

arms, legs) from in front, and standing side by side, each one with a bow and arrow at his left side (Feldbusch, p. 101).

So the drawings analyzed in this study may perhaps be seen as an ontogenetic correspondence to a phylogenetic phase represented by e.g. the Ewes. This attempt of a 51/2-year-old girl at creating a written language of her own was, however, in the long run doomed, and this for two reasons. First, she had already acquired the conventional alphabetic writing system of her culture and knew how to use it in order to create texts. Second, her budding interest in creating life-like pictures was soon to take over, making her abandon the art of stereotyped drawing.

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Working Papers 36 (1990), 191-212

Vertical, monovocalic and other "impossible" vowel systems: a review of the articulation of the Kabardian vowels

Sidney A. J. Wood

ABSTRACT

The Caucasian language Kabardian has become famous for its minimum vowel system, for the controversy concerning the analysis of its vowel phonemes, and for the central role of that analysis in phoneme theory generally and the laryngeal theory in particular. Phonetically, Kabardian is interesting for the extensive assimilation of its few vowel phonemes to the surrounding consonants. Two published descriptions of these assimilations are compared in this article, and the articulatory processes involved are reinterpreted in terms of gestures that shape and tune the vocal tract, as an alternative to the Bell model of vowel articulation. The assimilations are more complex than was expected, some vowel allophones not acquiring articulatory components present in the environments, others appearing to acquire components not present in the environments. It is suggested that this can be explained by the spectral ambiguity of some palatovelar and pharyngovelar (uvular) configurations.

INTRODUCTION

This article is devoted to a review of the phonetic processes that may be involved in the assimilation of vowels to the surrounding consonants in the NW Caucasian language Kabardian. The review is mainly based on the descriptions by Catford 1942 and Kuipers 1960, and to a lesser extent on Bagov et al. 1970, Kumaxov 1984 and Smeets 1984.

The Kabardian vowels are of unique interest for the typology of vowel systems since, paradoxically, they are invoked by both sides in the debate concerning the status of systems smaller than three phonemes (Trubetzkoy 1939; Jakobson 1942; Allen 1965; Szemerényi 1967; Kuipers 1968; Kumaxov 1984), particularly the controversial one-vowel proposal for Proto-Indo-European (e.g. Allen 1965 and Gamkrelidze 1968 in favour, Szemerényi 1967 against). No-one looking for data in this literature can ignore that debate. The solutions proposed for the Kabardian vowel system involve either no, one, two or three vowel phonemes manifested in almost twenty allophones (Jakovlev 1923; Trubetzkoy 1925; Kuipers

1960). This is itself an observation worth noting. So-called impoverished vowel systems are often very rich in phonetic processes.

These solutions are usually expressed in terms of the *front-central-back* and *high-mid-low* dimensions of tongue location of the Bell-type model (Bell 1867), which was never confirmed. This model was invalidated at the first tests (Meyer 1910; Russell 1928), and repeatedly since (Ladefoged et al. 1972; Wood 1975, 1982a; Lieberman 1976; Nearey 1978). It was never discarded and the crisis has still not been resolved (Catford 1981; Fischer-Jørgensen 1985; Wood 1987). The elusive nature of many of the Kabardian vowel allophones offers a particularly challenging opportunity to review the articulatory processes involved in their production. These vowels are handled by the Bell model as *central* vowels of varying degrees of *retraction*, although these parameters are too coarse for the shaping and tuning of the vocal tract. An alternative articulatory description will therefore be explored, based on component manoeuvres that shape the vocal tract locally in relation to the nodes and antinodes of the standing waves of the respective resonance modes, in order to tune the vocal tract to the desired spectral output (Wood 1979, 1982b, 1986, in press; Wood & Pettersson 1988). There is, to my knowledge, no x-ray data available for the Kabardian vowels that will directly reveal the relevant articulations, but it is unrealistic to expect that such data can be obtained for every phonetic and phonological problem that arises. Articulations have to be deduced by interpreting old and new data – transcriptions, spectra etc. – from prior knowledge of the relationship between speech gestures and the resonance properties of the vocal tract. Certain assumptions are made here regarding the Kabardian vowel allophones and the assimilations, namely the obvious one that the vowel phonemes are actively assigned the same tongue body articulations as are needed for the adjacent consonants to which they are assimilated, and the less evident one that the spectral outputs of palatovelar and pharyngovelar (uvular) configurations are ambiguous for similar mouth openings.

Kabardian vowel phonology

Kabardian belongs to the Circassian group of North West Caucasian languages (Fig. 1). It is spoken by some 180,000 persons in the U.S.S.R., Adyge by about 88,000, while there were some 66,000 speakers of Circassian languages in Turkey in 1945 (Kuipers 1960). See Kuipers 1960, Catford 1977 and Smeets 1984 for more information.

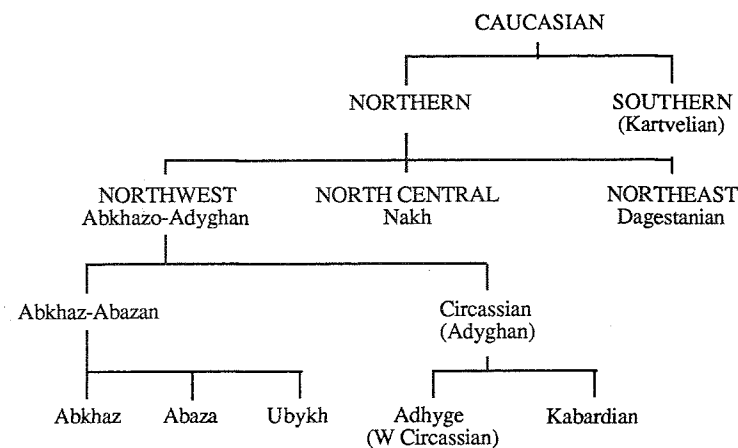


Figure 1. The Northwest Caucasian languages; Ubykh is now extinct.

BACKGROUND

The vowel allophones are said to be very variable, depending on the actual combination of consonants in the syllable (the consonants are described further on, see also Table 1), but this is generalized to certain lingual and labial processes. There is lingual and labial assimilation to prevocalic palatals, palatovelars and pharyngovelars, and then overriding labial and lingual assimilation to postvocalic rounded consonants. The lingual place assimilations point to common motor activity for these vowels and consonants, a conclusion that is in accord with the ancient tradition in phonetics that palatal and palatovelar vowels and consonants form natural series such as [i,j,ç,c] and [u,w,x,k]. To this can be added series like pharyngovelar [o,χ,q] and lower pharyngeal [a,h]. See also Stevens 1972 for quantal aspects of such series. Common activity for vowels and consonants is also foreseen in the SPE (Chomsky & Halle 1968; Halle 1983), palatovelars being *high back* (like [u]), pharyngovelars *mid back* (like [o]), pharyngeals *low back* (like [a]). It should also be implicit in any feature system that recognises such tongue body locations or gestural targets as palatal, palatovelar, uvular and pharyngeal (e.g. Ladefoged & Maddieson 1988; Hulst 1988; Browman & Goldstein 1989). However, any proposal that vowels and consonants share common motor organization is contradicted by Öhman's 1966 conviction that vowels and

consonants are produced by separate, at times conflicting, superimposed systems.

The phonemic analysis of the Kabardian vowels is controversial and hinges in part on how the so-called "short and long *a*" are interpreted. Jakovlev 1923 proposed a "vertical" three-phoneme solution comprising *high vs mid* and "short *a*" vs *low* "long *a*", on finding [e(i),o(i),a] to be contextual variants; the three phonemes were then reduced to two by including "long *a*" in one single *non-high* phoneme with allophones [e(i),o(i),a(i)]. He also proposed that Old Kabardian had had only one vowel phoneme. These three proposals were unique at that time – a vertical (rather than triangular) three-vowel system, and two and one-vowel systems. No-one had ever before reported a vowel system, that lacked phonemic rounding, and very few since. Trubetskoy 1925 accepted the novel vertical solution but rejected the two-vowel solution on diachronic grounds: he argued that Kabardian "long and short *a*" had two different origins and that a three-vowel system must have existed since common Proto-Circassian. He argued that "long and short *a*" were distinguished by sonority rather than quantity and that there was consequently a phonemic opposition between them. Later, in 1939,87, Trubetskoy reported the vertical three-vowel solution as fact for Adhyge, Abkhaz, and Ubykh, ignoring Jakovlev's two and one-phoneme solutions for Kabardian.

The current cyrillic alphabet, in use since 1937 (Kuipers 1960,117), embodies this view. The letter *ы* denotes the *high* phoneme, the letter *э* the *mid* phoneme and "short *a*", the letter *а* denotes "long *a*". The [u,e,o]-like allophones are either written explicitly with the letters *у е о*, or understood from *ы* and *э* in the appropriate consonant environment.

Catford 1942 reported the three-vowel solution for Kabardian informants he had interviewed for a sample of phonetic transcription. Catford 1977 also rejected Jakovlev's proposal that all the *non-high* vowels were allophones of one phoneme, on the evidence of phonetic data that failed to demonstrate any duration increment for "long *a*" beyond any inherent lengthening expected for a *low* vowel anyway, thus offering experimental support for Trubetskoy's criticism.

Jakovlev had observed that glide+vowel sequences *ji, je, wu, wo* metathesize to diphthongs that yield long vowels *i:, e:, u:, o:*. Kuipers generalized this by proposing *ha>ah>a:*, thereby still seeing "long and short *a*" in complementary distribution in a two-phoneme system. He then reduced the vowel phonemes first to one, by deriving the *high* set from

predictable epenthetic juncture phenomena, and then ultimately to none by seeing the *non-high* set as the result of assimilation to a consonantal feature of openness (comparable to palatalization or labialization).

In the meantime, a one-phoneme solution has been proposed for Abaza by Allen 1965, and two-phoneme solutions for Old Adyghe (Shengelia 1983), for common Proto-Circassian and for some modern Circassian dialects (Smeets 1984,80, the other modern dialects getting the vertical three-phoneme solution). Smeets 1984,82 also records a growing tendency for loanwords not to be adapted to Circassian phonology, and he predicts that Circassian vowel systems will become much larger within a few decades. This indicates changing levels of language maintenance in these multilingual communities, partly under pressures from dominant languages like Russian and Turkish.

Thus far, the analysis of the vowel phonemes may seem to be a parochial problem of Circassian linguistics that could be solved by studying appropriate data. For example, Kumaxov 1984 queries the aptness of Kuipers' examples and the treatment of vowel+glide complexes, especially the derivation of "long *a*" from /*ha*/, and insists that common features of the modern Circassian dialects necessitate a three-phoneme solution for Proto-Circassian. However, the Circassian vowels have attained a universal significance. Trubetskoy, after rejecting Jakovlev's solutions, formulated the general doctrine that all languages must have contrasting consonant and vowel systems and that a system must consist of at least three elements in mutual opposition. Jakobson 1942 followed Trubetskoy, but he also observed that the developing child passes a period with two contrasting vowels before reaching the minimum system of three. With this in mind, Halle 1970 reviewed Kuipers 1960 and concluded that the two-phoneme solution supports Jakobson's thesis, but he rejected Kuiper's smaller solutions because of their reliance on "empty notational devices". Trubetskoy's doctrine forbids proceeding with phoneme analysis beyond a minimum of three vowel phonemes even if it were possible in a given set of data, so that the original data on which the doctrine itself is based cannot be tested. As a consequence we have an anomalous situation where proponents of very small vowel systems, like Allen and Kuipers, point to Circassian for evidence that the doctrine is false, while opponents, like Szemerényi, point to that same doctrine and its same Circassian evidence to prove that very small vowel systems are impossible.

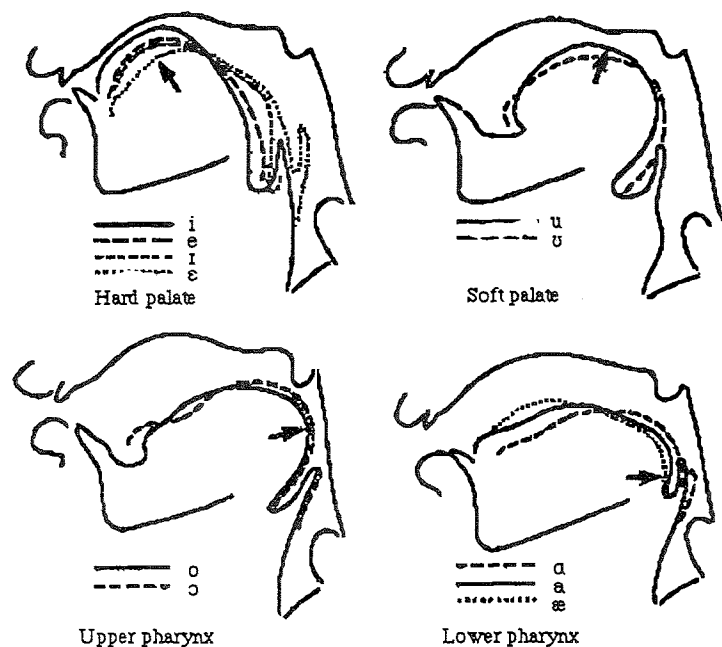


Figure 2. Lingual manoeuvres that shape the vocal tract for the four vowel classes (palatal [i-ε], palatovelar [u-u], pharyngovelar [o-ɔ], low pharyngeal [a-æ]). Cf. Figs. 2,3,4. From the same subject as Fig. 3 (bottom) and Fig. 4. From *Head and Neck Surgery*, eds. C. W. Cummings et al., C. V. Mosby, St. Louis, 1986, Vol. 3 p. 1781.

Vowel articulation

The revolutionary innovation of Bell's 1867 vowel model was what we know today as *central vowels* (Bell called them *mixed*) located between *front* and *back*. This *central* class was not just a simple pedagogical device. Bell claimed a scientific discovery that he tied into the single-cavity theory to explain the relationship between articulation and timbre. He postulated that the anterior cavity was tuned to a vowel timbre by locating a *configurative aperture* between the upper surface of the tongue and the roof of the mouth, somewhere along the *front* to *back* continuum of the hard and soft palates, and then by setting the magnitude of that aperture with an appropriate tongue *height*. This aperture was said to be

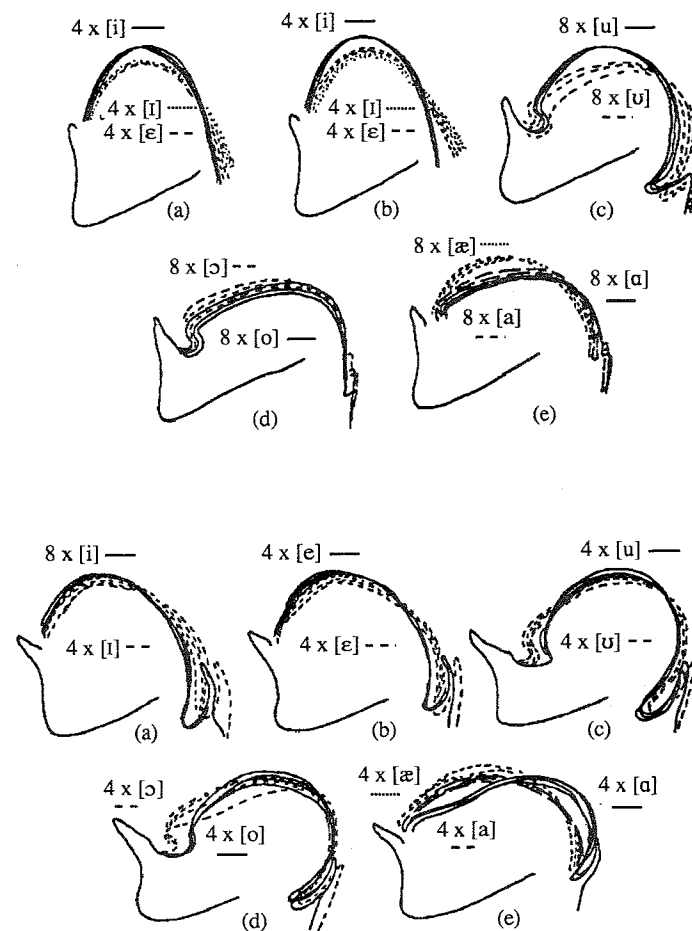


Figure 3. Postures of the tongue relative to the mandible by a Southern British English speaker (above), (a) slower speaking rate, (b) faster rate, (c-e) both rates, and by a speaker of Egyptian Arabic (below). For both subjects, the profiles are arranged according to the four vowel classes: (a,b) palatal, (c) palatovelar, (d) pharyngovelar, and (e) low pharyngeal (cf. Fig. 2). The different postures in tense-lax pairs are also illustrated. From Wood 1979.

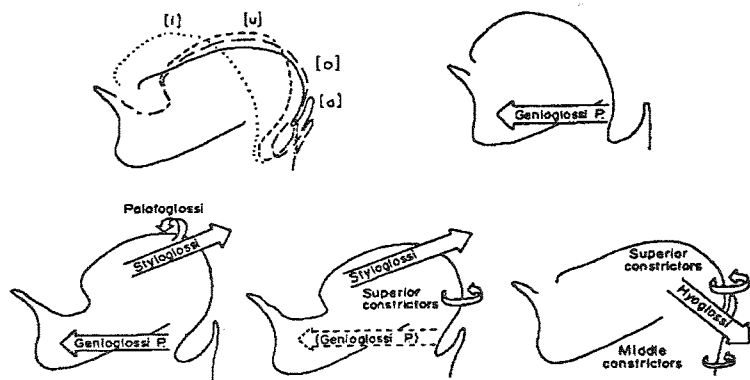


Figure 4. The direction of constriction of the extrinsic musculature of the tongue and of the pharyngeal constrictors, arranged according to their presumed activity for the formation of the four constriction locations (cf. Fig. 2). From Wood 1979.

finely adjusted by *advancing, retracting, raising* or *lowering* the tongue slightly. Unfortunately, the single-cavity theory (like its subsequent two-cavity extension) is too simplistic. It disregards the dependency of all the resonance modes on all parts of the vocal tract, it is blind to the quantal properties arising from the consequent discontinuities between gestures and spectral output, and the postulated articulatory correlates are not substantiated by x-ray analysis of speech manoeuvres (Wood 1987). Instead, analysis of x-ray motion films of speech (Wood 1979, 1982a) demonstrates four basic lingual movements for vowels (Figs. 2,3), and four corresponding constriction locations:

- (i) a palatal movement that narrows the passage along the hard palate for [i-ε,y-æ]-like vowels,
- (ii) a palatovelar movement that narrows the faucial passage for [u-u,ɯ]-like vowels,
- (iii) a pharyngovelar movement (i.e. uvular) that narrows the upper pharynx for [o-ɔ,ɣ]-like vowels,

	CONSTRICTION LOCATION			
	palatal	palato- velar	pharyngo- velar	low pharyngeal
pharyngeal	-	-	+	+
palatal	+	+	-	-
velar	-	+	+	-

Figure 5. Feature specifications for the four basic tongue body manoeuvres.

- (iv) a pharyngeal movement that narrows the lower pharynx for [ɑ,a,æ]-like vowels.

Within these four classes, vowel timbres are differentiated by coordinated local adjustments that bunch (tense) or flatten (relax) the tongue posture (Fig. 3), and that set an appropriate lip posture, mandible position and larynx height (Wood 1982b, 1986, in press). The muscular activity involved in these manoeuvres is illustrated in Fig. 4. The spectral consequences of these manoeuvres have been elucidated by reproducing them in model experiments, and they are readily understood by seeing the entire vocal tract as one continuous transmission system in which the respective standing waves of each resonance mode exhibit local sensitivities that are exploited by selectively aimed component gestures. The features used in this article are based on such component gestures and thus relate motor behaviour to the spectral output. These features are summarized in the next section. Feature specifications for the four basic tongue body manoeuvres are given in Fig. 5.

The tongue body features of the SPE quite correctly avoid *central* tongue positions since vowels are seen as only *back* or *nonback*. The four locations outlined above can therefore be translated into SPE categories as follows: (i) the palatal narrowing is *high* and *mid nonback*, (ii) the palatovelar narrowing is *high back*, (iii) the pharyngovelar narrowing is *mid back*, and (iv) the low pharyngeal narrowing is *low* (Fig. 6). Jaw opening is implicit in *height* in the SPE system, a property inherited from the Bell model where the jaw was seen as an encumbrance and explicitly excluded from being an independent parameter. Like the Bell model, the SPE sys-

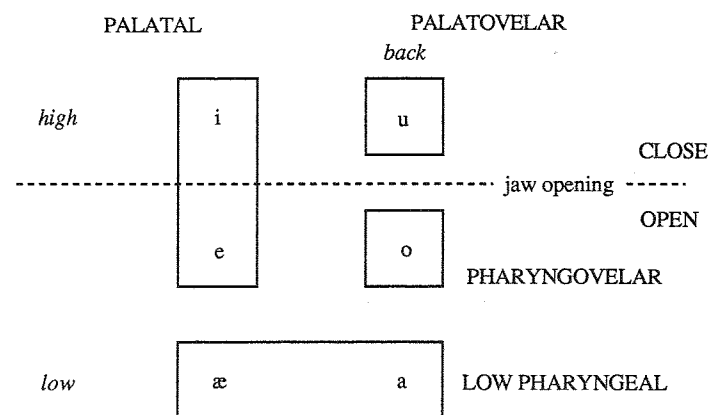


Figure 6. The relationship of the four vowel locations to the corresponding SPE features (*italics*).

tem cannot therefore combine *high* with *low* or with *mid* for the close pharyngeal and close pharyngovelar configurations found in x-ray data from Bulgarian (Wood & Pettersson 1988). It is suggested below that similar configurations may be relevant in Kabardian.

Articulatory features for vowels.

Pharyngeal refers to the hyoglossal and/or pharyngeal constrictor activity that (i) narrows the lower pharynx to raise F1 beyond 600 Hz for low pharyngeal [ɑ, a, æ]-like vowels, and (ii) is combined with **velar** to direct the tongue posteriorly into the upper pharynx for pharyngovelar [o, ɔ, ɣ]-like vowels (Figs. 5,6).

Palatal refers to the genioglossal activity that widens the lower pharynx and helps raise the tongue body in order to narrow the anterior palatal passage for palatal [i-ε, y-æ]-like vowels (F1 below about 550 Hz and F2 above about 1750 Hz); **palatal** is also combined with **velar** to direct the tongue anteriorly towards the faucial passage for palatovelar [u, u, u]-like vowels, and it is combined with **pharyngeal** to widen the low pharyngeal constriction to raise F2 beyond 1500 Hz for palatalized [æ-a]-like vowels (F1 still staying above 600 Hz).

Velar refers to the styloglossal activity that draws the tongue towards the nasopharynx; it is combined with (i) **palatal** in order to widen the lower pharynx (F1 below about 350 Hz) and to direct the tongue anteriorly towards the faucial passage where a palatovelar constriction is located precisely by the palatoglossi for [u-u, u]-like vowels, sensitive to tongue blade elevation which raises F2 beyond 1250 Hz and towards 1500 Hz, and (ii) with **pharyngeal** to direct the tongue posteriorly into the upper pharynx where a pharyngovelar constriction is located precisely by the superior pharyngeal constrictors (F2 about 800 Hz for rounded [o]-like vowels); the hyoglossi and middle pharyngeal constrictors remain inactive in order to keep the lower pharynx open (F1 lower than about 550 Hz for [o-ɔ]).

Open refers to the lower mandible position (usually 8-12 mm) of [e, ε, o, ɔ, a]-like vowels, compared to the higher position (usually 5-8 mm) of *close* [i, u, u]-like vowels; this varies the magnitude of the mouth opening and the position of the tongue relative to the palate and pharynx.

Tense refers to (i) increased activity in the lingual musculature for the more bunched tongue postures of e.g. [i, e, u, o] relative to [ɪ, ε, u, ɔ] respectively, and (ii) more laryngeal depression and increased labial activity for the more rounded lip posture of e.g. [u, o] relative to [u, ɔ].

THE KABARDIAN CONSONANTS: THE CONDITIONING ENVIRONMENTS

Table 1 lists the consonants according to the sources consulted. There are some obvious differences between Catford's report and the rest, although both Catford and Kuipers have had recourse to similar informants – Kuipers has natives of Nal'čik and Amman, Catford has a native of Nal'čik resident in Athens and a native of Amman. Kuipers states that the only differences between the Nal'čik and Amman dialects concern minor details of morphology.

The following comments refer to the numbered items in Table 1.

(1) The fricatives /ç', ç, ʒ/ are described as alveopalatal; neither /ç', ç, ʒ/ nor palato-alveolar /ʃ, ʒ/ are said to be palatalizing environments for Kabardian vowels; they are distinguished from the pure palatals (2,3,4) by being [+coronal].

(2) All the laterals are described as palatal fricatives; Catford recognizes their palatal character but does not include them in the palatalizing environment for vowels.

(3) All sources agree that these unrounded stops are purely palatal although typography is oftentimes simplified to k',k,g; Catford and Kuipers record that their subjects exhibit the recent innovation of affrication; Bagov et al. note that the change to palatal affricates is now complete.

(4) These fricatives are also palatal, but again typography is usually simplified to x,y or similar synonyms; the IPA has hitherto not distinguished between a voiced palatal fricative and the palatal semivowel, although there is now a proposal to do so, using the character j.

Kuipers has (2,3,4) as palatalizing environments for vowels; Catford reports (2,3,4) as palatals but gives only the semivowel /j/ as the palatalizing environment.

(6) Catford identifies the pharyngovelar stops differently but this is of no consequence for the uvularization of vowels.

(7) There is also a voiced pharyngeal fricative retained in loanwords from Arabic. Kuipers has the pharyngeals as a vowel *backing* environment for the *non-high* phoneme.

(8) Kuipers also has the laryngeals (but not the glottalized consonants) as optional *backing* environments for vowels. Uvularized or pharyngealized vowels in laryngeal environments cannot be instances of lingual assimilation since there is no apparent physiological reason for the tongue to be adjusted in response to vocal fold activity. Halle 1970 accommodates these environments by lumping (6,7,8) together as [+back], although laryngeals are usually undefined for tongue activity.

THE KABARDIAN VOWEL ASSIMILATIONS

The assimilations

The complementary distribution between the *mid* and *low* allophones in Kuipers' two-phoneme solution is seen in Fig. 7. Catford's informants (Fig. 8) are subject to some optionality, and with their three vowel phonemes they do not exhibit the same complementary distribution between their *mid* and *low* allophones (the *mid* [ɛ]-like allophone in Fig. 8 refers to "short a"). The following is found in Catford's sample of narrow transcription: the *high* phoneme is assimilated to any adjacent plain pharyngovelar and to all rounded palatovelars, whereas the *mid* phoneme is assimilated to post-vocalic pharyngovelars only, not to prevocalic pharyngovelars, and is not assimilated to any rounded palatovelar (the *lower* the phoneme, the less assimilation there seems to be). Each *height* appears to have its own assimilation rules for Catford's informants.

Table 1. Kabardian consonants according to Catford 1942, Kuipers 1960, Bagov et al. 1970 and Smeets 1984, retranscribed according to IPA conventions with the guidance of notes in the sources. The numbers refer to comments in the text. Assimilation environments according to Kuipers are (2-4,5,6,7,8), and according to Catford /j/ at (3), and (5,6). Kuipers classifies j,w as h^j,h^w respectively. The character j at (4) denotes a voiced palatal fricative.

	glottal	voiceless	voiced	sonorant	
	p'	p	b	m	
	f'	f	v		
	t'	t	d	n r	Catford interprets ts
	ts'	ts	dz		and dz as t+s and d+z
		s	z		
(1)	ɸ'	ɸ	ʒ		
		ʃ	ʒ		
(2)	ʎ'	ʎ	ʎ		
(3)	c'	c	ɟ	j	
(4)		ç	ʝ		
(5)		x ^w			
	k ^w '	k ^w	g ^w	w	
(6)	q'	q			Catford has q,q ^h and
	q ^w '	q ^w			q ^w ,q ^{wh} instead
		χ	ʁ		
		χ ^w	ʁ ^w		
(7)		h			
(8)	ʔ	h			
	ʔ ^w				

	VOWEL ASSIMILATION ENVIRONMENT				
	palatal c ç j etc	rounded kw qw etc	plain uvular q etc	pharyngeal h	elsewhere
high	i	ü/u	u		ə
mid low	e	ö/o	ɑ	ɑ	ɑ

Figure 7. The vowel assimilation allophones in Kuiper's two-phoneme solution, showing complementary distribution between the *mid* and *low* allophones of the *non-high* phoneme. The allophone [a] refers to "short a" and [ɑ] to "long a".

The default vowel allophones

The distinctive articulatory difference between Kuipers' two phonemes is the degree of jaw-opening, a close set of [i,ə,u,ʊ]-like allophones contrasting with an open set of [e,o,a,ɑ]-like allophones. This is reminiscent of Bulgarian, for which Wood & Pettersson 1988 found a close set of phonemes /i,u,ǎ/ contrasting with a non-close set /e,o,a/. The *highest* unassimilated variant is denoted [ə] by Kuipers, Smeets and Trubetskoy, and [i] by Catford. It is distinct from both [i] and [u]. I assume it might be something similar to the close [ɐ]-like pharyngeal configuration we found for the Bulgarian "indeterminate phoneme" /ǎ/. A close pharyngeal configuration cannot be expressed by the Bell model or the SPE system, where vowels cannot be simultaneously *high* and *low*.

The *lowest* unassimilated variant is denoted [æ] by Kuipers. But he clearly states he means a *central* vowel, for which an expected F2 would be about 1250 Hz, requiring a low pharyngeal constriction of at least 1 cm² (an even narrower pharyngeal passage would lower F2 to the 1000 Hz typical of darker [ɑ] while a wider passage would raise F2 towards the 1600 Hz more typical of true [æ]).

For the two-phoneme solution then, the default vowels may well be close pharyngeal and open pharyngeal, respectively. Unfortunately, this interpretation blocks the possibility of a three-phoneme solution, where, according to Catford, the default allophone for the *mid* phoneme is precisely [ɐ] (the "short a"). This brings us headlong against the physio-

	VOWEL ASSIMILATION ENVIRONMENT			
	palatal j	rounded kw qw etc	plain uvular q etc	elsewhere
high	i	u/ʊ	ə	i
mid	e	o/ɔ	ʌ	ɐ
low		ɒ	ɑ	ɑ

Figure 8. The vowel assimilation allophones in Catford's three-phoneme solution, showing no complementary distribution between the *mid* and *low* vowels. The allophone [ɐ] refers to "short a" and [ɒ,ɑ,ɑ] to "long a". In Catford's example of narrowly transcribed Kabardian, there are further constraints such that the *mid* phoneme is only assimilated to postvocalic (not prevocalic) pharyngovelars and is not assimilated to any rounded palatovelar.

logical weakness of the Bell model. The property that made Bell's model so attractive for so long was the postulated but unconfirmed *central* articulation between *front* and *back*, providing a vacant range of pigeon holes for classifying vowels like those under consideration here. It is perhaps telling that it has to be in a situation as controversial as the Kabardian vowel system that the confrontation is complete. The articulation of so-called *central* vowels obviously needs clarification.

The palatal allophones

The palatal assimilation occurs after any palatal consonant (semivowel, laterals, and stops or affricates) according to Kuipers, while Catford has only the semivowel /j/ in the palatalizing environment.

Both state that the palatal assimilation is overridden by a postvocalic rounded consonant, which instead triggers labial assimilation. Kuipers describes these allophones as *half-rounded central* [ü,ö] rather than the labiovelar [u,o]-like allophones found in nonpalatal environments, so I take it he does not mean they are palatal [y,ø] (i.e. rounding superimposed on the palatal allophones). Catford, in contrast, reports just [u,o], as in any other rounded environment.

The palatovelar and pharyngovelar assimilations

The *high* unrounded pharyngovelar allophone, denoted [y] by Kuipers, is described as *back* and is presumably an [ɯ]-like vowel parallel to the [u] appearing in rounded environments. Catford denotes the same allophone [ə], although he obviously does not mean schwa. I presume for now, like Halle 1970, that this allophone is related to an [ɯ]-like timbre.

The adjustments to the palatovelar and pharyngovelar environments turn out to be less straightforward than might be expected. If the *high* [u,ɯ]-like allophones are palatovelar, then they acquire a palatal component not present in pharyngovelar environments. Similarly, the *non-high* [o]-like allophone seems to acquire a pharyngeal component not present in palatovelar environments.

A possible solution to this anomaly, prompted by our model experiments on vowel reduction in Bulgarian, is based on the finding there that narrowing the jaw and lip opening of a pharyngovelar [o]-like configuration shifts the spectrum to that of [u] without the internal configuration being altered to palatovelar. The spectral outputs of close rounded palatovelar configurations and close rounded pharyngovelar configurations are ambiguous (note also that the close pharyngovelar configuration cannot be expressed by the Bell model, where vowels cannot be simultaneously *high* and *mid*). I hypothesize that something similar is going on in Kabardian pharyngovelar assimilation.

Similarly, the dark [ɑ]-like allophone does not seem to acquire a *velar* component that is present in the palatovelar and pharyngovelar environments, although the rounded [o]-like allophone does. Catford agrees with Kuipers that the *low* allophone is dark [ɑ], while his *mid* allophone [ʌ] is presumably expected to acquire the velar component. The dark [ɑ]-like timbre requires additional low pharyngeal narrowing that lowers F2 to around 1000 Hz, rather than a velar component, i.e. it would be tense relative to the default open allophone [a]. Here again, it is possible that there is some spectral ambiguity between the respective acoustic outputs of unrounded pharyngovelar and unrounded low pharyngeal vowels. The SPE is faced with the same problem in the pharyngovelar *mid back* environment. The plain allophone is unexpectedly *low* [ɑ] (i.e. no pharyngovelar assimilation) although the rounded allophone is assimilated to *mid* [o]. The *mid back* and *low back* vowels are particularly difficult to describe, whether by acoustics or articulation (see e.g. Jespersen 1897,480

written just a few decades after Bell 1867). More data is required on these Kabardian allophones to clarify these issues.

Pharyngeal assimilation

Kuipers also reports the [ɑ]-like allophone when the open phoneme is preceded by the pharyngeal /h/. Catford does not report this assimilation, and has the default allophones instead.

DISCUSSION AND CONCLUSIONS

Reliability of the reported data

It has been taken for granted here that the reported differences between Kuipers' and Catford's informants reflect genuine variation in Kabardian speech in the form of individual mixes of optional perseveratory and anticipatory assimilations. The difference between the two phoneme solutions poses a more serious problem, especially since the informants have the same regional background. The controversy regarding the Kabardian vowel phonemes would suddenly become trivial if it turned out that the various disputed phoneme solutions actually exist side by side in different speakers of the same dialects. That is not what is happening of course. It all depends on how "short *a*" is interpreted - paired off with "long *a*" in one *non-high* phoneme, or, by virtue of its timbre, included in a *mid* phoneme contrasting with "long *a*" in a separate *low* phoneme.

The assimilations

Kuipers' account is more general: there is perseveratory palatal assimilation, perseveratory velar assimilation after plain pharyngovelars, perseveratory labiovelar assimilation after rounded consonants, and anticipatory labiovelar assimilation to following rounded consonants. The assimilations reported by Catford are more idiosyncratic - the palatal environment is limited, and labial assimilation is optional when there is just one adjacent rounded consonant. The informant exemplified in Catford's narrow transcription sample has different assimilation patterns for each *height* and therefore requires rules to cover all situations.

The simplest general rule would just assimilate all place features and rounding of any adjacent segment. But this would immediately lead to a conflict between differing prevocalic and postvocalic environments, which can only be resolved by stipulating some priorities. Kuipers' and Catford's accounts distinguish between (i) perseveratory lingual and labial

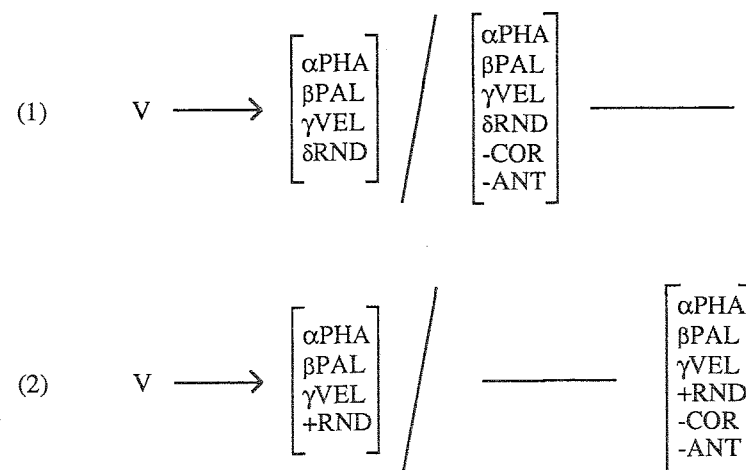
	PREVOCALIC ENVIRONMENT				
	pal	pal-vel	phar-vel	low phar	other
vowel output	i e	u (o)	(u u) (ɤ) o	(a)	ɐ a
phar	- -	- -	+ + +	+	+ +
palatal	+ +	+ +	- - - -	-	- -
velar	- -	+ +	+ + + +	-	- -
round	- -	+ +	- + - +	-	- -
open	- +	- +	- - + +	+	- +

Figure 9. The output of Rule (1). The outputs in brackets are discussed in the text.

assimilation to prevocalic palatals, palatovelars and pharyngovelars, and (ii) overriding anticipatory place and rounding assimilation to postvocalic rounded palatovelars and pharyngovelars.

Rule (1) assumes that the spectral output of palatovelar and pharyngovelar configurations is ambiguous for the same rounding and openness, as discussed above, and that both will produce [u] or [u]-like timbres for the close phoneme in pharyngovelar environments and [o] for the open phoneme in rounded palatovelar environments (Fig. 9). The open [ɐ]-like allophone (Fig. 9) is incorrect, as discussed previously, since dark [ɑ] is reported. This is the anomalous situation where the open vowel does not seem to assimilate the velar component from the unrounded environment, but gets more of its pharyngeal self instead (i.e. the pharyngeal gesture is tensed). This can be checked in model experiments. Above all, both these situations will be checked by spectral analysis of Kabardian speech.

Rule (2) overrides the output of Rule (1) when the postvocalic consonant is round, adding roundness to the vowel and adjusting the tongue body: This will also generate [u] for the close phoneme and [o] for the open phoneme, assuming the same spectral ambiguity between rounded palatovelar and rounded pharyngovelar configurations at the same degree of openness.



Stop press

I have just seen Choi's 1990 report on a phonetic study of the Kabardian vowels. He finds three spectrally distinct sets, with low, medium and high F1 frequencies respectively, corresponding to the previously reported *high*, *mid* and *low* sets of allophones, and, like Catford 1977, he finds the duration of "long a" to be inherently proportional to *height* rather than to a quantity contrast (confirming again Trubetskoys argument against incorporating the *mid* and *low* allophones into one phoneme). That approach takes care of Jakovlev's two-phoneme solution, but not Kuipers', where one either accepts the postulated glide+V generalization (e.g. like Halle) or one does not (e.g. like Kumaxov).

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