Minimality and Syllabification in Kabardian

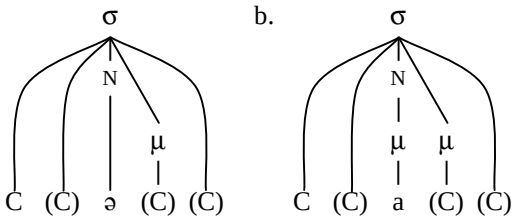
Tyler Peterson
University of British Columbia

1.0 Introduction

Most previous studies in Kabardian phonology have focused primarily on the controversy surrounding its phonemic vowel system and the distribution and status of epenthetic schwa (Kuipers 1960; Halle 1970; S. Anderson 1978; Colarusso 1988, 1992; Wood 1991; J. Anderson 1991; Choi 1991), while neglecting to adequately address both the surface syllable structure and consonant clustering properties of the language (but see Kuipers 1960; Anderson 1978; Padgett 1995). This paper presents a preliminary account of the Kabardian syllable, based on the hypothesis that prosodic structure in the phonology of the language bears directly on the properties governing the distribution of epenthetic schwa and how it interacts with language-internal conditions on consonant clustering. The principal motivation for adopting this hypothesis is that universal principles of syllable well-formedness and proper headedness within the prosodic hierarchy can account for the empirical surface forms found in Kabardian, revealing a regular CV:/CVC-type syllable. Two proposals follow from this hypothesis: first, that Kabardian has only one underlying vowel, [a], which must be specified underlyingly while schwa's distribution can be wholly predicted from the morphology, prosody and other factors regarding the properties of consonant clusters. Secondly, the Kabardian syllable is subject to a type of minimality condition, whereby moraic weight must be independently realized in the prosodic structure – regardless of the moraic weight that can be presumably provided by a vowel – thus accounting for a prevalent and predictable gemination pattern found in the language.

This approach to deriving Kabardian surface forms suggests that syllable structure must recognize both nuclear headedness and moraic weight as independent structural properties (Shaw 1993, 1996). This produces the following core syllable canons for Kabardian:

(1) a. b.



A key feature of (1) is that only [a] projects a nuclear mora, while [ə] is non-moraic, or 'weightless', and thus headed directly by a N(ucleus). This moraic/non-moraic distinction can also capture many apparent asymmetries between the surface distribution of [a] and [ə]. It follows from (1) that schwa and its surface allophones are never 'long'. Moraic [a] and its allophones can surface long through coda assimilation and subsequent compensatory lengthening, as a coda mora and consonant will always be independently realized through the satisfaction of a language-specific minimality condition on syllable structure. Thus, all weight-effects are derived: bimoraic low vowels such as [aː] which do surface in the language, can only be derived by the assimilation of a coda consonant and its mora, usually the effect of stress on that syllable. (1)a. also illustrates that moraic weight within the syllable is independent of a mora-less schwa. It will be shown in the following analysis that the distribution of a moraic coda is not only autonomous from the nucleus, but an obligatory component of the Kabardian syllable.

After an overview in the next section of some of the observations on the segment, morpheme and syllable in Kabardian, section 3.0 and 3.1 present the groundwork of an analysis within the Optimality Theoretic framework. This includes building the foundations for syllable structure through a set of universally motivated constraints and how they interact with the relevant issues in Kabardian – specifically, morpheme integrity and consonant clusters. Section 3.2 demonstrates how this analysis be extended to account for the pattern of coda gemination found in the language, also known as 'onset-copying'; while section 3.3 discusses how morpheme integrity can play a critical role in syllabification. Section 3.4 shows how this impacts the Kabardian lexicon of minimal roots and their respective surface forms. Section 4.0 concludes by discussing some of the theoretical and typological implications of this analysis.

2.0 The Segment and Morpheme

The phonemic inventory of Kabardian is well documented for its propensity for consonants and paucity of phonemic vowels (Kuipers 1960; Colarusso 1988, 1992; Smeets 1984; Wood 1991):

Table 1: Kabardian Consonant Inventory (Wood 1991; Colarusso, 1992)

Plosive	b		d				ɟ	gʷ						
	p		t				c	kʷ	q	qʷ		ʔ	ʔʷ	
Glottal Ejective	pʼ	fʼ	tʼ	t͡sʼ	ɬʼ		ɕʼ	cʼ	kʼʷ	qʼ	qʼʷ			
Fricative		v	z	d͡z	ɮ	ʒ	ʑ	ɟ		ʁ	ʁʷ	ʕ	(ɦ)	
		f	s	t͡s	ɬ	ʃ	ɕ	ç	xʷ	χ	χʷ	ħ	h	
Resonants	m		n, r					y	w					

There are three natural classes of within the Kabardian consonant inventory that can be defined in terms of the laryngeal features Voice and Glottalization. Tautosyllabic consonantal clusters occur under the condition that the laryngeal feature is constant across the consonant cluster. This is formalized as the following principle:

(2) *Laryngeal Feature Agreement (LFA)* (adapted from Colarusso 1992)
Each consonant segment C in Σ, where Σ is a tautosyllabic consonant cluster, must agree in the laryngeal features VOICE and GLOTTALIZATION.

The LFA principle in (2) makes use of the notation 'Σ' (adapted from Kuipers 1960), where Σ is theoretically any number of consonant segments agreeing in the laryngeal features VOICE and GLOTTALIZATION, if the occur in the same syllable. This expression of Σ is made with reference to prosody, but throughout this paper 'Σ' will also be used to refer to any group of pre-syllabified tautomorphemic consonants: /Σ(a)/ = /C*(a)/. Morphemes that have a string of consonant segments C* that do not agree in laryngeal features will be represented as *non-harmonic* Σ*-morphemes* (Σ^{NH}) such as /fz/ *'woman'*, as opposed to *harmonic* Σ*-morphemes* (Σ^{H}) like /pɬ/ *'to look'*.

Another unique feature of this and other Caucasian languages (such as and Shapsug) is the apparent lack of phonemic vowels. This is controversial, and has been the source of much discussion and disagreement amongst Kabardian scholars. The details are complex and it would take us too far afield to consider each point in turn (see Chirikba, 1996: 50), but essentially the controversy has been fuelled by the disagreement as to whether there are two underlying vowels, /ə, a/, or three /ɨ, ə, a/. These vowels can be distinguished solely by height in the vowel space and hence known as an example of a 'vertical' vowel inventory, or a phonemic vowel system lacking any F2 contrasts (Flemming 2003). Trubetzkoy (1925) initially posited the three vowel inventory (roughly maintained by Choi 1991). Chirikba (1996:51) also claimed a variant of the three vowel system, where /a, a, ə/ represent distinctive degrees of 'openness' (and reconstructed for proto-Common West Circassian). A two-vowel analysis by Kuipers (1960) analyzed the low vowel /a/ as being derived from /ah/ – the result of which is essentially a 'voweless' system. Anderson (1978) takes up Kuipers' approach, suggesting that all the surface vowels can be predicted from the phonology. Out of this debate, there is one important generalization that can be extracted: vowels are contrastive only in height, as there are no positions in which a distinct and contrastive vocalic element surfaces except along the

height dimension. This two-way height contrast is maintained (roughly) by the phonetic allophones of [a] and [ə] on the surface.

An informal analysis of Kabardian lexicon reveals that a large portion of the morphemes are mono or bi-segmental (3) - (5), as practically every segment and cluster is a morpheme (6) - (8). These morphemes also form a minimal pair contrast along the /a/-/ə/ dimension (data from Kuipers 1960: 82):

(3)	/f/	[fə]	'rotting'	/fa/	[fa]	'skin'
(4)	/v/	[və]	'ox'	/va/	[va]	'ploughing'
(5)	/x^{w}/	[x^{w}ə]	‘millet’	/x^{w}a/	[x^{w}a]	‘sinew’
(6)	/ps/	[psə]	'water'	/psa/	[psa]	'soul'
(7)	/tχ^{w}/	[tχ^{w}ə]	‘butter’	/tχ^{w}a/	[tχ^{w}a]	'grey'
(8)	/p’c’/	[p’c’ə]	'pounding'	/p’c’a/	[p’c’a]	'garret'

Kuipers (1960) states that nearly all of these forms are free words, suggesting the minimal word in Kabardian is [Σ{ə,a}].

2.1 Syllable Structure: Preliminary Observations[1]

Colarusso (1992) states that syllables can begin or end in any of the clusters. Medial syllables must be closed by either an overt coda (9) or, if no consonant is available, by ‘copying’ the following onset as a coda (10). He characterizes this as a ‘light gemination’ effect:

(9) /∅-ʒ-f-ʔa-n-ɕ/ → [ʒɪf.ʔɛnɕ] (Colarusso 1992:8b)
3-back-2pl-say-FUT-AFF
'you (pl) will say it'

(10) /w-q’-t-da-k’^{w}-a-aʁ-ɕ/ → [wəq’.q’əd.da k’^{w}.k’^{w}aːɕ] (Colarusso 1992:8d)
you-HOR-us-with-move-INTR-PAST-AFF
'you came with us'

Lopatinskii (1891, noted in Kuipers 1960) first noticed this gemination-type effect in consonants, and offers numerous (impressionistic) examples.

[1] All of the underlying forms in this paper are my adaptations of the data reflecting the hypothesis that schwa is not underlying; i.e. Colarusso’s forms for (9) and (10): /∅-ʒə-f-ʔa-n-ɕ/ and /wə-q’ə-t-da-k’^{w}ə-a-aʁ-ɕ/ respectively. Also, surfaces allophone of schwa (i.e. [ɪ, ɛ]) are used.

Catford (1942:17) transcribed this geminate-type effect in his studies: /qʾasa/ → [qʾas.sa] 'he arrived'. Kuipers corroborates Lopatinskii's and Catford's impressions: "Both the voiceless and voiced consonants…sound somewhat emphatic in Kabardian, and when occurring alone (i.e. not in groups) they often make the impression of geminates." (1960:19). These observations will form the empirical foundation for the proposal that there is a minimality requirement on the Kabardian syllable, causing a gemination-type effect on coda consonants.

3.0 A phonological Approach

The first step in approaching an analysis of the Kabardian syllable is determining the prosodic affiliation of segments. With such a large number of potential consonant clusters, it is not always possible to rely on tests such as sonority sequencing to determine syllabic affiliation (cf. Lushootseed, Urbanczyk 1996; hən'q'əmin'əm', Shaw 2002). The syllabification of /C*/ is not always so straightforward: segments can be grouped together to form complex onsets or codas, or when medial, belong to separate syllables. Given the extensive inventory of consonants and clusters in Kabardian, the following approach suggests that it may be more economical (and ultimately more explanatory) to examine exactly what *cannot* surface as a licit cluster in the language, rather than deriving surface cluster forms from various syntagmatic constraints on sonority, manner and place. This leads to the present proposal that will be developed in this section: to approach consonant clusters paradigmatically as represented by the prosody, and through principles of syllabification and syllable well-formedness. It is also through a discussion of the Kabardian syllable and these principles that govern its formation, that we may re-engage in the debate regarding epenthetic schwa.

Kuipers (1960) was the first to propose that there are no underlying vowels in Kabardian, claiming instead that the surface distribution of all vowels (including /a/) can be derived from sets of extrinsically ordered rules (involving glide consonants and metathesis). Colarusso (1992) maintains that at least one vowel, /a/, at the very least must be present underlyingly as its distribution cannot be predicted. Colarusso is doubtful of the possibility of predicting the epenthetic distribution of schwa, offering various arguments for this, including minimal pair contrasts between schwa and /a/, problems with overgeneration and epenthetic schwa, exceptions to schwa realization, and certain ambisyllabic errors (involving so-called 'onset-copying'). It will be demonstrated that a prosodic approach cuts the underlying vs. derived vowel hypothesis down the middle: adopting Colarusso's argument, /a/'s distribution can't be predicted, due to the lexical contrasts between /Σa/-/Σ/ (cf. (3)(8)). However, siding with Kuipers, schwa's distribution can be

wholly derived, not through rule application, but rather through standard operations of syllabification.

A core assumption is made that prosodic structure includes the notion of weight as encoded by the mora (Hyman 1985; Hayes 1989). Weight is not encoded underlyingly but rather derived through mora projection: the only underlying vowel, /a/, projects a mora while [ə] has no moraic status. Secondly, as vowels, both are headed by N(ucleus).[2] Standard syllabification can proceed: pre-vocalic elements will be parsed as onsets and any available post-vocalic consonant as a moraic coda. Syllabification can also be predicted on independent grounds mediated by universal conditions on syllable well-formedness. These crucially include two notions: syllable headedness (11), and structure (12):

(11) PROPHEAD (Itô and Mester 1994, Shaw 2002):
PROPHEAD-PRWD ⊃ PROPHEAD-Φ ⊃ PROPHEAD-σ ⊃ PROPHEAD-N
a. PROPHEAD-PrWd: A Prosodic Word (PrWd) is headed by a Foot (Φ)
b. PROPHEAD-Φ: A Foot is headed by a Syllable (σ)
c. PROPHEAD-σ: A Syllable is headed by a Nucleus (N)
d. PROPHEAD-N: A Nucleus is headed by a mora (μ) *or* V(owel)

(12) σ/μ
Syllables must have weight (as encoded by the mora)[3] (Shaw 1996, 2002)

(11) is a class of constraints that expresses the notion that, while each of the component constraints in a.-d. is independently violable, they are in an entailment relation (⊃) such that the satisfaction of PROPHEAD at each successively higher level of prosodic structure is directly dependent on the satisfaction of PROPHEAD in one of the constituents it immediately dominates (Shaw *to appear*). It will be built into the definition of PROPHEAD-N that only vowels can head a nucleus in Kabardian – if no

[2] I will assume without further motivation that the featureless properties of schwa are what distinguishes it as being non-moraic. However, it consists of just of enough featural material to be identified as a vowel, hence parsed to a Nucleus.

[3] The slash '/' means 'headed by'. i.e. α/β is interpreted 'α is headed by β' or 'a syllable is headed by a nucleus: σ/N'. However, generalizing from the notion of headedness, I will extend the slash notation to denote two other types of prosodic representation: one to more broadly mean any kind of dominance relation: i.e. α/β = β is dominated by α or 'σ/μ: a mora is dominated by a syllable'. The second is parsing, where α/β = β is parsed to α or 'σ/μ: a mora is parsed to a syllable'.

vowel is available to head a nucleus, schwa is epenthesized to provide one. This re-stated in (13):[4]

(13) σ/N (PROPHEAD-N)
A Syllable (σ) is headed by a Nucleus (N)

What is crucial is that the weight requirement stipulated by (12) is independent of the nucleus requirement of (13), insofar as the moraic nucleus that derives [a], as shown in (14)a.'', will *not* satisfy σ/μ:

(14) a. σ → a.' σ a.'' σ
N N N
(μ) μ
V [ə] [a]

Given (11)d., only vowels can head a nucleus in Kabardian – if no vowel is available to head a nucleus, schwa is epenthesized to provide one. DEP-NUC is then activated to constrain the addition of a nucleus to the syllable:

(15) DEP-NUC
Every nucleus in the Output has a corresponding nucleus in the Input.

Colarusso (1992: 24, 25) in his opening arguments against the predictability of schwa offers the following minimal pairs:

(16) a. /pɬ/ → [pɬə] 'to look'
b. /p-ɬ/ → [pəɬ] nose-lie 'to lie near something'

On the surface there is indeed a contrast between (16)a. and (16)b., but the two share the same epenthetic properties: In the monomorphemic /pɬ/ → [pɬə], the epenthetic schwa surfaces on the right edge of the morpheme. In /p-ɬ/ → [pəɬ] the schwa also surfaces on the right edge, but on the first morpheme instead of the second. Both epenthesize schwa in order to satisfy

[4] I will assume there is preference for sonorous nuclei, possibly captured by the PEAK hierarchy of constraints (cf. Prince and Smolensky 1993), where schwas are sonorous enough to serve as a nucleus but consonants aren't.

σ/N, but in (16)b. σ/μ will always prefer that epenthesis take place where it can be satisfied with a consonant segment to parse to it. However, (16) also provides evidence that segment contiguity in monomorphemic forms is respected. This will be reflected in (17):

(17) CONTIGUITY$_{MCAT}$
The segments of any given Morphological Category (MCat) contiguous in the Input are contiguous in the Output.

To see how this works, consider (18):

(18) /p-ɬ/ → [pəɬ]; /pɬ/ → [pɬə]

/p-ɬ/		σ/N	CONTIG$_{MCAT}$	σ/μ	DEP-NUC
a.	[pɬ]	*		(*)	
b.	[pɬə]			*	*
c.	[pə.ɬə]			*	**
d.	[pəɬ.ɬə]				**
e. ✌	[pəɬ]				*
/pɬ/		σ-NUC	CONTIG$_{MCAT}$	σ-MORA	DEP-NUC
f.	[pɬ]	*		(*)	
g.	[pəɬ]		*		*
h. ✌	[pɬə]			*	*

This is the core constraint set driving syllabification and schwa epenthesis in Kabardian: i) syllables require a nucleus, and this is presumed to be undominated and inviolable. ii) Maintaining morpheme contiguity is as important as providing a nucleus (σ/N co-ranked with CONTIG$_{MCAT}$); and by extension, morpheme contiguity is more important than providing coda (CONTIG$_{MCAT}$ ⪢ σ/μ). Lowly ranked DEP-NUC is necessarily the most violable, and left to control overgenerating the epenthesis of schwa.

3.1 Consonant Clusters and Syllabification: AGREE

The examples in (16) belong to the Σ^{H} class of roots, as the tautomorphemic segments in /pɬ/ satisfy the LFA. The examples in (19)-(21) are members of the Σ^{NH} class of roots, or roots that contain consonant clusters which do not agree in laryngeal features:

(19) /fz/ [fɪz] 'woman' (Colarusso 1992:16a)
(20) /ʃkʼ^{w}mpʼ/ [ʃkʼ^{w}əmpʼ] 'bad egg' (Kuipers 1960:28)
(21) /mɮ/ [mɪɮ] 'ice' (Colarusso 1992:16b)

These represent a class of examples where epenthesis is expected but does not occur, and where epenthesis occurs but is not expected. However, all Σ^{NH} roots such as those in (19)-(21) violate $\text{CONTIG}_{\text{MCAT}}$ and show an interaction between the LFA and epenthesis:

Table 2

	Actual SR	*Expected SR*	*LFA*	*Epenthesis*	*$\text{CONTIG}_{\text{MCAT}}$*
/fz/	[fɪz]	*[fzɪ]	×	yes	*
/ʃkʼʷmpʼ/	[ʃkʼʷəmpʼ]	*[ʃkʼʷəməpʼ]	×	no	*
/mɬ/	[mɪɬ]	*[mɬɪ]	✓	yes	*

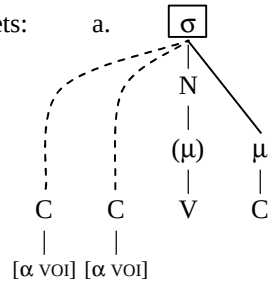
However, how does a cluster adhere to the phonotactic constraint reflected in the LFA? Consider (19), where, given the analysis presented so far, *[fzɪ] would be the predicted outcome. The higher ranked $\text{CONTIG}_{\text{MCAT}}$ would ensure against tautomorphemic epenthesis. However, in *[fzɪ], the surface onset cluster *[fz…] violates LFA, as the complex onset cluster segments (once parsed as a syllable) differ in voice. This reference to prosody forms the forth core constraint for syllabification in Kabardian: prosody determines where LFA applies. This is implemented as an agreement-type constraint on adjacent segments in a consonant cluster:

(22) AGREE
Adjacent consonants parsed to the same prosodic level must agree for one of two laryngeal features: Voice and Glottalization.

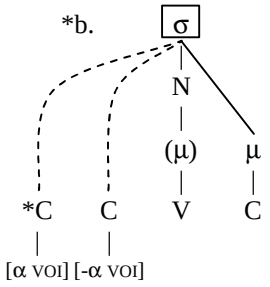
The notion motivating this proposal is that root node laryngeal features such as [CONSTRICTED GLOTTIS] and [VOICE] can be viewed as direct properties of onsets, rhymes and nuclei and not features of segments themselves (Golston and van der Hulst 2000). Alternatively, laryngeal features are licensed not by root nodes but by higher syllabic nodes.[5] Adopting this concept in principle, AGREE states that a segment's laryngeal features must share the same specification as every other segment's laryngeal features parsed to that prosodic node. This is schematized:

[5] See Golston and van der Hulst, 2000, for details and motivation. In their model, laryngeal features are licensed by nodes that mediate between the segment and syllable, i.e. a segment is parsed to an ONSET node that is then parsed to the syllable.

(23) Onsets: a.



*b.



*[fz…] as a complex onset does not share the same specification for [VOICE] at the prosodic node they are parsed to: (σ). The solution is that they are separated through schwa epenthesis, achieved by AGREE, which must crucially dominate $\text{CONTIG}_{\text{MCAT}}$:[6]

(24) /fz/ → [fɪz]

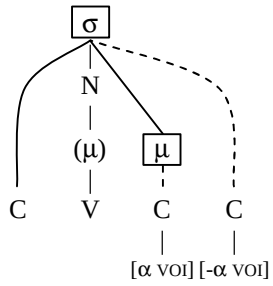
		σ/N	AGREE	$\text{CONTIG}_{\text{MCAT}}$	σ/μ	DEP-NUC
a.	[fz]	*!	*		(*)	
b.	[fzɪ]		*		*	*
c.	[fɪ.zɪ]			I	**	**
d	[fɪz.zɪ]			I	*	**
e. ✌	[fɪz]			I		*

In (20) [ʃkʼʷəmpʼ], the onset consonant sequence [ʃkʼʷ…] adheres to AGREE, as the cluster agrees in voice parsed at the syllable level.[7] If the next consonant in the underlying string [ʃkʼʷm…] was included in the complex onset, AGREE would be violated and epenthesis occurs. However, the resulting coda consonant cluster segments […mpʼ] also do not share the same laryngeal features. This forms a licit coda sequence on the surface because onset/coda asymmetries are captured through the prosodic application of AGREE, in the post-nuclear position of the syllable:

[6] Voice assimilation or deletion are possible alternative strategies to epenthesis: [fsi]. I would assume laryngeal (voice) assimilation be ruled out by highly-ranked faithfulness constraints (i.e. IDENT(LAR.), MAXC ⪢ $\text{CONTIG}_{\text{MCAT}}$).

[7] However, the complex onset, [ʃkʼʷ…] doesn't agree for constricted glottis. I'll set this issue aside, suggesting that [ʃ] may be in fact extra-prosodic, possibly parsed to a higher prosodic node.

(25) Codas:



The coda consonant adjacent to the nucleus is parsed to the coda mora, while the peripheral consonant is parsed directly to the syllable node. Since these two adjacent consonants are headed by different prosodic nodes, AGREE is satisfied and must crucially dominate $\text{CONTIG}_{\text{MCAT}}$ in order to drive epenthesis. This can be observed in tableau (26):

(26) /ʃkʼʷmpʼ/ → [ʃkʼʷəmpʼ]

		σ/N	AGREE	$\text{CONTIG}_{\text{MCAT}}$	σ/μ	DEP-NUC
a.	[ʃkʼʷmpʼ]	*	**		*	
b.	[ʃkʼʷməpʼ]		*	ə		*
c.	[ʃəkʼʷ.kʼʷəmpʼ]			əə		**
d. ✌	[ʃkʼʷəmpʼ]			ə		*

Resonant-obstruent behaviour in clusters, on the other hand, can follow from constraints from the Sonority Hierarchy, where *RO]$_{\sigma}$ is the least marked complex coda from the $\text{COMPLEX}^{\text{CODA}}$ family of constraints: *OR]$_{\sigma}$ ⩥ *OO]$_{\sigma}$ ⩥ *RO]$_{\sigma}$. Likewise in onset clusters containing potential RO sequences, where all instances of resonants occurring in onset and coda clusters with obstruents can be reduced to syllable-edge, cluster markedness hierarchies. (see Shaw 2002 for details.) This can be observed in /mɮ/, where the two morpheme segments agree for voice, satisfying AGREE parsed to the syllable node as a complex onset, but epenthesis occurs: [mɪɮ]. This reflects the activation of the prosodic markedness constraint against syllable initial RO sequences, the highest ranked member of the $\text{COMPLEX}^{\text{ONSET}}$ family of constraints:

(27) *$_{\sigma}$[RO (Shaw 2002)
A Resonant-Obstruent cluster cannot occur at the left edge of a syllable.

*$_{\sigma}$[RO must be at least ranked with AGREE in order to ensure the grammatical output [mɪɮ]:

(28) /mɮ/ → [mɪɮ]

		σ/N	AGREE	*σ[RO	CONTIG$_{MCAT}$	σ/μ	DEP-NUC
a.	[mɮ]	*				(*)	
b.	[mɮɪ]			*		*	*
c. ✌	[mɪɮ]				ɪ		*

Two key observations have emerged from this analysis so far: i) Kabardian is regular and predictable in its prosodic structure: CVC ii) A foundation for syllable structure can be built upon the interaction of five primary and cross-linguistically motivated constraints, integrating prosodic headedness and weight with morpheme contiguity: σ/N, AGREE, *$_σ$[RO ⩾ CONTIG$_{MCAT}$ ⩾ σ/μ ⩾ DEP-NUC. One constraint on syllable markedness is needed, *$_σ$[RO, co-ranked with AGREE (and never violated), as both are constraints on output cluster well-formedness.

3.2 Onset-Copying and s-MORA

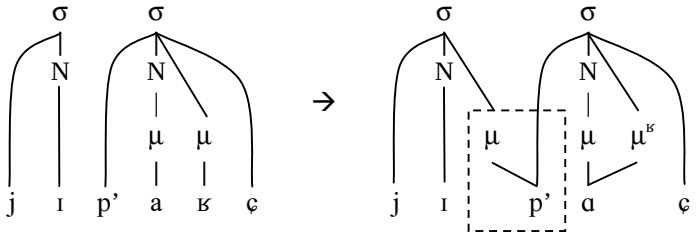
While only σ/N is active in Σ^{H} roots such as (16)a. /pɬ/ → [pɬə] (and σ/μ necessarily violated), both σ/N and σ/μ are active in forms such as (16)b. /p/-/ɬ/ → [pəɬ], with σ/μ crucially determining [pəɬ] ≻ [pɬə]. This is of the desirable effects of σ/μ in that it can work in tandem with σ/N in capturing schwa's distribution. σ/N and σ/μ are independently required by conditions on syllable proper-headedness and well-formedness, and the satisfaction of these constraints will always yield the linear order [Cə$^{σ/N}$ C$^{σ/μ}$]. While /p/-/ɬ/ → *[pɬə] could actually be a legitimate output to (16)b. (with all higher constraints satisfied), σ/μ will prefer epenthesis where a coda consonant can be parsed ([…ɬ$^{σ/μ}$]^{σ}), driving the epenthetic schwa to the left of any final consonant. In other words, σ/N provides a nucleus if none exists, σ/μ functions in directing the surface position of this nucleus (when AGREE and CONTIG$_{MCAT}$ are indifferent), as both operate in parallel. What is notable is that forms such as /p/-/ɬ/ → [pəɬ] satisfy AGREE and could be become a legitimate onset, and from a cross-linguistic perspective this would seem to counter the generalization that syllables prefer to be open, maximally syllabifying consonantal material as (complex) onsets where possible. This is preference for closed syllables is a prevalent feature in Kabardian, and this section presents further evidence that σ/μ plays an additional, independently motivated role in the analysis presented so far: A Kabardian syllable requires a weighted (moraic) coda, regardless of the presence of a moraic nucleus. However, what if there is no available consonant? σ/μ strives to be satisfied, and a mora will be inserted despite the lack of any existing, underlying

segment that could serve as a coda. The result of this are shown in (29), where a gemination effect can be observed:

(29) /∅-j-p'-aʁ-ɕ/ → [jɪp'.p'ά:ɕ] *[jɪ.p'ά:ɕ] (Kuipers 1960:19, fn. 2)
3-3-educate-PAST-AFF
'he educated him'

Considering the sequence [jp'…] could not serve as a legitimate onset (violating AGREE for disharmonic laryngeal features parsed to the same prosodic node), schwa (surfacing as [ɪ]) would be inserted to break up the sequence and provide the syllable with a head (σ/N). Yet the result is ungrammatical: *[jɪ.p'ά:ɕ]. Colarusso notes that syllables in Kabardian prefer to be closed (1992: 15), if not through an available consonant then through 'copying' the consonant onset of the following syllable. σ/μ will ensure the epenthesis of a mora to which the following onset can license and thus close the syllable with a consonant coda, as shown in (30)b.:

(30) a. Syllabification: b. Onset-copying: σ-MORA and μ → p'



However, what chooses between copying the onset of the following syllable from simply 'lengthening' the epenthetic vowel (similar to the numerous examples of [a]+[ʁ] → [ɑ:] assimilation, in order to satisfy σ/μ? This can be achieved by assuming that a moraic schwa is ruled out by the undominated *μ/ə, where schwa is banned from parsing to a mora:[8]

(31) *μ/ə
A Schwa cannot be parsed to a mora (schwa is weightless).

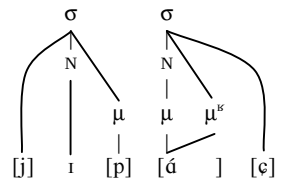
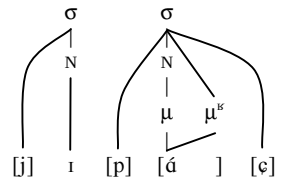
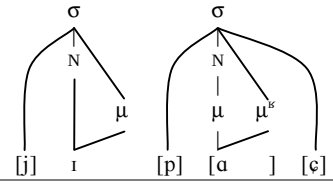
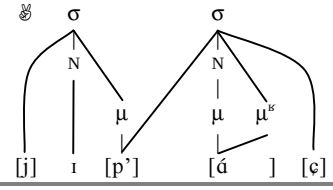
However, if there is no available coda consonant σ/μ must realized by

[8] /a/ can assimilate to the following coda consonant when stressed: in the second syllable of (30)b., /a/ has assimilated the voiced uvular fricative /ʁ/, which is parsed as an available coda to the mora epenthesized by σ/μ. /a/ can now link to the coda mora, lengthening (and also *colouring* the vowel, see Colarusso, 1992, for details).

alternative means; this is achieved through hetero-syllabic gemination of the following consonant, achieved by linking it to the preceding syllable's mora – or 'onset-copying', as in (30)b. A potential candidate *[jɪpʼ.ɑ́ːɕ] would be ruled out by a highly-ranked ONSET.

(32) ONSET
Syllables prefer Onsets. (Kager 1999: 93)

(33) /∅-j-pʼ-aʁ-ɕ/ ? [jɪpʼ.pʼɑ́ːɕ]

/∅-j-pʼ-aʁ-ɕ/	ONSET	σ/μ	*μ/ə	DEP-NUC
a. 	*			**
b. 		*		**
c. 			*	**
d. ✌ 				**

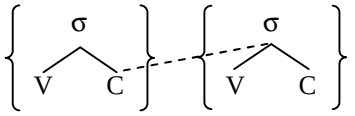
3.3 Morpheme Integrity and ALIGN

It has been demonstrated so far that morpheme integrity (mediated by $\text{CONTIG}_{\text{MCAT}}$) in Σ^{H} morphemes can control schwa epenthesis: a morpheme's internal structure must be maintained, and schwa epenthesizes violating $\text{CONTIG}_{\text{MCAT}}$ can only occur in order to break non-harmonic consonant clusters found in Σ^{NH} morphemes, forced by crucially dominating AGREE. However, integrity also applies to a morpheme's edges. Consider the following near minimal pairs:

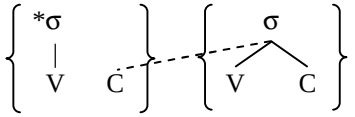
(34) /ʔʷa-bʒa/ → [ʔʷɔ́b.bʒɛ] *[ʔʷɔ́b.ʒɛ] ‘gate to the cattle pen’
cattle.pen-door

(35) /∅-j-pç-aʁ-ɕ/ → [jɪp.pçáːɕ] *[jɪp.çáːɕ] 'he bound it up'
3-3-bind-PAST-AFF (Colarusso 1992:17d)

In (34) and (35) there is also a potential moraic coda consonant in the first segment of the following morpheme, such as /pç/: a mora would be inserted and licensing [p]. But this expected form is ungrammatical *[jɪp.çáːɕ] – the [p] is actually copied as a moraic coda and not simply heterosyllabically parsed: […p.ç…]. The output of gemination is [jɪp.pçáːɕ]. This type of ‘prosodic contiguity’ can be captured with a principled use of *Non-Crisp* ALIGNMENT (Itô & Mester, 1994; McCarthy & Prince, 1993b). Itô & Mester propose that *Non-crisp* edge alignment which subsumes not only ‘crisp’ edge alignment defined in McCarthy & Prince 1993b, but also alignment of edges of the two categories where a segment is doubly parsed to two prosodic units (hence ‘non-crisp’ edge alignment). For example, highly ranked ONSET would force the morpheme-final consonant to form the onset of the following vowel-initial morpheme. The prosodic structure in (36)a. meets a hypothetical *Non-crisp* ALIGN-RIGHT[MCAT; PCAT: σ], whereas b. violates ALIGN because the right syllable edge of the first syllable (PCAT) does not coincide with the right edge of the MCAT (denoted by the square brackets):

(36) a. 

→ {VC$_1$}.{C$_1$VC}

b. 

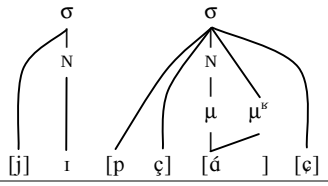
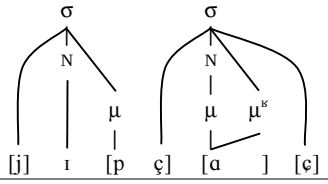
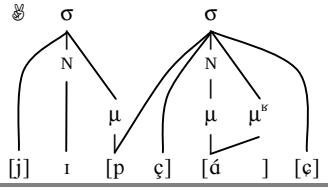
→ *{V.C}{VC}

(36)b. is ungrammatical in Kabardian because the morphological boundaries ‘{}’ are not in alignment with the relevant phonological boundaries, in this case the syllable ‘.’. The left-most segment of a morphological category is the left-most segment of a syllable but it is not tautomorphemically syllabified. Implementing this notion of alignment is what will drive the ambisyllabic (geminate) effects in (34) and (35):

(37) ALIGN[MCAT, L; σ, L] (*Non-Crisp*)
The left edge of a Morphological Category (MCat) must be *at least* aligned with the left edge of a Phonological Category, a syllable (PCat).

ALIGN-L[MCAT; PCAT: σ] (*Non-Crisp*) as formulated in (37) will attempt to prevent any morpheme from being parsed hetero-syllabically, as it ensures the alignment of the edges of morphological and prosodic categories (MCATS and PCATS). However, hetero-syllabic parse must exist to satisfy the minimality/coda condition imposed by σ/μ. Under Itô & Mester's (1994) definition of non-crisp alignment, the MCAT /pç/ is left-aligned with a syllable in the sense that, tracing down from the syllable node, the leftmost segment coincides with the left edge of an MCAT. *Crisp Alignment* would not allow the ambisyllabicity of the coda mora linking to the first segment /pç/, resulting in *[jip̲.ç̲á:ç], while a *Non-Crisp* notion of ALIGN would allow the grammatical [jɪp.pçá:ç] in candidate d:

(38) /∅-j-pç-aʁ-ç/ → [jɪp.pçá:ç]

	σ/μ	ALIGN[MCAT, L; σ, L]
a. 	*	**
b. 		***
c. ✌ 		**

A set of constraints and a ranking now emerges that will bring together the two key empirical facts found in Kabardian: i) σ/N, the integrity of root morphemes ($\text{CONTIG}_{\text{MCAT}}$) and how they are mediated by the principles of AGREE in predicting epenthetic vowels in non-harmonic consonant clusters; ii) σ/μ and onset-copying. We are now in a position to derive the consonant clusters found in Kabardian: under this proposal, any string of consonants can be a legitimate output cluster – AGREE simply places a condition on this string through the prosody, making a parallel assessment of consonant clusters surfacing in any given output syllable. (39) is the constraint ranking that drives syllabification and minimality in Kabardian:

(39) σ/N, AGREE, *$_{σ}$[RO ⩥ CONTIG$_{MCAT}$ ⩥ σ/μ ⩥ *μ/ə ⩥ ALIGN, DEP-NUC-IO

3.4 S-Roots and the Minimal Word

If all instances of schwa can be predicted, how does this impact the lexicon? All of roots previously analyzed as having schwa underlyingly can be reanalyzed (*pace* Colarusso 1992):

(40) Root: /Σ^{H}/ → Minimal word: σ/N → [Σə] (Kuipers 1960: 85)

a. /v/ → [və] *'ox'*

b. /tχ^{w}/ → [tχ^{w}ə] *'butter'*

c. /psk'^{w}/ → [psk'^{w}ə] *'washing'*

To be a minimal word in Kabardian, [ə] is epenthesized in order to satisfy Proper Headedness (σ/N). In Σ^{H} roots σ/μ is necessarily violated (because of higher ranked CONTIG$_{MCAT}$) as there is no consonant material to parse as a coda, and an epenthetic mora can't license schwa because of co-ranked *μ/ə.

(41) Σ^{H}-*Roots and the Minimal Word*

/Σ^{H}/	σ/N	*μ/ə	ONSET	CONTIG$_{MCAT}$	σ/μ	DEP-NUC
a. [Σ]	*				(*)	
b. [Σə^{μ}]		*				*
c. [əΣ]			*		*	*
d. Σ / [C*əC*]				*		*
e. ✌ [Σə]					*	*

A key empirical correlation of the predictable schwa epenthesis approach alluded to in §2.0 is that no contrast is lost in the lexicon: there exists no contrast between [Σ] and [Σə]. However, there is a root-level contrast between Σ and Σ*a*; Compare (42) with (40):

(42) Root: /Σ*a*/ → Minimal word: [Σa] (Kuipers 1960: 85)

a. /va/ → [va] *'ploughing'*

b. /tχ^{w}a/ → [tχ^{w}a] *'grey'*

c. /psk'^{w}a/ → [psk'^{w}a] *'shuddering'*

Σ*a*-roots already satisfy σ/N, but like Σ-roots, there is no consonant material for σ/μ to license. Further evidence for this type of minimality comes from a class of roots with a bi-syllabic *CaaCa* shape and its interaction with stress (Colarusso 1992):

(43)	maaχ^{w}a	' lucky/blessed'	(44)	q'aaɮa	'town'
(45)	pç̣aaç̣a	'girl'	(46)	daaça	'beautiful'

First, none of the similar forms surveyed in Colarusso's grammar showed any contrast with a short vowel in the same position (or a long vowel in the second syllable). Secondly, since σ/N is vacuously satisfied, the effects of σ/μ can be observed in unstressed syllables, such as the following:

(47) /pç̣aaç̣a-d̲aaça-maaχ^{w}a/ → [pç̣ɛç̣.ç̣ɛd.dəç̣.çæm.má:.χ^{w}a]
girl-beautiful-lucky/blessed
'lucky/blessed beautiful girl' (Colarusso 1992:31c)

Setting aside some of the finer details, stress in Kabardian is generally assigned to the rightmost heavy syllable. The combination of the weighted nucleus /a/ and the mora inserted by the minimality requirement, σ/μ, will always create a heavy syllable. When stress is assigned to this heavy syllable, /a/ is realized [ɑ:], while in unstressed syllables, coda gemination occurs. Given this, it is possible to reanalyze these bi-syllabic /ΣaaΣa/ forms as /ΣaΣa/ within the current proposal: the minimality condition imposed by σ/μ will always ensure [Σa{a,C_1}.C_1a] surface forms.

4.0 Conclusion

At the syllable level, [ə] provides a nucleus around which segments can be parsed into a properly headed syllable. Only vowels can head a syllable, and if no lexical vowel (/a/) exists underlyingly, schwa is the default nucleus, ensuring the satisfaction of σ/N and thus universal notions of Proper-Headedness. A crucial issue that emerged in the syllabification of Kabardian was morpheme contiguity. A morpheme's internal structure must be left in tact where possible (CONTIG$_{MCAT}$), but in complex Σ^{NH} morphemes, the constraint AGREE was activated. In this proposal, LFA violations were assessed contextually through the prosody, and as non-harmonic segments cannot be parsed to the same prosodic node, epenthesis was then triggered to separate them. This operation was driven by AGREE, which crucially dominated CONTIG$_{MCAT}$. The effects of morpheme contiguity also had an effect on the prosody, as a morpheme must be tauto-syllabically syllabified wherever possible. This is not an exclusive condition, as a hetero-syllabic

parse may exist in order to satisfy other components of syllable structure, namely, a minimality condition on syllable weight. This key prosodic requirement was built into the model of the Kabardian syllable: σ/μ was implemented as a minimality condition, ensuring that an optimal syllable in Kabardian is a closed one. Note this minimality condition doesn't necessarily entail that all syllables in Kabardian are heavy: σ/N and σ/μ function independently, and the fact that a Nucleus may or may not be moraic has no impact on the assessment of σ/μ violations.

An interesting implication that follows from an Optimality Theoretic approach to the Kabardian phonemic vowel controversy is what Lexicon Optimization tells us about underlying representations. This in turn has a (slightly ironic) impact on the 'one-vowel-versus-two' controversy in Kabardian, as Lexicon Optimization is going to pick as the underlying representation that output candidate that is most harmonic with regards to the constraint ranking. Taking minimal words for example, the constraints and their ranking as proposed here would pick output candidates that have schwa versus output candidates without schwa: Σə ≻ Σ. In turn, L.O. predicts Σə to be the underlying form, giving Kabardian an underlyingly two-vowel inventory. On the other hand L.O. should also predict Σ*a*Σ*a* ≻ Σ*aa*Σ*a*.

The Kabardian syllable would appear to present us with a typologically marked syllable. However, from a broader cross-linguistic perspective, a language that prefers heavy, closed syllables should not be unexpected when placing a typology of possible syllable types on a continuum from light, open CV.CV to heavy, closed CVC.CVC. The 'light', CV-type end of the continuum represents the unmarked majority that is attested in most of the world's languages, while Kabardian represents the predictable opposite end of the continuum. What has not been addressed in detail as to why a language would prefer this. It seems plausible to suggest that because the statistical majority of roots in Kabardian are mono- or bi-segmental, it is not surprising that the language will employ any strategy – in this case by lengthening consonants through gemination – for making these morphemes as perceptually salient as possible. To this end, another avenue to explore is the correlation between the segment and morpheme, as first suggested by Kuipers (1960): Kabardian presents an interesting case a language with remarkably large consonantal phoneme inventory yet with only one vowel underlyingly (as argued here). Could there be indeed a correlation? In other words, would a language with such 'small' roots also have a large phonemic inventory as well? And if is the case, would this be correlation be specifically represented in the consonantal inventory as it is with Kabardian? This would seem like a plausible suggestion given the exponentially wider

range of perceptually distinct articulations available with consonants as compared to vowels.

Finally, it should be noted that the present analysis is intended to offer a preliminary, alternative approach to the syllable in Kabardian. Many issues are left unresolved and data unaccounted for, and this analysis needs to be tested to see how it interacts with other phonological processes in the language, but it should be possible to take this as a framework for tackling the finer details requiring prosodic structure as a foundation, such as stress and other suprasegmental processes. This next step should also include the collection of instrumental data on consonants and consonant clusters in order to assess the phonetic nature of these geminate patterns.

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References

Anderson, J. 1991. Kabardian disemvowelled, again. *Studia Linguistica 45,* 1848.

Anderson, S. 1978. Syllables, Segments Syllables, Segments, and the Northwest Caucasian Languages. in *Syllables and Segments.* A, Bell and J.B. Hooper, eds.: North Holland Publishing Company

Catford, J. C. 1942. “The Kabardian Language," Maitre Phonetique, 3rd series, 1942, 77, 15-18

Chirikba, Viacheslav A. 1996. *Common West Caucasian: The Reconstruction of its Phonological System and Parts of its Lexicon and Morphology*. Lieden: CNWS pp. 452.

Choi J.D. 1991. An acoustic study of Kabardian vowels. *Journal of the International Phonetic Association 21,* 4-12.

Colarusso, J. 1992. *A Grammar of the Kabardian Language.* University of Calgary Press

_____ 1988. *The Northwest Caucasian Languages: A Phonological Survey*. Garland, New York

Fleming, E. 2003. “Speech Perception and Phonological Contrast.” To appear in *The*

Handbook of Speech Perception. D. Pisoni and R. Remez (eds.) Blackwell.

Golston, Chris and Harry van der Hulst. 2000. Stricture is structure. In Ben Hermans and Marc van Oostendorp eds.., *The Derivational Residue in Phonological Optimality Theory*. Benjamins.

Halle, M. 1970. Is Kabardian A Vowel-Less Language? [Foundation Of Language Fl. - International Journal Of Language And Philosophy, 6, 1970, Pp. 95

Hayes, B. 1989. Compensatory lengthening in moraic phonology. *Linguistic Inquiry* 20, 253-306.

Hyman, Larry. 1985. *A theory of phonological weight.* Dordrecht: Foris.

Itô, J. & R.-A. Mester. 1994. Reflections on CodaCond and Alignment, in J. Merchant, J. Padgett & R. Walker eds.. *Phonology at Santa Cruz,* Vol. 3. S.C.: Linguistics Research Center. 27-46.

Kuipers, Aert H. 1960. Phoneme and morpheme in Kabardian Eastern Adyghe. *Janua Linguarum*, no. 8.. The Hague: Mouton.

Padgett, J. 1995. *Stricture in Feature Geometry.* Stanford, CA, CSLI Publications.

McCarthy, J. & A. Prince 1993b. Generalized Alignment. in G. Booij & J. van Maarle eds. *Yearbook of Morphology* 1993. 79-153.

Shaw, P. 2002. On the Edge: Obstruent Clusters in Salish. in L. Watt and I. Wilson, eds. *Proceedings of the Workshop on Structure and Constituency of the Languages of America (WSCLA 7)*

_____ 1996. Degenerate Syllables 8th International Phonology Conference, Vienna: Handout.

_____ 1993. The Prosodic Constituency of Minor Syllables, in *Proceedings of the annual meeting of the West Coast Conference on Formal Linguistics* WCCFL 1993. University of California at Santa Cruz.

Smeets, R. 1984. *Studies in West Circassian Phonology and Morphology*. Hakuchi Press, Leiden.

Wood, S. 1991. Vertical, monovocalic and other impossible vowel systems: a review of the articulation of the Kabardian vowels. *Studia Linguistica* 45, 49-70.

Urbanczyk, S. 2001. *Patterns of Reduplication in Lushootseed*. New York: Garland; Outstanding Dissertations in Linguistics.