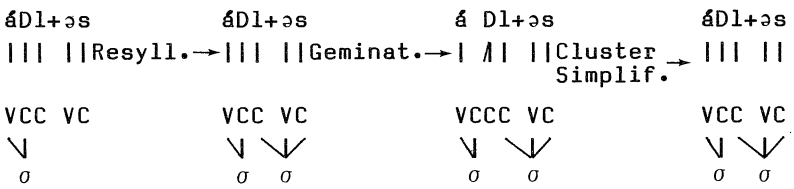
We can therefore formulate the context of gemination without mentioning the vowel:

(20)

$$\frac{\left\{\begin{matrix}B\\G\end{matrix}\right\}}{\_\_}\ R$$

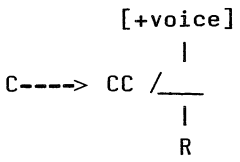
Can the rule be further simplified? Let's consider the conditions on the segment undergoing the rule. The other element in the voiced series, d, can be excluded on other grounds. A dl cluster can never form a syllable onset: it never occurs initially in a word, and in heteromorphemic sequences the d can undergo assimilation to the l, thus proving its syllable-final character. If the d is syllable-final, it can undergo gemination and, not being able to syllabify with the l, as b and g do, it will follow in the same way as bb and gg that are final or followed by an obstruent, namely degemination. Consider **atlas** 'atlas', which can be pronounced both [ádləs] and [álləs].[13]

(21)

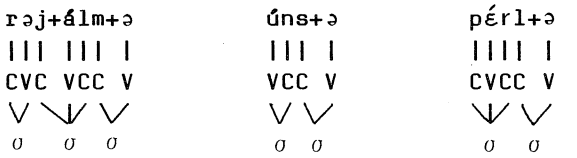


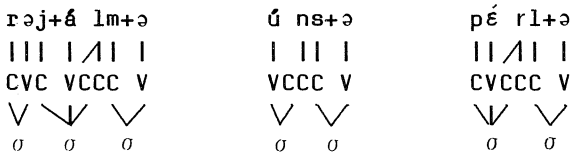
The same can be said of fricatives, which can never be syllabified with a following l except for f. But f is voiceless, and the gemination rule should independently be restricted to voiced consonants, since p and k do not geminate. In any case, even if f should geminate, it would be degeminated by a rule that merges sequences of identical fricatives in all dialects. Thus, in those dialects which geminate also p and k,[14] a word like **rifle** 'rifle' would go through a stage [rífflə], but the ff would simplify to f even if syllabified with the following l, just for the same reason that there is simplification in [dəsəntrá] from [dəs+səntrá] 'to put off center', or in [əzɣərífórt] from [əzɣəríf] 'fright, alarm' and [fórt] 'strong'.[15]

We thus arrive at the following formulation of the gemination rule:

(22)


For sonorants, the same inability to syllabify with a preceding consonant will have similar effects. But let's consider some cases. The examples will be **reialme** 'realm' with **lm**, **perla** 'pearl' with **rl**, and **unça** 'ounce' with **ns**. The first element in the cluster being voiced, it will undergo gemination, and the representations in (23b) will be obtained:

(23)a.


b.


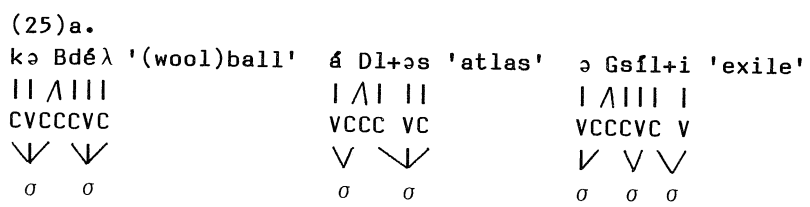
The sequences **llm** and **nns** will not be able to receive a proper syllabification and the geminate will simplify. But for rrl there is a legitimate phonetic interpretation. Recall that intervocalically the contrast between [r] and [ɾ] can be traced back to simple /r/ vs. double /rr/, and that by (3) /rr/ turns into [r]. At the time (3) applies, words like **serra** (see (1)) and **perla** will both contain a geminate rr:

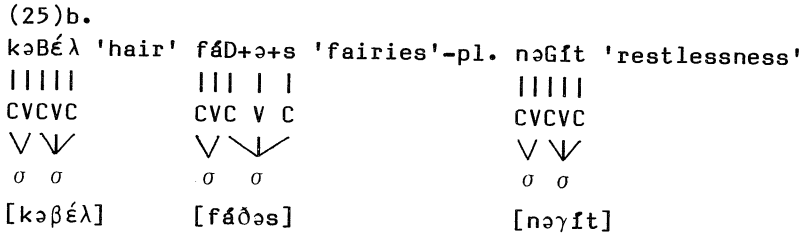
(24)


We can thus predict both [séɾə] and [pérlə]. The effect of our previous rule (2) is just a consequence of the rule of

gemination and rule (3). We will expect to get gemination, and hence [r], no matter what follows, as long as the r is syllable-final, given our formulation of gemination. We get, indeed, always [r]: [pérsə] 'Persian', [iβérn] 'winter', [ór] 'gold', etc.

Now consider another intermediate representation, i.e., after gemination but before cluster simplification, namely those cases in which b, d and g are not followed by l, and hence no resyllabification allows the gemination to surface, in the case of b and g. Compare some of these cases (25a) with other instances of b, d, g in syllable-initial position (25b):



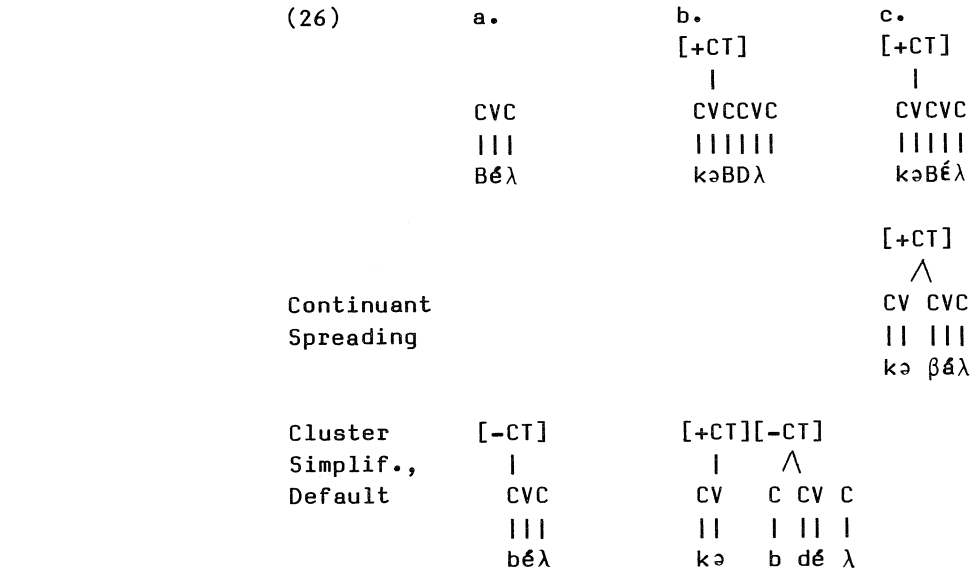


Notice now that there is an exact coincidence between the set of structures that undergo (5), Stop Formation, and the set of structures that show a geminate at some stage of the derivation. More interestingly, there is a way to predict that precisely structures like (25a) are going to get the specification [-cont], without having to make any language particular stipulation at all. So (5), or any similar formation rule like the one proposed by Mascaró (1984), can be dispensed with.

It has been repeatedly observed that geminates are immune to most phonological processes. I will not discuss here the theoretical mechanisms from which such an effect can be derived (see Steriade (1985) for the most recent proposal, and Schein and for references), but I will assume that, as has been proposed in the literature, these mechanisms should predict that spreading processes such as spirantization should be

blocked (Guerssel (1978), Schein (1981), Harris (1985)), whereas degemination should not.

Following Harris (1985) we might assume that if the obstruents B, D, G, which are unmarked for [continuant], do not get a specification for that feature from Continuant Spreading, the unmarked value, namely [-cont], is assigned to them by default. This is what happens, both in Catalan and other Romance languages with spirantization, in absolute initial position, where no element to the left of the obstruent will be able to spread its [cont] specification. After gemination has applied, Continuant Spreading applies to (26c) only, since (26a) has no [cont] autosegment to the left of the obstruent, and in (26b) the geminate blocks the application of the rule; degemination by Cluster Simplification and the assignment of the unmarked value by a default rule give the surface forms (irrelevant structure is omitted):



To sum up, we might approach this analysis from an acquisitional and from a typological perspective. Given the cluster simplification data in (7), the language learner constructs the simplest hypothesis compatible with them, namely two very general rules, Cluster Simplification and rule (22). The facts about r-tensing and syllable-final stop formation simply fall out from this hypothesis. This means

that if the language would lack such processes, a more complex grammar would ensue, which in turn means that the clustering of (descriptive) processes found in the dialect discussed here is what should be expected. Typologically, the present analysis suggests that these processes are not independent, and that the combinations to be found are those dictated by the analysis that we have presented. In fact, in Catalan dialects like Valencian, and more clearly in Spanish, there is no rule (22), but there is spirantization, hence no r-tensing in syllable-final position, no geminat-ion, and no syllable-final stops.

NOTES

1 Standard analyses are Wheeler (1979: 287-324) and Mascaró (1978: 41-58). See Mascaró (1983) for an auto-segmental analysis.

2 See Wheeler (1979: 191-194) and Mascaró (1978: 47-51). Both authors recognize the tense, trilles character of syllable-final **r**. In the previous literature it is usually transcribed as [r], but this is an unfortunate transposition from Spanish descriptions. Early experimental work also recognized the trilled character of **r** in this position (Barnils (1933: 96-97)).

3 Harris (1969): 50-51) defended this solution for Spanish, and it was extended to Catalan in such works as Wheeler (1979) and Mascaró (1978).

4 The first to propose such a rule was Goldsmith (1979: 10-14). A more detailed analysis, especially of the Catalan case, is Mascaró (1984); for Spanish see Harris (1985).

5 I use the term 'dialect' ina loose sense, covering the terms 'dialect', 'subdialect', etc. in the traditional literature.

6 The data in DeCaesaris (1981) should be checked against Coromines (1971: 247-248) who corrects some of DeCaesaris's sources. In particular **qui-sap-lo** (meaning, indicentally, not 'who knows', but 'a lot, very much') is pronounced, both in dialects with gemination and in Barcelona, [kisáblu]. **Escup-lo** 'spit it' is pronounced [əskúblu] in Barcelona, although it is an item difficult to check, because the genuine form has an infinitive with final ə, (see Fabra (1913: 10)), [əskúpəl]. The general pronounciation in Barce-lona of words with **bl**, **gl** groups is, despite prescriptive pressure which might have confused some of the descriptions

(see Wheeler (1980) for references), nongeminate, i.e. [pl] and [kl]. **Ser clandestí** 'to be clandestine' is not distinguished usually from **segle en destí** 'century in destiny', both being [sékləndəstí] (the second might be pronounced a little bit tenser). In any case both contrast clearly with **cec clandestí** 'clandestine blind', [sékkləndəstí], which shows gemination.

7 The analysis presented would predict gemination in such cases. The first case would be strange because of the stress before a heavy syllable. An example of the second case would be **problema** 'problem' (see (7d)) if **ema** is analyzed as a morpheme and **pro** is not underlyingly stressed. Even so, morpheme boundary doesn't coincide with limit of cyclic domain, especially for the boundary related to unproductive suffixation.

8 There are no examples in the reverse listing of Fabra (1932) to which I have had access, either in **bb**, **gg** endings, or when these are followed by **e** (the orthographic representation of the epenthetic vowel), **a** (the feminine suffix), and other common suffixes.

9 There are of course other possibilities. Here I have limited myself to clusters of stops and sonorants, excluding clusters of two sonorants. See Mascaró (1985).

10 The distribution of [r] and [r̄], in Catalan and in languages that exhibit a similar pattern, is still puzzling. The right generalization seems to be that the flap can never be the first element of the syllable. This would explain why it is tensed in [r̄íw] and [ənr̄ík] (see (1)), why the syllabification **pə.βrə** is preferred over **pəb.rə**, and why there is **d**-insertion in cases like the future form [tindré], from [tin+ré] (Mascaró (1978: 80-82)).

11 Some dialects have gemination before a glide, presumably because the rules that syllabify glides differ. See, for example, Veny (1982: 132).

12 Even assuming that gemination were to apply to **angle**, **sembla**, they would simplify anyhow. I am assuming, however, that the **g** or the **b** cannot be syllabified with the preceding nasal. Extrasyllabicity is one of the conditions for Cluster Simplification.

13 The morpheme boundary is justified by related forms like **atlo-**, which appears in compounds, and by the fact that **atlas** is invariable in the plural, like other words with an inflectional marker which ends in **s**.

14 See Fabra (1912: 20-21).

15 See Wheeler (1979: 321-324) and Mascaró (1985) for discussion of the process.

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