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BADE/NGIZIM VOWELS AND SYLLABLE STRUCTURE*

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Among the vowels of Bade and Ngizim, the short high vowels play a functional role different from the other vowels. Although word final i and u are full-fledged phonemes (non-predictable and contrastive), both the position of occurrence and the quality of the phonetic high vowels [i, ə, u] is predictable in medial position: the quality is determined by other segments in the environment; the position is determined by restrictions against certain groupings of consonants. Bade and Ngizim differ in one important respect in the placement of non-final short, high vowels, viz. through a change called PROTHESIS, original initial sequences of the type *C_1əC_2 ... (still realized as such in Ngizim) are now realized as əC_1C_2 ... in Bade if C_1C_2 is not an impermissible sequence. This is true for all words with no more than two consonants, though the situation is somewhat more complicated in longer words; tone of the initial syllable is also seen to play a role. The permissible sequences of consonants, and as a consequence the environment for PROTHESIS, are discussed in the light of universal hierarchies of consonantal strength and principles of syllabification in conjunction with a restriction in Bade/Ngizim against two consonants occurring at a syllable margin.

1. Introduction

1.1. The languages. Bade and Ngizim are two closely related languages of the West Chadic branch of the Chadic family spoken in northeastern Nigeria.[1]

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[1]The most recent classification of Chadic languages [Newman 1977] divides the Chadic family into four major branches: West Chadic, spoken almost entirely in northeastern Nigeria; Biu-Mandara, spoken in northern Cameroon and adjacent areas of Nigeria and Chad; East Chadic, spoken in Western and central Chad; and Masa, spoken in Cameroon and Chad south of N'Djamena.

Ngizim is spoken in an area fanning out to the east from Potiskum. Bade is spoken north of Ngizim in an area from Gashua to the west and south. Bade and Ngizim are no longer in contact, but the migration of the Ngizims southward and the ultimate separation of the two language communities has taken place only in the last few hundred years.

Ngizim has virtually no dialect differentiation other than a few lexical differences among villages. Bade, on the other hand, has considerable differentiation at all linguistic levels (see Schuh [1977a] for many examples in the determiner system and associative noun phrases). The dialect used here is that of Gashua and adjacent villages. Although there are a number of phonological differences between this dialect and others, all dialects are virtually identical in the respects relevant to this study.

1.2. Scope of the present study. One of the main areas of interest in Bade and Ngizim phonology is the distribution of high vowels. In fact, high vowels in both languages function primarily as epenthetic vowels to break up impermissible consonant sequences. The paper begins with a summary of the vowel phonology of this group, concentrating on the distribution of high vowels.

Following this is a description of a phonological difference between Bade and Ngizim, which is discussed and illustrated in detail. Briefly stated, this difference is the following: under certain conditions, in an initial sequence $C\begin{bmatrix} V \\ +high \end{bmatrix} C$ Bade has dropped the vowel and added a prothetic high vowel to give a sequence $\begin{bmatrix} V \\ +high \end{bmatrix} CC$, whereas Ngizim has not done this, e.g. Ngizim gùzə́p 'slave' but Bade ùgzə́f 'slave'.

Finally, certain universal principles of syllabification which have been proposed are cited as bearing on the distribution patterns of Bade and Ngizim high vowels.

2. Bade/Ngizim Vowels

2.1. Vowel nuclei. The simple vowel nuclei of Bade and Ngizim are given in (1):

(1) i, ii [ə] u, uu

ee oo

a, aa

Doubled vowels represent long vowels; the symbol ə represents phonetic [ɨ] and hence is one of the set of high vowels.

The mid vowels are of secondary origin, having entered the languages through borrowing and monophthongization of diphthongs. Long aa and short a contrast in all environments, though long aa is extremely rare in word final position. Some minimal or near minimal pairs are given in (2):[2]

(2)

aa			a		
Ngizim	Bade		Ngizim	Bade	
ɗàasú	ɗàasú	'pour'	ɗàsú	ɗàsú	'finish'
gàadú	kàadú	'bite'	gàdú	kàdú	'break'
àaɗáu	àaɗáu	'south'	àɗán	àɗán	'crying'

No high vowels can be reconstructed word initial for proto-Bade/Ngizim,[3] though in Bade the sound change mentioned above and discussed in detail below has produced initial [uu] (< *wu), [ii] (< *yi), [uC] (< *Cu), and [əC] (< *Cə).

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[2]Tone marks are acute accent (´) for high tone, grave accent (`) for low, circumflex accent (^) for falling, and tick (') for downstep. The following transcription conventions should also be noted: c and j are voiceless and voiced palatal affricates respectively; sh and zh are voiceless and voiced palatal fricatives respectively; ny is a palatal nasal, analyzed as a unit phoneme, not a sequence; 'y is a glottalized palatal semivowel; tl and jl are voiceless and voiced lateral fricatives respectively; kw and gw are labialized velar stops, not stop-semivowel sequences.

[3]This statement is true for nouns. There may be one or two survivals of initial *i in verbs (see Table, fn. 15). If we move one historical step back, we must reconstruct initial *i in both nouns and verbs. Duwai, the most closely related language to Bade and Ngizim, has initial i, which is phonetically [ii] but does not contrast with [i] in this position, e.g. ìidà 'eye' (cf. Bade and Ngizim dà), ìijé 'dog' (cf. Bade and Ngizim jă).

Medially the long high vowels, ii and uu contrast with each other and with other vowels. There are no minimal ii/uu pairs, but there is no way to predict which vowel will be used on the basis of phonological environment. As we will see below, the short high vowels i/u/ə are not in contrast medially--the quality of a medial short high vowel is phonologically predictable. Some minimal or near minimal sets showing medial contrast between ii and uu and between these vowels and the medial short high vowel(s) are given in (3):

(3)

long high vowels			short high vowels		
zìidú	sìidú	'slaughter'	zàdù	àzdù	'six'
víidà	fíidà	'hare'	vàdà	àvdà	'open space'
dúuzhì	dúuzì	'owl'	dàzhí	dàzí	'vein'
rùunú	lùunú	'spread to dry'	ɾnú	ɾnú (< *rànú)	'fornicate'

Long high vowels do not occur underlyingly in word final position. There is, however, a monophthongization rule shared by Bade and Ngizim which changes the word final diphthong -ai to [ii] and -au to [uu] when the word occurs in the middle of a phrase, e.g.

(4)

(Ng)	rákài	'bed'	rákíi bái	'it's not a bed'
(Ba)	lákài		lákíi bái	
(Ng and Ba)	sásàu		sásúu bái	'it's not a hut'

The short high vowels i and u are in contrast with each other and with a and aa (also with the mid vowels ee and oo) in word final position. There are no lexical minimals pairs distinguished only by final i or u ,[4] but choice of i , u , or the absence of a vowel cannot be predicted phonologically. The vowel [ə] does not occur underlyingly word final, but word final /i/ and /u/ change to [ə] medially in a phrase under the appropriate conditions (see below).

[4]Minimal sets can be constructed in the verbal system where different verb forms are marked by final vowel changes, among other things, e.g. Ngizim jà kàrú 'we stole', jà kàrì 'that we steal', jà kàrá 'we should steal'.

(5)

Final i			Final u		
nyàmí	nyàmí	'fat'	kúnâmú	kỳnàmú	'fan palm'
màrí	màlí	'beard'	áatárú	átálú	'ridgerow'
zàyí	zàyí	'rope'	kwàyú	ádʃ̀yú	(Ng) 'jujube'
					(Ba) 'gourd'
gázábì	kóosávì	'hawk'	gàbáabù	dáabù	(Ng) 'billy-goat'
					(Ba) 'middle'
dùkshí	dùksí	'heavy'	kùtàsú	dʃ̀úksù	(Ng) 'shea-nut'
					(Ba) type of weed
vàjí	àvjí	'monkey'	zàdù	àzdù	'six'

Final C		
kwàm	kwàm	'bull'
zàgér	àzgə́l	'foot'
gùzái	ùgzái	'pubic hair'
[gùzáy]	[ùgʷzáy]	
gùzép	ùgzə́f	'slave'
àrás	àlás	'sorrel'
bábát	pábə̀t	'ashes'

2.2. Quality of medial short high vowels. The quality of medial short high vowels is determined by phonological environment. The rule for determining the choice of [i], [u], or [ə] is given in (6).[5]

(6) $\begin{bmatrix} V \\ +\text{high} \\ -\text{long} \end{bmatrix} \rightarrow \begin{cases} i & \text{in the env. of } y \\ u & \text{in the env. of } w \text{ or labialized velar} \\ ə & \text{elsewhere} \end{cases}$

Conditions: (1) Vowel does not precede pause.

(2) When the env. for both [i] and [u] are met, the env. following the vowel overrides the env. preceding the vowel.

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[5]Phonetically a wider range of vowels than these exists. Thus, following palatals the vowel tends to be somewhat fronted, e.g. Ng jə̀jə́m [j̈ɪ̈j̈ɪ́m] 'thorn', and following labial fricatives the vowel tends to be somewhat rounded, e.g. Ng vàrú [vòrú] 'go out'. Also, the following environment generally exercises a stronger influence than preceding. Thus, the vowel following w is not as strongly rounded as when preceding w, and in my field notes I have often transcribed a ə instead of a u following w but never preceding w, e.g. Ng wàdú or wùdú 'cut', but only Ng fùwú 'get down', never

The conditioning environments for [i] and [u] may either precede or follow the vowel. In the transcription used here it is the vowel u which marks a velar as labialized (there are no labialized consonants at other points of articulation). Thus, in Ngizim the word for 'stomach' is underlyingly /kʷənú/ and 'heavy' is underlyingly /dəkʷší/, where ə is used as a cover symbol for "short high vowel". Some examples of each of the medial short high vowels are given in (7). Many more examples can be seen above and below.

(7)

[i]			[u]		
gáyìm	gáyìm	'cat'	wùrwùrú	wùdwùdú	'sprinkle on'
fìifìyú	fìifìyú	'whistle'	fùwàk	fùwàk	'horn'
			kùnú	kùnú	'stomach'
[ə]			gùmcí	gùmcí	'chin'
bábát	pábàt	'ashes'	dùkshí	dùksí	'heavy'
dédém	tédém	'blood'			
kàrú	kàlú	'steal'			

As condition (2) states, if the environments for both [i] and [u] are present, the following environment takes precedence.

(8)

wíyàk	wíyàk	'vulva'
dàakwìyà	ákwíyà	'deaf person'
yùwán	(no exs.)[6]	'sleeping'

Rule (6) is not only a statement of phonetic constraints on high vowels within words but is also a productive phonological rule applying to any word final high vowel when it occurs in the middle of a phrase.

(9)

(Ng and Ba)	/ácì bái/	--->	[ácá bái]	'it's not him'
	/átù bái/	--->	[átú bái]	'it's not her'
	/átù yàayé/	--->	[átí yáayé]	'even her'
(Ng)	/gùmcí-w/	--->	[gùmcúu]	'the chin'
(Ba)	/gùmcí-wú/	--->	[gùmcùwú]	'the chin'

[6]For reasons given below, in Bade there could never be a high vowel before y with a w or velar following.

2.3. <u>Position of medial short high vowels</u>. Except for word final i and u, short high vowels appear only where they are needed to break up impermissible consonant sequences. A major consonant sequence restriction can be summarized by the observation that "the maximum syllable is CVC". This restriction rules out the sequences CCC, #CC, and CC#. Numerous examples have already been seen where a high vowel appears in #C__C to break up a word initial cluster and in C__C# to break up a word final cluster. It is difficult to find examples within a word where a high vowel which breaks up a CCC sequence cannot be explained by some other sequential restriction as well. However, as with rule (6), this restriction is a productive phonological rule as well as a restriction on word formation. An example of an underlying CCC sequence broken up by a high vowel is seen in Noun + Noun associative constructions. These constructions have the form N_1-k N_2. If the first noun (N_1) ends in a consonant and the second (N_2) begins in a consonant, a three consonant sequence would result. This sequence is broken in up by inserting ə after the associative morpheme /k/ (see 10a). Note that no ə is inserted if N_1 ends in a vowel or N_2 begins in a vowel (see 10b).

(10) a. (Ng) /yàɗ́-k tɬà/ -->[yàɗ-gə́ tɬà]
(Ba) /ʼyàt-́k tɬà/-->[ʼyàt-kə́ tɬà] } 'hair of a cow'

b. (Ng) [tə̀ká-k tɬà]
(Ba) [tə̀kà-k tɬá] } 'body of a cow'
(Ng) [ám-g ákà]
(Ba) [ám-k ákà] } 'hot water' (lit: 'water of fire')

Use of high vowels to break up word initial and word final sequences is also a productive rule which comes into play when morphemes are combined. Example (11a) illustrates use of a high vowel to break up an impermissible CC# sequence, but the non-appearance of this vowel where the consonant sequence is not word final. Example (11b) illustrates the same thing for a word initial sequence. In this position examples are found only in Ngizim since Bade would have #əCC rather than #CəC (see below).

(11) a. (Ng) rán 'fornication' but ná-rnú } 'I fornicated'
(Ba) àrén ná-rnù }
where the consonants of the root are r-n

b. (Ng) tàfú 'he entered' but ná-tfú 'I entered'
vàgú 'he fell' but ná-vgú 'I fell'
where the consonants of the roots are t-f and v-g respectively

Besides these restrictions on the number of consonants which may appear in a sequence, there are also restrictions on which consonants may appear in a sequence. The most important restriction, shared by both languages, is the impermissibility of the sequence obstruent + sonorant consonant. Obstruents include all oral stops, fricatives, and affricates; sonorants include all nasals, liquids, and semivowels. Some examples of words containing obstruent + sonorant sequences separated by short high vowels are given in (12).

(12)

Ngizim	Bade			
ázhòmák	ázèmák	*'Acacia seyal'*	but no	*azmak , etc.
zàpènú	sàbènú	'churn'		*zapnu , etc.
kákárà	kákélà	'load'		*kakra , etc.
kàtèrú	ùkcèrú	'hop'		*katru , etc.
séséwà	tésúwà	'stalk'		*səswa , etc.
vàvìyú	ɓàɓìyú	'singe'		*vavyu , etc.

A more detailed discussion of sequence restrictions shared by both languages is given in section 3.2.

There are a few differences between the languages in restrictions. Bade, but not Ngizim, has relaxed the restriction against obstruent + sonorant if the obstruent is /g/. Note in (13), however, that when /g/ has been allowed to abut with a following sonorant it has also undergone phonetic changes. We will return to this point in sections 3.2 and 4.

(13)

Ngizim	Bade		
zègèmú	sègmú	[sèŋmú]	'plant'
mágèráf	màgrà	[mèɣrà]	(Ng) 'visitor'
			(Ba) 'grey-headed sparrow'
mégìyá	mêgyá	[mêɣyá]	'ratel'

Bade, but not Ngizim, freely allows syllables of the shape CVVC (a long vowel in a closed syllable).[7] In Ngizim, the second C belongs to a separate syllable with a short high vowel nucleus. I have found no cognates where Bade has $C_1VVC_2C_3$ ... and Ngizim has $C_1VVC_2əC_3$ ..., but the examples in (14) will illustrate the situation in the two languages.

(14)	(Ba)	tàagdʊ̂	'step on'	cf. Ng	tàkdʊ̂
		báangàì	'babbon'	cf. Ng	bángàì
	(Ng)	gáagàzhìn	'remainder'	but no	*gaagzhin, etc.
		màadébár	'corpulence'		*maadbər, etc.

A restriction found in Bade but not in Ngizim prohibits the sequence obstruent + glottalized consonant.[8]

(15)	(Ng)	ràpdʊ̂	'boil'
	(Ba)	ǀàpàdʊ̂	

I should stress here that the epenthetic function of vowels discussed

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[7]Ngizim does have a few words of the shape $C_1aaC_2C_3$... . They are all verbs and they usually have a verbal noun of the form $C_1aaC_2aC_3$, e.g. kàaktǀú 'measure' with verbal noun kàakátǀ , nàanmú 'beat (drum)' with verbal noun nàanám . This restriction seems to be lexically specific word medial.

[8]This restriction seems to be lexically specific word medial. Alongside the word 'boil' given in (15) is sàpdʊ̂ 'pound grain to remove bran' in both languages. There are also several other examples, mostly where the first obstruent is a velar, in which both languages allow a consonant sequence, e.g. ákdâ 'desert date' in both languages and the verb 'step on' in (14). The restriction in Bade against obstruent + glottalized consonant sequences is absolute where these are the first two consonants of a word, as will be shown in 3.2.

in this section applies only to short high vowels. Other vowels can occur freely in any position, as illustrated in (16).

(16) (Ng and Ba) pátà 'the bush' vs. áptà 'flour'
(Ng) mâbú 'large calabash' vs. ámbàì 'locust bean cakes'
(Ba) mâzám 'blacksmith' vs. ámzèm 'groaning'

In these examples, ə appears between pairs of consonants which can freely abut (p + t , m + b , m + z) or before these pairs of consonants. This freedom of occurrence is not possible for short high vowels, e.g. corresponding to the first set of words in (16), *əpta would be impossible in Ngizim and *pəta would be impossible in Bade.

3. Bade and Ngizim Word Initial Sequences

3.1. Bade PROTHESIS. A conspicuous sound change, or better, a change in word structure, has affected Bade but not Ngizim. This change can be formulated as in (17):

(17) Bade PROTHESIS

proto-Bade-Ngizim words of the structure *#C_1əC_2 ...
in Bade acquire the structure *əC_1C_2 ...

where ə = any short high vowel and C_1C_2 form a permissible consonant sequence in Bade

It would be tempting to formulate this change as *#C_1əC_2 ... > #əC_1C_2 ..., but this formulation makes the change look like simple metathesis of *C_1 and *ə . By using the formulation in (17) and by calling this change PROTHESIS, my intention is to stress that viewing this change as a metathesis is not the correct way to conceptualize what has taken place, viz. a change in Bade in the way impermissible word initial segment sequences are avoided. The change can perhaps be viewed as involving two discrete but simultaneous steps: (i) deletion of *ə between *C_1 and *C_2 and (ii) the consequent addition of prothetic ə (what Lukas [1967/68] calls a *Stutzvokal*) to avoid the sequence #C_1C_2 ... . Or, as an alternative, more abstract analysis, we could say that proto-Bade-Ngizim (and modern Ngizim) inserted ə between C_1 and C_2 whereas Bade now inserts ə before C_1C_2. There are cases of true metathesis in Bade, e.g. Bade péksà ,

Ngizim fáskà 'face' (< *fáskà); Bade ègvú , Ngizim vègú 'fall down' (< *vègú). Cases such as these differ from PROTHESIS in that no principles of organization of the phonology of Bade have been changed--two segments have merely switched place in certain lexical items. In the case of PROTHESIS, there is a change in the phonological structure of Bade--conditions or rules for the positioning of short high vowels have changed.

3.2. Comparison of Bade and Ngizim initial sequences. The environments where PROTHESIS has *not* applied in Bade are the same as those word medial environments where a vowel is required to prevent an impermissible consonant sequence. In (18) I have a more detailed listing of the impermissible consonant sequences of Bade (and Ngizim) than was presented in 2.3. These are the sequences which must be separated by a vowel and therefore have not permitted PROTHESIS to apply in Bade.

(18) a. identical consonants: may not come together to form geminates; this includes cases where $C_1 \neq C_2$ only with respect to voicing

b. obst + obst: impermissible if (i) C_1 is a stop and C_2 is a homorganic fricative

(ii) C_2 is glottalized (in Bade only, though Bade does allow /g/ + glottalized)

all other obst + obst sequences are permissible

c. obst + son: none permissible (except in Bade where C_1 = /g/)

d. son + obst: all possible with the following qualifications

(i) of nasals, only /m/ can disagree in point of articulation with C_2

(ii) sporadic cases of m followed by s/z require epenthetic ə

e. son + son: impermissible if C_1 is n and C_2 is a semivowel

all others permissible, with some variation where C_1 is m or where both C_1 and C_2 are nasals

Examples of all the possible sequences illustrating PROTHESIS or absence of PROTHESIS are given in Table 1. Discussion of (18) and Table 1 continues on page 266. Footnotes to Table 1 are on p. 265.

Table 1. Examples of PROTHESIS or absence of PROTHESIS in Bade

The left-hand word is from Ngizim, the right-hand word from Bade. Unless otherwise stated, the words are cognates with identical meaning. A notation such as (*bəd ...) means no words containing that sequence were found. Unless otherwise indicated, lines marked "no examples" probably represent accidental gaps. See the end of the Table for footnotes.

OBSTRUENT SEQUENCES

	Sequence possible			Sequence impossible		
	Ngizim	Bade		Ngizim	Bade	
Stop + Stop						
lab + lab				bə́bə́t	pə́bə́t	'ashes'
lab + alv	pə̀tú	ə̀ptə̀kú	(Ng) 'pull out' (Ba) 'be able'			
	(*bəd ...)	ə̀bdú	'ask'			
				pə́ɗə́m	bə̀dǔ	(Ng) 'far' (Ba) 'toss up'
lab + vel	- - - - - - - - - - - - - -		no examples	- -		
alv + lab	də̀bú	ə̀dbú[9]	'establish'			
				də̀ɓú	də̀ɓú	'water animals'
alv + alv				də́də́m	tə́də́m	'blood'
alv + vel	tə̀kà	ə̀tkwà	'body			
	də̀gà	ə̀dgà[9]	'arrow'			
	ɗə̀káu	ə̀ɗkwáĭ[9]	(Ng) 'exceed' (Ba) 'metal'			
vel + lab	gùbə̀mtú	ə̀gbə̀mtú	'sweel up'			
	gùɓú	ùuɓú < *ùgɓú	'moisten'			
				(*kəɓ ...)	kùɓú	'close'

(Ba) 'metal'
vel + lab gùbàmtú àgbàmtú 'sweel up'

	gùɓú	ùuɓú	'moisten'			
		< *ùgɓú		(*kəɓ ...)	kùɓú	'close'
vel + alv	kùtù	ùktú	(Ng) 'wash w.o. soap'			
			(Ba) 'take'			
	gùdú	ùgdú	'gourd'			
	gəjì	àgjì[9]	'thirst'			
	(*gəɗ ...)	ùuɗà	'haste'			
		< *ùgɗà		kəɗén	kəɗáu	(Ng) 'one'
						(Ba) 'exceed'
vel + vel				kúkù	kúkwàu	'baobab'
<u>Stop + Fricative</u>						
lab + lab	- - - - - - -	- - - - - - -	no examples	- - - - - - -	- - - - - - -	- - - - - - -
lab + alv	pəsú	àpsú	(Ng) 'be worn out'			
			(Ba) 'bathe'			
	bəzú	àbzú	'leave'			
lab + vel	- - - - - - -	- - - - - - -	no examples	- - - - - - -	- - - - - - -	- - - - - - -
alv + lab	təfú	àtfú	'enter'			
	dəvíɗ	ədvəɗ[9]	'night			
alv + alv				dəzhí	dəzí	'vein'
alv + vel[10]	- - - - - - -	- - - - - - -	no examples	- - - - - - -	- - - - - - -	- - - - - - -
vel + lab	gùvàrú	àgvàalàkáu	'*Acacia nilotica*'			
vel + alv	kùtlái	ùktlái	'children'			
	gəzhàn	àgzàn	'Nile monitor'			
vel + vel[10]	- - - - - - -	- - - - - - -	no examples	- - - - - - -	- - - - - - -	- - - - - - -

	Sequence possible			Sequence impossible		
	Ngizim	Bade		Ngizim	Bade	
Fricative + Stop						
lab + lab	- - - - - - - - - - - - - - - -		no examples	- -		
lab + alv	fə̀tə̀k	fə̀tú	(Ng) 'hoof'			
			(Ba) 'postpone'			
	və̀jʃ́	ə̀vjʃ́	'monkey'			
				fə́dʃ́ú	fə́dʃ́ú	'four'
				və̀dʃ́áu	və̀dʃ́áu	'urine'
lab + vel	və̀gú	(*əvg ...)	'fall'			
	tlə̀pú	ə̀tlpú	'clap'			
	zə̀bú	ə̀zbú	(Ng) 'meet'			
			(Ba) 'throw away'			
				(jlə̀ɓə̀rú)	tlə̀ɓə̀lú	'split wood'
	sə̀tú	ə̀stú	(Ng) 'sharpen to point'			
			(Ba) 'burn'			
	zə̀dù	ə̀zdù	'six'			
				zə̀dʃ́ù	jlə̀dʃ́ù	'dig'
	tlə̀kwə̀kùrə̀k	ə̀tlkwə̀akwə̀lə̀k	'bark'			
	zə̀gáu	ə̀zgáu	'know'			
vel + lab, alv, vel[11]	- - - - - - - - - - -		no examples	- -		
Fricative + Fricative						
lab + lab				(*fəf ...)	fə́fə̀́u	'breast'
lab + alv	- - - - - - - - - - - - - - - -		no examples	- -		
lab + vel[10]	- - - - - - - - - - - - - - - -		no examples	- -		
alv + lab	sə̀fú	ə̀sfú	(Ng) 'coax'			
			(Ba) '[illegible]'			

fricative + fricative

lab + lab				(*fəf ...) fófáu	'breast'
lab + alv	- - - - - - - - - - - - - - - -	no examples	- -		
lab + vel[10]	- - - - - - - - - - - - - - - -	no examples	- -		
alv + lab	sə̀fú	àsfú	(Ng) 'coax'		
			(Ba) 'sweep'		
	(zə̀bàbì yú)	àzvàvì yú	'wash grain'		
				sésàu sésàu	'hut'
				(*jìəjí...) jìə̀jìá	'fennec'
alv + vel[10]	- - - - - - - - - - - - - - - -	no examples	- -		
vel + lab, alv, vel[10]	- - - - - - - - - - - -	no examples	- -		

OBSTRUENT + SONORANT[12]

obs + nas

		(no ex. of lab + m)		
		bə̀nú	bànú	'cook'
		fə̀nà	fànà	'calabash'
		də̀mán	dèmán	'rainy season'
		zə̀mànú	zèmànyí	'ostrich'
		tlə̀nú	tlènú	'blow nose'
		kúnâmú	kùnàmú	'fan palm'
gə̀mà	[ŋmá]	'thigh'		
gənú	[ŋnú]	'accept'		
gənyí	[ŋnyí]	'penis'	(but cf. Ba gənà 'like, as')	

obs + liq

bə̀lân	bèlân	'good'
fə̀rà	fèlà	'illness'
tə̀rá	tèrá	'moon'
tlə̀rə̀mú	tlèlèm	'harvest season'

	Sequence possible			Sequence impossible		
	Ngizim	Bade		Ngizim	Bade	
obs + s.v.	gəràɓú	[ɔɣlàɓú]	'be startled'	kərú	kàlú	'steal'
				(but cf. Ba	gùlú	'jealousy')
				bùwà	bùwà	'trip'
				vìyú	vìyá	(Ng) 'wash'
						(Ba) 'tiger nut'
				tùwàyú	tùwàyú	'forget'
				zhìyám	zìyám	(Ng) 'molar'
						(Ba) 'cuspid'
				kùyú	kùyú	(Ng) 'grasp'
						(Ba) 'package'

(there are no examples of /g/ + semivowel word initial)

SONORANT + OBSTRUENT[13, 14]

m + lab	mbàsú	m̀bàl	(Ng) 'sit'
			(Ba) 'beer'
	m̀pàatú	m̀pàatú	'provide for'
	(máfíyà)	m̀fú	(Ng) 'breathing'
			(Ba) 'grunt, groan'
m + alv	màɗú	m̀ɗú	(Ng) 'tie up'
			(Ba) 'rool into balls'
	màtú	m̀tú	'die'
	màsàk	m̀sàk	'husband'
	màzàmú	m̀zàmú	'grunt' (but cf. Ba màzàmá a type of fish)

m + vel	- - - - - - - - - - - - - - -	no examples	- -
n + lab	- - - - - - - - - - - - - - -	no examples	- -
n + alv	ndìiwà	ǹdá	'people'

	mètú	m̀tú	'die'
	mèsèk	m̀sèk	'husband'
	mèzèmú	m̀zèmú	'grunt' (but cf. Ba mèzèmá a type of fish)

m + vel	- - - - - - - - - - - - - - - -		no examples -
n + lab	- - - - - - - - - - - - - - - -		no examples -
n + alv	ndì̀ìwà	ǹdá	'people'
	ǹtú	ǹtú	'swallow'
	(*n(ə)s ...)	ǹsì̀	'hippopotamus'
/n/ + vel	ŋgàs	ŋ̀gàs	'spear'
	ŋ̀kàìtú	ŋ̀kú	(Ng) 'care for'
			(Ba) 'fill'
r/l + lab	rèpú	èlpàatú	(Ng) 'close'
			(Ba) 'weave (mat)'
	rèvú	èlvú	'sip'
	rèɓú	èlɓú	'move'
r/l + alv	r̀dú	r̀dú	'crawl'
	r̀ǰlú	r̀ǰlú	'moisten'
	r̀dʃ̀ǔ	r̀dʃ̀àyú	(Ng) 'stop'
			(Ba) 'melt'
r/l + vel	règú	èlgú	'migrate'
y/w + lab[15]	ì̀ìvú	(*ì̀ìv ...)	'leave'
	- - - - - - - - - - - - - - - -		no w + lab -
y/w + alv	wùtú	ùutú	'go to meet'
	- - - - - - - - - - - - - - - -		no y + alv -
y/w + vel[15]	ì̀ìkáu	ì̀ìkáu	'see'
	- - - - - - - - - - - - - - - -		no w + vel -

SONORANT + SONORANT

	Sequence possible			Sequence impossible		
	Ngizim	Bade		Ngizim	Bade	
m + n	mènú	m̀nú	'await'			
				mènáafôk	mènáafòk = Ba màlàk	'hypocrite'
m + liq	mèràk	m̀làk	'oil'			
				(màrí)	màlí = Ba mìyá	'beard'
m + s.v.	mìyá	m̀yá	'mouth'			
n + m	nèmìyú	èlmìyú < *ènmìyú	'flood'			
				nèmú	nèmú[16]	
n + liq	- - - - - - - - - - - - - - -		no examples	- -		
n + s.v.	- - - - - - - - - - - - - - -		no n + w	- -		
				nìyú	nìyú = Ba làmáu	'swim'
r/l + m	rèmáu	èlmáu	(Ng) 'run away' (Ba) 'leave'			
r/l + n	ṛ̀nú	ṛnú	'fornicate'			
r/l + s.v.	rùwái	èlwái[9]	'farming'			
	rìyàk	èlyàk[9]	'*Andropogon gayanus*'			
y/w + nas	wùnú	ùunú	'spend the day'			
	(*yin ...)	ìiná	'departure'			
	- - - - - - - - - - - - - - -		no y/w + m	- -		
y/w + liq	wùrá	ùulá	'neck'			
	- - - - - - - - - - - - - - -		no y + liq	- -		
y/w + s.v.	yùwán	ìiwàn	'sleeping'			
	(*wuy ...)	ùuyú	'hang'			

[9]There is a strong vocalic transition between the consonants but this seems not to be perceived by speakers. It is probably also present between corresponding unvoiced

- - - - - - - - - - - - - -		no y + liq	- -
y/w + s.v.	yùwán	ì̀lwàn	'sleeping'
	(*wuy ...)	ùuyú	'hang'

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[9]There is a strong vocalic transition between the consonants but this seems not to be perceived by speakers. It is probably also present between corresponding voiceless consonants but is not so obvious because it is voiceless. I did not investigate which sequences of consonants have the strongest such transitions or how systematic it was.

[10]There are no velar fricatives in Ngizim or the Gashua dialect of Bade. In Gashua Bade, reconstructable *x and *ɣ have changed to k and g ; in Ngizim their fate is somewhat more complicated and need not concern us here. The Western and Southern dialects of Bade do preserve *x and *ɣ, usually pronounced [h] and [ɦ] respectively, though noticeable velar friction can still be heard with some speakers. These sounds are relatively infrequent so that there are lexical gaps for most potential sequences involving velar fricatives. Of stop + fricative sequences only the word ɗəhán 'land' is found (cf. Gashua dialect ə̀ɗkà). Absence of PROTHESIS suggests that h now functions as a sonorant though it was originally an obstruent.

[11]See fn. 10. An example of h + ɗ is hə̀ɗə̂wú 'dry up' (cf. Gashua Bade kə̀ɗə̂wú).

[12]Western Bade has velar fricative + sonorant separated by high vowels in hùnú 'flay' (cf. Gashua Bade kə̀nú), hə̀rú 'save' (cf. Gashua kə̀ɬú), and hùyú 'package' (cf. Gashua kùyú).

[13]In Ngizim, word initial nasals followed by a homorganic voiced stop form a prenasalized stop; the nasals are syllabic before other consonants. In Bade, all word initial nasals followed by a consonant are syllabic.

[14]Western Bade has sonorant + velar fricative sequences in ŋ̀hwú 'fill' (cf. Gashua ŋ̀kú) and ə̀ɬhú 'say' (no cognate in Gashua).

[15]The examples cited here may not have been original *yiC ... at all. Initial *i must be reconstructed for the proto-language (see fn. 3); these may be survivals of this vowel, which has been lost in Ba and Ng nouns.

[16]Both Ngizim and Gashua Bade have alternative pronunciations ɬə̀mú . This results from a fairly common dissimilation of *n > ɬ when a nasal follows. Western Bade has only ə̀ɬmú for this word.

(18a) Geminate consonants are not found in native words in Bade or Ngizim except where they are separated by a morpheme boundary, e.g. Bade /wún-lì/ → [wúlìì] 'his son', Ngizim /àasók-gú/ → [àaséggúɔ] 'the market'. Abutting obstruents must agree in voicing, so this restriction prevents pébə̀t 'ashes' from becoming *əpbət or *əbbət , etc. Geminates do occur in a few borrowed words, e.g. Ng kákkádì , Ba kákkádù 'paper' from Kanuri.

(18b) (i) The only examples of stops followed by homorganic fricatives involve alveolars as in Bade dèzí 'vein', which does not become *èdzí ; the absence of *pəf ... , *bəv ... and the absence of *kəh ... , etc. in Western Bade (cf. fn. 10) may or may not be systematic gaps in the lexicon. (ii) The restriction in Bade against the sequence obstruent + glottalized consonant which seemed to be lexical in the middle of a word (cf. (15) and discussion) is nearly absolute in word initial position, i.e. there are words like Bade sèʃ̀ú 'wash' but no *èsʃ̀ú , etc. The only exception is /g/ + glottalized consonant. Here, PROTHESIS has applied, *g has shifted to w , and the initial high vowel has assimilated to it by rule (6), ultimately giving initial long [uu], e.g. [ùuɓ́úɔ] 'moisten' < *gùɓ́ú .

Aside from the above restrictions, all obstruent sequences are possible with the priviso in the discussion of (18a) above that abutting obstruents must agree in voicing. The voice feature of obstruents in both languages is heavily determined by environmental factors. Not only is there the rule that abutting obstruents must agree in voice but also the ubiquitous rule of final devoicing, e.g. Ng mágèráf , Ba mágèláf 'visitor' with underlying final /v/ as evidenced in the plurals mágèràvàvín and mágèlàlvón respectively (Ngizim also has an alternative plural mágèràfcín where /v/ is devoiced preceding the voiceless c). Moreover, Ngizim has undergone a sound change assimilating an original voiceless obstruent to voiced if the next syllable begins in a voiced obstruent, e.g. Ng gâazá 'chicken' (cf. Hausa kàazáa). Bade has undergone just the opposite dissimilation process of devoicing an original voiced obstruent if the next syllable begins

in a voiced obstruent, e.g. Ba kádùwà 'Grimm's duiker' (cf. Hausa gàdáa).[17] Given the unstable nature of the voicing feature of obstruents in this language group, it is not surprising to find that PROTHESIS in Bade has applied with obstruent sequences, whether or not the consonants originally agreed in voicing, e.g Ba àzdù 'six' (cf. Hausa shídà), àgdém 'crocodile' (cf. Hausa kádàa).

(18c) Both in the middle of a word and word initial, the restriction against the sequence obstruent + sonorant is absolute. The relaxation of this restriction for /g/ + sonorant in Bade (but not Ngizim) shows some dialect variation in Bade. Gashua Bade has gone about the furthest of any dialect here, but even Gashua Bade speakers freely allow pronunciaitons such as gèmá 'thigh' and gàlàɓú 'startle' as alternatives to the pronunciations given in Table 1. Also, a few lexical items seem not to admit a variant where PROTHESIS has applied (see Table 1).

In sequences where obstruents are generally disallowed as the first of abutting consonants, then, the restriction in Bade has been relaxed only for /g/. But even here a phonetic [g] is not found. In (19) the effects of following consonants on /g/ are summarized:

(19) /g/ → [w] / ____ [+glottalized]
[ŋ] / ____ [+nasal]
[ɣ] / ____ [C, +sonorant, -nasal][18]
[g] elsewhere

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[17]These sound changes have affected obstruents only when the following syllable began in a voiced *obstruent*. Thus, Ngizim has kàrú 'steal' without voicing of k (cf. Karekare čàrú-) and Bade has gàlú 'grow old' (cf. Kirfi gàarò 'old') without devoicing of g. There are no productive alternations resulting from these changes in Ngizim or Gashua Bade, but in part of the Western Bade area alternations such as the following are found: té-jlàwí 'seated' but dè-tlávà 'pierced'.

[18]Though there are no words with original *#giy ... > #əgy ..., Bade /g/ → [ɣ] / ___y was seen in mə̂ɣyá 'ratel' in (13). I know of no words with the original sequence *guw . Presumably these would become [gʷ] in Bade since labialized velars contrast with plain velars, e.g. gáylm 'cat', gwàyí '*Acacia albida*'.

Since [ŋ] and [ɣ] are not phonemic, words with these phonetic consonants can still be analyzed as having underlying /g/. Variant pronunciations with [g] probably protect the underlying status of /g/ in such words. Note that there are some words without variant pronunciations where original *g before liquids has become [w], causing merger with original *w , e.g. âu|ái 'hare'--cf. Western Bade ágùrén .

(18d) Sonorant + obstruent sequences are all possible. Only the sequence m(ə) + obstruent needs some comment. The phonemic nasals are /m , n , ny/, but only m may disagree in point of articulation with a following obstruent, e.g. m̀tú 'die' but no *nb ... , *nyt ..., etc. There are no words in either Bade or Ngizim with the sequence m + velar. The absence of an initial sequence *mə + velar is probably an accidental gap (the word *mágìyá 'ratel' seen in (16) has such a sequence, but Bade has changed this to [mêɣyá], not *əmgiya). The absence of such sequences within a word is apparently the result of an old assimilation process *m > ŋ / ____velar, which is probably no longer productive. Evidence for this assimilation is found in the single word [də̀ŋkú] 'sew' in both languages (cf. Hausa ɗ̀ìmkàa) with the Bade verbal noun də̀mák . The antiquity of the assimilation is seen from the reanalyzed Ngizim verbal noun, də̀nák , with /n/ substituted for */m/.

PROTHESIS has always applied in Bade when the consonant following m is any labial or when it is an alveolar stop. It has usually applied when the next consonant is an alveolar fricative, e.g. m̀zə̀mú 'groan', but with a few lexical items it has not, e.g. mə̀zə̀má 'the fish *Gymnarchus niloticus*', mə̀zə̀lí 'day after tomorrow'.

(18e) With the sole exception of n + semivowel, all sonorant sequences are possible. There are no examples of original *nuw ... , but words such as Bade kàancínùwà 'merciful' suggest that *nw is impossible as is the sequence n + y illustrated in Table 1. When C_1 is m there is some variability if the next consonant is n or a liquid (the only word with m semivowel is 'mouth', which has variants both with and without PROTHESIS in Bade). The only words I found with *mən ...

are given in Table 1: Bade has undergone PROTHESIS in one but not the other. If C_1 is m and C_2 is a liquid, some words have variants with and without PROTHESIS (m̀làk = màlàk 'oil'), some do not have a variant with PROTHESIS (màlí 'beard').

Original *n can abut with m but in the only examples that I know of in Gashua Bade, *n has dissimilated to [l], viz. àlmìyú 'flood' and kàlmú 'beat drum' (cf. Bade verbal noun kànám = kàlám and Ngizim kànmú). Even the word nèmú 'build', where for some reason PROTHESIS has not applied, there is a variant pronunciation lèmú (cf. fn. 16). Note that there are variants with [n] and [l] only where the phoneme in question was originally *n , not where it was a liquid (cf. Bade àlmáu = làmáu 'run away' < *ràmáu , but never *nèmáu/*ànmáu). There are no examples of n + liquid. This may or may not be an accidental gap, but note that n + liquid would become a geminate liquid by a productive assimilation rule, e.g. Ba /wún-lì/ → [wúllì] 'his son'.

In Bade when PROTHESIS has applied where C_1 is a nasal or liquid, the phonetic result is not always əCC ... . Rather, no initial ə is found, nasals become syllabic, and liquids become syllabic before alveolars[19] (but not consonants at other points of articulation). This is consistent with the analysis of the change in Bade on p. 256, where I stated that the initial ə was a prothetic vowel added to avoid an initial consonant sequence, not the original *ə which had switched places with the preceding consonant. In those cases where the initial consonant can itself constitute the full syllable, no prothetic vowel is needed for this purpose.

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[19]Two sound changes are relevant here. The original */r/ of proto-Bade/Ngizim (perhaps proto-Chadic) was phonetically a "retroflex flap" as it still is in Ngizim (see Ladefoged [1964] for a phonetic description of the same sound in Hausa). In Bade/Ngizim (and probably proto-Chadic) this phoneme is realized as an alveolar tap or trill when followed by alveolar non-continuants (f , d , ɗ , n) or lateral fricatives. In Gashua Bade the retroflex flap, but not the laveolar tap/trill has changed to l . Thus, while Bade has àlvú 'sip' and Ngizim has [ràvú] with a retroflex flap initial, both languages have [r̃nú] 'fornicate' with syllabic alveolar trill.

In Ngizim where C_1 is a sonorant, original $*C_1əC_2$ ... has changed to give phonetic results similar to those in Bade. The cases in point can be summarized by the following ordered rules:

(20) a. ə → Ø / m ____ labial e.g. mbàsú 'sit'
/ n ____ alveolar, velar e.g. ndì|wà 'people'
/ngàs/ 'spear'
/ r ____ alveolar e.g. ɾdú 'crawl'
ɾnú 'fornicate'

b. n → ŋ / ____ velar e.g. ngàs → [ŋgàs] 'spear'

c. $\begin{bmatrix} C \\ +son \end{bmatrix}$ → [+syllabic] / # ____ C
except nasal followed by homorganic voiced stop
e.g. ᵐpàatú 'provide for'
ⁿtú 'swallow'
ɾdú 'crawl'

The main rule in (20) is part a. While the phonetic effects of (20a) in Ngizim are identical to those of Bade PROTHESIS, except for the non-syllabicity of nasals followed by homorganic voiced stops (cf. (20c)), I believe the process must be viewed in a different way. On p. 256 I argued that Bade had developed a new way to handle word initial sequences where the first two consonants could abut, viz. the consonants are allowed to abut and the impermissible initial cluster is avoided by adding a prothetic vowel. There is no evidence for such a process in Ngizim. Here, a high vowel has simply been deleted in $\#C_1əC_2$ where C_1 could itself constitute a full syllable or, in the case of nasals followed by homorganic voiced stops, where it could combine with the following consonant to constitute a unit phoneme.

3.2.1. The influence of initial high tone. So far no mention of tone has been made with respect to Bade PROTHESIS. However, inspection of the illustrations in Table 1 will show that in all words where PROTHESIS has occurred, the word begins with low tone. A reasonable suggestion would be that the prothetic vowel is automatically given low tone. This hypothesis is disconfirmed in two ways: first all the Ngizim cognates

have initial low tone, making it likely that the words should all be reconstructed with initial low tone; second, and more important, are Bade examples such as the following, where PROTHESIS has not applied:

(21)					
	pə́jʃ́	'bran'	cf.	ə̀pcə̀aʃə̀kə́u	'the plant *Calotropis procera*'
	tə́bə́	'round cover'	cf.	ə̀dbú	'establish'
	də́gə̀	'platform'	cf.	ə̀dgə̀	'arrow'
	ʃúkwə̀k	'udder'	cf.	ə̀ʃ́kwə́ì	'iron'
	kûvə́	'chest'	cf.	ə̀gvə̀aʃə̀kə́u	'*Acacia nilotica*'
	kúzʃ̀yák	'swollen scrotum'	cf.	ə̀ksə́dù	'be familiar with'
	súgʃ́m	'planting hoe'	cf.	ə̀zgə̀mú	'plant'
	sə́vùwə̀	'bee'	cf.	ə̀zvú	'join'
	gúmə̀	'ten'	cf.	[ə̀ŋmə́]	'thigh'
	ʃə́vùwə̀	'chaff'	cf.	ə̀ʃvú	'sip'
	wúdʃ́	'knife'	cf.	ù̀utú	'go to meet'
	mésə́akə́u	'tamarind'	cf.	m̀sə̀k	'husband'
	wúnyə̀	'girl'	cf.	ù̀unú	'spend the day'
	míyə̀	'100'	cf.	m̀yə́	'mouth'
	wíyə̀k	'vulva'	cf.	ù̀uyú	'hang'

The only relevant difference between the words in the left-hand column, where PROTHESIS has not applied, and those in the right-hand column, where it has, is the tone on the first syllable. A careful examination of the Bade nominal lexicon reveals that all words where PROTHESIS has applied have initial low tone and the large majority of those where PROTHESIS could potentially have applied but has not have initial high tone. I will return to the few exceptions to this statement in 3.2.3.

Nouns have fixed lexical tone so nouns can be categorically listed as having initial high or low tone. Underlying tone of verbs is not so obvious since tone is in part conditioned by verb aspect. However, it is a reconstructable feature of proto-Bade/Ngizim as well as a feature of the modern languages that verbs having *Cə as the initial syllable have a verbal noun with initial low tone. It is not at all clear that

the verbal noun should be taken as the underlying form of the verb, but all verbs of the original structure *C_1əC_2V ... where C_1 could abut with C_2 have undergone PROTHESIS whereas verbs with other reconstructed syllabic structures have not (but see section 3.2.2). This restructuring of original *C_1əC_2V ... verbs may have been reinforced by the low tone which verbs take in other aspects (perfective, second subjunctive).

The question which arises is why high tone has prevented PROTHESIS. A final explanation would require a more careful phonetic study than I was able to make, but in Schuh [1977b] I suggest that the extra amplitude associated with high tone was enough to prevent weakening of the ə separating C_1 and C_2 to the point where it could be lost. Since the #C_1əC_2 ... structure was thus maintained, no prothetic vowel was needed.

3.2.2. Syllabification with longer sequences. The discussion above has concentrated on exemples where Ngizim has CəCV ... and Bade has əCCV ... with the remainder of the word being the same, other things being equal. There are words with three or more consonants, $C_1C_2C_3$... , where both the sequence C_1C_2 and the sequence C_2C_3 are permissible. If C_2 and C_3 are allowed to abut, PROTHESIS would not be possible in Bade because PROTHESIS in a word of the structure C_1əC_2C_3... would form an impermissible three consonant cluster. On the other hand, if C_1 and C_2 are allowed to abut through PROTHESIS, C_2 and C_3 will have to be separated by ə , again to prevent a three consonant sequence, giving a word structure əC_1C_2əC_3 ... . With a number of exceptions, Bade has chosen the latter strategy so that words of the form əCCəC ... in Bade correspond to words of the form CəCC ... in Ngizim.[20] In words where C_2 and C_3 cannot abut, Bade again has əCCəC ... but Ngizim has CəCəC ...; where C_1 and C_2 cannot abut, both languages have CəCC ... ; where C_1 cannot abut with C_2 nor C_2 with C_3, both languages have CəCəC ... . Examples of all these combinations are given in Table 2.

[20] This strategy of syllabification in Bade is consistent with the position into which ə is inserted as illustrated in (10a), viz. between the second and third consonants rather than the first and second.

Table 2. Examples of syllabification in words with 3 or more consonants

The left-hand column is Ngizim, the right-hand column is Bade.

C_1, C_2, and C_3 can all abut		
dàgzú	àdgàzú	(Ng) 'fuck'
		(Ba) 'copulate (animals)'
pèstú	àbzàkú	(Ng) 'split palm fronds'
		(Ba) 'today'
zùktú	àzgàtú	'pierce'
ràptú	àlbàtú	'open'
ràbgú	àlbàgú	(Ng) 'destroy'
		(Ba) 'stove in'
C_1 and C_2 can abut, C_2 and C_3 cannot		
(gùjlàjlú)	ùgjlàjlú	'wake up'
gùjlàjlìr	ùgjlàrgùjlár	(Ng) 'loose bark'
		(Ba) 'lower back'
sèkùnú	àskùnú	'increase'
màzàmú	m̀zàmú	'groan'
nàmìyú	àlmìyú	'flood'
C_1 and C_2 cannot abut, C_2 and C_3 can		
tàrkú	tàlkú	'orphan'
vàrdá	vàrdá	'first ripe heads of millet'
bàntú	bàntú	(Ng) 'pass by'
		(Ba) 'narrowly miss'
sàmdú	sàmdú	'sneak up on'
Neither C_1 and C_2 nor C_2 and C_3 can abut		
(jlàɓàrú)	tlàɓàlú	'split wood'
(wùdú)	kàdùwú	'dry up'
dɓ̀mìyú	----	'guard'
gùgùyú	----	'shake (blanket, etc.)'

High tone on the initial syllable has prevented C_1 and C_2 from coming together in Bade just as illustrated in (21) for words of the structure $C_1əC_2V$ ... . Thus, for words in Bade beginning with high tone, when C_2 and C_3 can abut they do; when they cannot abut they are separated by a high vowel, but always with a high vowel separating C_1 and C_2 as well. The examples in (22) are all from Bade.

(22)

C_2 and C_3 can abut		C_2 and C_3 cannot abut	
légdà	'ladle'	cákúɗàk	'adze'
ɗúksù	'the weed *Mitracarpum scabrum*'	ɗúkúmàk	'tweezers'
ségvà	'spur-winged goose'	kútárú	'puppy'
gúskwàk	'worm'	mátlálàm	'cobra'
kûzvú	'female slave'	wújálàl	'trilling'
[lâɣyá]	'small calabash'	sóvìyák	'elephant snount fish'
[cáŋnà]	'molar'	lávùwà	'chaff'
wûrjí	'scorpion'		
wúrnàk	'burnt mush'		

There are very few words with four or more consecutive consonants where any two consecutive consonants could abut and where only short high vowels intervene. The only two examples, aside from a number of reduplicated forms (see section 3.2.3), that I have found in Bade are tèkpèsú 'begin' and màskòtú 'turn'. Words such as those in the first two sections of Table 2 suggest that the principle behind Bade PROTHESIS might be stated as in (23):

(23) "(1) If the first two consonants of a root form a permissible sequence and are not separated by a vowel other than a short high vowel, let those consonants abut and add prothetic ə ; (2) if no vowel follows C_2, add epenthetic ə and proceed by grouping the next two consonants if possible."

Such a principle would predict *ətkàpsú and *msèktú . In fact, there are no words in the language which have been syllabified in this way

where the proto-form was *CəCCəC ... .[21] I have no formal explanation for why tèkpèsú has not become *ètkèpsú , but if one considers the string of operations speakers would have had to go through to convert the former into the latter during the period when PROTHESIS was a change in progress, one can well imagine why this and the few other words like it would have resisted change. The change of words like *lèptú 'open' to èlɓètú also involves a fairly radical restructuring so it is not surprising that a fairly large proportion of the verbs and several nouns having three consonants where PROTHESIS and resyllabification could have taken place have also resisted the change, e.g. tèktlú 'trace designs' ≯ *ètkètlú , lèktú 'bring ruin' ≯ *èlkètú , dɓbdú 'sell' ≯ *èdɓèdú , [sèŋmú] 'plant ≯ *èzgèmú (this word has become èzgèmú in Western Bade), kùdvú 'carry on back' ≯ *ùgdèvú (but cf. verbal noun ùgdáf), tlèfcí 'worn out mat' ≯ *ètlfècí .[22]

In fact, there are very few words of three or more syllables which have undergone PROTHESIS even if it would have affected only the initial syllable. For long words the principle for deciding on clustering seems to be as in (24):

(24) "Find the first obligatory vowel, allow the two consonants preceding that vowel to abut if possible, and add ə before them."

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[21]The Bade words ùgjlèrgùjlér 'lower back' and ùgzèmtèm 'marabou stork' have the structure əCCəCCV ..., but in these words the reconstructed shape would be *CəCəCCV ..., not *CəCCəCV ... .

[22]I collected 24 verbs with three consonants, any two of which could abut and which were separated only by high vowels. Of these 24, 11 have the structure CəCCə, 13 have əCCəCu. An alternative explanation for these verbs not being restructured is a tonal one, viz. verbs with an initial syllable CVC must be reconstructed as having high tone verbal nouns. PROTHESIS seems to have taken place only sporadically with verbs other than those having low tone verbal nouns (see section 3.2.1). Among nouns I found only 8 clear examples with the relevant structural characteristics: èbzèkú 'today', ègzègè 'herd', dùksí 'heavy', kèské 'easy', tlèfcí 'worn out mat', mègbá 'monitor lizard', [mèɣrè] 'grey-headed sparrow', wùr'yí 'fart'. The word kèské is a Kanuri borrowing and borrowings have usually not undergone PROTHESIS (see sec-

"Obligatory vowel" here will be either a high vowel which separates two consonants which cannot abut or a "lexical" vowel, i.e. a mid or low vowel or a long high vowel, the position of which is not predictable. The principle in (24) almost works in general for the language but fails to predict the word shapes in the first two sections of Table 2, which encompass a fairly substantial number of words. In (25) are some examples of words syllabified according to (24). In column (a) the "obligatory vowel" follows C_2 so that C_1 and C_2 abut and require the prothetic ə . In column (b), the "obligatory vowel" follows C_3. Even though C_1 and C_2 could potentially abut in these words, they do not since by principle (24), it is C_2 and C_3 which must abut, requiring that a ə be inserted between C_1 and C_2. The obligatory vowel is underlined.

(25) a.	m̀sə̀sàawà	'the plant *Guiera senegalensis*'	b.	mədvə́lfyàk	'biting ant'
	ùgzə̀mtə̀m	'marabou stork'		bùgzə̀rá	'lying dead'
	ə̀gvə̀alə̀káu	'*Acacia nilotica*'		kùtfə̀lú	'untie'
	ə̀zvə̀vlyú	'wash grain'		cə̀kpə̀pú	'squat'
	ə̀gbə̀kwə̀tú	'decay'		tlə̀kpə̀lú	'go mad'
	ŋgə̀rə̀mtú	'gallop'		tə̀gbə̀bə̀dú	'slosh out'

Note that principle (24) predicts tə̀kpə̀sú no better than (23). In this word the first obligatory vowel is the final one and (24) would thus give the incorrect *ə̀tkə̀psú .

3.2.3. True exceptions and morphologically conditioned exceptions to PROTHESIS. The environments where Bade PROTHESIS has taken place are governed by three essential factors: (1) the initial syllable of the word must bear low tone; (2) C_1 and C_2 are not prevented from abutting by one of the factors listed in (18); (3) the principle of

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tion 3.2.3); PROTHESIS in mə̀gbá or [mə̀ɣrà] would give an initial m̀g ... sequence, which otherwise does not exist in Bade or Ngizim. Not included among the nouns are those with initial syllabic nasal since in an undetermined number of words the nasal comes from syllabification of the nasal onset of a prenasalized consonant and hence is not a true example of a three consonantal word which has undergone PROTHESIS, e.g. ŋgúdì 'poor' > Kanuri ŋgúdì 'poor person'.

syllabification in (23) must not be overriden by that in (24), which applies mainly to words of three or more syllables. There are some true exceptions to PROTHESIS--words where no phonological or morphological factors predict that the word should not have undergone PROTHESIS, e.g. dàgàrìyà 'barb' (a type of fish), dàvàarák 'crownbird', gàtáǃ 'abandoned town site', gùtǃámtǃàm 'strong smell', dùgwú 'hear'. In the materials I collected, true exceptions such as these total only 10-15 as opposed to well over 200 words where PROTHESIS has applied. Besides these true exceptions, there are several classes of apparent exceptions which have resisted PROTHESIS for morphological or other reasons.

Relatively recent borrowed words have not been affected by PROTHESIS, e.g.

(26)	gùzàrì	'provisions'	<	Hausa	gùzúrí
	dàpú	'1000'	<	Kanuri	dábú
	kàské	'easy'	<	Kanuri	kàské

Two types of verbal nouns have not been affected by PROTHESIS. One type, illustrated in (27a), derives from verbs of the shape CaCV. These verbal nouns end in -i and the underlying /a/ of the initial syllable assimilates in height to this -i to become ə. The verbs 'die' and 'know' have irregular verbal nouns of a similar structure and have not been affected by PROTHESIS, though interestingly the verbs have been. The second type of verbal noun, illustrated in (27b), is derived from some verbs of the structure CVCC$_u$. These verbal nouns have the structure CV$_1$CV$_2$C where V$_1$ is the vowel of the first syllable of the verb root and V$_2$ is sometimes the same as V$_1$, sometimes a even where V$_1$ is ə.

(27)	a.	kàtí	'returning'	<	kàtáu	'return'
		gàfí	'catching'	<	gàfáu	'catch'
		wùní	'sending'	<	wànú	'send'
		màtú	'death'	<	mtú	'die'
		sàgí	'knowledge'	<	àzgáu	'know'

b.	zàgém	'planting'	<	[sàŋmú]	'plant'
	tàkátɨ	'tracing'	<	tàktɨú	'trace'
	dàgàs	'copulation'	<	dàgzú	'copulate'
	ɨùwái (= àɨwái)	'farming'	<	ɨùuyú	'farm, hoe'
	(but cf. ùgdáɨ)	'child on back'	<	kùdvú	'carry on back')

Next, statives, which are derived from verbs with a prefix də- , have been preserved with initial də- with all verbs.

(27) c.	dəkwáadə̀	'spoiled'	<	kwàadú	'spoil'
	dəbàkí	'roasted'	<	bàkú	'roast'

Finally, reduplications have uniformly resisted restructuring to permit PROTHESIS.

(28)	dègdèkí	'perch (fish)'
	dèvdèfá	'greasy'
	cèkcèkú	'sift'
	sùksùkwú	'loosen'
	kùzgùzú	'teach'
	kètkètú	'scratch ground'

To permit PROTHESIS these words would have to be totally restructured, e.g. *ècècèckú . Their failure to undergo PROTHESIS may be explained as well by resistance to this type of restructuring (cf. discussion of tèkpèsú, p. 275) as by their reduplicated structure.

4. Bade/Ngizim and Universal Principles of Syllabification

The discussion to this point has concentrated on noting sequences of segments which are possible or impossible and designating how such sequential restrictions are maintained by placement of vowels. In this section I hope to show how a single statement for possible syllable types in Bade/Ngizim, combined with certain hierarchies of segments, can unify what has been basically a list of restrictions.

The general principle restricting possible Bade/Ngizim syllable types can be stated as in (29):

(29) No syllable in Bade or Ngizim may have more than one consonant at either margin, i.e. the maximum syllable is CVC.

This automatically accounts for the impermissible sequences CCC, #CC, and CC#. In order to account for the permissibility or impermissibility of the sequences listed in (18), we must refer to some proposed universal hierarchies of consonant types and principles of syllabification.

Observations on the organization of phonological segments dating at least to Saussure and supported by a variety of phenomena in a number of languages point to hierarchies of consonantal "strength" along certain parameters (some of the linguists most recently concerned with this issue are Foley, Vennemann, and Hooper--see Hooper [1976:195 ff.] for references and discussion). The most frequently noted hierarchy is along a parameter called "sonority" or "openness". Cross-cutting this hierarchy are two further hierarchies, given in (30b) and (30c):

(30) a. Sonority: stop > fricative > nasal > liquid > semivowel
b. Phonation type: voiceless > voiced > glottalized
c. Point of articulation: labial > alveolar > velar
(read > "is stronger than")

In addition to these hierarchies based on inherent characteristics of segments there are hierarchies of strength associated with position of a segment in a string of segments. Of interest here is the relatively greater strength of syllable initial position over syllable final position, evidenced by such phenomena as the frequency of neutralization or loss of syllable-final consonants as opposed to the relative infrequency or non-existence of such phenomena in syllable initial position. Positional strength correlates with inherent strength of segment types, so there is a rough hierarchy of suitability for initial and final positions in syllables [Hooper 1976:196]. Those segment types in descending order from left to right in (30a) are more "suitable" as syllable initial consonants, those ascending from right to left as

syllable final. This is seen, for example, from the fact that in many languages, syllable initial sequences such as tr , zy , etc. are possible, whereas rt , yz are rare if they exist at all. On the other hand, many languages allow only sonorant consonants in syllable final position, whereas few if any allow only obstruents in this position.

Languages show minor individual variations in the hierarchies in (30) and variations in the way syllabification is done, e.g. some languages have ambisyllabic consonants while others do not, in some languages morphological boundaries affect syllabification, etc. Nevertheless, there is a high degree of cross-language predictability of how strings of segments will be syllabified which follows from the observations above. The three following statements for Babe and Ngizim would have counterparts in many languages: (1) a weak segment can always come in direct sequence with a following strong one since syllabification will always be between the two segments, e.g. Ngizim tə̀r=kú 'orphan' because the sonorant r is weaker than the stop k (the symbol = represents syllable boundary); (2) a segment can usually come in direct sequence with one of relatively equal strength since syllabification will normally be between the two, e.g. Bade/Ngizim áp=tà 'flour', but there is some variation with certain pairs of segments (see below); (3) a strong consonant cannot occur in direct sequence with a relatively weak one because syllabification would come at the beginning of the sequence, e.g. there could be no word *təkru . This would be syllabified tə=kru , as such sequences invariably are in languages that allow them, producing an impermissible syllable of the shape CCV, disallowed in Bade/Ngizim by (29). Bade and Ngizim assure that such syllables will not occur by requiring that a vowel separate such sequences of consonants; words which have as their first two consonants a strong consonant followed by a weak one comprise the largest set of cases where PROTHESIS has not taken place in Bade.

With these observations in mind, let us consider in turn each of

the types of segment sequences listed in (18b-e):[23]

- obstruent + obstruent: Nearly all such sequences are possible, indicating that the strength differential between obstruents is not great. A stop may even be followed by a non-homorganic fricative, e.g. Ba ɔ̀tfú 'enter'. But if the fricative is homorganic to the stop, i.e. if everything between the segments is equal except their relative position on the sonority hierarchy, then they cannot occur in sequence, e.g. Ba dɔ̀zí 'vein' (not *ɔ̀dzí). In (30b) glottalized stops are claimed to be weaker than non-glottalized. This accounts for the fact that PROTHESIS has never taken place in Bade words where the first two consonants are plain obstruent + glottalized stop. The relative weakness of glottalized stops is supported by independent evidence as well: Le Saout [1974] describes a variety of phenomena in some Kwa and Mande languages where glottalized sounds pattern with sonorants, not obstruents; in Hausa, glottalized k in some dialects is weakened to ʔ (classed as a glide in some frameworks), not to a corresponding obstruent; tonal phenomena in Bade are more easily described if glottalized sounds are classed with sonorants than with obstruents. Nonetheless, glottalized stops must not be radically weaker than plain obstruents since there is no restriction on other obstruents abutting with them in Ngizim, and word internal in Bade, the restriction is only sporadically observed (see (15) and discussion).

- obstruent + sonorant: Such sequences are impossible, except for /g/ + sonorant in Bade. Recall, however, that when this sequence occurs in Bade, /g/ changes to [w], [ŋ], or [ɣ] depending on what follows (see (19)), so that the phonetic form of the word will automatically be syllabified between /g/ and the next consonant.[24] The

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[23] In (18a) sequences of identical consonants, i.e. geminate consonants, are excluded. This restriction is unrelated to questions of syllable structure. In the few words where geminates are found, syllabification is between the consonants.

[24] This is assuming that the sound symbolized ɣ is classed as a sonorant rather than an obstruent. This is reasonable, considering the phonetic facts. The ɣ is very lightly articulated, approaching [ɦ].

question is why /g/, an obstruent, should be allowed to abut with sonorants in the first place. The answer seems to be that /g/ is virtually the weakest obstruent in Bade (being velar, it is at the weakest point of articulation, and being voiced it is the weakest velar, since there is no glottalized velar). It therefore approaches sonorants in the strength hierarchy and with the slight phonetic adjustments which are made it can be brought down to equal strength with sonorants, hence calling for a syllable boundary between it and the following sonorant rather than before it. This borderline status of /g/ on the strength hierarchy also provides an explanation for why some words in Bade show variant pronunciations, e.g. ŋmá = gəmá 'thigh', and others do not allow /g/ to abut with a sonorant at all, e.g. gànà 'like, as', gùlú 'jealously'. While the placement of syllable boundaries with most consonant sequences can be unequivocally determined, e.g. =trV but never *t=rV , b=g but never *=bg , the placement of syllable boundary with /g/ + sonorant is less firm. The result is that whether /g/ is allowed to abut with a following sonorant has been determined on a word by word basis.

- <u>sonorant + obstruent</u>: All such sequences are possible with sporadic lexical exceptions where m is followed by s or z (see below for discussion).

- <u>sonorant + sonorant</u>: Most such sequences are possible, but there is more variation here than with other types of sequences. This is especially true in the cases where one of the consonants is a nasal. If the first consonant is /n/ and it is followed by a nasal, it frequently dissimilates to l , in which case it may come in contact with a following nasal since liquids are weaker than nasals, e.g. èlmìyú 'flood' < *ènmìyú . However, /m/ never dissimlates and it is with /m/ as the first of the sequence that the most variation occurs. Nasals are ambivalent since by their oral closure they resemble obstruents, yet by their non-obstructed airflow they are sonorants. Because of this ambivalence we find variation in whether m may come in contact with s or z (i.e. fricatives, which fall immediately above nasals in

strength) and with other sonorants (liquids, which fall immediately below nasals in strength). For specific examples, see above, p.268.

In summary, we see that hierarchies of "strength" and principles of syllabification that have been proposed as possible universal features of language allow us to predict fairly accurately the types of consonants which may or may not occur in sequence in Bade and Ngizim, when combined with the statement of permissible syllable types given in (29). This means of predicting possible sequences of consonants in turn allows us to predict where the change termed PROTHESIS could occur in Bade.

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