Africa as a phonological area

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3. **Africa as a phonological area**

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3.1. Phonological zones in Africa

Some 30% of the world's languages are spoken in Africa, by one current estimate (Gordon 2005). Given this linguistic richness, it is not surprising that African languages reveal robust patterns of phonology and phonetics that are much less frequent, or which barely occur, in other regions of the world. These differences are instructive for many reasons, not the least of which is the fact that they bring to light potentials for sound structure which, due to accidents of history and geography, have been more fully developed in Africa than in other continents. Just as importantly, a closer study of "variation space" across African languages shows that it is not homogeneous, as some combinations of properties tend to cluster together in genetically unrelated languages while other imaginable combinations are rare or unattested, even in single groups; crosslinguistic variation of this sort is of central interest to the study of linguistic universals and typology. A further important reason for studying phonological patterns in Africa is for the light they shed upon earlier population movements and linguistic change through contact.

In preparing this chapter, we initially set out to examine characteristics that are more typical of the African continent as a whole than of other broad regions of the world (a goal initially set out by Greenberg 1959, 1983). However, this goal quickly turned out to be unrealistic. From a genetic-historical point of view, Africa contains several independent or very distantly related language groups, each of which show characteristics different from the others. Apart from contact areas where these languages meet, the features of any one region tend to coincide with inherited features of the languages spoken in it, often over thousands of years. From a geographical point of view, Africa is a vast expanse consisting of many regions differing in the conditions they offer for movement and exchange among peoples. For these reasons there is little reason to expect any great overall linguistic uniformity.

Our preliminary research quickly confirmed that there is no characteristically African phonological property that is common to the continent as a whole, nor even to the vast sub-Saharan region. Indeed, many of the characteristics for which Africa is best known to non-specialists, such as its clicks, its labial-velar consonants or its tongue-root based (ATR) vowel harmony, are geographically restricted. In view of this fact, we found it more enlightening to focus our study on properties that are characteristic of smaller, more specific regions.

The central thesis of this chapter is that the African continent can be divided into six major zones, each of which is defined by a number of phonological properties that occur commonly within it but much less often outside it. These will be referred to by the neutral

term "phonological zone" in order not to prejudge the question whether the shared features arise from common inheritance, diffusion, or other factors. These zones are shown in Map 1.

(insert Map 1 here)

Needless to say, it is impossible to draw rigid boundaries around assumed linguistic regions, and these boundaries should not be taken too literally. All such boundaries are porous, and shift as populations move and intermingle over time. In a few cases, boundaries correspond roughly to geographic or climactic frontiers – e.g. the Sudanic belt is bounded roughly by the Sahel on the north and the equatorial rain forest on the south -- but even these boundaries are not perfectly sharp, and it is usually best to recognize "transition zones" showing features of the zones to either side. Geographic features are not a sure guide in placing boundaries, and where doubt arises we have taken the linguistic evidence as decisive.

The largest zone we call the *North*, defined broadly to include the Mediterranean coastal region, the Sahara and the Sahel. This zone is fairly homogenous from a linguistic point of view, as its phonological properties coincide largely with those of the Arabic and Berber languages spoken within it. This is less true toward the south and east of the zone, where alongside local forms of Arabic and Berber (and Beja in the east) a number of non-Afroasiatic languages are spoken, including northern varieties of Fulfulde and Songay, the Saharan languages Tedaga, Dazaga and Zaghawa, and the Nile Nubian languages Nobiin (or Mahas) and Kenuzi-Dongola.

A second zone, which we call the *East*, encompasses the Horn of Africa (Ethiopia, Eritrea, Djibouti, and Somalia). This zone is linguistically more diverse than the North. Though nearly all its languages are usually classed in the Afroasiatic phylum, they involve three independent stocks: Ethiopian Semitic in the north, Cushitic in the east and south, and Omotic in the west. Linguistic features within Ethiopia tend to hug genetic boundaries to a certain extent (Tosco 2000), though a few, such as the common presence of implosives in consonant inventories, cross boundaries as well. Due in large part to the common Afroasiatic heritage, many linguistic features of the East are shared with the North, though as we shall see it also has characteristic traits of its own.

The linguistically most dense of the six zones is one we call the *Sudanic belt*, or *Sudan* for short.[1] This region includes the vast savanna that extends across Sub-Saharan Africa bounded by the Sahel on the north, the Atlantic Ocean on the west and southwest, Lake Albert on the southeast, and the Ethiopian-Eritrean highlands on the east, and corresponds roughly to the "core area" recognized by Greenberg (1959). This region is linguistically diverse, containing all non-Bantu (and some Bantu) languages of the Niger-Congo phylum, the Chadic subgroup of Afroasiatic, southern varieties of Arabic, and most Nilo-Saharan languages except for peripheral members in the north and southeast. Where these languages come into contact, we find evidence of phonological diffusion across genetic lines. (For further discussion of the (Macro-)Sudanic belt, with maps of several of its linguistic features, see Güldemann, chapter 5 of this volume.)

A fourth large zone, which we call the *Center*, comprises south-central and southeast Africa and includes most of the equatorial forest, the Great Lakes Region, and the subequatorial savanna to the Kalahari Basin on the south and the Indian Ocean on the east. This geographically diverse zone is almost exclusively Bantu-speaking and is characterized by the linguistic features typical of Bantu languages. (For overviews of Bantu phonology see Hyman 2003 and Kisseberth & Odden 2003.)

A fifth zone, which we call the *South*, comprises the remainder of the continent to the south and includes semi-desert, savanna, and temperate coastal regions. While its phonological characteristics derive from those of the Khoisan and Bantu languages spoken within it, several of them are shared rather widely across genetic boundaries, and it is these that define this zone in phonological terms. This zone contains some of the richest consonant and vowel inventories of the world's languages, led perhaps by !Xóõ (Southern Khoisan) with some 160 distinct phonemes (Traill 1985). (For discussion of the Kalahari Basin area, see Güldemann 1988).

A final zone, called the *Rift Valley* (or simply *Rift*), includes much of the eastern branch of the Great Rift Valley in northern Tanzania and southwestern Kenya. In this region, languages of all four of Greenberg's super-families[2] (Afroasiatic, Nilo-Saharan, Niger-Congo, Khoisan) meet in a jigsaw-like pattern. In general, their phonological features do not appear to be widely shared among different groups, except as a result of independent genetic heritage. However, a number of apparently contact-induced features in an area southeast of Lake Victoria have been described by Kiessling, Mous & Nurse in chapter 8 of this volume.

Many microareas can be identified within these broad zones, some of which have received detailed study in other publications. Our purpose here, however, will not be to refine these zones but to examine their general characteristics and interrelationships.

This chapter is organized around two main "core" sections, the first dealing with segmental phonological properties and the second with prosodic properties. Each begins with a brief overview and then examines a number of selected features in more detail. In our selection of features we have given priority to those that are well documented in a large number of languages, that appear in genetically distant (but not necessarily totally unrelated) languages in a contiguous area, that are broadly represented across smaller genetic units within this area, and that appear with much less frequency in languages outside the area, especially outside Africa. The chapter concludes with a review of proposed diagnostics of the major zones.

3.2. Segmental features

3.2.1. Preliminaries

As noted above, no "typically" African sound is found throughout the African continent. Properties that are widely shared across the continent as a whole amount to little more than typologically unmarked features, such as the near-universal presence of voiceless stops, or a

preference for open syllable structure. Once we restrict our attention to particular zones, however, certain relatively unusual features emerge.

In order to study the distribution of speech sounds across zones in quantitative terms, we constructed a data base of 150 African phoneme systems representing all major linguistic groupings and geographic regions of the continent. This data base is divided into six subsets corresponding to the six zones described above. It emphasizes languages of the Sudanic belt (N = 100) in keeping with their large numbers and genetic diversity, but also contains representative languages from the other zones (N = 50). All African languages in the data base are listed in Tables A and B of the Appendix. These languages are complemented by a further set of 345 non-African languages which provide a basis for comparison. The full data base of 495 languages forms the basis for our quantitative generalizations, though our qualitative discussion is based upon an independent survey of the available literature and on our first-hand experience.[3]

3.2.2. Three Sudanic consonant types

A study of the data base brings to light three consonant types that are especially representative of languages spoken in the Sudanic belt: labial flaps, labial-velar stops, and implosives. Table 1 shows their distribution in African and non-African languages. The last column shows the ratio of the percentage of occurrence of each sound in the Sudanic belt (% Sudanic) over the percentage of its occurrence outside Africa (% non-African).

Consonant type:	Sudanic (100)	North (7)	East (12)	Center (13)	Rift (9)	South (9)	Non-Afr (345)	ratio % Sudanic / % non-Afr
labial flaps	12	0	0	1	0	0	0	-
labial-velar stops	55	0	0	0	0	0	2	94.9
implosives	46	0	6	2	2	2	13	12.2

Table 1. Number of languages having each of three consonant types in 150 African languages and 345 non-African ("non-Afr") languages. African languages are given by zone. The total number of languages in each set is indicated in parentheses.

The first two sounds are nearly unique to Africa. Labial flaps occur in 12 of the 100 Sudanic languages in our sample and in only one language elsewhere in Africa.[4] Labial-velar stops occur in over half the Sudanic languages of the sample (55%) but in none of the other African languages and only two non-African languages (0.6%).[5] As shown in the last column, these sounds are over ninety times as frequent among Sudanic languages as among non-African languages. Third on the list, but still much commoner in Sudanic languages (46%) than in non-African languages (3.8%), are implosive stops, which are about twelve times as frequent

in the Sudanic belt as outside Africa Labial flaps and labial-velar stops will be discussed in the next two sections, and implosives will be examined in section 3.2.7.

3.2.3. Labial flaps

Greenberg (1983) was first to point out the widespread occurrence of labial flaps across a broad zone in north central Africa. Due to their rarity and often marginal status, these sounds have tended to be overlooked in the past, but have been correctly described since the early twentieth century. In Shona S10,[6] the Bantuist Clement M. Doke described the labiodental version of this sound as follows (1931, 224): "It is a voiced sound in the production of which the lower lip is brought behind the upper front teeth with tensity. The teeth touch well below the outer eversion of the lip, which is flapped smartly outwards, downwards." (See also his photographs, p. 298.) Bilabial versions of this sound have also been described, but are not known to contrast with the labiodental variant. As far as their phonology is concerned, these sounds usually constitute independent phonemes and may occur in "crowded" phoneme systems containing many competing labials. For example, in Higi, a Chadic language of northeast Nigeria, the labial flap /v̌/ occurs in a consonant system also containing five other voiced labials / b ɓ m v w /, though its use is restricted to a few ideophones such as *v̌áv̌áv̌á* 'signal of distress' (Mohrlang 1972). For more information, the reader is referred to Olson & Hajek's thorough survey (2003).

These sounds have been reported in at least seventy African languages, heavily concentrated in the center of the Sudanic belt in an area encompassing northern Cameroon, the Central African Republic (CAR), and adjoining parts of Nigeria, Chad, Sudan and the Democratic Republic of the Congo (DRC). (See the language list in Olson & Hajek 2003 and the map in Güldemann's chapter, this volume). In this area, they occur in language families of three different phyla, Chadic (Afroasiatic), Central Sudanic (Nilo-Saharan), and Adamawa-Ubangi (Niger-Congo), as well as in a few neighboring northern Bantoid languages (Niger-Congo). A separate concentration is found in the Nyanja (Bantu N30) and Shona (Bantu S10) language groups spoken in Malawi, Zimbabwe and adjacent areas of Botswana and Mozambique. Outside Africa, labial flaps have been reported only in one language, Sika, an Austronesian language of Indonesia.

Labial flaps are not widely distributed across the Sudanic belt. In spite of their concentrated distribution, common inheritance from a single proto-language can be ruled out. Olson & Hajek (2003) suggest that they might have arisen in Adamawa-Ubangi languages of Cameroon and spread from there into the eastern CAR and Sudan, from whence they would have been borrowed by Central Sudanic languages. How these sounds arose in the first place (i.e. via sound change, in ideophones, just once or several times independently) is still uncertain.

3.2.4. Labial-velar stops

Almost equally unique to Africa, and to the Sudanic belt in particular, are labial-velar stops. These are doubly-articulated sounds produced with overlapping labial and velar closures (see Connell 1994, Ladefoged & Maddieson 1996 for detailed phonetic descriptions). In spite of their complex articulation, they constitute single phonemes, as is shown by a number of diagnostics. For example, they cannot be split by epenthesis, they are copied as single units in reduplication, and they typically occur in syllable-initial position where consonant clusters are not otherwise allowed. In general, labiovelar sounds, including stops and the glide /w/, tend to pattern with labial rather than velar sounds in phonological systems (Ohala & Lorentz 1977). However in homorganic nasal-stop sequences, it is the dorsal feature that typically spreads to the preceding nasal, yielding [ŋmgb] or [ŋgb].[7] A fuller discussion of their phonology can be found in Cahill (1999).

The commonest labial-velar stops are a voiced oral stop /gb/, a voiceless oral stop /kp/, a nasal stop /ŋm/, and a prenasalized stop usually realized as [ŋmbg] or [ŋgb]. One or more of these sounds occur in 55 of the 150 African languages in our data base (see Table 2).

	number	percent of total
gb	54	98.2
kp	54	98.2
Ngb	13	23.6
ŋm	7	12.7

Table 2. Frequencies of four types of labial-velar stops in the African data base. (Total languages with labial-velar stops = 55)

Other types of labial-velar sounds are very rare in our data, the most unusual being the labial-velar trills reported in the Bantu language Yaka C104 (Thomas 1991). As the numbers in Table 2 suggest, /kp/ and /gb/ usually accompany each other in a system. This fact may seem unusual, given the crosslinguistic tendency for voiced stops to be less frequent than voiceless stops. In the Sudanic belt, however, this tendency does not hold; within our sample, only 4% of Sudanic languages lack voiced stops, and these are all Bantu languages spoken in the transitional zone in the south. A regular pairing of /gb/ and /kp/ is therefore to be expected in this area.[8]

As far as their geographic distribution is concerned, labial-velar stops are found in over half the languages of the Sudanic belt in our sample, but are extremely infrequent in languages outside this area, whether in Africa or elsewhere. They occur across the entire Sudanic belt from the Atlantic Ocean in the west to Lake Albert and the Nubian Hills in the east. They are well represented in all major branches of Niger-Congo except Dogon, including, along the periphery of this zone, central and southern Atlantic languages (e.g.

Biafada, Bidyogo, Temne, Kisi, Gola), several Grassfields Bantu languages (e.g. Mundani, Aghem, Yamba, and Nweh), and a Kordofanian language (Kalak/Katla). In Nilo-Saharan they are typical of Central Sudanic languages, and also occur in Dendi Songay, spoken in Benin, and a few Nilotic languages (Kuku Bari of southern Sudan, Alur of the DRC). They are also found in a few Chadic languages (Bacama in northeastern Nigeria, Daba, Mofu-Gudur, Kada/Gidar, and the Kotoko cluster in Cameroon). As an areal feature which cuts across genetic lines, they constitute a primary phonological diagnostic of the Sudanic belt. (See Greenberg 1983 for a fuller description of their geographical spread, and Güldemann, chapter 5 of this volume for further discussion and a map of their distribution.)

Labial-velar stops are not common in Bantu languages. However, they occur in a fair number of northern Bantu languages of zones A, C and D spoken in the equatorial forest and Congo Basin from the Atlantic on the west to Lake Albert on the east, as shown in Map 2.

(Insert Map 2 here)

The zone A languages, spoken from southeastern Cameroon well into Gabon, include several members of the Lundu-Balong group A10 such as Londo A11, Bafo A141, and Central Mbo A15C, several of the western Duala languages A21-3, Kpa/Bafia A53, Tuki A64, the Ewondo-Fang group A70, and Makaa A83. The zone C languages, spoken in the central Congo Basin, include several members of the Ngundi group C10 (notably Yaka/Aka C104, Pande C12a, Mbati C13, and Leke C14), many members of the Bangi-Ntumba group C30 spoken between the Ubangi and Congo Rivers, Ngombe C41 with 150,000 speakers, and further upstream along the Congo River, Beo/Ngelima C45, Topoke/Gesogo C53, and Lombo C54. Among zone D languages, labial-velar stops are found in the Mbole-Ena group D10 including Lengola D12, Mituku D13, and Enya D14, in Baali/Bali D21, and far to the east in several members of the Bira-Huku group D30 including Bila D311, Bira D32, Nyali D33, and Amba D22, the latter spoken in the northern foothills of the Ruwenzori mountains and adjacent areas of Uganda. Well to the south of the Congo River at the southern limit of the tropical forest, labial-velar stops occur in a few roots in Sakata C34. This list is very likely incomplete, as information for most languages in the area is sparse.[9] In this broad zone, Bantu languages are (or presumably have been in the not distant past) in contact with other Sudanic languages having labial-velar stops: southern Bantoid languages in the west, Adamawa-Ubangi languages in the center, and Central Sudanic languages in the east.

In the Rift zone of eastern Africa, labial-velar stops occur in several Bantu languages spoken on the southern Kenyan coast, including Giryama E72a, where they have arisen through internal change (e.g. Giryama E72a *kua > [kpa], *mua > [ŋma]).[10]

It is usually thought since Greenberg (1983) that labial-velar stops originated in Niger-Congo languages and diffused from there to neighboring Central Sudanic languages, constituting a block from whence they spread to Chadic languages on the north, Nilotic languages on the east and Bantu languages on the south. Labial-velar stops have also arisen through internal change from labialized stops (usually velar, but sometimes labial), but such

evolution has happened predominantly in areas where labial-velars are already present in neighboring languages, constituting a regional norm (the Kenyan Bantu languages mentioned above are exceptional in this respect).

Although labial-velar stops are extremely rare on other continents, the African diaspora has carried them to northeastern South America where they occur in some West-African-based Creole languages such as Nengee, spoken in French Guiana, and Ndyuka and Saramaccan, spoken in Surinam. They have arisen independently in a number of Papuan languages including Kâte, Amele and Yeletnye, as well as at least two Eastern Malayo-Polynesian languages, Iai (see note 5) and Owa, spoken in the Solomon Islands. In sum, though not entirely unique to Africa, they are one of the most characteristically African, and specifically Sudanic, speech sound types.

3.2.5. Nasal vowels and nasal consonants

Another characteristically Sudanic feature is the presence of a series of phonemic nasal vowels. We first consider the distribution of nasal vowels in Africa, and then take up the question of languages lacking (contrastive) nasal consonants.

While nasal vowels are not uncommon in the world's languages, they are especially common in the Sudanic belt. Statistics are as follows:

African languages with nasalized vowels:		26.7 %
Sudanic:	34 %	
elsewhere in Africa:	6 %	
Non-African languages with nasalized vowels:		21.2%

Table 3. African languages in our sample with nasal vowels.

In our sample, nasal vowels are 60% more frequent in the Sudanic belt than they are outside Africa, and nearly six times more frequent in the Sudanic belt than they are elsewhere in Africa. The only other area in which they are frequent is among Khoisan languages of southern Africa. This heavy skewing is reflected in Map 3.

(insert Map 3 here)

Outside the two principle areas just mentioned, distinctive nasal vowels are found in a small number of Bantu languages in the west Central zone, including Bembe H11 and Umbundu R11, shown on the map, some varieties of Teke B70, and Yeyi R41 in the South. Here, however, contextual vowel nasalization is much more widespread than phonemic nasalization. In spite of their scarcity, Dimmendaal (2001) cites comparative evidence suggesting that

contrastive nasal vowels may have been present in Proto-Bantu and have undergone historical loss in all languages but Umbundu.

To this geographic restriction corresponds a genetic distinction. Contrastive nasal vowels are common in Niger-Congo and Khoisan, but rare in Nilo-Saharan and Afroasiatic languages. Within Niger-Congo they are especially common in Mande, Kwa, Gur, and Adamawa-Ubangi languages, as well as much of non-Bantoid Benue-Congo in Nigeria. In Nilo-Saharan, nasal vowels are found in Songay, which straddles the border between the Sudanic and Northern zones, and in the Mbay variety of Sara (Central Sudanic), which borders on Adamawa-Ubangi. We have found no examples among Chadic languages. This genetic and geographical distribution suggests that nasal vowels have had at least two separate origins in Africa, one in a proto-core group of Niger-Congo languages (as proposed by Stewart 1995) and one in the Khoisan languages of southern Africa, including at least proto-Khoe (Central Khoisan) as reconstructed by Vossen (1997a).

Outside Africa, too, nasal vowels are not distributed randomly but have strong areal limitations. Hajek (forthcoming) shows that outside Africa they are primarily concentrated in equatorial South America, south central Asia, and parts of North America. They thus tend to form clusters in certain areas and to be absent in others.

Looking more closely at the Sudanic belt, we find the typologically unusual phenomenon of languages lacking contrastive nasal consonants. Such languages have been widely reported in a continuous zone including Liberia on the west, Burkina Faso on the north and eastern Nigeria on the east. This area, enclosed in dashed lines in Map 3, lies squarely within the nasal vowel zone. These languages, so far as they are known to us at present, are the following:[11]

Liberia:	Kpelle (Mande); Grebo, Klao (Kru)
Burkina Faso:	Bwamu (Gur)
Côte d'Ivoire:	Dan, Guro-Yaoure, Wan-Mwan, Gban/Gagu, Tura (Mande); Senadi/Senufo (Gur); Nyabwa, Wè (Kru); Ebrié, Avikam, Abure (Kwa)
Ghana:	Abron, Akan, Ewe (Kwa)
Togo, Benin:	Gen, Fon (Kwa)
Nigeria:	Mbaise Igbo, Ikwere (Igboid)
CAR:	Yakoma (Ubangi)

Table 4. Languages reported to lack distinctive nasal consonants.

Such languages typically have an oral vs. nasal contrast in vowels, and two sets of consonants. Members of set 1 are usually all obstruents and are realized as oral regardless of whether the following vowel is oral or nasal. Members of set 2 are usually nonobstruents, and are realized as oral sounds before oral vowels and as nasal sounds before nasal vowels. For

example, the dental sonorant may be realized as [l] before oral vowels and as [n] before nasal vowels. In most cases, the corresponding oral/nasal pairs never contrast in any context, so that nasality is entirely nondistinctive in consonants.

The analytic line between languages which lack and do not lack contrastive nasal consonants is not sharp. A particularly clear case of a language that lacks them is Ikwere, an Igboid (Benue-Congo) language of Nigeria as described by Clements & Osu (2005). That nasality is distinctive in vowels is shown by pairs like *ódó* 'mortar' vs. *òdõ̰* 'yellow dye' (vowel nasality is indicated by subscript tildes). The full consonant system is as follows:

Set 1: obstruents	p	b	t	d	c	j	k	g	k^w	g^w	f	v	s	z
Set 2a: oral non-obstruents	b̰	ʼb̰	l	r	y	ɣ	w	h	h^w					
Set 2b: nasal non-obstruents	m	ʼm	n	n̰	ỹ	ɣ̃	w̰	h̰	$h̰^w$					

Table 5. Ikwere consonants.

(*b̰* and *ʼb̰* are voiced and preglottalized nonobstruent stops, respectively; see Clements & Osu 2002 for a phonetic study.) The key observations are that each oral consonant in set 2a has a nasal counterpart in set 2b and vice-versa, and that the paired consonants are in complementary distribution before vowels, those of set 2a appearing only before oral vowels and those of set 2b only before nasal vowels. Examples are given in (1).

(1)

before oral vowels (set 2a)		before nasal vowels (set 2b)	
áb̰á	'paint'	ámą̰	'matchet'
á'b̰á	'companionship'	à'mą̰	'path, road'
ɔ-lú	'to marry'	ɔ-nṵ	'to hear'
érú	'mushroom'	ɛ́n̰ṵ	'work'
à-yá	'to return'	áỹą̰	'eye'

Since the paired consonants are in complementary distribution in other contexts else as well, they can be derived from a single series of phonemes unspecified for nasality and obstruence, e.g. [b̰] and [m] from a phoneme /B/, [l] and [n] from a phoneme /L/, etc. A constraint *[+nasal,+obstruent] prohibits the assignment of nasality to obstruents, and the nasal variants are derived by an exceptionless rule spreading nasality from a nasal vowel to any consonant that does not bear [+obstruent]. As in many other languages of this type, this rule is independently supported in Ikwere by regular patterns of alternation. For example, it accounts for alternations in the verbal suffix *rò* as illustrated in the words *ɔ̀ byà̰-rò* ('she came...') vs. *ɔ̀ w̰ą̀-n̰ṳ̀* ('s/he drank...').

Such analyses explains an otherwise puzzling fact about the distribution of nasal consonants in languages of this type: prevocalic nasal consonants typically fail to appear

before vowels that do not occur with distinctive nasalization. For example, if the oral vowels /e/ and /o/ have no distinctive nasal counterparts, nasal consonants typically do not appear before [e] and [o], nasalized or not. (Lexical exceptions may arise from reduplications, loanwords, frozen compounds and the like.) Such gaps provide an independent diagnostic of the absence of distinctive nasality in consonants.

Not all systems as straightforward as that of Ikwere, however. For example, most varieties of Gbe (the closely-knit group of Kwa languages including Ewe, Gen, and Fon) are similar to Ikwere in relevant respects except that set 2a contains two obstruents, *b* and *d̨* in place of the nonobstruents *ḅ* and *ʼḅ*. Though the complementary distribution between set 2a and 2b is still complete, the class of nasalizing sounds is no longer phonologically natural, as it contains both obstruents and sonorants. Stewart (1995) offers comparative evidence showing that the present-day obstruents *b* and *d̨* are reflexes of proto-Gbe-Potou-Tano (= tentative proto-Kwa) implosive stops *ɓ* and *ɗ*, which shifted to ordinary explosives in all Gbe languages. This shift explains the modern pattern. Nasal spreading applied in pre-Gbe just as it does in Ikwere, affecting the full set of nonobstruents. Once the implosives shifted to explosives, however, the uniformity of the class of nasalizing segments was destroyed, leading to the "unnatural" rule of the present-day Gbe lects.

Other systems differ from those of Ikwere and Gbe in that there is a surface contrast between one member of the class of nasals, typically *m*, and its oral counterpart, such as *b* or *ɓ*. In the Nigerian language Gokana (Benue-Congo, Cross River), as discussed by Hyman (1982), we find a distribution of consonants into sets 1 and 2 as above. As in Gbe, set 2a contains obstruents as a result of evolutions from earlier sonorants (*w > v, *y > z). In Gokana, however, the complementary distribution is spoiled by the fact that *b* appears before both oral and nasal vowels, as is shown by minimal contrasts like *bá* 'arm, hand' vs. *bą́* 'pot' vs. *mą́* 'breast'. In other relevant respects, the system resembles that of Gbe and Ikwere. In a later analysis of these facts, Hyman (1985) proposes to treat all set 1 consonants, including the *b* that fails to nasalize, as underlyingly specified for the feature [-nasal], which serves to protect them from nasalization. However, the feature [+obstruent] would equally well serve this purpose if we assume the general constraint *[+nasal,+obstruent] as in Ikwere. The set 1 /b/ would then be specified as [+obstruent], consistent with its realization, while the paired set 2a/2b consonants [b]/[m] would constitute a single phoneme /B/ unspecified for both obstruence and nasality, also as in Ikwere. If /B/ occurs in a nasal context, it receives the feature [+nasal], while if it occurs in an oral context it receives the features [-nasal] and [+obstruent] by default, merging with /b/. What crucially distinguishes Gokana from Gbe, then, is the presence of an underlying /b/ vs. /B/ contrast. (It is tempting to interpret the nonobstruent /B/ of Gokana as the reflex of an earlier nonobstruent stop such as *ɓ*, in parallel to Gbe, but we have no information on the historical source of this sound.)

The analysis of nasality is often intricate, and there are legitimate grounds for disagreement among linguists. Disagreement often has as much to do with one's theoretical framework as with the nature of the facts. It seems, nevertheless, that many West African nasal systems can be ranged along a continuum in regard to the plausibility of a "no-nasal" analysis, with fairly transparent systems like Ikwere occurring at one end, systems like Gbe in

the middle, and more complex systems like those of Gokana, containing a basic /b/ vs. /B/ contrast but still lacking an underlying nasal phoneme /m/, at the other end. The position of a language on the continuum corresponds, in part, to the degree to which it has become "denaturalized" by subsequent historical evolution.

It is not clear to us whether nasal systems of this type have been inherited from a common source, whether they result from diffusion, or whether they have evolved independently in different languages. Within Africa, we know of no similar systems in other zones. Outside Africa, however, some South American languages have typologically similar systems, occasionally with the additional twist that voiceless obstruents are skipped in the spread of nasality, yielding discontinuous nasal spans such as ...*ãtã*.... (see Peng 2000 for examples and discussion). Systems of this type are rare in Africa, if they occur at all. Elsewhere in the world, languages without underlying nasal consonants are reported in North America (e.g. Hidatsa, Puget Sound Salish, Quileute) and in certain languages with very small consonant inventories, such as Rotokas, a language of Papua New Guinea.

3.2.6. Vowel systems and vowel harmony

Africa has three types of vowel harmony systems which are apparently unknown elsewhere in the world, found in three nonoverlapping areas. We discuss them in turn.

3.2.6.1. ATR vowel harmony

One of the best-known and most-discussed features of African phonology is the widespread use of the feature of tongue root advancing (ATR = advanced tongue root) in creating systems of word-level vowel harmony. Such vowel harmony systems are found widely through the Sudanic belt and in adjacent areas to the east, ranging from the Atlantic language Diola-Fogny in the west to the Cushitic languages Somali, Boni and Rendille in the east. (See the map in Güldemann's chapter, this volume.)

In its commonest variety, as first described for Akan by Stewart (1967), ATR harmony is found in languages with two series of high vowels and two series of mid vowels. The higher vowels in each series, usually including / i u e o/, are characterized by the feature [+ATR] and the lower vowels, usually including / ɪ ʊ ɛ ɔ /, by the feature [-ATR]. Within a word, all vowels, including those of harmonizing prefixes and suffixes, agree in the feature [+ATR] or [-ATR]. In many such systems, the low vowel has no [+ATR] counterpart and remains neutral, combining with vowels of both series. In some languages, however, such as Kalenjin (Southern Nilotic), the low vowel has a [+ATR] counterpart, often /ɜ/ but in Kalenjin /ɑ/, as is illustrated by the following examples (Hall et al. 1974).[12]

(2) Cross-height ATR vowel harmony in Kalenjin

	[-ATR] roots *par*, *kɛr*		[+ATR] root *ke:r*	
a.	kɪ-a-par-ɪn	'I killed you'	ki-ɑ-ke:r-in	'I saw you'
b.	ki-ɑ-kɐr-ɐ	'I was shutting it'		

In (2a), affix vowels agree with the [ATR] value of the root vowels, and are thus [-ATR] with the [-ATR] root *par* 'kill' and [+ATR] with the [+ATR] root *ke:r* 'see'. In (2b), the non-harmonizing suffix vowel /e/, which is invariantly [+ATR], requires all vowels, including the underlying [-ATR] vowel /ɛ/ of the root *kɛr* 'shut', to take [+ATR] values. Such systems have been called "cross-height vowel harmony" since they operate *across* vowel heights; thus a [+ATR] vowel in mid vowels -- such as the suffix vowel /e/ in the above examples -- requires [+ATR] in high vowels and vice-versa. In systems of this type, the value [+ATR] is usually dominant (i.e. phonologically active), though in some languages [-ATR] is active as well.

A reduced form of ATR harmony is found in languages with two series of high vowels but only one series of mid vowels. A typical vowel phoneme inventory in such languages would be /i u ɪ ʊ ɛ ɔ a/. In these languages too, [+ATR] is usually the dominant value, and as in Kalenjin [-ATR] mid and high vowels shift to [+ATR] in the context of [+ATR] high vowels. Examples from Nande (Bantu DJ42) are shown in (3), from Mutaka (1995); we have replaced his vowel symbols to agree with those used elsewhere in this chapter.

(3) Reduced ATR harmony in Nande

	[-ATR] roots *yɪr*, *hʊm*		[+ATR] roots *yir*, *hum*	
a.	ɛrɪ-yɪr-a	'to have'	eri-yir-a	'to dislike'
b.	ɛrí-hʊm-a	'to roar	erí-hum-a	'to move'
c.	erí-hum-is-i-a	'to make someone roar'		

In (3a,b), prefixes have [-ATR] values before [-ATR] roots (left column) and [+ATR] values before [+ATR] roots (right column). In (3c), the nonharmonizing [+ATR] suffixes *-is* and *-i* require [+ATR] prefixes and root in the form 'to make someone roar'. This system differs from that of Kalenjin in that the [+ATR] mid vowels [e o] created by harmony are allophonic, not phonemic.

It is usually the case, especially outside Bantu, that if an African language has two sets of high vowels, it has ATR harmony as well. We can therefore get a fairly good idea of the distribution of ATR vowel harmony in non-Bantu languages by examining the distribution of vowel systems with two series of high vowels.[13]

Table 6 shows the distribution of five types of vowel systems, classified by number of contrastive vowel heights, across the six zones. "2H" designates a language with two series of high vowels, "2M" one with two series of mid vowels, and so forth.

Vowel heights	Sudanic (100)	North (7)	East (12)	Center (13)	Rift (9)	South (9)
2H-2M	22	1	2	0	3	1
2H-1M	6	0	0	2	0	0
1H-2M	46	0	1	2	2	0
1H-1M	25	5	9	9	4	8
1H-0M	1	1	0	0	0	0

Table 6. Frequency of vowel systems in 150 African languages, classified by number of contrastive vowel heights.

It will be immediately seen that 2H systems, as shown in the first two rows – that is, those which, like Kalenjin, typically have ATR harmony – are very largely concentrated in the Sudanic belt. Here they occur in 28% of the languages in our survey. This is typologically unusual, as outside Africa 2H systems occur in only 2% of our sample languages. 2H systems are very likely to have two series of mid vowels as well, as shown in the first row. This is even more unusual, as 2H-2M systems are 73 times more frequent in our Sudanic languages (22 languages, 22%) than they are in our non-African languages (1 language, 0.3%). 2M systems are also strongly favored even in languages with just one high vowel series, where they outnumber 1M systems by a ratio of 46 to 25 (rows three and four). Thus, Sudanic languages do not follow the common crosslinguistic preference for the 5-vowel system /i u e o a/, preferring instead to double the number of mid vowels, high vowels, or both by the use of the feature [ATR].

In geographic terms, 2H systems (usually with ATR harmony) are found commonly across the Sudanic belt, but they are not ubiquitous. The strongest concentrations are in southeastern Mande, Kru, Kwa, Gur, Ijoid, many Benue-Congo languages (Edoid, Igboid, Cross River (Central Delta), and then again, within Nilo-Saharan, in Central Sudanic (especially the Moru-Madi, Mangbetu and Lendu languages in southern Sudan, northeastern DRC and northwestern Uganda) and the Nilotic languages. In Western Nilotic languages such as Shilluk, Nuer, and Dinka, ATR differences are often reinforced or replaced by voice quality differences such as "breathy" vs. "creaky".

Within this broad zone there are areas where such systems are less common:

-- most Atlantic languages

-- eastern Kwa (notably the Gbe languages)

-- Defoid (Yoruba, Itsekiri)

-- most Idomoid (except Igede), Platoid, Jukunoid, northern Bantoid

-- southern Grassfields Bantu and northwestern Bantu languages (zones A-D)

-- Adamawa-Ubangi, except the Zande group (Azande has a system resembling that of Nande as described above except that vowel raising is non-neutralizing in high vowels and mid, Tucker & Hackett 1959).

2H systems become less frequent toward the north (northern Mande, Fulfulde, Songay, Dogon, Chadic), the northeast (where the rare 2H systems include the Kordofanian languages Jomang and Tima and several East Sudanic languages including Tama, Tabi, Nyimang and Temein), and the far east, where rare 2H systems include Hamer (Omotic) and strikingly, Somali (Cushitic) with thoroughgoing ATR harmony. Bantu 2H systems will be discussed below.

This scattered pattern has given rise to a still-unresolved debate whether 2H vowel systems with ATR vowel harmony are derived from a 2H-2M proto-system /i u ɪ ʊ e o ɛ ɔ a/ in Niger-Congo, with losses in separate areas due to the merger of one or more of the marked vowels /ɪ ʊ ɜ/ with their less marked neighbors (Williamson 1983-4), or from a simpler 2H-1M or 1H-2M system with a fourth height series arising by diffusion or independent innovations. In some cases, good arguments for the latter view can be made. Thus, Przezdziecki (2005) presents persuasive evidence that an innovative series of [-ATR] high vowels evolved in Akure Yoruba out of a more standard 1H-2M variety of Yoruba lacking ATR harmony as a result of phonetically-motivated internal change. On the other hand, Dimmendaal (2001) reviews a number of cases in which ATR harmony appears to have evolved by diffusion. An example is the Chadic language Tangale, whose ATR harmony system is anomalous within Chadic languages but can be plausibly explained by long-term contact with neighboring Benue-Congo languages.

Outside Africa, two-height vowel inventories (and vowel harmony systems based upon them) are rare, except when accompanied by length differences as in English. Vowel harmony systems resembling African ATR systems have been described in Nez Perce (Penutian, North America), Khalkha Mongolian (Altaic), and several languages of northeast Asia including Chukot/Chukchi (Chukotko-Kamchatkan) and the Manchu-Tungus languages (Altaic). However, these systems usually have reverse polarity in which tongue root retraction acts as the dominant value, and might be better viewed as RTR (retracted tongue root) systems.

3.2.6.2. Bantu vowel harmony

ATR harmony as described above is absent in the great majority of Bantu languages, where instead we typically find a quite different type of vowel harmony, which again appears to be unique to Africa.. This type has three common variants according to the vowel system in question, as shown in (4) below.

(4)	*vowel system:*	*vowel harmony:*				
A.	i u ɪ ʊ ɛ ɔ a	ɪ	is replaced by	ɛ	after stem vowels	ɛ ɔ
		ʊ	is replaced by	ɔ	after stem vowel	ɔ
B.	i u e o ɛ ɔ a	e	is replaced by	ɛ	after stem vowels	ɛ ɔ
		o	is replaced by	ɔ	after stem vowels	ɛ ɔ
C.	i u ɛ ɔ a	i	is replaced by	ɛ	after stem vowel	ɛ ɔ
		u	is replaced by	ɔ	after stem vowel	ɔ

Harmony applies within the stem (root plus suffixes), usually triggering suffix alternations. Kikuyu E51 illustrates a type B system (Armstrong 1967); here, harmony controls both root vowel sequences and the *-ɛr ~ er* alternants of the applicative suffix:

(5)	*after root vowels /E •/*		*after root vowels /i u e o a/*	
	ko-mɛɲɛr-ɛr-a	'to take care of'	ɣokiɲ-er-a	'to catch up with'
	kw-ɛrɔ́r-ɛr-a	'to look on at'	ko-rut-er-a	'to work for'
			ɣw-ekér-er-a	'to pour out for'
			ko-hetók-er-a	'to pass by'
			ko-ɣamb-er-a	'to bark at'

Whether the operative feature in type B systems is [ATR] or a feature of relative vowel height remains a matter of debate (see Maddieson 2003a for phonetic evidence that both types of systems may be present among Bantu languages). Type C systems are commonly found across the center of the Bantu-speaking area, type B in the northwest, and type A in the east, though there is a good deal of intermingling, and it is often difficult to decide in any given case whether a 3-height system is of type A or B. Of course, not all Bantu languages have vowel harmony. See Hyman (1999) for a comprehensive overview of Bantu vowel harmony systems and maps showing their distribution.

A few northern Bantu languages with 2H-2M vowel systems have been described as having some features of cross-height ATR harmony as found in non-Bantu languages. Where evidence is available, it appears that these systems have evolved as a result of internal innovation and/or diffusion from neighboring languages with ATR systems. They are found in two clusters:

1. One is located a region in northeastern DRC including several mostly adjacent languages of zone D30. In Bila D311, as described by Kutsch Lojenga (2003), ATR harmony applies in verbs but not in nouns, where instead we find a more conventional B-type system. Grégoire (2003) suggests that these systems might have originated from long-term contact with neighboring Central Sudanic languages.
2. The other is located in a region in southwest Cameroon including mostly adjacent languages of zones A40-60 such as Nen A44, Numaand A46, Kaalong/Mbong A52d, and Gunu Yambasa A62a. Some dialects of Nen have two phonetically identical vowels /o/, one of which patterns as an [+ATR] vowel and the other as an [-ATR]

vowel; in other dialects, the corresponding vowels are phonetically distinct (Mous 2003). Stewart (2000-1) argues that the [+ATR] mid vowels are an innovation, resulting from earlier [-ATR] mid vowels through assimilation to the [+ATR] high vowels /i u/.

In the case of Nen, it might be argued that [+ATR] was already present in the system as a distinctive feature, if we assume, following Stewart, that all varieties of Nen had a type A system with two series of high vowels, [+ATR] and [-ATR], at the point when mid vowel raising took place. It should be noted, however, that the presence of distinctive [+ATR] vowels is not a necessary precondition for mid vowel raising. In Zulu S42, whose phonemic vowels are /i u ɛ ɔ a/, the mid vowels /ɛ ɔ/ shift to [e o] before the redundantly [+ATR] high vowels /i u/. Raising of this type is found elsewhere in Africa, as in the five-vowel system of Kaado Songay (Nicolaï and Zima 1997).

3.2.6.3. Raising harmony in the Sotho-Tswana languages

A yet different type of vowel harmony, again apparently unique among the world's languages, is found in the Sotho-Tswana group of Bantu languages (S30) in the South zone. Atypically among Bantu languages, Southern and Northern Sotho and Tswana have nine distinctive vowels, /i u ɪ ʊ e o ɛ ɔ a/, of which the upper mid vowels /e o/ are recent innovations. These languages have regressive vowel harmony according to which /ɛ/ and /ɔ/ are raised to /e/ and /o/ if the next syllable contains a higher vowel. This raising is not conditioned by the feature [+ATR], as the [-ATR] vowels /ɪ/ and /ʊ/ are included among the triggers. In addition, /ɪ ʊ/ have raised allophones before a high vowel /i u/, creating a marginally distinctive third high vowel series. For further discussion and examples see Krüger & Snyman (1986), Khabanyane (1991), Gowlett (2003) and references therein.

This chapter cannot review the great variety of ways in which ATR vowel harmony can be implemented in Africa nor the several further types of vowel harmony to be found in African languages. Studies giving some idea of the diversity of African vowel harmony systems include Clements (1991), Archangeli and Pulleyblank (1994), Kabore & Tchagbalé (1998), and Williamson (2004).

3.2.7 Implosives and other nonobstruent stops

Another characteristic African sound is the implosive. As we saw in Table 1, implosive stops, especially *ɓ* and *ɗ*, are frequent in languages of the Sudanic belt, where they occur about twelve times more frequently than elsewhere in the world. Implosives occur even more frequently, it appears, in Cushitic and Omotic languages of the East zone, and are also found in Bantu languages of the South. We give special attention to these sounds due to their broad distribution and their typological and genetic importance.

According to the typical textbook definition, implosives are produced with an ingressive glottalic airstream, in which the lowering of the closed glottis rarifies the air behind the closure, causing a rapid inflow of air into the mouth when the oral closure is released.

Following this definition, field linguists have tended to use the terms "implosive" and "glottalized stop" interchangeably, and many phonologists use a feature of glottal construction to distinguish implosives from other sounds.

However, more recent research, much of it by Peter Ladefoged (see Ladefoged 1968, Ladefoged et al. 1975, Ladefoged & Maddieson 1996), has shown this definition to be incomplete, if not quite misleading. It is now known that:

-- "implosives" may be nonglottalized, that is, produced with no glottal closure or significant laryngealization (e.g. Lindau 1984);

-- "implosives" may involve no negative oral air pressure or ingressive airstream (e.g. Ladefoged 1968, Lex 2001);

-- larynx lowering is not unique to "implosives" but often accompanies the ordinary voiced stops of languages such as English and French (e.g. Ewan & Krones 1974);

-- ingressive airflow can be produced with no larynx lowering (Clements & Osu 2002);

-- normally (modally) voiced "implosives" do not correlate with glottalized sounds in phoneme inventories, while ejectives and laryngealized sounds do (Clements 2003).

These observations suggest that implosives cannot be neatly distinguished from nonimplosive sounds in terms of an alleged glottalic airstream mechanism.

In view of these difficulties, Clements & Osu (2002) have proposed to define implosives and related sounds as *nonobstruent stops*. Nonobstruents are, in phonetic theory, sounds that are produced with no buildup of air pressure in the oral cavity (Stevens 1983). As there is no buildup of air pressure, there is no explosion at release. The full class of nonobstruents stops therefore includes not only prototypical implosives, produced with negative air pressure behind the primary closure, but also unimploded sounds, involving neither negative nor positive air pressure and lacking an explosive burst. This more general definition of implosives, which does not require glottal closure or larynx lowering, is consistent with the various observations in (1), and accommodates less prototypical types of nonexplosive sounds along with the "classical" implosives of the textbooks.

A direct advantage of this definition is that it explains why implosives, unlike explosive stops, are typically voiced; this is because voicing is the normal realization of nonobstruent sounds in general (Creissels 1994). It also explains why implosives, unlike other voiced stops, do not trigger voicing assimilation (for Oromo, see Lloret 1995); this is because such assimilation typically takes place between obstruents only. Another observation is that implosives frequently pattern with sonorants; for example, implosive *ɓ* often alternates with *m* in nasalization contexts, as we have seen in Ikwere (section 3.2.5), if we allow that the nonexplosive stop *ḅ* of this language is a type of implosive under the more general definition proposed above. Similarly, implosive *ɗ* often alternates with *l* or *r* (see e.g. Kaye 1981). Facts such as these have sometimes led linguists to view implosives as liquids or as sonorant stops. However, nonexplosive stops lack several properties associated with true sonorants, such as the ability to form syllable nuclei. For this reason Clements & Osu conclude, with Stewart (1989), that implosives are both nonobstruent and nonsonorant sounds.

If implosives are not inherently glottalized, we should expect to find contrasts between plain and glottalized implosives, just as we do between plain and glottalized explosives. This is just what we do find. Contrasts between two types of implosives, variously described in the literature as plain vs. voiceless or plain vs. preglottalized, have been examined phonetically in Owere Igbo by Ladefoged et al. (1976), in the closely related Ikwere language by Clements & Osu (2003), in Ngiti by Kutsch Lojenga (1994) and in the closely related Lendu language by Demolin (1995).[14] These studies have shown that the voiceless member of the contrast is usually produced with full glottalization (that is, a complete glottal stop) somewhere during the occlusion, usually toward the beginning. While there is some variation in the way such sounds are realized, from a phonological point of view it appears sufficient to recognize two categories of nonexplosive stops, plain (modally voiced) and laryngealized/glottalized (produced with glottal creak or glottal closure). In languages lacking a contrast between these two types, implosives may have little if any laryngealization, as in most Bantu languages, strong glottalization as in Hausa (Lindau 1984, Lindsey et al. 1992), or more rarely, complete glottal closure as in Bwamu (Manessy 1960).

The term "nonobstruent stop" may therefore replace the older term "lenis stop". The latter term has been used in the Africanist literature to refer to various unrelated sounds: i) nonexplosive stops which are not necessarily implosive (e.g. Stewart 1989); ii) extra-short sounds which contrast with sounds of normal length (e.g. Elugbe 1980); and iii) sounds of normal length which contrast with extra-long sounds (see Faraclas 1989 and references therein). These three senses are quite different, but have often been used interchangeably, leading to some confusion. For example, the extra-long "fortis" consonants of some Plateau and Cross River languages of Nigeria, which contrast with "lenis" sounds in sense (iii), have usually arisen from a relatively recent fusion of consonant clusters (e.g. Hoffman 1963) and have nothing to do with "lenis" stops in senses (i) and (ii).

Let us now consider the geographic distribution of implosives in this larger sense. The occurrence of voiced and laryngealized implosives in our sample is shown in Map 4.

(insert Map 4 here)

This map shows that voiced and laryngealized implosives occur primarily in a broad band across the center of Africa, taking in most of the Sudanic belt, and extending eastward into the East and Rift zones as well. Implosives are not common in the Grassfields Bantu languages of southwestern Cameroon, but reappear in northern Bantu languages where their geographical distribution parallels that of labial-velars (Grégoire 2003). Implosives occur again in southern Africa (Guthrie's Zone S), appearing in the Shona group S10, the Nguni group S40, and Copi S61.

There is an important isogloss dividing the broad west-to-east implosive area into two smaller regions. According to Greenberg (1970), if a language has only one implosive, it is almost always the labial *ɓ*. This is true of all but one of our Sudanic languages (Berta, see just below) and all of our Bantu languages. However, it is not true in Ethiopia, Somalia, and Kenya, where a lone implosive is always *ɗ*; examples include the Omotic languages Kullo

and Wolaytta, the Cushitic languages Oromo, Somali, Sidamo, and Rendille, and Berta, a Nilo-Saharan language spoken in the Sudan-Ethiopian border area. The presence of "only-*ɗ*" languages appears to be a unique linguistic feature of eastern Africa.

The box in Map 4 highlights a large area in which implosives are almost totally missing. This area extends from the Bandama River in central Côte d' Ivoire to the Niger River in central Nigeria, continuing inland to the Sahara. Within this area, except for Fulfulde, implosives are lacking in most languages including Songay, Dogon, Senoufo, Mòoré, Kabiyé, Baatonum, Akan, Guang, Gbe, Yoruba, most Edoid languages, and Izon. In contrast, implosives are well represented on both of its flanks; indeed, the sole Edoid and Ijoid languages with implosives (Delta Edoid, Kalabari, Defaka, etc.) are those that are spoken on the east bank of the Niger. The major language families represented in this zone of exclusion are Songay, Gur, and Kwa: 1) According to data in Nicolaï and Zima (1997), implosives are absent in representative varieties of Songay. 2) According to Mannesy (1979), implosives are absent in the core section of Gur (Central Gur), though implosive, glottalized or lenis /b d/ occur in some western Gur languages (Naden 1989) including Bwamu as mentioned above. 3) According to Stewart (1993), implosives are absent in all Kwa languages except Ega and Avikam, isolates lying outside this zone to the west, and the Potou Lagoon languages Ebrié and Mbatto, spoken just 100 km east of the Bandama River. Here, then, we are dealing with "a wave of proscription over a wide area," to use Stewart's apt phrase. Such phenomena can sometimes be explained by several independent sound shifts. In this case there is comparative evidence that earlier implosives shifted to nonimplosive sounds, e.g. *ɓ* > *b/v*, *ɗ* > *d/ɖ/l* in Central Gur (Manessy 1979) and the two largest Kwa units, Tano (including Anyi-Baule, Akan, and the Guang group) and Gbe (including Ewe, Gen, and Fon) (Stewart 1995). These appear to be parallel developments, perhaps influenced by contact.

As one might expect from their broad distribution, implosives are found in several different genetic units. Among Niger-Congo languages of the Sudanic belt, the western implosive area includes Atlantic, Kru, and southeastern Mande languages and the eastern area includes eastern Ijoid (Kalabari, Defaka), southern Edoid (Isoko, Delta Edoid), southern Igboid (Igbo, Ikwere), Cross River (Central Delta, a few Upper Cross languages), Adamawa-Ubangi, and northern Bantu languages. In Nilo-Saharan, implosives are prevalent in Central Sudanic and occur in several East Sudanic groups (Surmic, Tama, Daju) as well as Gumuz, Koman, and Kado. Within Afroasiatic, all Chadic languages have *ɓ* and *ɗ*, according to Schuh (2003) ; these sounds are usually glottalized to some extent, and for this reason they are usually classified as glottalized or laryngealized stops in descriptions of Chadic languages. Glottalized implosives *ɗʕ* and *ʄʕ* also occur in varieties of Arabic spoken in southwestern Chad, where they have replaced emphatics (Hagège 1973).

In the East and Rift zones, implosives are again distributed through several genetic units. In Afroasiatic, they occur distinctively in Omotic languages (e.g. Hamer, Kullo) and in Cushitic languages as far south as Dahalo on the central Kenyan coast. In Eastern Sudanic (Nilo-Saharan), they occur in the Kuliak languages of Uganda and in several Nilotic languages (e.g. Bari, Alur, Päkoot, Maasai). In eastern Bantu languages, they occur in the Swahili group G40 and continue southward into southern Kenya and Tanzania, occurring in at

least E70 (e.g. Pokomo E71, Giryama E72a), some members of G30 (e.g. Sagala G39), and G50 (Nurse & Hinnebusch 1993, 570-6).

This wide distribution does not suggest a pattern of diffusion from a single source, at least in recent times. Indeed implosives have been reconstructed for Chadic (Newman 1977), for core sections of Niger-Congo (Stewart 2002) and Nilo-Saharan (Bender 1997), and for a number of smaller units such as Central Gur (Manessy 1979), possibly Mande (Grégoire 1988), Edoid (Elugbe 1989b, 297), and Proto-Sabaki, comprising Bantu E71-3 and G40 (Nurse & Hinnebusch 1993, 61). In Bantu languages, implosives are usually reflexes of Proto-Bantu **b* and **d*, sometimes thought to have been implosives themselves. Of course, the fact that so many proto-units have implosives raises the question of whether diffusion might have been at work in the distant past.

Not all implosives are inherited directly from proto-languages. Bilabial implosives, for example, often evolve from earlier labial-velars. In Isoko (Edoid) and southern Igboid languages (Owere Igbo, Ikwere), voiced and voiceless labial-velars are in various stages of transition to velarized bilabial implosives; this pattern of evolution accounts for at least some of the "only-*ɓ*" languages in the Sudanic belt. In Surmic languages of western Ethiopia (East Sudanic), implosives *ɓ, ɗ, ɠ* have developed out of voiced geminate consonants (Yigezu 2001).

Outside Africa, as noted above, implosives are unusual sounds, occurring notably in Mon-Khmer languages (e.g. Vietnamese, Khmer/Cambodian), Tibeto-Burman (Karen languages), and a small number of languages of North and South America.

Thus implosives are a characteristic feature of broad areas of Africa. They are of typological interest not only in themselves, but in the fact that they occur commonly alongside voiced and voiceless stops, creating a nearly unique exception to the usual rule that triple stop systems have only one voiced series (Hopper 1973).

3.2.8. Ejectives, aspirated stops and clicks

Here we review stop consonant types that are especially characteristic of the South zone: ejectives, aspirated stops and clicks. These consonants are much more frequent in the South zone than they are outside Africa. In our sample, ejectives are over four times as common in the South than outside Africa, and aspirated stops are over twice as common (Table 7). Clicks are immensurably more common as they occur in all the South zone languages of the sample (Bantu and Khoisan alike) and none of the non-African languages.

Consonant type:	South (9)	Sudanic (100)	North (7)	East (12)	Center (13)	Rift (9)	Non-Afr (345)	ratio % South / % non-Afr
ejective stops	6	4	0	9	1	3	52	4.4
aspirated stops	7	3	0	1	2	2	105	2.6
clicks	9	0	0	1	0	2	0	-

Table 7. Frequency of three characteristic consonant types of the South zone.

We consider the distribution of these sounds in turn.

Ejective stops are a major feature of the eastern half of Africa, covering nearly half the continent. In the South, ejectives are ubiquitous in Khoisan languages and very common in Bantu languages (a partial list will be given in Table 8 below). But they are found elsewhere as well. In the East zone, these sounds occur widely in Ethiopian Semitic, Cushitic, Omotic languages. In the Rift they are represented in a number of genetically diverse languages including Ik (Kuliak, Uganda), Dahalo (Cushitic, Kenya), Sandawe and Hadza (Khoisan, Tanzania), and the coastal Bantu languages Upper Pokomo E71, Ilwana E701, and Giryama E72a. In the Sudanic belt they are very rare outside Hausa, occurring mostly in the Sudan/Ethiopian border (e.g. Berta, Gumuz, Koman, and the Surmic languages Me'en and Koegu). In Bantu, however, they are usually only weakly ejective and sometimes vary with plain voiceless stops; for example, Jessen (2002) notes variation between ejective and nonejective realizations in Xhosa S41, and Dickens (1987) finds that the ejectives described in earlier studies of Qhalaxarzi/Kgalagadi S31d are now mostly realized as simple voiceless stops. Ejectives are nearly absent in the Center.

Map 5 shows the distribution of emphatic consonants and ejectives in our sample languages.

(insert Map 5 here)

As a comparison of Maps 4 and 5 shows, ejective consonants occur largely in areas where implosives do not. Indeed, it was earlier thought that implosive and ejective consonants never contrast. However, they contrast in just the two areas where their distribution overlaps. The first is eastern Africa, where a four-way contrast among voiceless stops, voiced stops, ejectives and implosives is found in Koma (Nilo-Saharan) and Kullo (Omotic) in Ethiopia, Oromo (Cushitic) in Ethiopia and Kenya, Dahalo (Cushitic) in Kenya, and Ik (Kuliak) in Uganda. The second area is southern Africa, where implosives and ejectives contrast in the Nguni group of Bantu languages including Xhosa S41, Swati S43, and, at least historically,[15] Zulu S42.

The geographic distribution of ejectives is due in part to common inheritance. Glottalized sounds, including ejectives, are reconstructed for Proto-Afroasiatic (Wedekind

1994, Hayward 2000) and Proto-Khoe (Vossen 1997a). In other languages, however, where ejectives are not reconstructed, contact or independent innovation may have been at work.

Contrastive *aspirated* stops are rare in most of Africa. The major exception is the South, where contrastive aspirated stops occur in nearly all Khoisan and Bantu languages. They also occur in Swahili coastal dialects from Mozambique to southern Somalia, and in some adjacent languages along the coast and inland. Elsewhere they occur notably in Owere Igbo (Igboid, Nigeria), Kohomuno (Cross River, Nigeria), several northern Bantu languages such as Beembe/Bembe (H11, Republic of the Congo), as well as Sandawe and Hadza in Tanzania. Aspirated stops are reconstructed for Proto-Khoe, but not for Bantu, where they have typically evolved from prenasalized stops (e.g. *nt* > t^h) or from unaspirated stops before high vowels (e.g. *ti* > $t^h i$).

A third characteristic feature of the South zone, and the most notorious, is the widespread presence of *clicks*. Among the world's languages, clicks are found in just five groups of languages, all spoken in Africa:

- all Khoisan languages of southern Africa
- two Khoisan isolates, Hatsa and Sandawe, spoken in Tanzania
- Dahalo, a Cushitic language of Kenya.
- several southwestern Bantu languages (the Kwangari cluster K33, Yeyi R41), spoken in northwest Botswana and northeast Namibia
- many southeastern Bantu languages, including at least two Sotho-Tswana languages (Southern Sotho S33, Qhalaxarzi/Kgalagadi S31d), the Nguni group S40, the Tsonga group S50, and also Copi S61, spoken in Mozambique

Elsewhere in the world, clicks as regular speech sounds have been reported only in Damin, a ceremonial form of the Lardil language (Hale & Nash 1997).

Clicks originated in Khoisan languages and subsequently spread into Bantu languages through contact. Yeyi has borrowed most extensively, with four basic click places of articulation (dental, alveolar, lateral, palatal) crossclassified by up to nine accompaniments ("effluxes"), including a unique prenasalized glottal accompaniment that apparently does not occur even in Khoisan languages. Zulu and Xhosa have three places of articulation (dental, alveolar, lateral) which combine with six or seven accompaniments. Most other Bantu click languages are less well endowed. For further discussion of the history and spread of clicks in Bantu languages, see Herbert (1990), Vossen (1997b).

It is a common, but misleading practice in introductory textbooks to discuss clicks out of the context of the larger consonant systems in which they are embedded. This makes them appear much more unique than they actually are. Apart from their phonetic complexity, clicks are stop consonants much like any others and contrast along many of the same feature dimensions, including aspiration and ejection. This can be seen by an examination of Table 8, which shows parallel non-click and click consonant types in a number of Khoisan and Bantu languages.

KHOISAN	T	T'	T^h	#	#'	#h
Sandawe	+	+	+	+	+	+
Hadza	+	+	+	+	+	+
!X (!Kung)	+	+	+	+	+	+
Ju|'hoan	+	+	+	+	+	+
G|ui	+	+	+	+	+	+
Kxoe	+	+	+	+	+	+
Nama	+	-	+	+	+	+
!Xóõ	+	+	+	+	+	+
‡Khomani	+	+	+	+	+	?
‡Hõã	+	+	+	+	+	+
BANTU	T/D/D^h	T'	T^h	#	#'	#h
Zulu	T~D^h	+	+	+	-	+
Xhosa	D^h	+	+	+	+	+
Swati	D^h	+	+	+	-	+
Ndebele	D^h	+	+	+	-	+
Tswana	D	+	+	(+)	-	-
Southern Sotho	D	+	+	-	-	+
Qhalaxarzi	D	+	+	+	-	-
Tsonga	D^h	-	+	+	-	-
Copi	D^h	-	+	+	-	+
Shona (Ndau)	D	+	+	-	-	-

Table 8. Some varieties of non-click and click consonants in Khoisan and southern Bantu languages. + = occurs contrastively at least one place of articulation in each language, ( ) = rare or marginal. T = plain voiceless stops, T' = ejective stops, T^h = aspirated voiceless stops, D = plain voiced stops, D^h = slack voiced stops, # = simple oral clicks, #' = post-glottalized clicks, $\#^h$ = aspirated clicks. (Data from Güldemann 1999 and other sources.)

As Table 8 shows, the click accompaniments of aspiration and glottalization strictly parallel the distinctive features of aspiration and glottalization found in non-click consonants. If a language has one of these click accompaniments, it always has the corresponding feature in non-clicks, at least in the languages shown here. A treatment of these "effluxes" as a feature unique to clicks would fail to explain this generalization.[16]

Table 8 shows a fourth consonant type that belongs to the syndrome of southern African characteristics. The southern Bantu stops represented by the symbol D^h are usually described as murmured, weakly voiced, or completely voiceless sounds, followed in some languages by some amount of breathy voice. In Zulu they are voiced only in nasal clusters, *mb*, *nd*, *ŋg*. These characteristics resemble the description of the "slack voice" phonation type described by Ladefoged & Maddieson (1996). Since they often function as phonological tone

depressors, they might perhaps be assigned the feature [+slack vocal cords], as we have suggested in the table (see also Jessen & Roux 2002). These sounds contrast with plain voiceless stops in Copi, and with plain voiced stops in Tsonga and Zulu.[17] However, we know of no southern Bantu language that has a three-way contrast between plain voiced, slack voiced, and plain voiceless stops.

In sum, ejectives, aspirates and clicks form part of a syndrome of characteristically southern African sounds. All have been reconstructed for Proto-Khoe, while their presence in Bantu, at least in the case of clicks, is due to diffusion. Even when these sounds have not been acquired through direct lexical borrowing -- Southern Sotho, for example, evolved its glottalized and aspirated series from prenasalized stops (e.g. **mp* > p^h, **mb* > *p'*) -- the fact that the features [spread glottis] and [constricted glottis] are prominent in the contact situation sets up conditions favorable to their acquisition and generalization.

3.2.9. Languages without P-sounds

It has been noted since Houis (1974) that many African languages lack P-sounds (voiceless labial stops) in their core phoneme inventories. In these languages, P-sounds either fail to occur, or occur only in loanwords or proper names, or are reserved for the expressive vocabulary (ideophones, interjections, etc.).

An example of a language that lacks a P-sound completely is Kikuyu (Bantu E51). According to Benson (1964), /p/ occurs in three ideophones (*pa* 'sound made by a door, box, gourd, etc. when struck', *pɛ* 'description of breaking or splintering', *pii* 'description of bullet passing close'). Even in these words, *p* is only likely to be used by those acquainted with Swahili and English, other speakers using *b* instead. In loanwords, /p/ is replaced by /mb/ or /b/: *mbaoni* 'pound (sterling)', *bɔɔthita* 'post office', *mbaka* 'cat' (< Swahili *paka*). The absence of /p/ in Kikuyu is due to the shift of earlier **p* to *h* (Guthrie 1967-71, vol. 2).[18]

A language in which P-sounds occur only in loanwords is Tigrinya, a Semitic language of Ethiopia and Eritrea. According to Woldu (1985), /p/ does not exist in the phonology of Tigrinya, though schooled Tigrinya speakers have little difficulty in pronouncing and perceiving it. It is mostly used for Italian loanwords (*pane*, *polizia*, *posta*, etc.). The absence of /p/ in Tigrinya and other Ethiopian Semitic languages is due to the shift of an earlier **p* to *f* (Hetzron 1987, 657).

A language in which P-sounds occur only in loanwords and ideophones is Tem, a Central Gur language of northern Togo. According to Tchagbale (1977), /p/ is found in loanwords from English and Akan, in word-initial position in ideophones, and nowhere else. Even in loanwords it is often replaced by the native phonemes /f/ or /kp/. Comparison with other Central Gur languages such as Winye, Phwi (Phwo) and Sisaala-Tumuli, which have /p/, suggests that its absence in Tem may be due to a recent, local shift of **p* to *f*.

Statistics from our data base are shown in Table 9. A language is counted as lacking a P-sound if it has at least one voiceless nonlabial stop but lacks a voiceless labial stop, or has such a stop only marginally, or only in ejectives, geminates, *mp* clusters, etc.

African languages lacking P-sounds:		21.3 %
North and East:	63.2 %	
Sudanic	16.0 %	
Other zones:	12.9 %	
Non-African languages lacking P-sounds:		8.1 %

Table 9. African and non-African languages lacking P-sounds

These figures confirm that P-lessness is an African feature. However, its distribution is unequal. In the North and East zones, the absence of P-sounds is about eight times as frequent as it is in other parts of the world. This feature is virtually ubiquitous in Semitic and Berber languages in the North, and is present in neighboring Nilo-Saharan languages, including the Songay and Nile Nubian groups. It also occurs in roughly one out of two languages in the East, including all major groups (Semitic, Cushitic and Omotic).

P-lessness spills over into adjacent areas of the Sudanic belt, where we find it for example in Hausa (northern Nigeria) and several northern Nilo-Saharan languages including Maba and Tama (central Chad), Nyimang (Sudan), and Kunama and Nera (Eritrea). Elsewhere in the Sudanic belt, P-sounds are generally more common. However, there is an important region in the Sudanic belt in which P-sounds are widely absent. This region extends from the Bandama to the Niger rivers – the same area, it will be recalled, in which implosives are also generally absent (see Map 4). P-less languages here include Guro, Gban, Alladian and Anyi-Baule (Côte d'Ivoire), most varieties of Gbe (Ghana to Benin), Yoruba (Benin and Nigeria), and an Edoid enclave (Ehu un and Ukue) in the Yoruba-speaking area. Among these P-less languages, labial stops tend to be represented by /b kp gb/. A second region, or perhaps a continuation of the first, extends from southeastern Nigeria through Cameroon into Gabon, and is represented by Lower Cross languages such as Efik, by Noni (Beboid), by several Grassfields Bantu languages including Aghem and Ngiemboon, and by some northwestern Bantu languages (the Ewondo-Fang group A70, Makaa A83). A third region, adjoining the first on its northwest flank, comprises most northern Mande languages including the Mandekan group (Grégoire 1988). We do find languages with *p* in these areas, but in many cases it is a fairly recent innovation. Akan, for example, lost its *p* when it shifted to *f* but got it back again when *kp* shifted to *p* (Stewart 2002). Gen (a variety of Gbe) acquired its *p* through rephonemicization by Akan- and Ga-speaking immigrants (Bole-Richard 1983a). Overall, as Table 9 shows, P-less languages are about twice as frequent in the Sudanic zone as they are outside Africa.

In the Center, the facts are a bit harder to put together duer to the large number of languages and the frequent absence of reliable descriptions. However, Guthrie's data (1967-71) suggest that the loss of proto-Bantu **p* was widespread in the Bantu-speaking area, taking place across a broad and largely contiguous region in the center, west, and north-east.[19] (Complicating the pattern, however, is the fact that some languages that lost **p* later reintroduced it though borrowing or internal change.) Turning to Khoisan, a phoneme **p* is reconstructed for Proto-Khoe by Vossen (1997a) and is widely retained in daughter languages. However, P-sounds are less common in Southern Khoisan languages, where in !Xóõ, for example, the voiceless labial stops /p p^h/ occur only in a few borrowings (Traill 1985).

In sum, P-lessness occurs widely across Africa from north to south, with special concentrations in the North and East, in much of the Sudanic belt, and in broad areas of the Bantu-speaking Center and East. In most cases, as in Semitic and Bantu languages, it arises from the historical shift of an earlier **p* to a fricative (*f* or *ɸ*). Outside Africa, P-less languages are much less common, but examples can be found in the Eastern Malayo-Polynesian languages of Indonesia, the Solomon Islands and the Philippines, in several languages of Australia and Papua New Guinea, and in several language families of the Americas.

What might explain the special concentration of this phenomenon in Africa? None of the usual explanations -- chance, external factors, shared inheritance, parallel development, language contact -- seems fully adequate on their own:

- chance can be eliminated, since the occurrence of P-lessness within Africa is vastly more frequent than in most other parts of the world;
- it is unclear what external factors might explain the phenomenon;[20]
- shared inheritance from a proto-language might account for Berber, Arabic, Ethiopian Semitic, Cushitic, perhaps Omotic, and some western and central Nilo-Saharan languages, but even so, why so many proto-languages in the area should share this feature remains unexplained;[21]
- parallel development due to universal phonetic principles cannot explain why *p* should be so much more unstable in Africa than elsewhere.

A final hypothesis, language contact, explains much of the residue left after other factors are duly considered. To a very large extent, we find that if a given language lacks P-sounds, its neighbors tend to do so, even when they are not closely related.

3.2.10. Features of the eastern Sudanic belt

We conclude this section with a brief review of features of the northeast sector of the Sudanic belt, as originally noted by Schadeberg (1987). In general, this region -- which includes most of central Chad and Sudan, as well as the western lowlands of Ethiopia and Eritrea -- tends to lack the characteristic Sudanic features described earlier, including labial flaps, labial-velar stops, ATR vowel harmony, and nasal vowels. Furthermore, while nearly

all Sudanic languages have a contrast between voiced and voiceless explosive stops, this contrast seems to be more fragile in the east; indeed, most Kordofanian languages lack a voicing contrast altogether, as do Southern Nilotic languages spoken farther south.

There is one positive feature that distingishes the eastern Sudan from the rest of the Sudanic belt. This is the characteristic presence of two series of coronal stops (or less commonly, fricatives), one usually described as dental and the other as alveolar or retroflex. The latter sounds are distinct from implosives and sometimes contrast with them, as in Kresh, Mangbetu, and the Moru-Madi group (all Central Sudanic); in these languages, stops of the more retracted series are realized as retroflex affricates, as in Kresh and Lugbara, or as post-trilled *tr dr (ndr)*, as in Mangbetu and most Moru-Madi languages. In some languages, such as Shilluk (Gilley 1992), the sounds of the two series are subject to a harmony constraint according to which only one series can appear in any root.

This contrast, relatively uncommon elsewhere in the world's languages, is found in several distantly related and unrelated languages, including those shown in Table 10.

Niger-Congo, Kordofanian:	most Kordofan, e.g. Moro, Jomang, Katcha, Tima
Nilo-Saharan, Central Sudanic:	Kresh, Lugbara, Madi, Mangbetu
Nilo-Saharan, East Sudanic:	Temein, Nyimang, Tabi (fricatives only), Hill Nubian, Western Nilotic (Dinka, Nuer, Shilluk, Luo)
Nilo-Saharan, other:	Maba, Kadugli, Berta (fricatives only)
Cushitic:	Beja

Table 10. Some languages of the eastern Sudan displaying minimal contrasts between dental and alveolar or retroflex consonants.

Elsewhere in Africa this contrast is much less common. Scattered examples include Temne (Atlantic), Kabiyè (Gur), Ewe-Gen (Kwa), Isoko (Edoid), coastal varieties of Swahili (Bantu), and Dahalo (Cushitic). In some cases, such as Ewe, the retroflex *ɖ* evolved from an earlier implosive *ɗ*.

On the basis of these characteristics, the eastern Sudan might merit consideration as a zone of its own (Schadeberg 1987). However, two characteristic Sudanic features are found to its east, implosives and multiple tone heights (for the latter, see section 3.3.2 below), raising the question whether the Sudanic belt defined here might not have been linguistically more homogeneous in the past.

3. 3. Prosodic features

We now consider prosodic features of African languages. We begin with an overview and then examine two selected features more closely: number of tone levels, and yes/no question intonation.

3.3.1. Overview

Most African languages (about 80% in the sample discussed by Heine & Leyew, this volume) are tone languages, in which tone serves a lexical and/or grammatical function. A smaller number, including Somali and many Bantu languages, are tonal accent languages, in which a distinctive or demarcative accent is expressed by a toneme of high pitch. An even smaller number (including Wolof) are neither tone languages nor tonal accent languages. Predictable stress-accent occurs across most varieties of Arabic, and penultimate stress-accent is found in a number of non-tonal eastern Bantu languages starting with coastal Swahili and leading across southern Tanzania into Malawi (Derek Nurse, personal communication).

African tone languages, especially in the Sudanic and Central zones, differ from more familiar East Asian tone languages of the Chinese type in several fundamental ways. A first difference concerns the nature of contour (rising, falling) tones. While contour tones in East Asian languages are usually considered unitary, that is, non-decomposable into smaller sequences, contour tones in African languages can almost always be analyzed into sequences of level tones. For example, a rising tone in an African language, though phonetically similar to a rising tone in an East Asian language, will typically exhibit phonological behavior showing that it consists of a low (L) tone followed by a high (H) tone. Almost any careful account of a West African or Bantu tone system will give ample evidence for such an analysis. This fundamental distinction may arise in part from the different historical origins of tone in the two cases. The ancestor of Niger-Congo languages is thought to have been a tone language with two basic levels, H and L, though there still exists no widely agreed-upon reconstruction. In East Asian languages, lexically distinctive tone arose through the influence of consonants (see e.g. Haudricourt 1954 for Vietnamese, and Karlgren 1960, Pulleyblank 1991, and Baxter 1992 for Chinese). Since these languages are typically monosyllabic, they offer no potential for the often pervasive patterns of tonal alternation found in many African languages which often provide the main evidence for tonal decomposition.

A second fundamental difference concerns the nature of tone *register*. By register we mean the subdivision of the overall pitch range within which a given tone or tone sequence is realized. A high tone produced in a low register will be lower in pitch – often distinctively so – than a high tone produced in a higher register. The fundamental difference between African and Chinese-type East Asian tone languages is that register functions typically in a *syntagmatic* manner in Africa and in a *paradigmatic* manner in Asia. That is, in African tone languages, register most often takes the form of downstep, a significant lowering of the register within which subsequent tones are produced, while in East Asia, register takes the form of a choice between two lexically distinctive registers, upper and lower. In African

languages, downstep may hold across spans containing many words, while in Chinese the domain of register (and most else in the phonology) is the word. A further difference is that register is recursive in in African languages, which typically allow a potentially unbounded number of downsteps within a single span. All these differences, too, stem ultimately from the different origin of tone on the two continents.

Another characteristic feature of African tone languages, rare or marginal in Asian languages, is the common occurrence of *floating tones* – tones which occur in the tone sequence but have no direct segmental realization. Floating tones originate in various ways, for example:

- through loss of a tone-bearing vowel, whose tone remains afloat
- through spreading of a H tone onto an adjacent syllable, dislodging its L tone
- through the mapping of a "tone melody" onto a word with fewer tone-bearing units than tones, leaving a final L tone without support

It is usually (though not always) the case that if an African language has floating tones, it also has distinctive downstep. This is mainly because some of the best synchronic evidence for floating tones comes from their function as downstep triggers. Other diagnostics of floating tones include 1) the failure of some word-final low tones to undergo final lowering, which can often be explained by positing a final floating H tone, and 2) tonal alternations in which a floating tone "docks" onto an available vowel, creating a contour tone. For more detailed discussion of the nature of tone in African languages, see Clements & Goldsmith (1984), Creissels (1994), Odden (1995), Rialland (1998), Hyman & Kisseberth (1998), and Yip (2002), among others.

While African tonology has attracted considerable attention from linguists, genuine cross-linguistic data bases are few. Data bases have occasionally been collected for specific purposes, but there still exists no data base for tonal inventories comparable, for example, to the UPSID data base for phoneme inventories. We will therefore limit our discussion to two features of African languages for which enough data has been collected that some generalizations can be drawn: 1) the number of discrete tones (tone levels) in a given system, and 2) nonsegmental markers for yes/no questions (general questions). We will show that each of these features has an interesting areal distribution.

3.3.2. Number of tone levels

One might say, for typological convenience, that the number of distinctive tone levels in African languages varies from zero to five. Nontonal languages have no tone at all (thus "zero tone levels"). A language making use of a contrast between H tone and its absence, i.e., one in which H tone functions as a privative feature as in typical tonal accent systems, can be counted as a one-level language. Such languages have sometimes been described as tonal, and sometimes as accentual. It is hard to place a sharp boundary between tonal accent languages and tone languages, and there exist transitional systems which behave as tonal in some respects and accentual in others. Many systems which seem largely accentual have

derived historically from tone systems, especially in the Bantu domain, where Proto-Bantu is usually reconstructed with a H vs. L contrast.

Somewhat more straightforward are systems with two or more tone levels, though even here too, problems arise. A number of languages make use of nondistinctive tone levels which are just as well-defined phonetically as their distinctive tone levels. A well-known case is the Gbe language cluster, including Ewe and Fon, whose three discrete surface tone levels -- H, M, and L -- can be reduced to a basic H vs. non-H contrast in underlying representation. Another example is the interesting system of Mupun (Chadic, Nigeria), which has three lexically contrastive levels but four surface levels as the result of a process by which verbs tones are "stepped up" by one degree with respect to noun tones; thus, a verbal M tone is realized at the same level as a nominal H tone, while a verbal H tone is realized on an extra-H level (Frajzyngier 1993).

At the other end of the spectrum we find languages with as many as five tone levels, which appears to be the maximum if we exclude register effects such as downstepped tones and extra-L sentence-final tones. For example, five distinctive tone levels are attested in the Santa variety of Dan (a southern Mande language spoken in the Côte d'Ivoire), as illustrated by the following nouns (Bearth & Zemp 1967):

(6) gba^{1} 'caterpillar'
gba^{2} 'shelter'
gba^{3} 'fine'
gba^{4} 'roof'
gba^{5} 'antelope'

(1 = highest tone, 5 = lowest tone). It seems that five represents the maximum number of contrastive tone levels, not only in Africa but in Asia and the Americas as well (Maddieson 1977, Yip 2002).

If we consider the geographic distribution of languages according to the number of tone levels they possess, we find a number of clear areal tendencies. As a broad generalization, non-tonal languages (those with "zero tone levels") are located primarily along the west, north, and east perimeter of the continent, and south across the Sahara to the Sudanic belt. On the west, we find non-tonal languages in the Atlantic family (Wolof, Seereer, Diola, etc.), including Fulfulde, spoken as far east as Cameroon; the Atlantic family is the only member of Niger-Congo whose members are mostly non-tonal. In the north and north-east, most Semitic languages have nondistinctive stress. In the east, as mentioned above, most forms of Swahili as spoken along the coast from Kenya to Mozambique have stress-accent systems.

The great majority of the remaining African languages are either tonal accent languages (especially Cushitic and many Bantu languages) or fully tonal. Consider the Niger-Congo language families spoken in the Sudanic belt. All except Atlantic are preponderantly tonal. Most appear to include no non-tonal languages at all (Williamson 1989). Within Afroasiatic, all Chadic languages are tonal; since proto-Afroasiatic was probably not tonal, the most likely

source of tone in Chadic is early and continued contact with non-Afroasiatic tone languages (Schuh 2003). The origin of the predominantly tonal or tonal accent systems of Omotic languages in the western Ethiopian highlands is more of a problem; if this group is a member of Afroasiatic, as is widely assumed, it is unclear where their tone systems might have come from. Most Nilo-Saharan languages are tonal and exhibit features similar to those of Niger-Congo languages, except that grammatically distinctive tones are sometimes commoner than lexically distinctive tones. Finally, Khoisan languages are tone languages. In sum, the widespread distribution of tone across sub-Saharan Africa owes both to shared genetic inheritance and diffusion.

It is instructive to consider the geographic distribution of tone languages according to the number of tone levels they possess. Just as toneless languages have an areal distribution, so do "tonally loaded" languages, that is, those with three to five tone levels. It was first observed by Wedekind (1985) that most such languages are located within a vast belt extending from Liberia in the west to the Ethiopian Highlands in the east. This is roughly similar to our Sudanic belt, together with southwest Ethiopia. A second such area lies in the Khoisan-speaking region in adjacent areas of Botswana and Namibia. These two areas are enclosed in rectangles in Map 6, which shows 76 languages with three or more contrastive tone levels. (The complete list of languages is given in the Appendix, Table C.)

(insert Map 6 here)

As this map shows, languages with four tone levels (shown with black circles) or five tones levels (shown with black squares) are found in several pockets within these two large areas. These are located in: 1) southern Côte d'Ivoire (Kru, southeastern Mande and Kwa languages), 2) northern Togo and Benin (Gur languages), 3) the eastern Nigeria-western Cameroon border area (Bantoid and Adamawa-Ubangi languages), 4) the southwestern CAR-northwestern DRC border area (Bantu and Adamawa-Ubangi languages), 5) northeastern DRC and northwestern Uganda (Central Sudanic languages), 6) southwestern Ethiopia (Omotic languages), and 7) Botswana (Khoisan languages). The rare languages with five contrastive tone levels are spoken inside these zones: Santa Dan (Mande, Côte d'Ivoire), Bench Gimira (Omotic, southwest Ethiopia), and perhaps Mbembe (Cross River, Cameroon).

Three of the areas with four or five tone levels are genetically heterogenous. In the Ivorian zone, such systems are found in three families in contact: Kru, southeastern Mande, and Kwa. In the Nigerian-Cameroon zone, such systems are found in several distantly related families within Niger-Congo: Adamawa-Ubangi (Tupuri, Yendang), Idomoid (Igede), Cross River (Kana), Jukunoid (Mbembe), and Northern Bantoid (Mambila, Ndoola). The CAR-DRC border zone contains such systems in two Niger-Congo language families, Adamawa-Ubangi (Munzombo) and Bantu (Mbati C13).

Where do such "tonally loaded" systems come from? Wedekind (1985) has argued that the five distinctive tone levels of Bench Gimira are related to its strong tendency toward monosyllabism, created by the historical loss of vowels, consonants and even syllables, which one can reconstruct by comparison with closely related languages. Such an account is

relevant for other languages as well. The link between segmental attrition and the appearance of an extra tone level can be illustrated by a comparison of examples from Moba, a four-level Gur language as spoken in northern Togo, with cognate forms from the closely related three-level language Gulmancema, spoken in Burkina Faso (Rialland 2001).

(7)		Gulmancema	Moba	
	a.	ò kándì [kā́ndì]	ù kā́nt	's/he stepped over…'
	b.	ò kándí [kándí]	ù kánt	's/he steps over…'
	c.	(kī) bígā	bík`	'the child'
	d.	(kú) fàagū	fàòg`	'the leaf'

Example (7a) shows how a distinctive extra-H tone came into being in Moba following the loss of a final vowel, retained in Gulmancema. The redundantly extra-high realization of a H tone before a L tone which we see in the Gulmancema form was phonologized as a new phonemic tone level in Moba following the loss of its final vowel. Examples (7b) and (7c) show that H tones before H and M tones in Gulmancema did not shift to extra-H in Moba, and example (7d) shows that final M tones became floating L tones in Moba. Synchronically, the extra-H tone in Moba (7a) contrasts with H tone both finally (7b) and before floating L tones (7c). The tonal evolution in Moba is linked to several factors: the loss of the final vowel of bisyllabic verbs (7a,b), the loss of the final vowel of noun class suffixes (7c), and the incorporation of a final vowel into the preceding syllable (7d). All of these changes result in monosyllabic forms.

Southeastern Mande languages are also preponderantly monosyllabic. Typical roots are of the form CV, CLV, or CVV. Northern Mande languages (Bambara, Soninke, etc.) have many bisyllabic roots as well. The explanation for this difference is that in southeastern Mande languages, word-internal intervocalic consonants have fallen out. In Dan, initial syllables dropped out in just those dialects that have four or five tone levels (see the examples given earlier in (6)). Interestingly, however, the attrition of tone-bearing elements through loss of consonants and vowels is not the only mechanism at work in these languages; the formation of new tones also seems to have arisen from the phonologization of consonantal influences on tones (Vydrine 2004). Such processes are comparable to those that gave rise to tones in Asian languages.

While systems with multiple tone levels usually arise from internal factors, the fact that such systems cluster together suggests areal diffusion, if not of multiple tonal levels directly, then of the phonological factors (loss of syllables, etc.) that underlie them.

3.3.3 "Lax" question markers: an areal feature?

A second characteristically African prosodic feature involves a special type of marker used for yes/no questions. It is often taken for granted that the use of rising or high-pitched

intonation to signal yes/no questions is universal, or nearly so. High-pitched question intonation markers have been viewed as the grammaticalization of a natural tendency shared by all humans. For example, Ohala writes (1984, 2):

> [This] pattern is too widespread to be explained by borrowing, descent from a common linguistic source, or chance. It follows that there is something common to all human speakers, at all stages in history, which creates this phenomenon.

However, a review of yes/no question markers in African languages shows that alternative types of question markers exist as well.

While a few data bases on question intonation exist, they are dated (Hermann 1942, Ultan 1969, Bolinger 1978). The first two are known primarily through citations in Bolinger (1978), and we do not know which African languages were included. Given this inadequacy, we have begun to compile a data base of yes/no question markers which includes 75 languages at present. This data base does not aim at genetic or geographical balance, and languages spoken in the Sudanic belt are greatly overrepresented (see the Appendix, Table D for a complete list). An important further problem is that sources vary in quality, and most do not include actual phonetic data, such as pitch (f0) contours. In spite of these limitations, a trend has emerged from this study: while many of the question markers found in Africa are commonly used elsewhere in the world, one type appears to be unique, or near-unique, to this continent: this consists of markers that do not involve high pitch or pitch raising. No less than 34 languages in our sample -- almost half -- are reported to have question markers of this type.

The following discussion briefly reviews the occurrence of the more familiar types of question markers (section 3.5.3.1), and then takes a closer look at question markers that do not involve high pitch or raising (section 3.5.3.2).

3.3.3.1 Type 1 question markers, involving H pitch or Raising

A common type of "raising" question marker takes the form of a sentence-final rise. This marker is very common cross-linguistically, especially in non-tone languages. For an English- or French-speaking person, it is the prototypical question intonation. In our data base, however, it is far from being the majority type. Where it appears, it is widely dispersed among language families; we find it in Atlantic (Fulfulde), Mande (Mende), Kru (Klao), Gur (Kulango), Benue-Congo (Edoid languages such as Isoko and Yekhee), Songay (Zarma), Chadic (Hausa), and a number of Bantu languages including Chewa N40, Saghala E74b and Ganda E15. Question markers consisting of a HL tone melody are reported in three languages in our data base: Farefare (Gur), Dahalo (Cushitic), and Swahili (Bantu G41-3).

Another family of "rising" patterns involves operations on register. These patterns include reduction or suppression of downdrift, raising of a H tone or H tone series (usually final), and suppression of final lowering. We consider them in turn.

Reduction or suppression of downdrift occurs in our data base in a non-tone languages (Wolof), in tonal accent languages (Rundi), in languages with two tone levels (Hausa), and in

one language with three levels (Nama). This type of question marker has a wide geographical distribution, ranging from Atlantic languages in the west to Nilotic languages in the east and Bantu and Khoisan languages in the south. In such diverse languages as Wolof , Efik, the Bantu languages Rundi DJ62 and Jita EJ25, and the Chadic language Niya it marks yes/no question by itself. It is often associated with other markers as well, such as rising intonation, as in Fulfulde, Mende and Chewa N40 (for the latter see Myers 1996), a segmental marker such as a *–à*, as in Hausa and Turkana, or a reduction of penultimate lengthening, as in some southern Bantu languages (see further discussion in section 3.3.3.3). Reduction of downdrift in questions is far from unique to African languages, and is found in many other languages of the world (Bolinger 1978).

Raising of a H tone or H tone series is much less common. In our sample, it is reported in several Chadic languages, including Hausa, Tera, Angas, and Sayanci (Leben 1989) and in Bantu languages such as Ganda E15 (Lindsey 1985) and Dzamba C322 (Bokamba 1976). In Nama, a yes/no question marker has the effect of raising the second syllable in an initial H-H sequence to H-XH (extra-high) in subjectless sentences (Haacke 1999).

Suppression of final lowering is reported in just three languages of our sample: Ga, a Kwa language, Mongo-Nkundu or Lomongo, a Bantu language (C61), and Arbore, a Cushitic language. However, we suspect that it may be more common than descriptions suggest.

We might include among this first group of question markers the so-called polar tone, usually realized as a H tone after a L tone and as a L tone after a H tone. It is reported in two Bantu languages in our sample, Holoholo D20 and Nyanga D24. In three-level systems, a M tone may serve a similar function, as in the Mande language Samo.

3.3.3.2 Type 2 question markers, not involving H pitch or Raising

A second type of question marker does not involve H pitch or Raising. This type takes several forms, which we describe in turn.

A first marker of this type consists of a *final L tone* or *falling intonation*. Our data base shows that this marker is well represented in the western sector of the Sudanic belt. The near-totality of Gur languages in our sample are reported to have it: Ncam, Akaselem, Kusaal, Nateni, Moyobe, Mòoré, Dagaare, Gulmancema, Kasem, Kabiyé, Tem, Nawdem, and Lobiri. It has also been reported in Mande (Baule, Guro), Kru (Bassa, Grebo), Kwa (Adioukrou, Akan, Gun and Fon), Idoid (Nembe, Degema) and Edoid (Isoko). Farther east it is reported in one of our Adamawa-Ubangi languages (Munzombo) and in Bagiro, a Nilo-Saharan language. These languages include two-level languages (Mòoré, Dagaare, Kabiye, Tem, Baule, Gun) as well as three- and four-level languages (Munzombo, Ncam, Akaselem, Gulmancema, Kasem).

We have found no Bantu, Afroasiatic or Khoisan language that has this marker without having register expansion or H tone raising as well. However, due to the limitations of our data base we cannot exclude the possibility that such systems may exist in these families too, or that they might even prove to be quite common.

Let us consider *final lengthening* next. In our data base only two languages, Nupe (Benue-Congo) and Wobé (Kru), use final lengthening as their only question marker. In a

very few contexts, Tikar (Bantoid) also uses this marker alone. In other languages, final lengthening is usually associated with other question markers, especially falling intonation as in Mòoré, breathy termination as in Moba, or both as in Ncam (all of which are Gur languages). Lengthening may add a mora, and thus a tone-bearing unit, to the last syllable, but there may be even greater durational effects. Falling intonation greatly lengthens the final vowel, and the breathy termination marker draws it out even more. Thus while lengthening can be self-sufficient, it is more often used in conjunction with other markers.

Breathy termination, characterized by a lengthening of the final vowel, is produced by a progressive opening of the glottis. It may contrast with the brusque termination produced by a sudden glottal closure (glottal stop) characterizing statements. Breathy termination occurs in Moba, where together with final lengthening it constitutes the only marker of yes/no questions (Rialland 1984). Breathy termination is also found in other Gur languages such as Mòoré, Ncam, Akaselem, and Gulmancema. However, in these languages it is associated with falling intonation (Mòoré, Ncam, Akaselem, Gulmancema) or occurs in alternation with rising intonation (Gulmancema, which has both rising and falling question intonation patterns). We have not found breathy termination markers in other language families, but it would be surprising if it were restricted just to Gur, and we suspect that it may have been overlooked in descriptions of other languages.

We have included *open vowels*, especially [a], among Type 2 question markers, due to the fact that it is always related to a L tone or falling intonation in our data. The adjunction of a final open vowel is found in Vata and Tikar, where it harmonizes in place of articulation with the last vowel of the root. Thus in Tikar we find [ɛ] after a root ending in any of the front vowels [i e ɛ], and [a] after a root ending in a back vowel [u o a] (Stanley 1991). The geographic distribution of this question marker is particularly vast. We find it in Kru (Neyo, Odie, Seme/Siamou), Kwa (the Gbe languages Ewe, Fon, Gun, etc.), Chadic (Pero, Sayanci, Angas), and sporadically in other groups: Gur (Ncam, Akaselem), Edoid (Engenni), Adamawa-Ubangi (Banda-Linda), non-Bantu Bantoid (Tikar, Ejagham), and even Nilotic (Turkana). No Bantu language in our data base is reported to have it, though some, such as Shi DJ53 and Southern Sotho S33, have CV markers ending in [a].

Interestingly, the open vowel question marker appears in combination or alternation not only with falling intonation (or final L tone) but also, on occasion, with the breathy termination marker. Such variant realizations can be observed within a single language and between dialects of closely related languages. For example in Ncam (Gur), these markers vary according to the following pattern (Cox 1988, 41; L tone marks falling intonation):

(8) a. *-a* appears after a consonant-final root:

ʊ̀ cò꞉ m̄	'S/he walks'	**ʊ̀** cò꞉m ā ˉ꞉꞉	'Did s/he walk?'

b. a final long vowel has extra length, with no change in quality:

án sū ˉ꞉	'It's rotten'	án sū ˉ꞉ ˉ꞉꞉	'Is it rotten?'
ʊ̀ pɔ̄ ˉ꞉	'S/he is well'	**ʊ̀** pɔ̄ ˉ꞉ ˉ꞉꞉	'Is s/he well?'

c. *-a* replaces a short final *i*, which is most often epenthetic:

ʊ̀ á́kì 'S/he repaired' ʊ̀ á́kà꜀꜀: 'Did s/he repair?'

d. *-a* is added after other short vowels, where it undergoes a variety of assimilations

e. falling intonation, final lengthening and breathy termination are regularly present

In (8a), the M tone borne by the final *m* in the statement shifts to the lengthened vowel *-a* in the question. The *-a* marker is absent in other languages of the Gurma group, such as Moba and Gulmancema, as discussed earlier. Outside the Gurma group, Mòoré uses a pattern of question marking similar to that of Ncam (vowel lengthening, breathy termination, falling intonation), but without the *-a* marker.

In Kru languages, one also finds a number of variant patterns involving open vowels, vowel lengthening, and L tones. For example, one finds languages with final *-à* (Neyo, Godié, Seme/Siamou), languages with an [+open] vowel (Vata), languages with only vowel lengthening (Wobé), and languages with a final lengthened vowel and L tone (Bassa, Grebo). We have so far found no mention of the breathy termination marker in Kru languages (see Marchese 1983, Vogler 1987). In the Gbe languages (Kwa) spoken from Ghana to Benin, the *-à* marker is particularly frequent. Though it is usually the sole marker of yes/no questions, L tone may be used alone in the Porto-Novo dialect of Gun (Fréchet 1989).

In the Adamawa-Ubangi group, Banda-Linda has final *-à* while Munzombo uses a simple L tone on a lengthened vowel. In Edoid languages, there is similar variation between L-toned *-à* or *-è* in expressions of doubt (Engenni) and L tone alone (Isoko, Degema). Of our two Bantoid languages, Tikar has an open vowel and Ejagham has L-toned *-à*.

In Chadic, Hausa employs an optional L tone in addition to its usual vowel lengthening and breathy termination, while Sayanci and Angas have final L-toned *-aà*.

The cluster of properties just reviewed -- open vowels, L tones, sentence-final falling intonation, and lengthening, often in combination -- constitutes a syndrome of what might be called *lax* features, centering around a relaxation of the vocal cords inducing pitch lowering and the presence of low vowels, bearing intrinsically low phonetic pitch. One might be tempted to speak of a "lax prosody" opposed to a "tense prosody", the latter involving rising intonation, tense vocal cords, and/or a raised larynx. This feature provides another diagnostic of the Sudanic belt, with a particular concentration in the western sector.

Map 7 shows the geographical distribution of lax question prosodies, broken down into its main forms (L tone/falling intonation, vowel lengthening, [open] vowel, *-à*) as well as a hybrid form (*-à* associated with a downdrift reduction or final H raising). The map only shows the Sudanic belt, as this feature, even in its hybrid form, was not found elsewhere.

(insert Map 7 here)

We speculate that this cluster of features might have originated in a single historical source form such as a L-toned *-a*, perhaps accompanied by breathy termination, which might have been transmitted from one or more source languages to neighboring languages through contact. One or another of these features is found throughout most of the Sudanic belt, but

appears most commonly in Niger-Congo languages (Atlantic, Mande, Kru, Gur, Kwa, Benue-Congo, and Adamawa-Ubangi), which appear to be its most likely historical source. Though "lax" markers occur outside Niger-Congo, they usually assume a hybrid form combining L-toned *-à(a)* with downdrift reduction or final H raising, as is found for example in Chadic languages such as Hausa, Angas, Sayanci, and Pero, and further to the east in Turkana (Nilotic). Apart from these cases, it is not represented in our small sample of non-Chadic Afroasiatic languages and Nilo-Saharan languages, nor have we found it in our sample of Bantu languages.

3.3.3.3 Cancellation of penultimate lengthening

A further mark of yes/no questions consists of the suppression or absence of penultimate lengthening in languages that employ such lengthening in statements. The H register is also expanded, raising H tones to extra-high, and downdrift is reduced. This cluster of features is restricted to the southern Bantu languages Zulu S42 and Southern Sotho S33 in our data. Compare, for instance, the following Zulu forms (Taljaard and Bosch 1988):

(9)	a.	ukali:le	's/he cried'	(statement)
	b.	ukalile	'did s/he cry?'	(question)

3.3.3.4 Conclusion: a "lax" question marker in African languages

To summarize, question intonation in African languages is much more diverse than one might have expected. Most strikingly, many question markers involve no high pitch or pitch raising, such as are often thought to be universal. Our data base, incomplete though it is, has brought this diversity to light, and has shown the Sudanic belt to constitute a prosodic area, characterized not only by multiple tone heights but by the widespread use of a typologically unusual feature of "lax" question intonation.

3.4. Summary and Discussion

Table 11 summarizes some of the main phonological features of African languages, as they occur across zones.

	NORTH	EAST	SUDANIC	CENTER	SOUTH	RIFT
absence of P-sounds	xxx	xx	x	xx	-	x
emphatic consonants	xx	-	-	-	-	-
non-tonal prosody	xxx	x	-	-	-	-
labial flaps	-	-	x	x	-	-
labial-velar stops	-	-	xx	-	-	-
implosives	-	(xx)	xx	x	/x/	x
nasal vowels	-	-	xx	-	[xxx]	-
two series of high vowels	-	(x)	xxx	xx	x	xx
3+ tone levels	-	(x)	xx	-	[x]	-
"lax" question markers	-	-	xx	?	-	?
ejective stops	-	xx	-	-	xxx	x
aspirated stops	-	-	-	-	xxx	/x/, [xxx]
clicks	-	-	-	-	xx	[xxx]
slack voiced stops	-	-	-	-	/xx/	-

Table 11. Phonological characteristics of African languages, by zone. xxx = very common or ubiquitous, xx = common, x = infrequent, - = very rare or absent, (x) = Omotic and/or Cushitic, /x/ = Bantu, [x] = Khoisan.

How well does this table support a division of the African continent into phonological zones? We again emphasize, as we did at the outset, that no zone is air-tight. Because of this, neighboring zones, as the table shows, often show features of both. For example, implosives and 2H vowel systems with ATR vowel harmony occur well beyond the eastern limit of the Sudanic belt in the East and Rift zones. Moreover, phonological isoglosses rarely coincide. A typical example is labial-velar stops, which have spread as far south as the Congo River. While these sounds have diffused widely into the Congo Basin, labial flaps, nasal vowels and 2H-2M vowel systems have not.

While the patterns are therefore complex, there appears to be some justification for the main thesis of this chapter, which is that Africa is best viewed as a set of zones rather than a single linguistic area. Three of the proposed zones, at least, are sharply distinguished by

independent, marked phonological features that occur across major genetic lines and which show substantial overlap. Let us review them briefly.

The North, as we see from an examination of the first three features in Table 11, is set apart by the absence of P-sounds, the presence of an emphatic series of consonants, and the prevalence of nontonal prosodic systems. These features span a major genetic boundary, that between Arabic and Berber. These two units share many other characteristic features, including a series of "guttural" consonants, contrastive consonant gemination, and small vowel inventories doubled by contrastive vowel length, the latter also found in most Nilo-Saharan languages in the region.

The Sudanic belt is well defined by the next group of features: labial flaps, labial-velar stops, implosives, nasal vowels, 2H vowel systems, multiple tone levels and "lax" question prosodies, among others. None of these features are as common in other zones. Nor, as we have seen, are they equally distributed within it; however, their overlap defines the Sudanic belt quite well, with the exception of the extreme northwest (northern Atlantic languages) and the northeast (the eastern Sudan, as discussed in section 3.2.10).

A third zone, the South, is sharply delineated by the remaining features in Table 11: ejective and aspirated stops, clicks, and slack voiced stops. To these features we could add their characteristic series of lateral affricates and fricatives. All these features are widely shared by Khoisan and Bantu languages in the region.

Less well demarcated is the East zone, whose languages share many features with those of the North due to their common Afroasiatic heritage. Nevertheless, the two non-Semitic families in this zone, Omotic and Cushitic, display features that distinguish most of this zone from the North, notably the widespread presence of tone or tonal accent systems and the common occurrence of implosives and ejectives (sometimes in the same language), and ejectives occur in Ethiopian Semitic languages as well (see Crass 2002 for a fuller account). We have also seen that only in this zone does *ɗ* occur as the unique implosive.

The Center is well defined by the inherited features of the Bantu languages spoken within it, and does not as a whole display the characteristic features of the Sudanic languages spoken to the north nor the Khoisan and Bantu languages spoken to the south. We have seen that it is well characterized by a unique system of vowel harmony.

As far as the more diverse Rift zone is concerned, this survey has not succeeded in identifying large-scale diffusion of phonological features across major genetic boundaries, the hallmark of a genuine phonological area. This fact might well call the independence of this zone into question. It remains to be seen, however, whether further study will reveal cases of such diffusion, at least in micro-areas.

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Appendix

The African phoneme data base used for this study is composed of most of the African languages contained in the UPSID data base (Maddieson & Precoda 1989) together with others that we have added, mainly in the Sudanic belt, in order to improve the geographical coverage. It is divided into six parts, according to zone. It contains 88 Niger-Congo languages, 30 Nilo-Saharan languages, 27 Afroasiatic languages and 5 Khoisan languages, for a total of 150 languages spoken indigenously on the African continent. We have corrected and updated information on certain UPSID languages based on more recent or more accurate information. Non-African phoneme systems have been drawn from the unmodified UPSID data base.

Table A shows the genetic composition of the SUDANIC data base. A few units, notably Gur, Kainji-Platoid, Cross River, Adamawa, Ubangi, and Chadic, are underrepresented in proportion to their numbers, but as these units are centrally located in the Sudanic belt this should not lead to a severe underestimation of shared Sudanic properties.

NIGER-CONGO (66)	
Dogon:	Dogon
Atlantic:	Wolof, Pulaar, Diola, Konyagi, Ndut, Temne, Bidyogo, Kisi
Mande:	Kpelle, Bambara, Bobo-Fing, Dan, Bisa
Kru:	Aizi, Klao, Bete
Gur:	Dagbani, Mòoré, Bwamu, Tampulma, Senadi, Bariba
Kwa:	Alladian, Adioukrou, Attié, Akan, Gã, Lelemi, Siya, Ewe-Gen
Ijoid:	Ijo (Izon)
West Benue-Congo:	Yoruba, Isoko, Igbo, Gwari, Igede
East Benue-Congo:	
non-Bantoid:	Amo, Birom, Tarok, Kpan, Efik, Ogbia, Kohumono
Bantoid, non-Bantu:	Mambila, Ejaghem, Noni, Aghem, Fe'fe'
Bantu:	Kpa/Bafia, Ewondo, Makaa, Basaa, Yaka/Aka, Egbuta, Bila
Ada*mawa:*	Doayo, Mumuye, Mbum, Lua
Ubangi:	Gbeya, Azande, Mba (Mba-Ne), Sango
Kordofanian:	Moro, Jomang
NILO-SAHARAN (23)	
Central Sudanic:	Yulu, Sar, Furu/Bagiro, Kresh, Lugbara, Ngiti, Mangbetu
Eastern Sudanic:	Nera, Nyimang, Tama, Mursi, Tabi, Temein, Daju, Dinka
Other:	Zarma, Central Kanuri, Maba, Fur, Berta, Kunama, Koma, Kadugli
AFROASIATIC, CHADIC (11)	
West:	Hausa, Kanakuru, Angas, Ngizim
Biu-Mandara:	Tera, Margi, Kotoko, Higi
East:	Kera, Dangaléat
Masa:	Lamé

Table A. Composition of the SUDANIC data base, by genetic groups.

Table B gives the composition of the NORTH, EAST, RIFT, CENTER, and SOUTH data bases.

NORTH (7)	
Afroasiatic, Berber:	Shilha, Tamasheq
Afroasiatic, Semitic:	Egyptian Arabic
Afroasiatic, Cushitic:	Beja
Nilo-Saharan:	Tedaga, Nobiin, Koyraboro Senni Songay
EAST (12)	
Afroasiatic, Semitic:	Amharic, Tigre, Chaha
Afroasiatic, Cushitic:	Awiya/Awngi, Oromo, Somali, Dahalo
Afroasiatic, Omotic:	Dizi, Hamer, Kefa/Kafa, Kullo
Niger-Congo, Bantu:	Swahili
RIFT (9)	
Afroasiatic, Cushitic:	Iraqw
Nilo-Saharan, Nilotic:	Luo, Maasai, Sebei
Nilo-Saharan, Kuliak:	Ik
Niger-Congo, Bantu:	Kikuyu, Ganda
Khoisan:	Hatsa, Sandawe
CENTER (13)	
Niger-Congo, Bantu:	Tsogo, Teke, Beembe, Mongo-Nkundu, Lega, Rwanda, Bemba, Mwera, Makhuwa, Luvale, Umbundu, Herero, Zezuru Shona
SOUTH (9)	
Central Khoisan (Khoe):	Nama
Northern Khoisan:	!X (!Kung)
Southern Khoisan:	!Xóõ
Niger-Congo, Bantu:	Gciriku/Diriku, Tsonga, Yeyi, Copi, Tswana, Zulu

Table B. Composition of the NORTH, EAST, RIFT, CENTER, and SOUTH data bases.

Table C gives the composition of the tone level data base, which contains 76 languages with three or more contrastive tone levels. The number of contrastive levels in each language is shown in parentheses.

NIGER-CONGO (55)	
Mande:	Samo (3), Guro (3), Santa Dan (5), Tura (4), Bobo-Fing (3)
Kru:	Wobé (4), Bété (4), Vata (4), Godié (3), Neyo (3), Dewoin/De (3), Nyabwa (4), Krahn (3)
Gur:	Togolese Moba (4), Bariba (4), Ncam (3), Akaselem (3), Nateni (3), Gulmancema (3), Kasem (3), Nuni (3) Biali (3)
Kwa:	Attié (4), Abbé (3), Alladian (3)
West Benue-Congo:	Nupe (3), Igede (4), Kana (4), Gwari/Gbari (3), Yoruba (3), Yala (3), Igala (3)
East Benue-Congo:	
non-Bantoid:	Mbembe (5?), Jukun (3), Birom (3), Kpan (3)
Bantoid, non-Bantu:	Tikar (3), Mambila (4), Ndoola (4), Bafut (3), Babanki (3)
Bantu:	Ewondo A70 (3), Mbati C13 (4?), Nyali D23 (3), Bira D21 (3), Bila D311 (3)
Adamawa-Ubangi:	Banda-Linda (3), Ngbaka (3), Zande (3), Sango (3), Tupuri (4), Yendang (4), Munzombo (4), Doayo (4), Mumuye (3)
NILO-SAHARAN (8)	
Central Sudanic:	Moru-Madi (4), Lugbara (4), Mangbetu (4), Bedionde (3), Yulu (4)
Nilotic:	Dinka (3), Shilluk (3), Nuer (3)
AFROASIATIC (9)	
Chadic:	Tera (3), Ga'anda (3), Angas (3), Kera (3), Lame (3)
Omotic:	Dizi (3), Sheko (3), Yem (3), Bench Gimira (5)
KHOISAN (4)	Nama (3), Kxoe (3), Tsoa (3), !Xóõ (4)

Table C. Composition of the tone level data base.

Table D gives the composition of the yes/no question intonation data base, containing 75 languages for which relevant information was found.

NIGER-CONGO (60)	
Atlantic:	Wolof, Fulfulde
Mande:	Mende, Baule, Samo, Guro
Kru:	Godié, Neyo, Bassa, Klao, Wobé, Vata
Gur:	Togolese Moba, Mòoré, Ncam, Akaselem, Kusaal, Nateni, Moyobe, Farefare, Dagaaré, Gulmancema, Kasem, Kabiye, Tem, Nawdem, Lobiri
Kwa:	Adioukrou, Akan, Ga, Ewe, Gun, Fon
Adamawa/Ubangi	Banda-Linda, Munzombo
Ijoid:	Ijo (Izon), Nembe
West Benue-Congo:	Isoko, Igbo, Yekhee, Degema, Engenni, Nupe
East Benue-Congo	
non-Bantoid:	Efik
Bantoid, non-Bantu:	Tikar, Ejagham
Bantu:	Bafut, Bajele, Mongo-Nkundu, Holoholo, Dzamba, Nyanga, Rundi, Shi, Saghala, Jita, Chewa, Southern Sotho, Zulu, Swahili
NILO-SAHARAN (6)	
Songay:	Zarma
Central Sudanic:	Bagiro, Ngiti
Nilotic:	Dholuo, Turkana, Nandi
AFROASIATIC (8)	
Chadic:	Hausa, Angas, Sayanci, Pero, Niya, Tera
Cushitic:	Dahalo, Arbore
KHOISAN (1)	Nama

Table D. Composition of the question intonation data base.

Map legends

Map 1. Six phonological zones in Africa.

Map 2. Northern Bantu languages with labial-velar stops. Languages are identified by their Guthrie codes as revised and updated by Maho (2003); see text for language names.

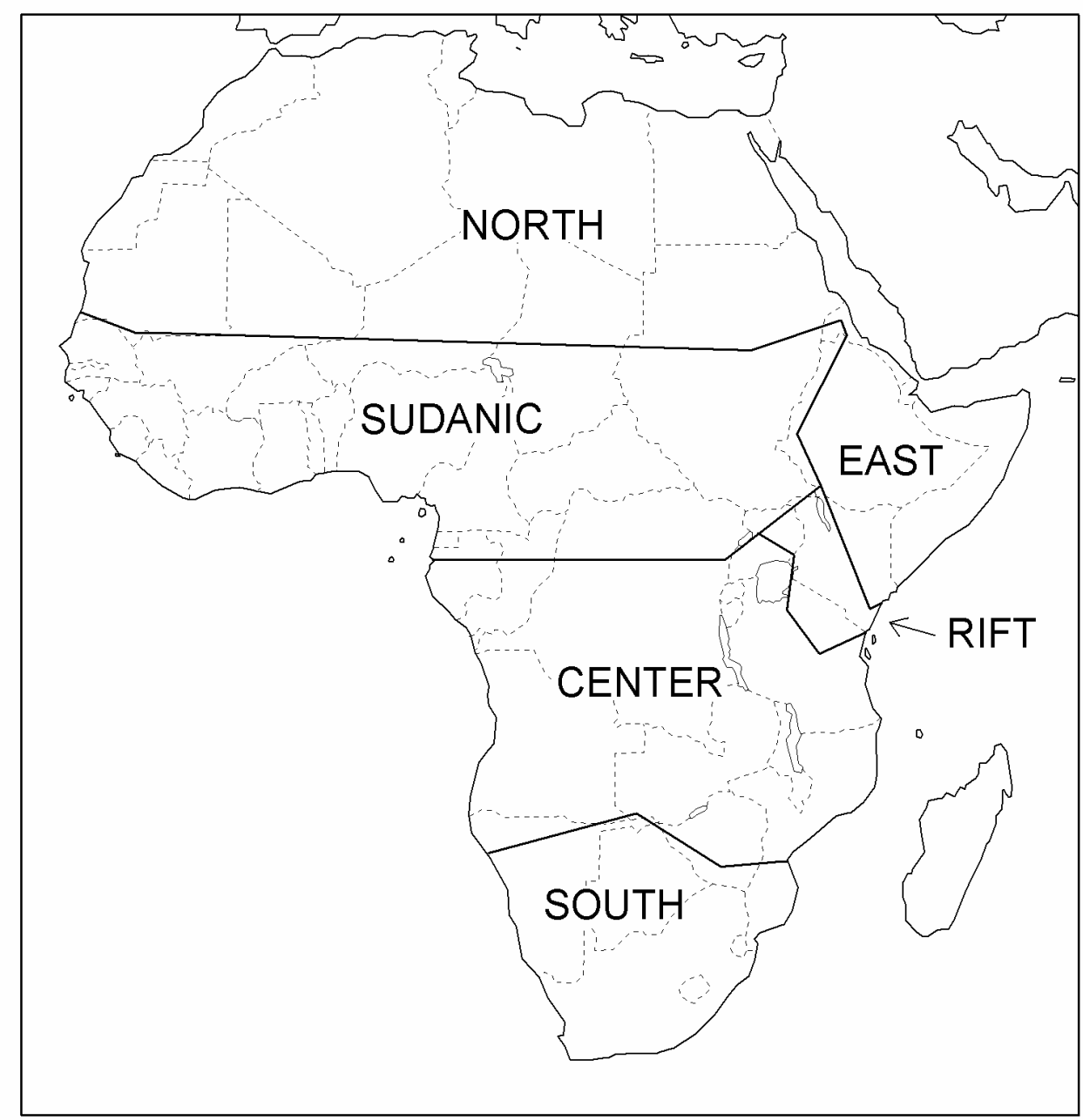
Map 3. Distribution of contrastive nasal vowels in a sample of 150 African languages. The area enclosed in dashes contains languages reported to lack distinctive nasal consonants.

Map 4. Distribution of voiced or laryngealized implosives in a sample of 150 African languages. Black circles show languages with implosives. The square at left highlights an area in which implosives are mostly absent. (Small circles = languages with less than 1m speakers; medium-sized circles = languages with 1-10m speakers; large circles = languages with over 10m speakers.)

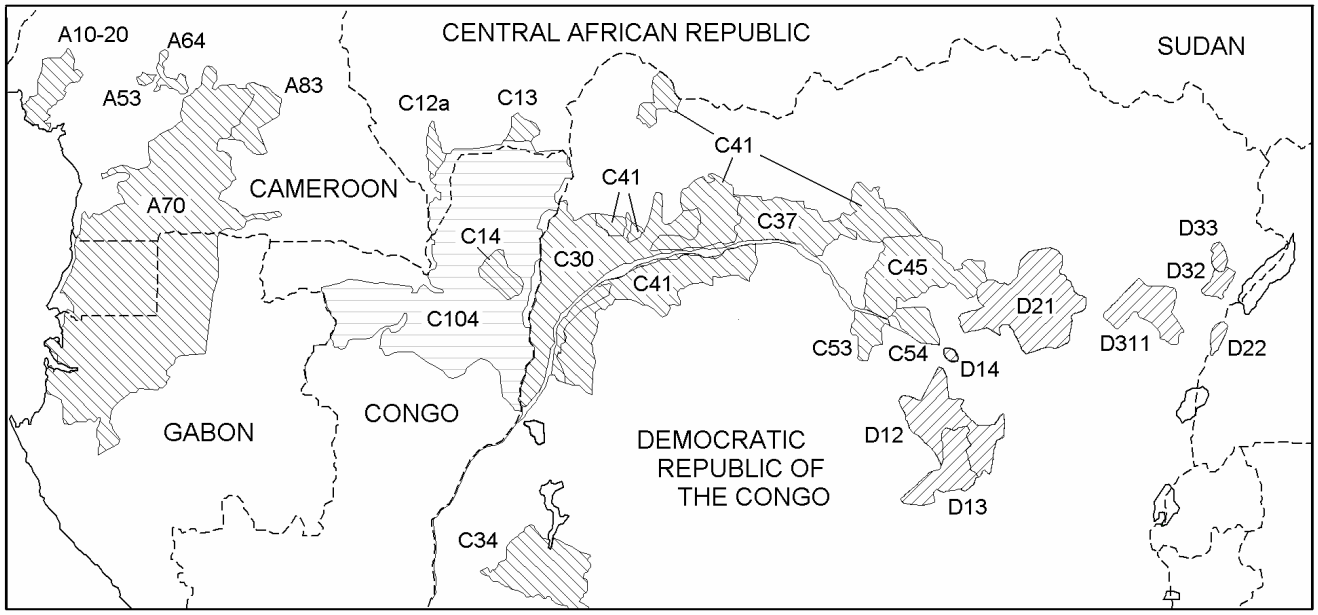
Map 5. Distribution of emphatic and ejective consonants in a sample of 150 African languages. Black squares show languages with emphatic consonants, and black circles show languages with ejectives. Symbol size varies with number of speakers as in Map 4.

Map 6. Distribution of 76 African languages with three or more distinctive tone levels. The two major concentrations are enclosed in rectangles. Languages with three, four and five tone levels are indicated by white circles, black circles, and black squares, respectively.

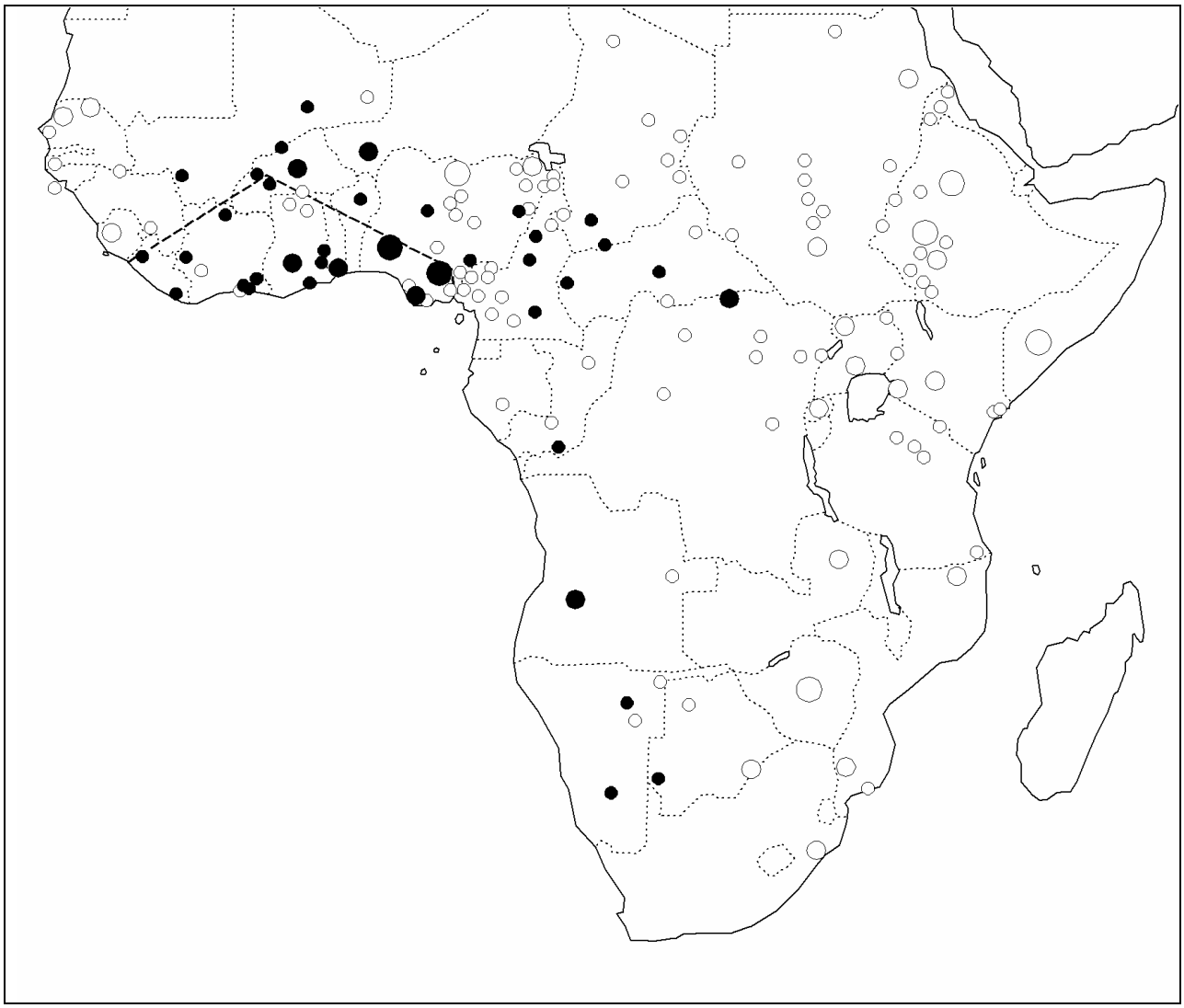
Map 7. Distribution of "lax" question prosody markers, which occur in 41 of a sample of 75 African languages for which relevant information was found.



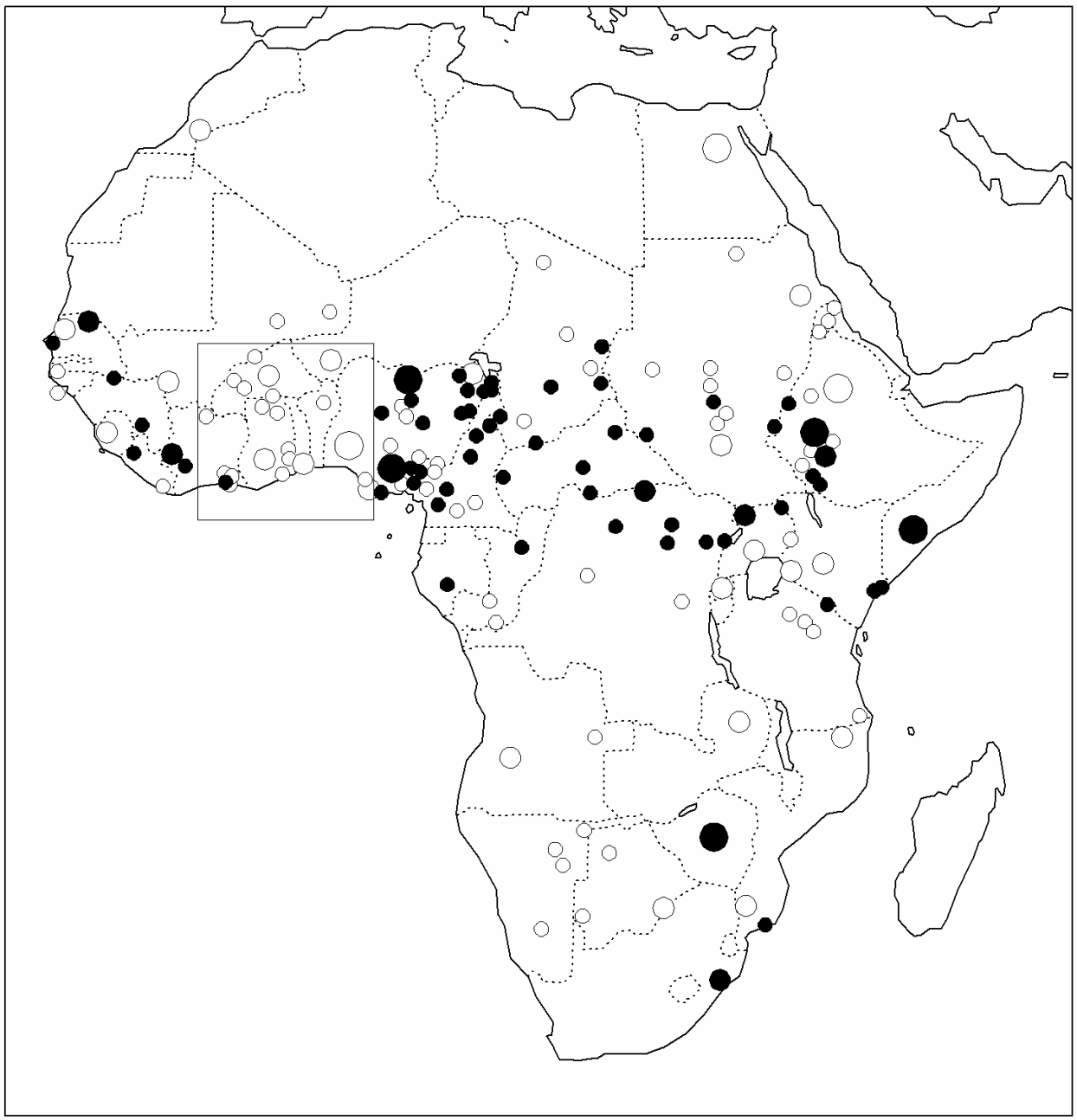
Map 1


A10-20
A64
A53
A83
A70
CAMEROON
CENTRAL AFRICAN REPUBLIC
SUDAN
C12a
C13
C41
C41
C41
C37
C14
C30
C45
C104
D33
D32
D21
D311
D22
C53
C54
D14
GABON
CONGO
DEMOCRATIC
REPUBLIC OF
THE CONGO
D12
D13
C34

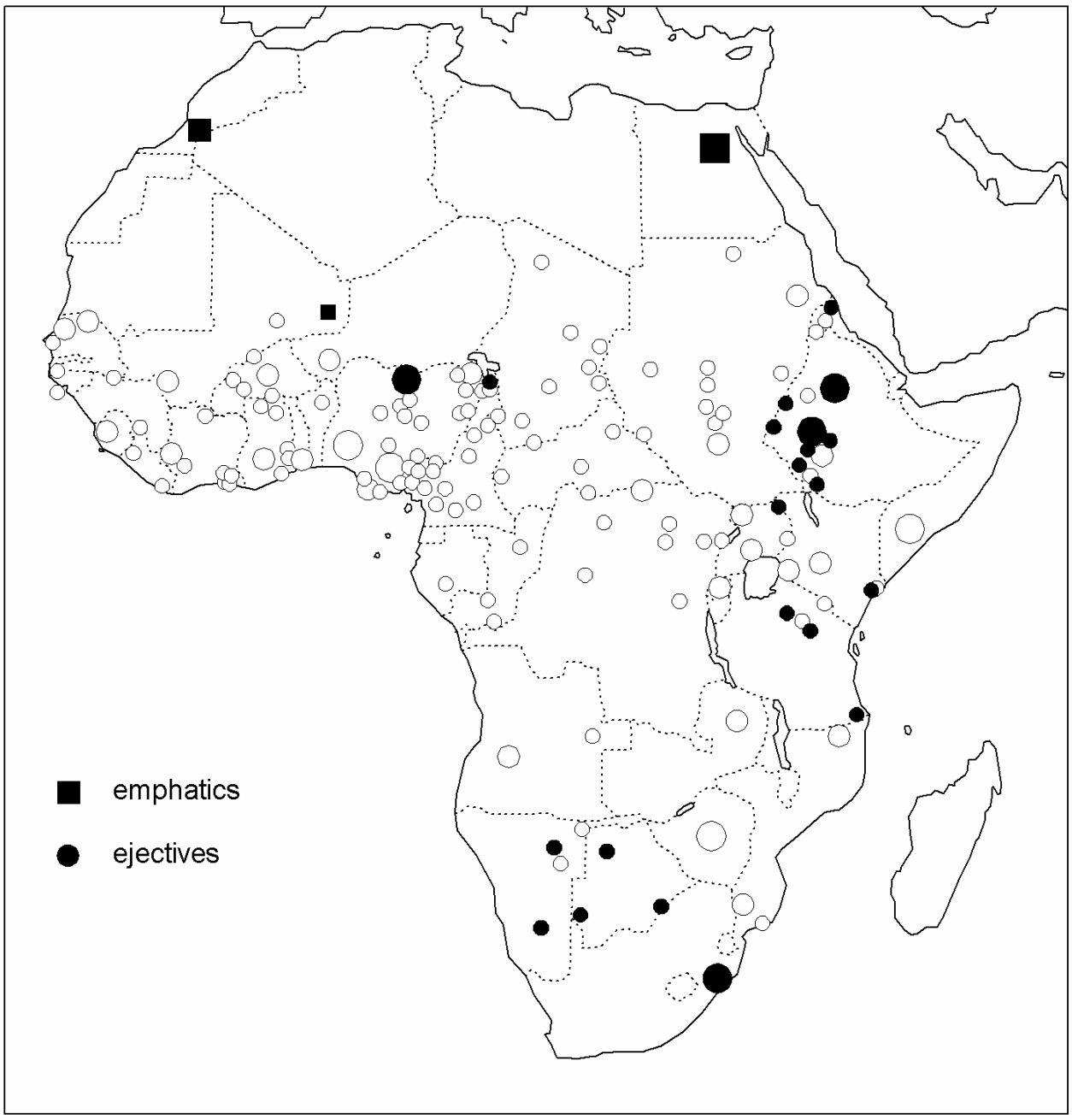
Map 2



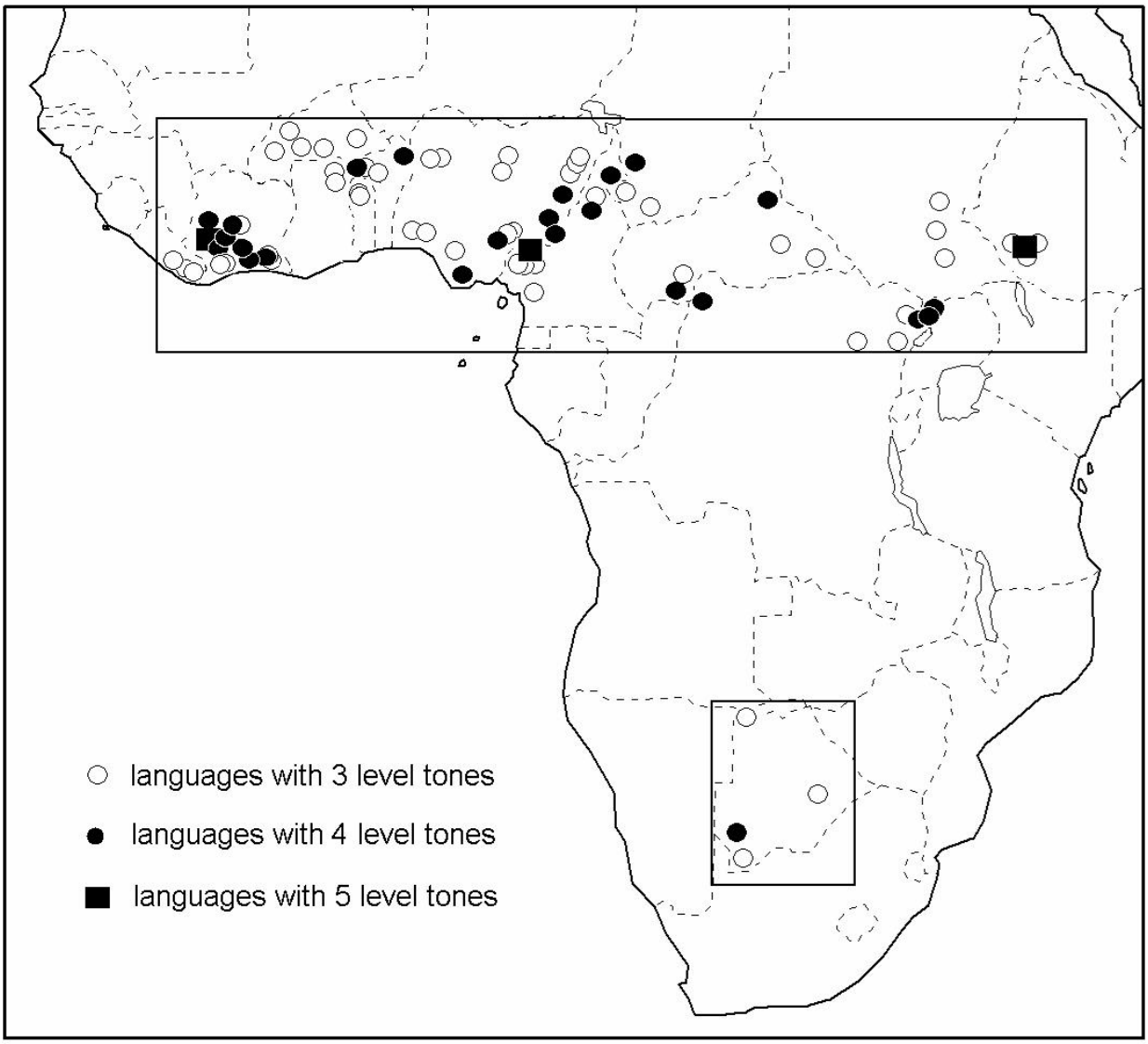
Map 3



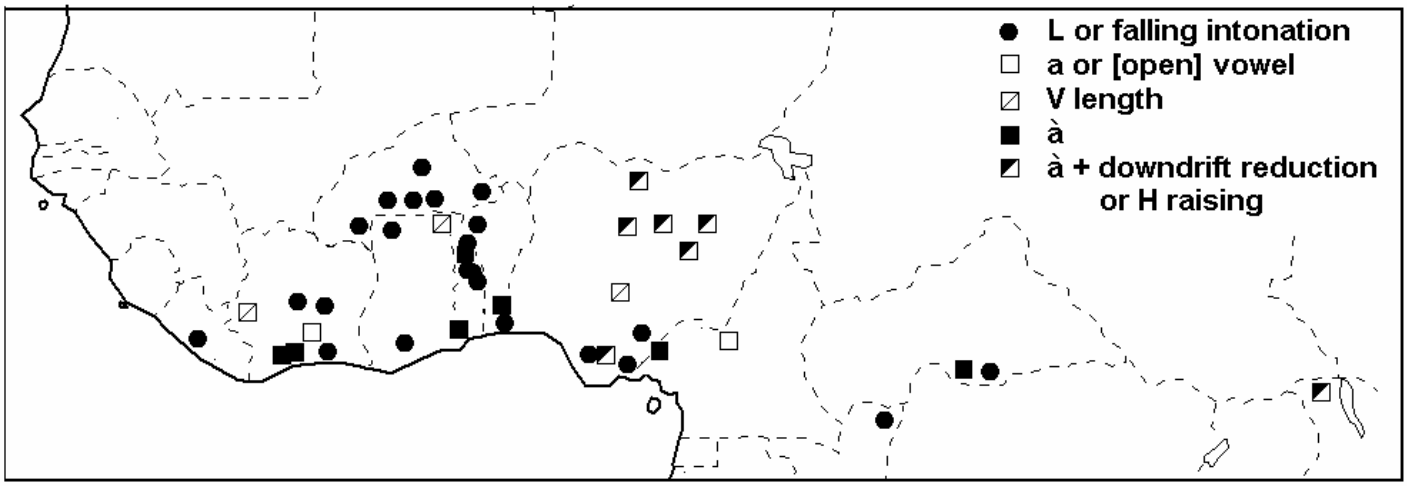
Map 4



Map 5


languages with 3 level tones
languages with 4 level tones
languages with 5 level tones

Map 6


L or falling intonation
a or [open] vowel
V length
à
à + downdrift reduction
or H raising

Map 7

Acknowledgements. We would like to thank a number of colleagues for their generous help in responding to queries and contributing language data, in particular Derek Nurse, Gerrit Dimmendaal and Mohamed Elmedlaoui, as well as Zygmunt Frajzyngier, Tom Güldemann, and Larry Hyman for reading and sending comments on the final draft version. We give special thanks to Raphaël Kaboré and the Bibliothèque Africaine of the Université de Paris 3, whose resources greatly aided us in compiling data on lesser-known languages.

Footnotes

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[1] The term "Sudanic languages" is used here and below as a convenient shorthand for "languages spoken in the Sudanic belt," and does not refer to any presumed genetic grouping. *Sudan* as a geographical term enjoys a long tradition, predating later linguistic adaptations. The term *Sudanic* in this historical sense is not to be confused with *Sudanese*, referring to the land and people of the Republic of the Sudan, nor with *Central Sudanic* and *East Sudanic*, designating genetic subunits of the Nilo-Saharan language family.

[2] We identify languages in terms of the traditional Greenberg-derived classification for convenience, though not all of its proposals are accepted by all scholars. In particular, many specialists prefer to treat the "Khoisan" languages as a grouping of as many as five unrelated families.

[3] The full data base draws on the (mostly non-Bantu) African phoneme systems collected in UPSID (The UCLA Phonological Segment Inventory Database, Maddieson & Precoda 1989), the Bantu phoneme systems collected in Nurse & Philippson (2003), and a variety of other published sources. All non-African languages are drawn from UPSID. We regret that space limitations preclude our citing sources for all language data mentioned in this survey. Standard sources have been used whenever they were available to us, and the best reliable sources were used otherwise.

[4] Shona, a Bantu language spoken in Zimbabwe.

[5] Amele, a language of Papua New Guinea, and Iai, a Malayo-Polynesian language spoken on Ouvéa Island in New Caledonia.

[6] Alphanumeric codes such as S10 refer to Guthrie's system of Bantu language classification, as updated and amplified by Maho (2003). We follow the current preference for referring to Bantu languages without their prefixes, e.g. Ganda rather than Luganda, Swahili rather than Kiswahili. In citing languages here and below we use the following conventions: "X/Y" indicates alternate names for the same language, "X-Y" indicates closely related languages or members of a dialect chain (exception: Diola-Fogny is a single member of the Diola cluster), and dialect names precede language names: Dendi Songay, Owere Igbo.

[7] An exception to this generalization occurs in the variety of Ma'di described by Blackings & Fabb (2003), where the prenasalized stop [m(ŋ)gb] begins with labial closure; the existence of a velar closure is reported as uncertain.

[8] It is just in these Bantu languages and other languages lacking voiced stops that we find a preference for /kp/ over /gb/. Excluding such languages, Cahill (1999) finds that languages having [gb] alone outnumber those with [kp] alone by a significant margin. One consideration that might explain such a trend is the occasional tendency for labial-velar stops to have implosive realizations, as in the case of the Nigerian languages Idoma, Isoko, and Igbo (Ladefoged 1968, Ladefoged & Maddieson 1996); implosives are of course normally voiced.

[9] Our sources include Richardson (1975), Guthrie (1967-71), Tylleskär (1986-7), Mutaka & Ebobissé (1996-7), Grégoire (2003), and Mangulu (2003), among others.

[10] Guthrie (1967-71 vol. 3, 303-4, vol. 4, 16), Nurse and Hinnebusch (1993, 171-3).

[11] Our sources are Schachter & Fromkin (1968), Le Saout (1973), Bentinck (1975), Singler (1979), Capo (1981, 1991), Bole-Richard (1983a,b, 1984), Ihionu (1984), Creissels (1994), and Clements & Osu (2005), to which we have added languages drawn from inventories in Bole-Richard (1985), Maddieson (1984), and Cohn (1993a,b). The zone in question is a Sprachbund, characterized by a complex of other features such as a strong tendency toward monosyllabism, "horizontal" (that is, front-back) root harmony, three or more distinctive tone levels and certain "lax"question markers. We discuss the latter two features in sections 3.3.2 and 3.3.3.

[12] Our transcriptions are phonemic; stops are voiced intervocalically.

[13] Languages like Yoruba or Kikuyu, with one high vowel series, two mid vowel series and constraints requiring consecutive mid vowels to be of the same height, have also been described as having ATR harmony. In such systems, unlike those with two series of high vowels, [-ATR] is usually the active value, at least in African languages (Casali 2003). See below for illustrations from Kikuyu.

[14] Phonemic voiceless implosives have also been reported, though without phonetic data, in the Gur language Bwamu (Manessy 1960), the Atlantic language Seereer-Siin (McLaughlin (1992-4), the Edoid language Isoko (Elugbe 1989a), and the Kwa language Ebrié (Bole-Richard 1983b).

[15] The implosive /ɓ/ was described for Zulu at the beginning of the last century by Meinhof and Doke, but appears to have shifted to a voiced explosive /b/ since then in at least some contemporary varieties of Zulu (see references and discussion in Clements 2003).

[16] Many other "effluxes" are best analyzed not as features at all, but as independent segments, forming clusters with clicks just as they do with non-clicks. See Traill (1993), Güldemann (1999) for further discussion.

[17] Plain voiced stops are recent innovations in Zulu; see note 15.

[18] In some P-less Bantu languages, *p* survives as the second member of a prenasalized cluster *mp*. However, this cluster does not qualify as a P-sound in the sense described above.

[19] Areas in which Proto-Bantu **p* is usually retained (though sometimes only as a reflex of **mp*) are the northwest (zones A-C), the center-east (zones G, M, N, P, as well as Shona S10), the southwest (zone R), and the southeast (the Nguni group S40). For fuller discussion of eastern Bantu languages see Nurse (1999, 22, 40) and especially Nurse (1979, 393-452), where the facts are set out in detail.

[20] Maddieson (2003b) speculates that P-lessness in African languages might be related, among other factors, to "the impact of cosmetic modification of the lips, once practiced among a number of the peoples of the Sahel, the northern rain forest, and the Ethiopian highlands". This hypothesis would not explain why the great majority of African languages lacking /p/ have other labial stops such as /b/, /kp/, and /m/.

[21] Note that **p* is reconstructed for Afroasiatic as a whole (Hodge 1994).