

THE TREATMENT OF GEMINATES:
EVIDENCE FROM BERBER*

Jilali Saib
Department of Linguistics, UCLA

This paper proposes a solution to the indeterminacy problem which has often characterized the treatment of geminate consonants. The indeterminacy consists in treating them--owing to their dual function--as underlying sequences of two-like segments with respect to some rules and as unit segments with respect to others. Harm's [1968:36] solution to the problem is found inefficient since it does not constrain the representation of geminates. Overwhelming evidence is brought forward for a sequential analysis of Berber geminates. A phonetically motivated and potentially universal convention is here presented, whereby the two elements of a geminate cluster fortify each other and as such are redundantly specified [+tense]. This explains why geminates in Berber and other languages (1) are exempt from spirantization viz. $tt \rightarrow \theta\theta$, (2) are not broken up by an epenthetic rule, and (3) undergo strengthening processes of their own.

0. Introduction

A longstanding problem concerning geminates is that, within a single language, they can function sometimes as sequences of two like-segments, or as unit segments. Phoneticians and phonologists alike have engaged in lengthy debates over how these segments should be represented. The

*This paper is a slightly revised version of a paper read at the Winter Meeting of the Linguistics Society of America, Dec. 1973. In writing it, I benefited from the comments and suggestions of the following scholars: Victoria Fromkin, Larry Hyman, Thomas Penchoen, Russell Schuh, and Michael Brame. Their help is gratefully acknowledged. Any errors or omissions are my sole responsibility, however. As this paper goes to press, I have received a paper on geminates by Mohammed Guerssel, entitled "Constraints on phonological rules", to appear in *Linguistic Analysis*. In his paper, Guerssel also argues for a sequential analysis of Berber geminates, follows the same line of argumentation, and utilizes the same arguments as those advanced here.

debate among phoneticians centers around the question of whether the production of geminates involves two phases, i.e. rearticulation of the segment, or one phase.¹

Among phonologists, the debate revolves around the issue of whether geminates, when contrasted with single consonants, are to be analyzed as a sequence of two like segments, i.e. CC versus C, or as one segment with a feature specification [+long] or [+tense].² Since there is much confusion surrounding this issue, the discovery of a language where compelling arguments can be made for defending one of these approaches is of major consequence.

One such language, Berber (the data are mainly drawn from the Ayt Ndhir dialect of Tamazight) is treated at length here, where it is argued that, in order to adequately explain a number of phonological facts, geminates must be treated as sequences of two identical consonants. At the same time, however, in order to explain other facts of the language, a general convention for interpreting each of the two identical consonants in the sequences as redundantly [+tense] is introduced and defended.

In what follows, a typology of geminates in Berber is given (Section 1), followed by an outline of general approaches to the analysis of these segments (Section 2). In Section 3, evidence is presented for analyzing Berber geminates as sequences of two like consonants. Some arguments for analyzing these geminates as single [+long] or [+tense] consonants, are given in Section 4. In Section 5 the aforementioned convention is offered, and its implications discussed (Section 6).

1. Geminates in Berber

The approach to be argued in this paper applies equally well to lexical (or underlying) geminates, as seen in (1):

¹A summary of the debate and references for the two opposing viewpoints can be found in Lehiste [1973:131-32].

²Cf. Swadesh [1937], Martinet [1959:223-27], and Mitchell [1957] as well as other papers in the volume where Mitchell's paper appears.

- (1) /ass/ [ass] 'to tie' (cf. /as/ [as] 'to fit')
 /aff/ [aff] 'to be full' (cf. /af/ [af] 'to find')

as well as to geminates derived by rule, as in (2):³

- (2) a. sg. /afus/ [afus] pl. [ɪfassen] 'hand'
 sg. /afud/ [afud] pl. [ɪfadden] 'knee'
- b. /ad + d # ddu + x/ [addeddɪx] 'that I will come over here'
 FUT DIR come I
- c. /ad # t + ddu/ [atteddu] 'she will go'
 FUT she go
- (FUT stands for future, and DIR for directional particle)

In (2a) the geminate consonants in the plural forms arise through a rule of derivational morphology. In (2b), the geminate consonants are the result of two identical consonants coming together across a grammatical boundary. Finally, in (2c), the geminate consonants result from a complete assimilation of one consonant to another. The fact that certain phonetic geminates derive from a sequence of segments raises the question of whether all phonetic geminates should be similarly derived.

2. Approaches to Geminates

Two possible analyses suggest themselves. Under one analysis, which I will call the *feature analysis*, geminates would be assigned a feature [±long] or [±tense].⁴ Under the other analysis, which I will call the *sequential analysis*, the geminates are analyzed as a sequence of two identical consonants.

³The changes in the quality of the vowels are ignored here since they are not crucial to the discussion. Since the present discussion applies to Berber in general, single consonants are represented as stops, not as spirants (cf. Saib [1974]). Throughout this paper schwa is represented as e; ɗ, ɓ, ɠ, correspond to ð, β, γ, respectively. A dot underneath a C indicates Pharyngealization.

⁴The feature [±tense] is explicitly proposed for geminate consonants in Berber by Mitchell [1957], Galand [1975], Harries [1966], Abdel-Massih [1968], and Penchoen [1973]. Of these authors, Mitchell bases his use of the feature on some phonetic experiments, mainly with palatograms and kymographs.

Given these two possible approaches, three logical claims can be made about the nature of the underlying representation of geminates. They are given in (3) - (5):

- (3) *Strong Claim:* only one of these analyses is correct and all geminates must be treated as such in *all* languages, i.e. one of these analyses is universally disallowed.
- (4) *Modest Claim:* both analyses are available, but only one can be used in a given language.
- (5) *Weak Claim:* both analyses are available to languages and can co-occur in a single language. (This is in accordance with a convention originally proposed by Harms [1968:36].)

At the outset it is clear from the linguistic literature that the strong claim is too strong. Therefore, I will first address myself to the modest claim. Given this constraint, which of the two approaches (the feature analysis or the sequential analysis) would be correct for Berber? The claim inherent in the feature analysis is that geminate consonants function like single consonants in Berber; the claim inherent in the sequential analysis is that geminate consonants function like sequences of two consonants in Berber. I shall now present evidence that the feature analysis cannot account in a non-ad hoc way for certain aspects of Berber phonology.

3. Evidence for the Sequential Analysis

The first piece of evidence is afforded by the feminine/diminutive formation of nouns. Examples are provided in (6):

- | | <u>Masculine</u> | | <u>Feminine/diminutive</u> | | | |
|----|------------------|-----------------------|----------------------------|--------------|------------|--------------|
| a. | /axam/ | [axam] | 'tent' | /t-axam-t/ | [taxamt] | 'small tent' |
| b. | /aħṛrat/ | [aħṛraṭ] ⁵ | 'plower' | /t-aħṛrat-t/ | [taħṛraṭt] | 'plowing' |

⁵Masculine singular nouns with t as the final radical are very rare in present day Berber dialects/languages. A t reappears in the plural of a number of nouns (e.g. arba 'boy' arbaten 'boys'), which suggests that 'boy' was probably */arbat/ to which the regular plural suffix /-n/ is added. Nonetheless, a sequence of t(#)t → [tt], e.g. /wwt#t/ 'hit him' [ewwet].

(6) cont.

- c. /afud/ [afud] 'knee' /t-afud-t/ [tafutt] 'small knee'
d. /abuɖ/ [abuɖ] 'bottom' /t-abuɖ-t/ [tabuɖtt] 'small bottom'

In (6a) we see that feminine/diminutive formation of nouns is achieved by prefixation and suffixation of a *t*. When two *t*'s come together, as in (6b), the result is a geminate. Note that there is a phonetic contrast between *t* in the masculine and *tt* (or *t:*) in the feminine. Similarly, when non-identical dental stops come together, as in (6c), regressive assimilation takes place, and the end result is a geminate. It is clear from these examples that at least some phonetic geminates must be derived from a sequence. Otherwise the masculine and feminine form would have to be listed separately in the lexicon, which would obscure the regular relationship between them.

A second piece of evidence is provided by the data in (7), taken from the Ntifa and Zayan dialects of Tamazight (cf. Laoust [1918:129, 130]; Loubignac [1924:206]), which illustrate a process of degemination by vowel insertion:

(7) <u>Zero Form</u>	<u>Intensive Form</u>
/fzz/ [fezz] 'to chew'	/tt-fzz/ [ettefzaz]
/gzz/ [gez] 'to gnaw'	/tt-gzz/ [ettegzaz]
/bdd/ [bedd] 'to stand up'	/tt-bdd/ [ettebdad]

The insertion of *a*, along with the prefixation of *tt*, is in line with the intensive form derivation of the so-called vowelless stems with a lexically geminate second radical, e.g. /C₁C₂C₂C₃/: /bddl/ 'to change' [bedde]. Put differently, the verbs in (7) pattern along the lines of verbs such as /bddl/, which form their intensive form with prefixation of *tt* and insertion of *a* before the last radical consonant: /tt-bddl/ → /ettebdad]. Since in the case of verbs such as those in (7) the second root consonant is a geminate, it is broken up for the purpose of *a* insertion required by the intensive form derivation.

While this type of degemination rule is only a minor rule in Berber phonology, and while it is motivated by the intensive form derivation, another motivation for it could have been, historically, the simplification of consonant clusters. In a sense, the *a* insertion might also

double up as an epenthesis rule in the intensive form of these stems. There exists in Berber a constraint against three consonants in a row (cf. Saib [1976: Chap. 3]). (For the insertion of a schwa in [ettbedda] 'to change' before the geminate tt instead of between the two t's, see the explanation given below in footnotes 7, 8 and 9).

Returning to the main discussion, we find that, not only is the [+tense] analysis unable to satisfactorily account for the insertion of /a/ between the geminate consonants in (7), but that it also cannot explain the motivation of this process; since, according to the feature analysis, a sequence of a consonant followed by a geminate would be viewed as only two consonants in a row. One could, of course, consider a sequence of a non-tense C and a tense C to function as a three consonant sequence, but this is just what a "geminate" solution is stating.

A third piece of evidence pointing to the necessity of the sequential analysis is drawn from a productive process of schwa insertion,⁶ illustrated in (8):

- (8) /bdu/ → [ebdu] 'to start'
 /gnu/ → [egnu] 'to sew'
 /rzu/ → [erzu] 'to look for'

The rule in (9) states that a schwa is inserted before two consonants followed by a vowel:

⁶For the sake of clarity, the rules of schwa epenthesis proposed here are stated so as to apply mainly to the verb stems in their simplest forms, i.e. Zero Form and Intensive Form without the affixes. Certain clusterings involving geminates and a single consonant do arise during the conjugation. However, they do not pose any problems as stated in footnote 8 below. Certain Berberists (Laoust [1918]) have claimed that in the particular dialect they were investigating, there is a clustering different from that occurring in my dialect, viz [gers] 'to slaughter' instead of [egres]. It should be pointed out that this state of affairs is understandable given that, with very few exceptions, Berber verbs have at least one sonorant consonant. It is a well known fact across languages that more clustering possibilities arise when sequences of consonants contain sonorants. For a complete investigation of the problem of schwa in Berber, see Saib [1974, 1976].

(9) $\emptyset \rightarrow e / \text{___ CCV}$

As seen in the examples in (10), this same rule applies when a geminate is followed by a vowel:

(10) /kku/ → [ekku] 'to mow'
/ddu/ → [eddu] 'to go'
/rru/ → [erru] 'to add'

Thus, in order for rule (9) to apply to the forms in (10), it is necessary to interpret these latter forms as beginning with *two* consonants--which in this case happen to be identical. If these geminates were interpreted as single consonants, then there would be no schwa insertion, as indicated in (11):

(11) a. [fa] 'to yawn' (no schwa insertion)
[su] 'to drink' " " "
b. *[kku] 'to mow'
*[ddu] 'to go'

Hence, if we were to view geminates as single consonants, we would expect the schwa-less forms in (11b). Since these do not occur, there is strong evidence for analyzing geminates as double consonants. One could also state the rule as (9a):

(9a) $\emptyset \rightarrow e / \text{___} \left\{ \begin{array}{l} \text{CC} \\ \text{C:} \end{array} \right\} \text{V}$

But this again makes C: equivalent to CC and makes a simple rule complex by stating two environments instead of one.

There is a second rule of schwa insertion operating in Berber, which is stated in (12):

(12) $\emptyset \rightarrow e / \text{CC ___ C\#}^7$

⁷It might be pointed out that, as stated, rule (12) would not yield the correct output for the citation form of the verbs in (7) above. Indeed, surface forms such as *[efzez] 'to chew' would result, if the final radical consonant is analyzed as a geminate cluster, as is argued here. This suggests that the rule must be reformulated so as to handle these verbs. While the machinery, for example, angle brackets, is available to us to do

In verb stems consisting of three underlying consonants (and no phonological vowel), a schwa is inserted to separate the last consonant from the two preceding consonants. As seen in the derivation in (13), this rule feeds into rule (9):

- (13) Underlying form: /x_dm/
 By rule (12): xdem
 By rule (9): exdem
 Phonetic form: [exdem] 'to work'
 cf. [egmes] 'to cover'
 [er_zem] 'to open'

What is important is that words which consist of a geminate consonant followed by another consonant follow exactly the same two rules, as illustrated in (14):

- (14) Underlying form: /kks/
 By rule (12): kkes
 By rule (9): ekkes
 Phonetic form: [ekkes] 'to take off'
 [ellef] 'to repudiate'
 [eqqn] 'to close'

As seen in the forms in (15), when a word consists of two underlying consonants, a schwa is inserted either before or between the two consonants.

- (15) /ng/ → [eng] or [neg] 'to kill'
 /ns/ → [ens] or [nes] 'to spend the night'

Thus, if the underlying geminates in (16a) were analyzed as single consonants, we would expect to find the phonetic forms in (16b):

- | | |
|-----------------------------|-----------------------|
| (16) a. /kks/ 'to take off' | b. *[ekks] or *[kkes] |
| /llf/ 'to repudiate' | *[ellef] or *[lllef] |
| /qqn/ 'to close' | *[eqqn] or *[qqen] |

so, we do not see any gain in unduly complicating the statement of the rule. Such forms are easily accounted for by the general constraint stated in footnote 8, below. Hence, all that would be needed is to add a condition on the schwa rule (12) saying that it cannot break up geminate consonants.

Since none of the forms in (16b) are found, (at least as citation forms, cf. footnotes 6 and 8), it is obvious that these geminates must be analyzed as sequences of two identical consonants. The one exception is when the schwa placement rule would insert a schwa between the two geminate consonants (e.g. during the conjugation of the verbs in those persons indicated by suffixes, such as -x 'I', etc.). This would, for instance, create such incorrect forms as *[keksex] (< /kks-x/ 'I took off') instead of the correct [ekkses]. A general constraint on the schwa rule will have to indicate that if a schwa would occur between the two elements of a geminate cluster, it automatically moves one place to the left, occurring before them. This is, however, *not* an argument for saying that geminate consonants should be treated as one segment. If this were to be seriously argued, it would mean that geminates would be counted as one segment just in case the schwa rule would not give the desired output, and would therefore be completely circular. Since I have given examples of where geminates must be counted as two segments for the same schwa insertion rule, this would amount to saying that we have to look ahead to the phonetic output and then decide whether we want to call a geminate consonant one or two segments. It is much sounder to start with one representation of geminates, viz. as a consonant sequence and have a condition on the schwa insertion rule which forbids the schwa from occurring between the like consonants. This condition is in itself well-motivated by the mutual effect that the two consonants have on one another, i.e. mutual strengthening.⁸

In summary, it should be clear from the above arguments that treating Berber geminates under the sequential analysis leads to a more general and explanatory account of Berber phonology.

⁸In fact, what the Berber data suggest is the following general constraint: an epenthetic rule would not normally break up a geminate cluster. The generality of this constraint is supported by the fact that it is found to be operative in a number of Arabic dialects. In Moroccan Arabic (Saib [1975], Dahbi [1975]), as is the case in Berber, the schwa insertion rules break up clusters of unlike consonants, e.g. /ktb/ → [ekteb] 'write', but not geminate clusters, e.g. /fkk/ → [fekkk] 'untie' not *[fkek]. See also Abdo's discussion of this phenomenon in the Mukabir dialect of Arabic (as reported in Brame [1971:569-70]), where an epenthetic ð can break up all clusters except geminates, e.g. y++ktb+u → [yik+tbu] 'they write' but radd → *[rad+ð] 'he returned'.

4. Evidence for the Feature Analysis

Despite the evidence given above, the feature analysis does appear to be better suited to handle other aspects of Berber phonology.

One such aspect involves the morphologically conditioned rule by which the intensive form of verbs is derived from the zero form. The examples in (17) illustrate that one way this is achieved is by geminating one consonant of the stem, in this case the second consonant:

(17)	<u>Zero Form</u>	<u>Intensive Form</u>	
	/x <u>dm</u> /	/x <u>ddm</u> /	→ [xɛddɛm] 'to work'
	/g <u>ms</u> /	/g <u>mms</u> /	→ [ɛgmɛs] 'to cover'
	/r <u>zm</u> /	/r <u>zzm</u> /	→ [rɛzzɛm] 'to open'

What is of interest here is that for those verbs which have underlying geminates in their zero forms, a prefix /tt/ is used to derive the intensive form, as seen in (18):

(18)	<u>Zero Form</u>	<u>Intensive Form</u>	
	/kks/	[ɛttɛkɛs] ⁹	'to take off'
	/llf/	[ɛttɛllɛf]	'to repudiate'
	/qqn/	[ɛttɛqqɛn]	'to close'

In order to determine how the facts in (17) and (18) can best be explained, let us examine roughly how the intensive rule is written under the two

⁹The phonetic forms in (18) are derived by rules (12) and (9). The schwa before the prefix tt is obtained by a reapplication of rule (9), since its structural description is met. In cases where the first stem consonant is non-geminate and is followed by a vowel, the intensive prefix tt reduces to t̄ in fast speech, and a schwa is then inserted before it, e.g. /tt-fafa/ 'to wake up' → [ɛtfafa]. It should be pointed out, however, that the existence of the careful pronunciation [ɛttfafa] does not constitute a problem for the analysis of schwa epenthesis proposed here. It is accounted for by the principled constraint proposed in footnote 8. Previous writers do not insert a schwa in this position, thereby implying that there exists none (Laoust [1918], Galand [1975], Abdul-Massih [1968], Penchoen [1973]). In fact Galand [1975], went as far as calling them "voyelles centrales imaginaires". However, an experiment which Jean-Marie Hombert and I ran at the UCLA Phonetics Laboratory clearly showed the existence of schwas word internally and reduced schwas word initially. I would like to thank Dr. Hombert for his help.

analyses. Under the feature analysis the data in (17) are accounted for by the informal rule in (19):

(19) . . . [-tense] . . . \rightarrow [+tense] / morphological information
C

Notice that the rule in (19) correctly predicts that in forms with underlying geminates, which are represented as single tense consonants, we will not obtain forms such as those in (20):

(20) *kekkes (from /kks/ 'to take off')
*lellef (from /llf/ 'to repudiate')
*qeqqen (from /qqn/ 'to close')

Since (19) converts a non-tense consonant to a tense one, it applies vacuously to such inputs as in the zero forms of (18).

On the other hand, under the sequential analysis the data of (17) are accounted for by the informal rule in (21):

(21) . . . C_x . . . \rightarrow C_x C_x / morphological information

In this conceptualization, the intensive form is seen to be derived from the zero form by means of a reduplication of a stem consonant of the verb. However, if (21) represents the correct approach to this derivation, then its prediction is that one of the geminate consonants should be able to undergo a second gemination as in (22):

(22) . . . C_x C_x . . . \rightarrow C_x C_x C_x / morphological information

However, as already seen in (20), this prediction is not borne out by the data.

Thus, one argument for the feature analysis is that it correctly predicts the inability of underlying geminates to further geminate in the derivation of the intensive forms of verbs. The only way a sequential analysis can be made to provide the same prediction is by adding a constraint in rule (21), reproduced now as (21'):

(21') . . . C_x . . . \rightarrow C_x C_x / Y (& morphological information)
where Y \neq C_x

The rule now states that this derivational process can reduplicate a consonant from the zero form of the verb, unless that consonant is

preceded or followed by an identical consonant (using Bach's neighborhood convention).

Although this condition accounts for the data, it should be noted that under the feature analysis no such condition is needed, since it is already built into the rule of (19) by using the feature specification [-tense] in the structural description.

A similar argument can be made concerning the phonological process of spirantization in Berber, which will now be considered from a historical perspective (cf. the discussion of spirantization in Biblical Hebrew reported by Sampson [1973]).¹⁰ In many Berber dialects, including my own, all non-geminate stops have been converted to spirants, as seen in the data in (23a):

(23a)	<u>Non-Spirantizing Dialects</u>	<u>Spirantizing Dialects</u>
a.	[tarik] 'saddle'	[θarišθ]
	[ender] 'to roar'	[ender]
	[tatbirt] 'pigeon (f.)'	[θaθbirθ]
b.	[afetta] 'couscous'	[afetta]
	[asebbab] 'trader'	[asebbab]
	[taddart] 'house'	[θaddarθ]

However, the geminate stops in (23b) are not affected by this rule in the spirantizing dialects.

Under the feature analysis we can assume the historical change in (24):

(24) [-tense] → [+cont]
 C

¹⁰The spirantization rule in Biblical Hebrew is similar to that operating in Berber except that in Biblical Hebrew a statable phonological environment for it exists. According to Sampson, it applies to single consonants post-vocalically, but not to geminates. In his squib, he argues for a feature analysis on the basis of the difficulty one would have in formulating the aforementioned spirantization rule in Biblical Hebrew. However, in a reply to Sampson, Barkai [1974:456-59], refutes Sampson's contention and convincingly argues for a sequential analysis. For a detailed study on spirantization in Berber, cf. Saib [1974, 1976].

Under the sequential analysis the historical change is stated as in (25):

(25) $C_X \rightarrow [+cont] / Y$, where $Y \neq C_X$

The condition in (25) is needed to ensure that a geminate consonant, which is here analyzed as a sequence of identical consonants, will not undergo spirantization. This would yield unacceptable forms such as those in (26):

(26) * $[afe\theta\theta a]$ 'couscous'
 * $[asebbab]$ 'trader'
 * $[\theta a\ddot{d}d a r \theta]$ 'house'

Thus, just as in the formation of the intensive form of verbs, it is the feature analysis which makes the correct prediction.

5. Conclusion

In conclusion, we can say that both analyses provide important insights into Berber phonology. Each analysis handles some aspects of phonological or morphological rules dealing with geminates, but each analysis seems inadequate with respect to other aspects. It would thus appear necessary to abandon even the modest claim made above in (4). In order to state the phonological properties of Berber, we find it necessary to refer to geminates both as sequences of identical consonants and also as $[+tense]$ consonants. In this case, we may find it necessary to use Harms' convention which would permit us to refer to the same phonetic entity either as a single consonant (for some rules) or as a sequence of two identical consonants (for other rules) (cf. also the treatment of vowel length phenomena by Kenstowicz [1970] and Pyle [1970]). This position, represented as the weak claim in (5), would unfortunately not place any constraints on the phonological representation of geminates in languages.

There is, however, a way out which should be considered. The importance of the arguments presented for the feature analysis in the preceding discussion is that we need to refer to geminates sometimes as $[+tense]$. No arguments were found, however, that these geminates had to be treated as single consonants. Thus, I propose the following convention in (27):

(27) C_X C_X
 ↓ ↓
 $[+tense]$ $[+tense]$

In Berber, all geminates will be analyzed as sequences of two identical consonants. However, they will be redundantly specified as [+tense]. In fact, (27) will reapply any time geminates are created. Thus, a single /t/, taken here as representing any single consonant, is [-tense], but when one /t/ abuts with another /t/, the two fortify one another and automatically become [+tense]. Since underlying /tt/ is now viewed as two consonants, both of which are specified [+tense], we can not only account for all of the data presented in favor of the sequential analysis, but also for all of the data handled by the feature analysis. Thus, the reason why geminates do not become intensified in the intensive form of verbs is that each of the geminate consonants is already redundantly specified [+tense]. Similarly, since each /t/ of /tt/ is specified [+tense], neither spirantizes to [θ].

6. Some Implications of Convention (27)

In Section 5, convention (27) is proposed to further motivate the sequential analysis argued for in the main body of the paper for Berber geminates. It is also presented to solve the almost endemic problem of indeterminacy concerning the representation of geminates faced by analysts. The question before us now is whether (27) is a language specific device, devised for Berber, or whether it has a universal application?

In the foregoing sections, we have seen, first, that geminates must be treated as consonant sequences in Berber; but, second, that they have characteristics of their own. In particular, having a sequence of two like-consonants is likely to produce a phonetically motivated strengthening of the articulation, so that /tt/ may differ from /t/ not only in duration but also in fortition.¹¹ Convention (27) is but a reflection of this phonetic fact.

As we have seen, one result can be that geminates may be exempt from weakening processes (e.g. spirantization) which other consonant sequences

¹¹This fact is documented in phonetic studies on geminates in languages belonging to different language families, cf. Delattre [1971], Lehiste [1973], and the references cited there.

undergo. This is explained by convention (27). In fact, with its demonstrably solid phonetic basis, (27) may prove to be a linguistic universal, (especially with respect to spirantization). Indeed, data from languages other than Berber, viz. Biblical Hebrew [Sampson 1973], Old Romance languages [Pope 1934], provide support for attributing universal status to (27). In both languages, as is the case for Berber, spirantization affects single consonants but not geminates. The difference between Hebrew and Berber is that storable environments can be found for the weakening rule. An illustration is given in (28) and (29):

(28) Biblical Hebrew [Sampson 1973:101]¹²

/gaadal/	[gaadaal]	'he became great'	but:
/giddeel/	[giddeel]	'he became great'	

(29) Romance (Old French) [Pope 1937:262]¹³

<u>Late Latin</u>	<u>Old French</u>	
gratu	gre [gre]	'liking'
*totta	tote > tute	tut 'all (fem.)'

It appears, thus, that there is indeed something universal about geminate consonants not weakening into a sequence of identical spirants, viz. tt ≠ θθ. This can be explained by the mutual strengthening effect of the two elements of the geminates captured by convention (27). If this claim withstands the test in other languages, it would represent an important constraint on geminates.

¹²So as to be consistent with the way geminates are represented throughout this study, Sampson's representation of these segments is not followed here. Moreover, VV is substituted for Sampson's V: for long vowels.

¹³Pope's other examples seem to suggest that the † in gratu, first weakens to d, then to ɖ in Gallo-Roman. The loss of the ending leaves ɖ in final position, hence the devoicing into θ, before complete disappearance in Middle and Modern French, viz. 'gre' [gRe]. Notice that the geminates in *totta, while not undergoing spirantization, can undergo reduction, a fact also accounted for by (27) (see below). The asterisk before *totta indicates that it is a reconstructed form, while the small zero under the e indicates that e is reduced to a schwa.

A second claim, which in effect is a corollary of the first, is also implicit in convention (27): geminates will reduce (degeminate) first, before undergoing spirantization (or other weakening processes). Thus, there is always going to be a time lag between reduction of geminates and spirantization. This predictive power of (27) explains certain reportedly "odd" alternations between geminates and their corresponding spirants in Berber, as exemplified in (30).¹⁴

(30) a.	<u>Singular</u>	<u>Plural</u>	
	ašəḡḡur	išəḡran	'flap of a cape'
	asekkur	išeḡwran	'partridge'
b.	<u>Zero form</u>	<u>Intensive form</u>	
	qqim	ttḡima	'to sit'
	ggal	ttjalla	'to swear'

This second claim implicit in convention (27) is further supported by changes which took place during the development of Modern French from Latin [Pope 1934], as illustrated in (31):

(31)	LL	OFII	Mid F	Mod F		
	toḡḡu	tot tut	tu(t)	tu	'tout'	'all'
	bassu	bas	ba(s, z)	ba	'bas'	'low'

In (31) it can be seen that Late Latin (LL) geminates tt and ss reduce in Old French (OFII), before undergoing first optional, and then obligatory deletion in Middle French (Mid F) and Modern French (Mod F), respectively.

A final piece of corroborating evidence for (27) is the existence of strengthening processes which only geminates undergo. Thus in a number of Berber dialects, among which is Taqbayliyt (=Kabyle), spoken in Algeria, ss > ts (symbolized as [cc]), but s > s. This is illustrated in (32):

¹⁴According to Loubignac [1924:39], some subdialects of Zayyan, where spirantization is not as pronounced as in Tamazight (Ayt Ndir) represented in (30), exhibit reduction but not yet spirantization.

(32) Taqbayliyt (At-Mangellat; Data from De Vincennes and Dallet [1960])¹⁵

<u>Zero form</u>	<u>Intensive form</u>	
f <u>sey</u>	fe <u>cci</u>	'to melt'
x <u>sey</u>	xe <u>cci</u>	'to be extinguished'
r <u>su</u>	re <u>ccu</u>	'to drive in (a stick)'

Supportive data illustrating the particular strengthening of the geminates can be drawn from languages other than Berber. In Spanish for example, Latin /ll/'s palatalize into [ʎ], while Latin /l/'s do not, e.g. caballo [kabalʎo] 'horse', malo [malo] 'bad'.

Since we have argued that the two elements of a geminate cluster are redundantly [+tense], while other consonants are [-tense], the processes illustrated by the data presented in this section are best explained by a theory incorporating convention (27).

REFERENCES

- Abdel-Massih, Ernest. 1968. *Tamazight Verb Structure*. African Series, Volume 2. Bloomington: Indiana University Publications.
- Abdo, Daud A. 1969. *On Stress and Arabic Phonology: A Generative Approach*. Beirut: Khayyats.
- Barkai, Malachi. 1974. "On duration and spirantization in Biblical Hebrew." *Linguistic Inquiry* 5:456-59.
- Brame, Michael. 1971. "Stress in Arabic and generative phonology." *Foundations of Language* 7:556-91.
- Dahbi, Mohamed. 1975. "On epenthesis in Moroccan Arabic." Ms., University of Southern California.

¹⁵In fact, in this dialect of Taqbayliyt (Kabyle), the intensive form prefix, tt, cf. (7) above, is an affricate transcribed here as cc (=tts). So is the lexical geminate tt in the following cognate forms:

<u>Tamazight</u>	<u>At-Mangellat</u>	
netta	necca	'he/him'
ttu-x	ccu-g	'I forgot'

Furthermore, in Tirifiyt (Northern Morocco), geminate /ll/ are rendered as [ʃʃ], e.g. Tamazight [ellef] 'to repudiate' = Tirifiyt: [eʃʃef].

- Delattre, Pierre. 1971. "Consonant gemination in four languages: an acoustic, perceptual and radiographic study." *International Review of Applied Linguistics* 9:31-52, 97-113.
- De Vincennes, Sr. L., and J.M. Dallet. 1960. *Initiation à la langue berbère (Kabyle)*. Fort National: Fichier de documentation berbère.
- Galand, Lionel. 1975. Review of Penchoen—*Tamazight of the Ayt Ndhir*. *Bulletin de la Société de linguistique* 70:345-48.
- Harms, Robert. 1968. *Introduction to Phonological Theory*. Englewood Cliffs, N.J.: Prentice Hall.
- Harries, M. Jeannette. 1966. "Syntactic structure of Tamazight." Doctoral dissertation, University of California, Los Angeles.
- Kenstowicz, Michael. 1970. "On the notation of vowel length in Lithuanian." *Papers in Linguistics* 3(1):73-113.
- Laoust, Emile. 1918. *Etude sur le dialecte des Ntifa*. Paris:Leroux.
- Lehiste, Ilse. 1973. "An instrumental study of consonant gemination." *Journal of Phonetics* 1:131-48.
- Loubignac, Victorien. 1924. *Etude sur le dialecte berbère des Zaian et Ait Sgougou*. Paris: Leroux.
- Martinet, Andre. 1959. "Du role de la gémination dans l'évolution phonologique." *Zeitschrift fur Phonetik* 12:223-27.
- Mitchell, Thomas. 1957. "Long consonants in phonology and phonetics." In *Studies in Linguistic analysis* 182-205. Oxford: Basil Blackwell.
- Penchoen, Thomas. 1973. *Tamazight of the Ayt Ndhir. Afroasiatic Dialects* Volume 1. Los Angeles: Undena Publications.
- Pope, M.K. 1934. *From Latin to Modern French*. Manchester: Manchester University Press.
- Pyle, Charles. 1970. "West Greenlandic Eskimo and the representation of vowel length." *Papers in Linguistics* 3:115-46.
- Saib, Jilali. 1974. "Gemination and the spirantization in Berber: diachrony and synchrony." *Studies in African Linguistics* 5:1-26.
- Saib, Jilali. 1975. "Epenthesis in Moroccan Arabic." Ms, University of California, Los Angeles.
- Saib, Jilali. 1976. "Schwa insertion in Berber: un problème de choix." *Afroasiatic Linguistics* 3(4):1-13.
- Saib, Jilali. 1976. "A phonological study of Tamazight Berber: dialect of the Ayt Ndhir." Doctoral dissertation, University of California, Los Angeles.
- Sampson, Geoffrey. 1973. "Duration in Hebrew consonants." *Linguistic Inquiry* 4:101-104.
- Swadesh, Morris. 1937. "The phonemic interpretation of long consonants." *Language* 13:1-10.