Studies in African Linguistics
Volume 5, Number 1, March 1974

GEMINATION AND SPIRANTIZATION IN BERBER: DIACHRONY AND SYNCHRONY[1]

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1. Introduction

Generative phonologists have become increasingly interested in questions relating to the psychological reality of grammars. It is clear that many different grammars can account for the data (i.e. be observationally adequate) but what is being sought is the unique grammar (if there is one) which will also represent a speaker's competence (i.e. is descriptively adequate). Various constraints have been proposed to accomplish this including the strong and weak alternation conditions (cf. Kiparsky [1968]), constraints on rule ordering (cf. Koutsoudas et alia [1971]; Vennemann [1973]; Hooper [1973]), markedness conventions (cf. Chomsky and Halle [1968]; Schane [1968]), etc. This paper is concerned with some aspects of this question as it relates to the representation of lexical formatives in Berber grammar.

The specific questions to be considered are those raised by the morphophonemic alternation between single and geminate consonants within the Berber languages of North Africa, and the occurrence of non-strident spirants, e.g. θ and ç , which alternate with geminate stops in the Northern and Central dialects of Morocco (e.g. Tirifiyt and Tamaziγt).[2]

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[1]I wish to gratefully acknowledge a number of comments and suggestions on earlier drafts of this paper (December 1971 and March 1973) by Professors Anttila, Bedell and Schuh. Special thanks are due to Professors Hyman, Vennemann, and most of all, to Professor Fromkin whose critical comments and insightful suggestions led me to undertake a number of revisions both in content and in style.

An abridged version of this paper was presented at the IVth Annual Conference on African Linguistics, Queens College, New York (April 1973). I wish to thank Professor Jeanette Harries, the Berberist at the University of Wisconsin, for her helpful comments and encouragements. Thanks are also due to another Berberist, Professor T. Penchoen, for being so helpful in discussing some of the data.

Any errors or omissions are my sole responsibility, however.

[2]Other Northern dialects such as Kabyle and Shawia are not included in this discussion.

The Southern dialects (e.g. Tachelḥiyt and Twareg) lack this series of non-strident spirants and exhibit instead simple stops in cognate alternating forms.

2. The Data

The simple consonant/geminate consonant alternations are illustrated by the following:[3]

		Zero Form	Intensive Form	Gloss
(1)	Tamaziɣt	eçmez	çemmez	'to scratch'
		eɣmes	ɣemmes	'to cover'
		ejnu	jennu	'to sew'
		eβnu	βennu	'to build'
		efley	felley	'to tear'
		emrey	merrey	'to rub'
		erẓem	reẓẓem	'to open'
		ens	nessa	'to wear'
(2)	Tachelḥiyt	bez	ebbez	'to peel'
		efṭel	feṭṭel	'to roll couscous'
		ebdu	beddu	'to start'
		enẓu	neẓẓa	'to be sold'
		enker	nekker	'to get up'

The examples under (1) and (2) are merely illustrative of the fact that this alternation is pervasive throughout the dialects. Other examples could be cited to show that all consonants (except for the voiceless bilabial stop p; cf. below) are affected. The 'zero forms' (hereafter Z.F.) in the above examples represent the shape of the verb that is used in the imperative (2nd person singular). It is the simplest form in that it is the most morphologically unmarked. The 'intensive form' (hereafter I.F.) is the imperfect (or continuous and habitual) aspect, and as seen in the examples, is a morphologically 'marked' form.

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[3] The forms presented in all examples are given in broad phonetic transcriptions. It should be noted that j represents a voiced palatal fricative, the voiced counterpart of ç, and e represents a schwa. A dot under a consonant indicates that the consonant is pharyngealized.

In the Southern dialects (Tachelḥiyt and Twareg) the only apparent exceptions to the alternations between simple consonants and identical geminates are the alternations ḍ : ṭṭ and ɣ : qq as shown in (3):[4]

(3)

Tachelḥiyt	Z.F.	I.F.	Gloss
	ebḍu	beṭṭu	'to divide'
	ekḍu	keṭṭu	'to smell'
	neɣ	neqqa	'to kill'
	reɣ	reqqa	'to be warm'

These cases are actually the result of a very general rule applying to simple and geminate pharyngealized consonants; the simple pharyngeals are voiced and the geminates always voiceless. The consonants symbolized as ɣ and q are pharyngealized velars (or uvulars). The rule is simple (assume for now that the underlying segment is non-geminate, an assumption which will be justified below):

(4) $\begin{bmatrix}+\text{consonantal}\\+\text{pharyngealized}\end{bmatrix} \rightarrow$ [+voiced]/ X : where X ≠ identical C

Using Bach's neighborhood convention (cf. Bach [1968]), this rule states that a pharyngealized consonant is voiced when the preceding or following segment is not identical to it.

One problem, then, to be accounted for in synchronic grammars of Berber dialects is this occurrence of C/CC alternations. A second problem arises when the Central and Northern Berber dialects of Morocco are examined. These dialects have, instead of all of the above alternations, a series of non-strident spirants alternating with geminate stops. That is, instead of the t : tt alternation, we find θ : tt . This may be illustrated by examples from the Aït Ndhir dialect of Tamaziɣt where spirantization is particularly widespread.

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[4] Though this paper deals with underlying representation, I will not concern myself with the question as to whether neɣ 'to kill', for instance, is underlying neɣ or enɣ or nɣ . Rather, I will give all the examples in their broad phonetic transcription (cf. footnote 3 above).

(5)

	Z.F.		I.F.	Gloss
f : ff	enfeḏ	:	neffeḏ	'to throb'
	erfes	:	reffeṣ	'to dip'
β : bb	enβeš	:	nebbeš	'to be nosy'
	erβel	:	rebbel	'to ramble'
θ : tt	efθel	:	fettel	'to roll couscous'
	enθel	:	nettel	'to hide'
ð : dd	eβðu		βeddu	'to start'
	enðu		neddu	'to become buttermilk'
ḏ : ṭṭ	erḏel	:	reṭṭel	'to loan'
	eβḏu	:	βeṭṭu	'to divide'
j : gg	jen	:	eggan	'to sleep'
	erjem	:	reggem	'to insult'
ɣ : qq	neɣ	:	neqqa	'to kill'
	reɣ	:	reqqa	'to be warm'

Some additional facts should be noted prior to a discussion of the historical processes which gave rise to these alternations and dialect differences and to the discussion of how best to account for these facts in Berber synchronic grammars. Of particular interest is the fact that in no dialect do we find a p or pp (an exception is the baby talk word pappa 'bread'). This non-occurrence of the voiceless bilabial stop is also found in other languages in the area (Arabic, Hausa, Somali etc.) where only a two-way labial obstruent contrast is found, usually between b and f ; neither p nor v occurs. In addition, as noted above, the non-geminate pharyngealized consonants are automatically voiced. Furthermore, they are spirantized in Northern dialects as shown in (6):

(6) Tamaziɣt (Aït Ndhir)

Z.F.		I.F.	Gloss
enḏel	:	neṭṭel	'to bury'

(See also examples in (5))

Finally, the spirant alternants of the geminates kk and gg are the palatals ç and j respectively in the spirantizing dialects, as seen in (7) (however, see (13), (14), (15b) below and Appendix I):

(7) Tamaziγt (Near Demnate)

Z.F.	I.F.	Gloss
erçel	rekkel	'to kick'
erçem	rekkem	'to boil'
erjem	reggem	'to insult'
emjer	megger	'to harvest'

This fronting may be due to the need for 'maximal differentiation' between velars and uvulars.

The question of the systematic phonemic representation of the verbs in the Aït Ndhir dialect will be considered here. Specifically the paper will attempt to resolve the problem of whether underlying forms have geminates, simple stops, or spirants. The solution to the problem has direct bearing on phonological theory. An historical account of the development of these dialect differences is relevant to the discussion and will hopefully also contribute to our understanding of historical change in general.

3. Diachronic account

It is generally accepted that historically the Berber spirants derived from stops (cf. Laoust [1918] and [1939]; Loubignac [1924]; Renisio [1932]; Basset [1952]). This process illustrates the historical 'weakening' found in many languages. In the dialect under discussion, there appears to have been no conditioning factor other than that the stop that undergoes spirantization is non-geminate. Aït Ndhir shows the most complete process; other dialects show varying degrees of spirantization. Thus, for example, while the Aït Izdeg dialect of Tamaziγt exhibits a number of instances of *k → ç (and even *k → š), and *g → j , it exhibits only a few instances of *t → θ and *d → ð. This is illustrated in (8) (cf. Mercier's lexicon [1937]):

(8)

Tamaziγt (Aït Izdeg)			Gloss
a.	açez	< /akez/	'to recognize'
	arjam	< /argam/	'insult'
	ašal	< /akal/	'earth'
b.	iθri	< /itri/	'star'
	amaðal	< /amadal/	'side'

Unfortunately, the published description of many of the dialects (see references above) are so sketchy that the reader is unable to determine what sound changes are posited for which dialect. Thus, it is not possible at this time to illustrate or analyze all the inter-dependencies as, say, Foley [1969] has proposed. What is clear is that all dialects have spirantized *p to f .[5]

The relationship between the *p → f spirantization and the other cases of spirantization is not clear-cut. This *p → f change characterizes most of the vast Afro-Asiatic family, including Arabic, Hausa, Somali and also Berber. (A similar change characterizes Japanese, though the resultant f is further modified to h [Ultan 1970] .) This change may have triggered the chain of subsequent spirantizations that characterize many Berber dialects. But, it is clear that this change is separated from the other spirantizations by a considerable period of time.[6]

Also, it should be noted that the other Afro-Asiatic languages do not spirantize as does Berber. Furthermore, in Berber, the *p → f change is unlike the other changes in that it affects the geminates as well as the non-geminates; there is no Berber dialect where single f alternates with pf which might be assumed as an intermediate step. Thus, all Berber dialects reflect the historical context-free rule (9):

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[5]This is assuming that Proto-Berber indeed had a *p .

[6]Borrowings with p from Latin are rendered with f , even in Tachelḥiyt, a non-spirantizing dialect. E.g. Latin pullus > Tachelḥiyt afullus 'chicken'. Yet, just as in native Tachelḥiyt morphemes, other stops remain unchanged in loan-words from Latin, e.g. Latin hortus > Tachelḥiyt urtu 'garden'. The Romans established their direct rule over Eastern North Africa shortly after the third Punic War. Parts of Morocco were colonized by the Romans from around 42 A.D. until the Arabic invasions (end of the seventh century, A.D.).

(9) *p > f

Moreover, the spirantizing dialects reflect additional historical rules resulting in the alternations: C_f^1 : C_s^2 (where C_f^1 = a single spirant and C_s^2 = a geminate stop).

Other than the voiceless labial spirantization, the only spirantization attested in all the Berber dialects I have investigated concerns the uvulars: all dialects appear to have a simple γ which alternates with qq .[7] Dialects such as Tachelḥiyt and Twareg, then, have only two cases of spirantization: f : ff and γ : qq ,[8] as shown in (10).

(10)

Tachelḥiyt			Twareg[9]			
Z.F.		I.F.	Z.F.		I.F.	Gloss
neγ	:	neqqa	enγ	:	negg (naqq)	'to kill'
reγ	:	reqqa	erγ	:	reqq (raqq)	'to be warm'
esfeḍ	:	seffeḍ	sfeḍ	:	seffeḍ	'to wipe'

Since the *p was presumably lost at an earlier period, possibly when this occurred in other Afro-Asiatic languages, and since at one stage speakers would hear only f and ff , this spirantization does not provide a viable model for stop/spirant alternations. We can hypothesize that the first spirantization in the later chain of historical development is an uvular pair. It is this pair, then, which may have triggered the rest, if triggering did indeed occur. It is, of course, possible

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[7] There are few instances of γγ however, e.g. aγγu 'buttermilk', taγγatt 'goat', etc.

[8] Actually the picture is not as clear as the previous authors would like us to believe. Spirantization is slowly spreading southwards. In 1971 I personally observed the spirantization of *k → ç and *g → j in the speech of a Berber from around Demnate. Doyle Hatt (personal communication) found this to be true of speakers of Tachelḥiyt, and Russell Schuh (personal communication) observed the same trends in the speech of some Twaregs. However, until a thorough investigation of this spread is done, I will assume only the two cases of spirantization illustrated in (10) for Tachelḥiyt and Twareg.

[9] The Twareg data, taken from Basset [1929], are reproduced here in their original transcription (cf. also footnote 4).

that each spirantization took place independently of the others when it was 'due' on the strength scale (Vennemann, personal communication).

Another indication that the labial change had little influence on subsequent spirantization is the relatively rare occurrence of β in Berber. There are some dialects that show an alternation between β and bb , but in many dialects the picture is one of general spirantization of single stops except for the labial *b . Thus, in addition to the spirantization problem, there is a labial problem. That is, whereas other places of articulation permit a four-way contrast (e.g. alveolar obstruents t , d , s and z) the labial position seems to permit only a two-way obstruent contrast between f and b . There appears to be some force in the language that strives to maintain this pattern.

A final case of historical change to be considered here is that of the fronting of the velars k and g . The spirantized realizations of these segments pose several questions. First of all, the expected spirants are ç and j , which are, in fact, widely attested in present day Berber dialects. However, some dialects have further modified these to š and ž while in other verbs the alternations are between šš , žž and š , ž , respectively as shown in the following examples.

(11) Tamaziγt (Aït Ndhir)[10]

	Z.F.	I.F.	Gloss
š : šš	mšeḍ	mešše ḍ	'to comb'
	enšef	nešše f	'to scratch'
ž : žž	eržem	režžem	'to lapidate'
	enžer	nežžer	'to saw'

The further change from č and j to š and ž , respectively, is not surprising. It has often been noted that [-back, -coronal] lingual continuents often become [+strident, +coronal] (cf. German ich which

[10] At first glance these forms would seem to pose a problem for the synchronic solution suggested below. However, these four verbs, borrowed from Arabic, are to my knowledge the only alternations between š/šš and ž/žž, and are therefore outside the main pattern.

dialectically becomes ǀš). Chomsky and Halle [1968], claiming that š and ž are less marked than ç and j , posit 'linking rules' to account for this 'natural process'.

In Berber, however, both ç and š and j and ž occur in single dialects without any apparent conditioning factor. In (12) forms from Tachelḥiyt and Tamaziɣt are compared, in which it is seen that Tachelḥiyt k corresponds to Tamaziɣt ç .

(12)	Tachelḥiyt	Tamaziɣt	Gloss
	aksum	açsum	'meat'
	aksar	açsar	'slope'
	azukenni	azuçenni	'thyme'
	akuz	açuz	'weevil'
	akz	açz	'to remember'
	aseksu	aseçsu	'couscous strainer'
	aseksa	aseçsa	'chick'
	uska	usça	'hound'
	akurdu	açurðu	'kind of bug'

In (13), however, Tachelḥiyt k corresponds with Tamaziɣt š :

(13)	Tachelḥiyt	Tamaziɣt	Gloss
	akal	ašal	'earth'
	akabar	ašaβar	'caravan'
	akanif	ašanif	'grill'
	tarikt	θarišθ	'saddle'
	tanekra	θanešra	'awakening'
	tiškert	θišširθ	'garlic'

We can see that it is not simply the case that in some dialects *k and *g have become ç and j , respectively, but that in others the process is extended further to yield š and ž . These dialects appear to represent "language change in progress" [Labov 1972].

In addition we also find the modification of *g to the glide y . The seven different realizations of Proto-Berber *agsum 'meat' as given in (14), show the changes which have occurred. These changes are all

attested in different dialects.

(14) *agsum (Proto-Berber)

a. agsum (no change)

b. aksum (devoicing)

c. açsum (devoicing and spirantization)

d. ašsum (devoic., spir., palataliz.)

e. ajsum (spirantization)

f. aysum (spirantiz., glide-creation)

g. ažsum (spirantiz., palatalization)

Not only do we find inconsistent historical reflexes in a single dialect, but, in addition, we find the same inconsistencies in borrowings from Arabic, where Arabic k is sometimes realized as ç and sometimes as š, again with apparently no statable conditioning factor(s):

(15)

	Arabic	Tamaziγt[11]	Gloss
a.	sellek	selleç	'to be lenient'
	esken	esçen	'to live'
	enker	ençer	'to deny'
	erkel	erçel	'to kick'
	ekra	içra	'he rented'
	(Arabic k → Tamaziγt ç)		
b.	eḥkem	eḥšem	'to rule'
	ekrem	ešrem	'to be dry'
	kemmel	šemmel	'to finish'
	lekta:b	lešta:b	'book'
	lehka:m	lehša:m	'judgment'
	(Arabic k → Tamaziγt š)		

There are some borrowings from Arabic which, to further complicate the problem, show phonetic k :

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[11] The Tamaziγt forms in (15a) would be representative of the transitionary dialects spoken near Demnate (cf. footnote 7 above).

(16)

Arabic	Berber	Gloss
lektatbii	aktatbi	'secretary'
elhakem	alhakem	'judge'

We can now summarize the historical changes which have occurred.

(17)

a. p → f

b. q → ɣ

c. k → ç → š
   g → j → ž

d. t → θ
   d → ð

e. ṭ → ḍ

f. b → β

4. Synchronic account

While the summary of the historical changes reveals the differences observed in Berber dialects and explains the alternations that now occur, the problem of how to account for the present situation is not necessarily resolved by the diachronic account.

The two major questions discussed here which must be resolved concern the representation of the simple/geminate consonant alternations, and the stop/spirant alternations.

The examples given above (cf. (1), (2), (3) and (5)) show the alternations between simple and geminate consonants in the Zero and Intensive Forms of the verb, respectively. Clearly, if this is a predictable regularity it can best be accounted for by positing a single phonological representation of the stems and a rule (or rules) for the alternant phonetic forms. This possibility has been denied by previous writers like Bisson [1940] who stated: "Il faut connaître la forme d'habitude (i.e. Intensive Form) de chaque verbe, car il est impossible de la construire soi-même de façon certaine (emphasis mine, J.S.)." Despite this claim, such rules exist and can be stated so as to reveal the generalizations. For convenience sake examples of the alternations are given in (18) (cf. also (1), (2), (3) and (5) above).

(18) Tamaziγt (Aït Ndhir)

	Z.F.	I.F.	Gloss
a.	efθel	fettel	'to roll couscous'
	erẓem	reẓẓem	'to open'
b.	neγ	neqqa	'to kill'
	ens	nessa	'to spend the night'
c.	seγ	ssaγ	'to buy'
	γer	qqar	'to call'
d.	ebδu	beddu	'to start'
	erzu	rezzu	'to look for'
e.	neqqer	ttneqqar	'to shake off'
	ferreγ	ttferraγ	'to pour'

The data in (18) show that Berber verbs behave differently with respect to the process of gemination (or lengthening) which takes place in the formation of the I.F. One pattern which emerges (from looking at the data) is that the selection of the consonant to be geminated (or lengthened) is dependent on the number of consonants in the stem of the Z.F. which is assumed here as the underlying stem. However, this leaves us with the problem of explaining the different behavior of the verbs in (18c). These verbs geminate (or lengthen) the first stem consonant instead of the second (cf. (18a, b, d)).[12] This points to a difficulty of the Berber verb system, a difficulty which may be resolved by the establishment of verb classes and the utilization of a diacritic feature $[-G_2]$ (where G_2 = gemination of second consonant) on the verbs in (18c). This diacritic feature would prevent the gemination of the second consonant and permit gemination of C_1.

The data in (18) are handled by a set of rules which stipulates that a simple C of the Z.F. becomes CC in the I.F., as well as other internal changes, such as vowel alternation, that sometimes occur. This

[12] In Twareg, which is regarded by Berberists as the most conservative Berber dialect, the tensing of the first consonant is not the exception but the norm for verbs with two consonants.

is assuming that the direction of the derivation is: Z.F. → I.F. (i. the Z.F. is the underlying form).

Conceivably, one might want to take another position. On the basis of the data given in (18) one could argue that it is just as reasonable to derive the Z.F. from the I.F.: all that is taking place, according to this alternative analysis, is the loss of gemination (or length) and some vowel alternations and deletion. There are other considerations, however, which make the derivation Z.F. → I.F. not only more motivated or more economical, but intuitively more satisfying.

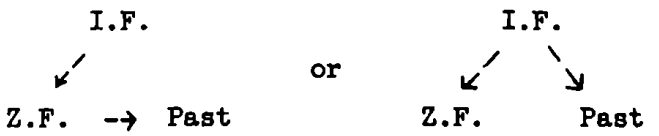
A certain number of arguments--two of which I present here--can be brought forth against this alternative analysis (and hence, for the Z.F. to I.F. analysis). This is in addition to the fact that the Z.F. is the citation form, as well as the least morphologically marked one. First, the predicating power of the I.F. to Z.F. analysis is not as great as that of the Z.F. to I.F. analysis. This is illustrated in (19) which shows that the Past and the Z.F. have the same consonant structure.

(19) Tamaziγt (Aït Ndhir)

Z.F.	Past	I.F.	Gloss
əfθəl	-əfθəl-	fettəl	'to roll couscous'
neγ	-neγ-	neqqa	'to kill'
əbḍu	-əbḍ-	bəṭṭu	'to divide'

Notice that if one starts with the I.F., then one is compelled to derive the Past from the Z.F., following the diagram given in (20):

(20)



This obviously points to the fact that a linguistically significant generalization is being lost, as other languages do not seem to operate in this way. Furthermore, it means that degemination rules must be written for both Z.F. and the Past. Also, the I.F. to Z.F. analysis would be at a loss to explain the alternations given in (21):

(21) Tamaziɣt (Aït Ndhir)

Z.F.	I.F.[13]	Past	Gloss
ggall	ttgalla	-ggull-	'to swear'
gganney	ttgannay	-ggunney-	'to wait'
qqim	ttɣima	-qqim-	'to sit'
qqar	ttɣara	-qqur-	'to be dry'
ǰiwen	ttgawan	-ǰiwen-	'to be full'
eč	ttetta	-eč-	'to eat'

If we start from the I.F., then we would have to say that what is taking place here is degemination of a stem consonant. Moreover, we would have to mark a great many verbs with lexical geminate with a [-Rule X] in the lexicon so as to insure that they do not undergo the degemination rule. Finally, the forms ǰiwen 'to be full' and eč 'to eat', would be very hard to derive from /tt-gawan/ and /tt-tta/ , respectively. Thus, we can see that the I.F. to Z.F. analysis makes the wrong predictions, leads to further complications, and proves to be very costly. No such complications result if the Z.F. to I.F. analysis is chosen.[14]

Another alternative solution would be to regard each case of alternation between a simple consonant and a geminate consonant as suppletive (not unlike English go : went) in which case we would be forced to recognize both C and CC for each morpheme. This does not exclude the possibility that where there are no alternating forms, surface CC's derive from underlying geminates. This is illustrated in (22) (cf. also (18e) above).

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[13]The prefixation of a tt is another means of forming the I.F. It is selected by verbs with lexical geminates and verbs with underlying plain vowels.

[14]Moreover, data from Kabyle-At Megellat (cf. Dallet [1953]) indicate that what is taking place is strengthening and not weakening, e.g. Z.F. efsu : I.F. feṣṣu 'to untangle' (where ṣ = ts), Z.F. erzu : I.F. reẓẓu 'to visit' (where ẓ = dz) (cf. also data from Tamaziɣt (Bou Hsousen) [Loubignac 1924]: Z.F. exsi : I.F. xeṣṣi 'to be extinguished', Z.F. exzen : I.F. xeẓẓen 'to hide'.)

(22) Tamaziγt (Aït Ndhir)

Z.F.		I.F.	Gloss
effeγ	:	tteffeγ	'to go out'
ekkes	:	ttekkes	'to take off'
eqqen	:	tteqqen	'to lock'

In these instances, to posit simple C's would strongly violate the naturalness condition. Such a solution would in actuality be a case of absolute neutralization where the morphemes would have to be marked by some diacritic to permit them to be operated on by a context-free C → CC rule, since all single C's in these morphemes would have to become geminate. Moreover, the contrast between simple and geminate consonants is a very basic one in Berber, as seen in (23).

(23) Tamaziγt (Aït Ndhir)

ass	'to tie'	as	'to fit'
aff	'to be full'	af	'to find'
suddem	'to drip	s-udem	'to the face'
uzzal	'iron	uzal	'hot period of the day'[15]

The conclusion then is to represent the alternating C/CC forms with a simple C and to represent non-alternating CC as derived from CC.

The second problem to be solved concerns those dialects like my own, in which simple stops have become spirants (cf. examples given in (5) for instance). Since these spirants alternate with geminate stops it is necessary to decide in some principled way as to whether the underlying segment is a stop or a spirant. This problem does not apply to dialects such as Tachelḥiyt and Twareg where spirantization has had little effect and where the only alternation of this kind is that between γ and qq, which, as stated above, is handled by a different rule.

(24) $\begin{bmatrix} + \text{ pharyngealized} \\ + \text{ back} \end{bmatrix} \rightarrow \begin{bmatrix} + \text{ voiced} \\ + \text{ cont.} \end{bmatrix}$ / X : where X ≠ identical C

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[15] uzal is in the 'construct state'. The noun is in this state when it is the subject of a verb or the complement of a preposition. In the 'free state' the noun is azal . sudem 'to the face' is from s + udem where s = 'to'.

The alternation between f : ff presents no problem in this regard except for those phonologists who would totally violate the naturalness condition (cf. Postal [1968]) and posit an underlying p for the reason that a language with an f and no p would be considered 'unnatural'. This solution would require an absolute neutralization rule such that in all cases p → f and seems so unmotivated that one cannot really consider it seriously (cf. Kiparsky [1968] et alia).

There are also cases, though sporadic, in which b alternates with f as is shown by the following examples:[16]

(25) Tirifiyt (cf. Renisio [1932])

Senhaja	sg.	θašebbaʃə	'flute'
	pl.	θisebbabin	
Touzine	sg.	θajaʃbufθ	'cover, case'
	pl.	θijaʃbab	

This presents no problem if we posit an underlying b which undergoes the regular voicing assimilation rule found generally in Berber and which in some cases is optional.

(26) Tamaziγt (Aït Ndhir)

/aδ#θ+ddu/ → [atteddu]
Fut.-she-go 'she will go'

Since in these dialects β does not occur, clearly the underlying segment must be the stop b , which when non-geminate and devoiced becomes the only permitted voiceless labial f .

It may be noted that voicing assimilation is general throughout the Berber dialects, and that the spirantization of b to f occurs even in dialects where manner assimilation does not occur. In Tachelḥiyt, for example, we find the sequence ft in ifta 'he left'. The rule should, therefore, not include voicing and spirantization assimilation as one

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[16] In Tamaziγt (Ait Ndhir) some Arabic loan words with b are rendered with f in the speech of country people: Arabic elbettix 'melon' Tamaziγt afettix ; Arabic lebṣel 'onion' Tamaziγt žefṣež , etc. In this speech, l → ž , or something very close to ž .

process. Since there is no dialect in which a p occurs, a segment structure condition for labials would be included. This constraint would reapply whenever applicable (cf. Stanley [1967]; Kisseberth [1970]; Shibatani [1973]). To include a segment structure condition in the grammar of Berber such as

(27)

$$\text{IF: } \begin{bmatrix} + \text{ anterior} \\ - \text{ coronal} \\ - \text{ voiced} \end{bmatrix}$$

$$\text{THEN: } [+ \text{ continuant}]$$

would reveal the historical spirantization of *p to f which has special status in the history of Berber. This is so because the *p to f spirantization has the following characteristics:

(i) It is also found in non-Berber Afro-Asiatic languages.

(ii) It has occurred in <u>all</u> Berber dialects.

(iii) It is true of the geminates as well as the single consonants. (In the I.F. of the verbs, for instance, ff occurs rather than pp which is not the case for other C/CC alternations.)

The representation of the labial consonants is thus straight-forward; we posit underlying b and f .

Let us now return to a dialect such as my own (the Aït Ndhir dialect of Tamaziɣt) where, as shown in (12) and (13), <u>all</u> simple stops are spirantized. Moreover, in the verb paradigm, instead of an alternation of simple/identical geminate stops, as in Tachelḥiyt (cf. (2) and (3)), the alternation exhibited by this dialect is one between non-strident spirants and geminate stops (cf. (5) above). Forms with lexical geminate stops like the ones given in (18e) and (22) do not alternate and are not affected by spirantization.

Since we have already concluded that the geminates in alternating forms should be derived from non-geminate consonants, the problem, then, is to decide whether the underlying segments should be spirants or stops. If stops are posited as the underlying segments, the grammar must include a spirantization rule that would be identical to the diachronic

rule. That is, it may be concluded that the diachronic rule is still operative, i.e. has been incorporated into the synchronic grammar of Aït Ndhir. With this rule in the grammar, one would claim that certain Arabic loan words are phonemically represented in Berber unchanged with the Arabic stops occurring in the lexical forms as shown in (28):

(28)

Arabic	Tamaziγt (Aït Ndhir)			Gloss
ɬetnayn	/ɬetnayn/	→	[ɬeθnayn]	'Monday'
ɬekta:b	/ɬekta:b/	→	[ɬešθa:b]	'book'

(via the rule: [- cont.] → [+ cont.] / X :
where X ≠ geminate)

Since the rule would not apply to underlying geminates, Arabic loan words with such geminates would not be affected, as shown in (29):

(29)

Arabic	Tamaziγt (Aït Ndhir)			
ettaman	/ettaman/	→	[ettaman]	'price'
eʕʕekkʷaz	/aʕekkʷaz/	→	[aʕekkʷa:z]	'cane'

This solution is observationally adequate and is also supported by concepts of markedness and implicational universals.

The proposed theory of markedness [Chomsky & Halle 1968] suggests that the non-strident spirants are more complex than the corresponding stops. Thus, θ is more complex than s which is more complex than t ; s must occur phonemically because of such alternations as in (30):

(30) Tamaziγt (Aït Ndhir)

Z.F.	I.F.	Gloss
efs̲er	fes̲s̲er	'to spread'
efs̲ey	fes̲s̲ey	'to melt'
exs̲ey	xes̲s̲ey	'to be extinguished'

The proposed solution then would be to have as systematic phonemes /t/ as well as /s/ which would be a more 'natural system' than one in which /s/ and /θ/ occur to the exclusion of /t/.

Further support for this solution may be drawn from the proposed implicational universals of Jakobson [1941, 1968] . Jakobson states:

> The acquisition of fricatives presupposes the acquisition of stops in child language; and in the linguistic system of the world the former cannot exist unless the latter exists as well. [1968:51]

Thus, the Aït Ndhir dialect, where spirantization is general, would be an obvious exception to this apparently well-established universal unless underlying stops are assumed for certain spirants. The fact that in non-alternating forms underlying geminates would occur phonemically would not help 'restore' a natural system since a language with geminates and no simple stops would also violate implicational universals.

There appears, then, to be strong evidence for positing underlying single stops and deriving the non-strident spirants (and geminates) from these segments. There is, however, counter-evidence which must be considered.

Since on the phonetic level no simple stops occur in this dialect, the solution posited above is a strong violation of the naturalness condition, and absolute neutralization results to some extent. That is, although some context is stated for the change from stop to spirant (i.e. the stop in question must be non-geminate), the stop will 'surface' as a spirant in all cases.

Furthermore, the spirants occur in the morphologically least marked category, the Z.F.; whereas phonetic stops, existing only as geminates, are found in the marked category, the I.F. One could argue that the spirants must be basic to the synchronic grammar, which is interesting in that such a solution would represent a further case of rule inversion [Vennemann 1972]. That is, at one stage in the history of the language a rule existed whereby the spirants were derived from stops; at present the rule would derive the stops from spirants.

Native speakers of this dialect never hear simple stops, except in Arabic and French loan words. Nor do they have access to the history of the language, nor to the comparative evidence which might lead to the positing of simple underlying stops. To argue for underlying simple stops because of markedness and implicational universals would be forcing the language to fit the theory rather than using language data to test

theoretical hypotheses. It should be noted, in addition, that other solutions attempting to arrive at a unique grammar using markedness conventions to determine the underlying representation of segments have been questioned. (See, for example, Schane's discussion of the underlying representations for French vendre 'to sell', and for German und 'and', which have been rightly criticized by Hyman [1970].)

The argument in favor of underlying non-strident spirants is not basically one of simplicity: although the spirantization rule would not be necessary, a rule which changes these spirants, when geminates, would have to be included:

(31) SD: $[-\text{ strident, } +\text{ cont.}]_1$ (#) $[-\text{ strident, } +\text{ cont.}]_2$

SC: $[-\text{ cont.}]_1$ $[-\text{ cont.}]_2$

(where 1 = 2)

(For justification of transformational rules in phonology, see Chomsky & Halle [1968].) The parenthesized word boundary is required since two sequential spirants agreeing in point of articulation become geminate stops across morpheme and word boundaries as illustrated in (32):

(32) Tamaziγt (Aït Ndhir)

a. /#θ+axam+θ##θ+axaθar+θ#/ → [θaxamttaxaθarθ]

'tent' 'big' 'the big tent'

(θ##θ = tt)

b. /#aδ+ð##l+aweḏ##muḥa#/ → [add yaweḏ muḥa][17]

fut.dir. arrive Muha 'Muha will arrive over here.'

Moreover, the examples given in (16) above, illustrating the fact that some Arabic loan words occur with phonetic non-geminate stops, indicates that the spirantization rule, if posited, is no longer an obligatory rule. If words with a phonetic spirant are represented with a stop, one would no longer have to treat these loan words as exceptions

[17] Dir = directional particle. It is used with verbs of motion to indicate the direction of the movement. It could be translated as 'over here' or 'towards here'.

or marked as [+ foreign] or [+ late loans]. If these words are marked as [+ foreign] and the other Arabic loans are not so marked the diacritic would merely be another way of stating [- rule X] and would falsely differentiate between the loans in the language. If instead the [+ late loan] feature were used as the diacritic, this would also be a false representation since there is no justification for determining the relative dating of such loans, given that there are no written documents to support such a classification. Furthermore, speakers learning the language would certainly not have access to such knowledge. What they do have access to is the phonetic pronunciation of these forms. The solution with underlying spirants, then, permits us to account for the loan words which do not undergo spirantization in a simple way; whenever a word in the lexicon includes a simple stop in its matrix it must be a loan word from Arabic or French.

The solution whereby non-strident geminates occur phonemically in non-alternating forms also suggests a possible direction for changes which may occur in the language. There is already a trend in some dialects to reduce the geminates. Thus, the stressed form of the third person pronoun netta 'he', which has a geminate stop, is more and more being pronounced as enta . This is also observed in the feminine nouns ending with geminate tt , for example, θaḥanutt vs. θaḥanut 'shop' and θaxbutt vs. θaxbut 'little hole'. One may hypothesize that the next step for Berber is to simplify geminates into simple stops. Thus, instead of a surface contrast between θ and tt , which in some cases would both be derived from /θ/, the new contrast between θ and t would simplify the alternation rules and, possibly in the future, lead to a rephonemicization whereby there would be a contrast between /θ/ and /t/.

One might speculate further that an inverse rule inversion will take place whereby the spirants are once more derived from the simple stops. Using Vennemann's notion of rule inversion [Vennemann 1972] we can describe the Berber situation as in (33), where t is taken to represent stops.

(33) Stage I /t/ /tt/
(no rule)
Stage II /t/ /tt/
(rule: /t/ → [θ], if non-geminate)
Stage III : /θ/ /tt/
(rule: /θ/ → [tt] in the I.F.)
Stage IV /θ/ /tt/
(no rule)

Between Stage III and the predicated Stage IV there is likely to be a stage where the rule is θ → [t] in Intensives, etc., due to degemination. So the rule loss would actually affect this rule, rather than the original inverse rule.[18]

Similar conversions of contrast have been observed in numerous languages; they are the historical basis of 'consonant gradation' (as in Finnish) and have been called 'drag chains' [Martinet 1955; King 1970] We are therefore justified in expecting such a conversion of contrast in Berber, i.e. in predicting degemination and rephonemicization.

5. Conclusion

The standard theory of generative phonolgy [Chomsky and Halle 1968] does not provide the basis for a choice between the two solutions outlined above. The evaluation metric, even if we knew how to apply it in all cases (e.g. in choosing between rewrite and transformational rules), would not necessarily choose the solution with stops over that with spirants, although the second solution would be to some extent simpler, in that loan words would not have to be marked as exceptions to a spirantization rule. Dependence on the theory of markedness or putative implication universals should only be resorted to when the solution so based is more predictive and more in keeping with the language data. The more

[18] The rule in Stage III is what Vennemann would call a 'partial inverse rule'. Indeed it is the 'partial inverse rule' of the rule given in Stage II. This mechanism of grammar change, for which Vennemann coined the term 'rule inversion', has been shown convincingly to obtain in Chadic in an article by Russell Schuh [1972].

concrete solution (such as would be required by constraints similar to those proposed by Vennemann [1972] and [1973]) seems to meet the criteria of descriptive adequacy better than does the solution positing underlying single stops. It seems clear that the theory must be strengthened (made more explanatory) by weakening it, i.e. by including constraints which force us to 'hug the phonetic ground' when a choice is to be made between 'non-unique' solutions.

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APPENDIX I

Regarding the variation in the spirantization of underlying k's in spirantizing dialects (cf. Sec. 3 above), Tom Penchoen (personal communication), upon returning from a field trip, offers the following observation concerning possible conditioning factors for the changes k → ç and k → š in Tamaziγt: k goes to ç 1) when followed by an u (e.g. takurt → θaçurθ 'ball'); 2) in words containing s , z , š , ž whether adjacent to k or not (e.g. aksum → açsum 'meat'; cf. however my proto-Berber form for 'meat' in (14); ekrez → eçrez 'to plough'); 3) in verbs preceded by the causative prefix ss (e.g. kneḍ 'to burn' [+ intrans.] → sseçneḍ 'to burn' [+ trans.]). Apart from these cases, k → š. It should be emphasized that this observation, if it obtains, would apply only to Tamaziγt, because Tirifiyt, for instance, has weakened k's into š's in words containing š (e.g. ašsum 'meat', cf. (14) above). And even within Tamaziγt the weakening of k's in some dialects (Aït Izdeg and Zaian, for instance) is not governed by the conditioning factors mentioned above. Aït Izdeg (cf. Mercier [1937]), a dialect in transition (i.e. not totally spirantizing), exhibits the following facts: 1) Some k's do not go to ç's when followed by an u (e.g. afešku 'utensil', not *afesçu ; akuz 'weevil', not *açuz). 2) Some k's go to ç's before (or after) any other vowel (e.g. açabar 'caravan' < akabar ; açniw 'twin' < akniw ; içfer 'turtle' < ikfer). 3) k's go to ç's in words containing consonants other than s , z , š , ž (e.g. açtay 'remembrance' < aktay ; imçra 'tenants' < imkra ; eçti 'to remember' < ekti). 4) Aït Izdeg has alternative pronunciations for some morphemes (e.g. tafuçt and tafušt 'sun'; areçtu and arештu 'dough') as well as instances of just š < k (e.g. ašal 'earth' < akal; ašer 'to steal' < aker; šraḍ 'three' < kraḍ). These are but a few facts which indicate that the weakening of k to ç and to š does not seem to be conditioned in Tamaziγt (Aït Izdeg). This is particularly interesting in that, if there is conditioning, one would expect to find it to be operative in a dialect in transition such Aït Izdeg and not in the most advanced spirantizing dialect (Aït Ndhir)