Spirantization and the 7-to-5
Vowel Merger in Bantu

Thilo C. Schadeberg

Rijksuniversiteit te Leiden

Abstract. Many Bantu languages have the balanced seven-vowel system i ɪ ɛ a ɔ ʊ u. It is the system that one would, on internal evidence, reconstruct for proto-Bantu. Many other Bantu languages have a reduced five-vowel system i ɛ a ɔ u. The five-vowel systems are historically almost always the result of a merger of the two highest front and back vowels, respectively; i.e., the result of a merger of *i /*ɪ and of *u/*ʊ ("7>5"). Another widespread sound change occurring in Bantu is the one here called "Spirantization". It occurs in seven-vowel languages and affects obstruents in the environment preceding the high vowels i and u (not ɪ and ʊ). It typically creates strident fricatives (s, f...) not formerly present in the system. Some remarkable observations can be made concerning the historical co-occurrence of the two sound shifts. Spirantization and 7>5: (i) No language has undergone 7>5 but not Spirantization; (ii) Only few languages have undergone Spirantization but not 7>5. (iii) In languages which have undergone both sound shifts, Spirantization always preceded 7>5. In this contribution I try to "explain" these patterns of co-occurrence without appeal to structuralist chain analyses. I consider both changes as being independently well motivated, and while admitting the possibility that the phonological system as such may favour or disfavour certain changes I argue that areal norm and areal spread are the major reasons for the widespread combined occurrence of Spirantization and 7>5, in that (apparent) order.

1.   Two common sound shifts

Many Bantu languages have a balanced seven-vowel system as in (1a) or in (1b). The system in (1a) appears to have a wider (and non-contiguous) geographical spread than the system in (1b). It is the system that one would, on internal evidence, reconstruct for proto-Bantu.

(1)	(a)	i	ɪ		ɛ	a	ɔ		ʊ	u
	(b)	i		e	ɛ	a	ɔ	o		u

Many other Bantu languages have a reduced five-vowel system as in (2a) or (2b). The system in (2a) is the one most commonly reported; for some languages conditioned variations ɛ/e and ɔ/o have been described. The system in (2b) is rare.

(2)   (a)   i   ɛ   a   ɔ   u
       (b)   i   e   a   o   u

The systems in (2) are, historically, almost always the result of a merger of the two highest front and back vowels, i.e., a merger of *i/*ɪ and of *u/*ʊ. We do not know any example of a five-vowel system derived from a merger of the two intermediate height vowels *ɪ/*e and *ʊ/*o (where *e and *o stand for [ɛ] and [ɔ], respectively). I shall refer to this vowel merger briefly as "7>5".

The choice of symbols used in actual descriptions is often misleading as to the phonetic quality of the non-low vowels. Languages with one of the five-vowel systems in (2) are almost invariably transcribed with the five Latin vowel symbols i e a o u. Languages with seven-vowel systems as in (1) are most commonly transcribed with the "cardinal" vowel symbols i e ɛ a ɔ o u. This vowel system was long considered to be the "basic" one for African languages; it was advocated through the "Africa alphabet" by the London-based International African Institute. Curiously, it is most popular amongst linguists in the francophone tradition; in Eastern and Southern Africa some rather peculiar spelling systems have been developed, e.g., the Central Kenya (mainly Gikuyu) orthography with tildes marking the high unadvanced vowels (i ĩ e a o ũ u) and the Sotho-Tswana tradition with circumflex accents marking the mid vowels (i e ê a ô o u).

The seven-vowel system was first reconstructed for Bantu by Carl Meinhof who transcribed it as î i e a o u û; later, when tones were added to Bantu reconstructions the circumflex accent was replaced by a diacritical cedilla below the two highest (sometimes called "first-degree") vowels: į i e a o u ų. This system is still the one most commonly used in comparative Bantu studies.

In case you are wondering, my excursion into spelling traditions does have a point: linguists are all too often influenced by their own spellings. Even leading scholars in the field of Bantu phonetics and phonology keep on referring to the first-degree vowels as "superclosed", and they describe the result of the change from the historically older seven-vowel system in (1) to the five-vowel system in (2) as the loss of the "superclosed" vowels. I believe that this is simply wrong. It is, however, exactly what Meinhof had in mind; he consciously coined the label "heavy" ("schwer") for the two first-degree vowels; I shall presently return to his

reasons for doing so. Meinhof's excuse is that when he developed his idea more than a century ago he had probably never heard a seven-vowel Bantu language.

The point I would like to make is that there is no mystery about the phonetic quality of the first-degree vowels i and u: they are just that, [i] and [u], in present-day languages as far apart as Lundu (A.11) in Cameroon, Nyamwezi (F.22) in Tanzania and Tswana (S.31) in Botswana. On this evidence, the only sensible reconstructions appear to be vowels of just this quality. After the 7>5 vowel change, the two highest vowels are retained, and it is the two second-degree vowels which are lost.

Another widespread sound change occurring in Bantu is the one here called "Spirantization" (SPIR). It occurs in seven-vowel languages and affects obstruents in the environment preceding the high vowels i and u (not ɪ and ʋ). It typically produces sound shifts such as shown in (3) and thus creates strident fricatives. Assuming that the reconstruction of *c and *j as palatals stops or affricates is correct, such fricatives were not formerly present in the consonant system of Bantu.

(3)   before i   before u
       p, b >   f, v (or: s, z)   p, b >   f, v
       t, l >   s, z   t, l >   f, v (or: s, z)
       k, g >   s, z   k, g >   f, v

The characteristic properties of this complex sound shift are that it affects all or most consonants, that it is triggered by both the front and the back–rounded first-degree vowels, and that its overall effect cannot be fully described as the spreading of the place features of these vowels (i.e., palatalization and labialization/velarization). The exact details of this sound shift vary from language to language.

(4)   PB >   Ganda E.15   Luba L.31a   Shambala G.23
                 /_i   /_u   /_i   /_u   /_i   /_u
       *p,b   w,b   s,z f,v ɓ,b   f,v f,v   h,w   f,v f,v/z
       *t,d   t,l   s,z f,v t,l   ʃ,ʒ f,v   t,l   ʃ,z ʃ,z
       *k,g   k,g   s,z f,v k,Ø   ʃ,ʒ f,v   k,ɣ   ʃ,z f,v

Meinhof's term "heavy vowels" was intended to catch the mysterious property of his reconstructed vowels *î and *û to trigger Spirantization. One of our questions is: What is the nature of Spirantization?
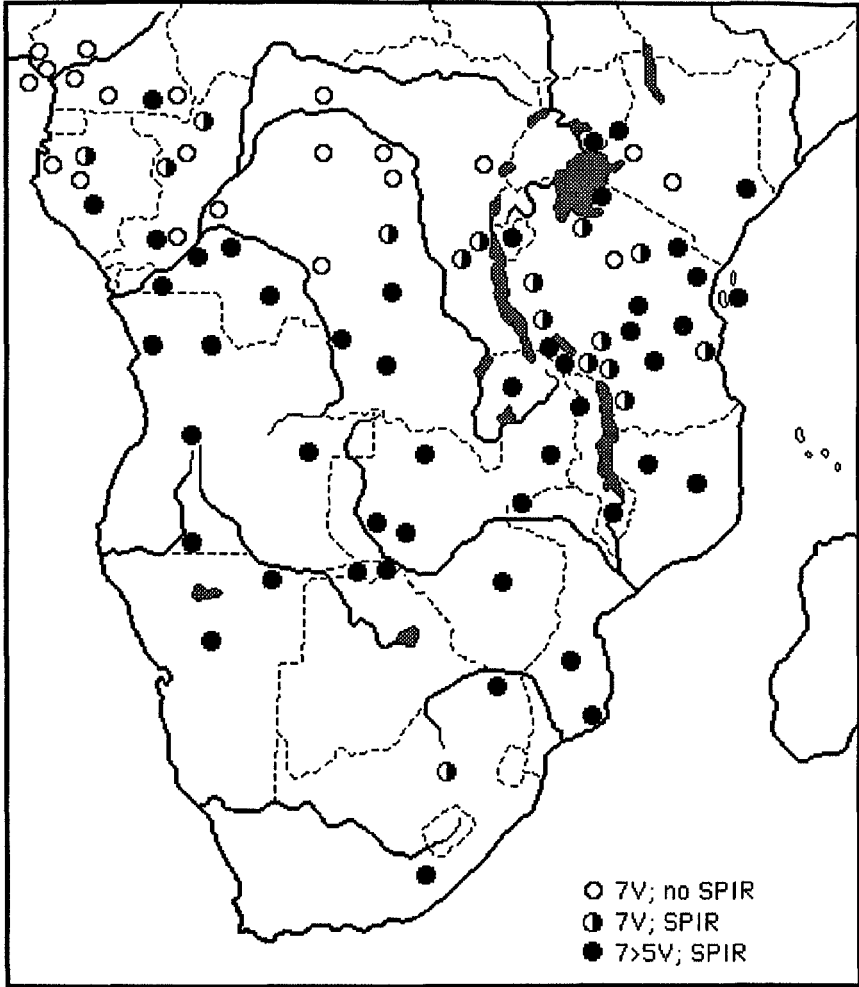
Co-occurrence of 7>5 and Spirantization.

2.   The co-occurrence of Spirantization and 7>5

Some remarkable observations can now be made concerning the historical co-occurrence of the two sound shifts Spirantization and 7>5. There are three kinds of languages:
  • languages which have undergone neither SPIR nor 7>5
  • languages which have undergone SPIR but not 7>5
  • languages which have undergone both SPIR and 7>5
The map below shows 85 languages as they have been classified with respect to the two sound shifts. The full list of languages represented on the map is given in the Appendix.

The map is based on Guthrie's "An Inventory of Bantu Languages" (*Comparative Bantu*, Part I, Vol. 2, pp. 28-64; 1971). I have tried to select from each "group" the one language with the best coverage. (In Bantuist parlance, "groups", referred to as A.10, A.20 ... S.60, are small ensembles of up to ten rather similar languages with a weak claim to being closely related. The fifteen "zones", indicated by letters between A and S, are geographically contiguous clusters of such groups without any claim as to their genetic status.) Only when languages within one group appear to fall into different categories have I presented more than one language from one group. I can't vouch for the accuracy of every detail. Guthrie's statements about the sound correspondences are not always accurate and frequently incomplete; by deciding about each statement whether it implies Spirantization and/or 7>5 I have no doubt further simplified things. The languages represented on the Map are listed in the Appendix. Note that almost all languages with doubtful Spirantization are seven-vowel languages. This has led to maximizing the number of languages of the middle category [+SPIR, -7>5]. The number of languages having undergone neither or both sound shifts could be greatly increased if the sample was extended.

The numeral breakdown of the three (or four) kinds of languages is as follows:

(5)   SPIR 7>5   nr of lgs   (total: 85 languages)
         –   –   21 lgs
         +   –   16 lgs
         +   +   48 lgs
         –   +   no lg

In spite of all kinds of inaccuracies in detail I believe that the following statements are justified:

(i)   No language has undergone 7>5 but not Spirantization.[1]
(ii)   Relatively few languages have undergone Spirantization but not 7>5.
(iii) In languages which have undergone both sound shifts, Spirantization must
       be assumed to have preceded 7>5.

In view of the great number of languages involved these facts cannot be the result
of mere coincidence. Obviously, the original seven-vowel system was (and is)
highly amenable to Spirantization, but not to 7>5. After the occurrence of
Spirantization, an unstable situation is created that calls for the speedy
application of 7>5. Our characterization of the two sound shifts does not account
for their obvious interdependence in a historical perspective.

       Since there is no bleeding or feeding relation between the two processes, the
problem appears to be a text-book case for invoking a structuralist solution, i.e.,
a solution that looks at a phonemic system as a whole and that assigns some kind
of change-provoking force to any imbalances in the system of oppositions. The
perceptual correlate of such forces would be the desire to make speech sounds as
distinct as possible. Communicative functionality would prevent any merger of
phonemes with a high functional load.

       Perhaps unfortunately, recent models of phonology do not offer instruments
to incorporate such considerations directly into phonological representations.

3.   Push-chain or drag-chain?

A classical push-chain works like this: Certain segments are liable to be subject
to some "natural" change by which they would merge with some other segments
in the phonological system. The system rejects the merger (which would cause
extensive homonymy) and avoids it by changing the inherently stable segments
threatened by the merger. A standard example is the raising of the mid vowels **e**
and **o** to **i** and **u** and the concomitant "breaking" of **i** and **u** to **ei** and **ou** (in English
and Dutch).

       John Stewart (p.c.) has offered a push-chain analysis for our two
phonological changes: The second-degree vowels **ɪ** and **ʋ** are highly marked,
being [+high, -ATR], and hence liable to merge with their less marked [+ATR]
counterparts **i** and **u**. These two unmarked high vowels make the way free by
"breaking" into **yi** and **wu**. The next step would be the "spirantization" of Cy and
Cw producing the strident fricatives **s** and **f**. An intermediate step may have been
affricates — not necessarily homorganic — such as **ps, pf, ts, tf, ks, kf.**

Elegant as it is, there are two problems with this solution.

First, the assumed initial phase of the change, in which the first-degree vowels have been broken into glide-vowel sequences, is — as far as I am aware — not attested. Even the second phase has only rarely survived, and almost exclusively in the north-western part of the Bantu area. This suggests that Spirantization — whether or not passing through a stage of affricates — is the original process rather than the sequel to an earlier vowel breaking.

Secondly, the existence of languages of the intermediate type, i.e., those that have undergone Sprirantization but not (or: not yet) 7>5, provides a powerful argument against a push-chain hypothesis. Clearly, the two changes linked by a push-chain explanation must occur simultaneously; the push-force is the primary and chronologically prior element which provides the motivation for the escape change which is secondary. It is difficult to believe that there can be languages in which we see the implementation of the secondary change but the primary motivation remains without effect.

On the other hand, a drag-chain explanation appears to be even less likely. In a classical drag-chain a certain phonological change produces a gap in the system, and the system responds by filling this gap. Phonetically speaking we could say that the first change leads to a situation where the acoustic space is not optimally used, and this motivates the second change moving another element into this unused space. A drag-chain explanation would agree well with the observed three types of languages, but it does not fit in with the actual two changes. The first one, Spirantization, produces a set of new segments, not a gap, and the second one, 7>5, is a merger and does nothing to create a more balanced system.

In fact, both structuralist devices, push-chain and drag-chain, do little to help us understand the nature of the two changes.

Spirantization is triggered by **i** and **u** — but what are the potent features of these vowels, and even more puzzling: why can the same two vowels not trigger the same change when they are part of a simple five-vowel system?

4.   Towards a solution

I better admit that I don't have a complete answer to my questions. But I think the answer should contain at least three elements.

(i) The two changes, Spirantization and 7>5, are not chained but are each motivated without direct reference to the other.

I agree with Stewart in regarding 7>5, i.e., the merger of the [+high, -ATR] vowels with their [+ATR] counterparts as a natural change.

The case of Spirantization is less clear. The natural, assimilatory basis of Spirantization lies in the fact that strident fricatives such as [s f z v] are intermediary in aperture between stops and high vowels. While Spirantization is not a common process in the world's languages, I have found a few comparable cases in the literature. Clements (1976: 100) cites standard Japanese as spoken in Tokyo, where "t is affricated before high vowels (i, ɯ) and in addition backed to palato-alveolar č if the high vowel is front (i)". Bhat (1978: 54f., 58) mentions six or seven more or less comparable cases (Papago, Tepehuan, Basque, proto-Iranian, Sentani, Tswana and Efik). Both Clements 1976 and Bhat 1978 are studies directed towards palatalization in which Spirantization caused by front and back high vowels is just a marginal phenomenon. It is possible that more instances would come to light in a cross-linguistic survey devoted directly to aspiration, affrication and spirantization.

In order to understand why 7>5 is apparently blocked unless it is preceded by Spirantization, and why Spirantization is blocked after 7>5, I (reluctantly) invoke the second element of my tentative approach to a solution:

(ii) The likelihood of a change in the feature system depends on the complexity of that system.

It is a widely shared belief that phonological segments are composed of features, and that these features are taken from a universal set. Languages differ in which features they actively use. I have suggested elsewhere that a certain set of statements about the feature inventory is a proper and necessary part of a grammar. (Of course, languages also differ in which combinations of features they admit. Statements about features and admissible feature combinations are logically equivalent to redundancy conditions and at the same time define the segment inventory.) What I would like to suggest now is that simple feature systems are more likely to add a feature than richer systems, and that rich feature systems are more likely to drop a feature than simple ones.

I realize that, in a way, this principle is the opposite of the one appealed to by the drag chain, which says that a given feature system should be maximally exploited, leaving no gaps. But that should not disturb us unduly: the universe of languages would not be what it is if there were no forces pulling in opposite directions.

The consonant system of Bantu languages prior to Spirantization is rather simple and shows very little redundancy. There are four places of articulation:

bilabial, alveolar, palatal and velar, and four modes: voiceless stop, voiced (stop or continuant?), nasal, and prenasalized. The stop-*versus*-continuant dimension is not well exploited but may have been present at a sub-phonemic level. This situation provides a fertile basis for the introduction of fricatives.

The seven-vowel system of Bantu languages has an inherent instability through the presence of two rather marked members: ɪ and ʋ. I suggest that the vowel system is protected precisely by the poverty of the consonantal feature system. (I assume that the 7>5 vowel merger also changes the feature system by making the feature ATR disappear from the inventory.) The protection is removed after the introduction of strident fricative consonants. The combined effect of the two changes is a shift of a distinction in the vowel system into the consonant system.

One could argue that this view on the relation between Spirantization and 7>5 is really very close to the push-chain analysis. However, I see two important differences. First, a proper, independent motivation is provided for Spirantization. Secondly, I escape the awkward teleological implications which I believe are simply incorrect. Can a change look ahead to its effects? I don't think so. I often read that a certain change does not occur because it would cause homonymy, homophony or ambiguity. This is probably always wrong. Historical linguistics provides numerous examples of mergers, and there are other strategies to resolve communicative problems which may arise.

Finally, there is a third element which has to be recognized in the explanation or understanding of the two rules, Spirantization and 7>5:

(iii) Areal norm and areal spread

The languages which haven undergone Spirantization, or both Spirantization and 7>5, are not genetic subgroups or branches of Bantu. I think this is a safe statement to make, even if the details of the genetic subclassification of Bantu are, after many decades of research, still rather hazy. Historical-comparative studies of (presumably) genetic subgroups of Bantu, even small ones, again and again end up reconstructing a consonantal system prior to Spirantization and a seven-vowel system prior to 7>5. A commonly used argument is the observation that the precise results of Spirantization differ even between closely related languages. Even synchronic descriptions of languages which have undergone both changes sometimes posit the situation as found prior to these changes for the underlying representation in order to account for regular allomorphic alternations. An example is Louise Polak–Bynon's grammar of Shi (D.53).

It is this non-genetic distribution of the two changes which has prompted me to choose a geolinguistic, quasi-dialectological presentation, and which calls for a more than incidental explanation of the interrelation between the two changes. We have already seen that one part of this explanation lies in the naturalness of the two changes when coupled with the properties of the phonological system of early Bantu. To this we now add the suggestion that both changes have been promoted by areal norm. Given the high degree of multilingualism in Bantu-speaking Africa (and not just there), it is natural to assume that speakers are tempted all the time to transfer phonological systems from one language to another. Our map supports this hypothesis: The languages which have undergone one or both changes cover a geographically contiguous area. The conservative languages which have not been reached by either change are all located along the northern edge of the Bantu area. The intermediate type languages which have participated in Spirantization but not (or not yet) in 7>5 are more or less situated between fully conservative and fully innovating languages, with a marked southern dip in Tanzania. In at least one instance, the case of Tswana, we see a partially conservative language totally surrounded by innovating languages.

It may be surprising to see how accurately speakers could detect and transfer the conditioning environment of Spirantization, probably even after the 7>5 vowel merger. However, this extraordinary ability of correct popular etymology of Bantu language speakers can be observed elsewhere in the context of transfer by contact. But this is a different story.

Afrikaanse Taalkunde
Rijksuniversiteit te Leiden
Postbus 9515
2000 RA Leiden, Netherlands
E-mail: schaberg@rulcri. LeidenUniv.NL

Appendix, based on Guthrie's Inventory:

		7>5	SPIR			7>5	SPIR
A.11	Lundu	–	–	G.42	Swahili	+	+
A.24	Duala	–	–	G.51	Pogoro	+	+
A.31	Bubi	–	–	G.62	Hehe	+	+
A.43	Basaa	–	–	G,65	Kinga	–	+
A.61	Yambasa	–	–	H.16	Kongo	+	+
A.74	Bulu	–	–	H.21	KiMbundu	+	+
A.81	Ngumba	+	+	H.33	Hungu	+	+
A.91	Kwakum	–	–	H.42	Hungana	+	+
B.11	Mpongwe	–	–	K.14	Lwena	+	+
B.22	Ngom	–	+?	K.33	Kwangali	+	+
B.31	Tsogo	–	–	K.42	Subia	+	+
B.43	Punu	+	+?	L.11	Pende	+	+
B.61	Mbete	–	+?	L.23	Songye	+	+
B.71	Teke	–	–	L.31	Luba	+	+
B.73	Yaka	+	+	L.41	Kaonde	+	+
B.83	Mfinu	+	+	L.52	Lunda	+	+
C.11	Ngundi	–	+?	L.62	Nkoya	+	+
C.22	Akwa	–	–	M.11	Pimbwe	–	+
C.32	Bobangi	–	–	M.15	Mambwe	+	+
C.41	Ngombe	–	–	M.22	Mwanga	+	+
C.52	Soko	–	–	M.25	Safwa	–	+
C.61	Mongo	–	–	M.31	Nyakyusa	–	+
C.71	Tetela	–	+	M.42	Bemba	+	+
C.81	Bushong	–	–	M.51	Bisa	+	+
D.11	Mbole	–	–	M.63	Ila	+	+
D.27	Bangubangu	–	+	N.11	Manda	–	+
D.42	Nandi	–	–	N.21	Tumbuka	+	+
D.54	Bembe	–	+?	N.31	Manganja	+	+
D.62	Rundi	+	+	N.41	Nsenga	+	+
E.15	Ganda	+	+	P.13	Matumbi	–	+
E.24	Kerewe	+	+	P.21	Yao	+	+
E.32	Luhya	+	+	P.31	Makua	+	+
E.41	Logooli	–	–	R.11	UMbundu	+	+
E.51	Gikuyu	–	–	R.22	Kwanyama	+	+
E.61	Meru	+	+	R.31	Herero	+	+
E.71	Pokomo	+	+	R.41	Yeei	+	+
F.11	Tongwe	–	+	S.10	Shona	+	+
F.21	Sukuma	–	+	S.21	Venda	+	+
F.31	Iramba	–	–	S.33	SeSotho	–	+?
F.33	Irangi	–	+?	S.41	Xhosa	+	+
G.11	Gogo	+	+	S.51	Tswa	+	+
G.23	Shambala	+	+	S.61	Copi	+	+
G.35	Ruguru	+	+				

Note

1.   There appear to be one or two exceptions to this generalization (Y. Bastin, p.c.).

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