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Laryngeal features and vowel length in Turkic

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Reconstructions of Proto-Turkic must account for the correspondence between minimal pairs distinguished by vowel length contrasts in some modern varieties and their cognate pairs distinguished by laryngeal features of stem-final consonants in others (Poppe 1965). The accounts given in various reconstructions generally hold that, at some stage, primary vowel length gave rise to the development of lenis (potentially voiced) stops in certain contexts (Tekin 1975, Johanson 1986, Kabak 2004, Başdaş 2007, Semedli 2012). Variation exists across the Turkic languages with regard to patterns of both contrastive vowel length (Anderson 1998) and laryngeal contrasts in post-vocalic obstruents (Dwyer 2000), necessarily complicating reconstruction. Here I propose an alternative view with regard to these correspondences, wherein vowel length contrasts occurring before stem-final obstruents reflect an earlier voicing contrast in final obstruents. This proposal is grounded in two phonetically-based, cross-linguistically common phenomena: final devoicing (Blevins 2006), and the 'voicing effect' (Chen 1970), whereby vowels are longer before voiced consonants.

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1. Introduction: Proto-Turkic

Proto-Turkic is a reconstructed proto-language from which all Turkic varieties are supposed to originate. The Turkic language family is divided into at least six major branches. The most important of these divisions is that between Chuvash, the sole survivor of the "Oguric" branch (Róna-Tas 2004) and all others (see Table 1):

Earliest stage	Proto-Turkic					
Earliest splits	Oghuric	Common Turkic				
Major subsequent splits	?	Oghuz	Karluk	Kipchak	Siberian	Arghu
Modern languages	Chuvash	Turkish, etc.	Uyghur, Uzbek	Kazakh, Tatar, etc.	Tuvan, Yakut, etc.	Khalaj

Table 1. A brief summary of a common model of major splits in the Turkic language family

Johanson (1998) summarizes what is a broadly accepted classificatory scheme for Turkic languages, noting that Yakut (classified by Poppe 1965 as its own branch within Common Turkic) is now widely viewed as part (along with Dolgan) of a Northern branch, which split from the other Siberian Turkic languages at an early stage.

Reconstructions of Proto-Turkic generally agree on certain features (Róna-Tas 2004): It is generally agreed to have had nine phonemic vowels or more (usually rendered <a>, <e>, <ė>,[1] <i>, <ï>, <o>, <ö>, <u>, and <ü>). It is also almost universally agreed to have contained consonant phonemes approximating /p/, /b/, /k/, /g/, /t/, /d/, /č/, /s/, /m/, /n/, /ŋ/, /ń/, /r/, and /l/[2] (of which the obstruents and perhaps /ń/ could appear in initial position, as well as /n/ in a single lexical item). This summary treats the distinction between e.g. /p/ and /b/ as one of voicing, but according to Róna-Tas, this distinction was likely one of aspiration rather than voicing, although he too transcribes the lenes with voiced symbols (<b>, <d>, <g>, cf. Hanyu Pinyin). This feature (fortis vs. lenis stops) will bear on the focus of this work: Proto-Turkic is generally accepted to have had contrastive vowel length in initial syllables. Most of the rest of the features reconstructed appear to be well-motivated by the facts of contemporary Turkic phonologies. Most varieties have a similar phonemic inventory to the one ascribed to Proto-Turkic; barring mergers of /č/ and /š/, /š/ is very limited in word-initial position in native Turkic lexical items (ascribed to historical palatalization of *si-), and /z/ likewise does not occur word-initially in native Turkic lexical items, while sonorants are likewise rare word-initially in Turkic roots. The fortis-lenis distinction is not universal, but is widespread, although the manner of fortis-lenis distinction seems to be areally determined (Dwyer 2000).

2. Proto-Turkic vowel length

Many contemporary Turkic varieties do not possess length contrasts in native roots as reconstructed for Proto-Turkic. However, three are usually cited as still maintaining the primary vowel length distinctions ascribed to the proto-language. These three are: Yakut, a North Siberian variety, also known as Sakha; Khalaj, which is currently held to be the sole surviving member of an Arghu branch; and Turkmen, an Eastern Oghuz variety. As two of these, Yakut and Turkmen, have been thoroughly studied by Turcologists for some time (see correspondences in Table 2),

1 This vowel, representing a "closed *e*" is of particular interest to Turcologists, and is the subject of a substantial literature of its own. Unfortunately, as this is not a general paper on reconstructing Proto-Turkic *per se*, this and many other important matters were left aside in the interest of focusing on the question of phonetic naturalness of sound change.

2 Additionally, all reconstructions accept two more phonemes, which were either /š/ and /z/ (as in Common Turkic), or two sounds usually transcribed as <ŕ> and <Ĺ> (on the basis of Chuvash correspondences which have merged with /r/ and /l/). Whatever they were, these phonemes could not occur word-initially.

these correspondences and the feature of contrastive vowel length were able to be posited as conservative holdovers from the proto-language as early as 1851 (Böhtlingk). Widely cited works on the reconstruction of Proto-Turkic by Tekin (1975), Doerfer (1976), and Johanson (1986) all assume these correspondences reflect Proto-Turkic vowel length maintained in languages such as Yakut, surfacing as another feature (voicing) in languages such as Azerbaijani, and lost altogether in languages like Kazakh.

	Gloss	Kazakh	Azerbaijani	Yakut (Straughn 2006)	Turkmen (Tekin 1975)	Proto-Turkic (Tekin 1975)
a	'name'	at	ad	āt	āt	*āt
b	'horse'	at	at	at	at	*at
c	'fire'	ot	od	uot	ōt	*ōt
d	'grass'	ot	ot	ot	ot	*ot

Table 2. Cognate sets comparing length-contrasting Turkic varieties with Azerbaijani (voicing contrast) and Kazakh (merger of the minimal pairs in question)

In the cognate sets in Table 2, one can see that while these minimal pairs have become indistinguishable in some languages, such as Kazakh, some others, such as Azerbaijani, distinguish the same minimal pairs but with a feature other than vowel length, in this case voicing of the final stop. The general assumption that will be challenged in this paper is that the correspondences shown in pairs (a)/(b) and (c)/(d) in Table 2 reflect a primary vowel length contrast which was replaced by a laryngeal contrast. Instead, I will assume that a laryngeal contrast such as the one shown in Azerbaijani in Table 2 was primary, and was partially neutralized in languages such as Turkmen, resulting in length contrasts, which became the only distinguishing feature in languages such as Yakut, or never developed in languages such as Kazakh, leading to the homophones we have seen.

Among the more widely-cited works on the question of correspondences related to vowel length in Turkic is Talat Tekin's 1975 work *Ana Türkçede Aslî Uzun Ünlüler* [Primary Long Vowels in Proto-Turkic], wherein he specifically posits final voicing as a change *motivated by* preceding long vowels (Kabak 2004, Başdaş 2007, Semedli 2012). Erdal, in his 2004 work *A Grammar of Old Turkic*, cites Tekin repeatedly as an authority on vowel length. While other widely-cited works on the reconstruction of Proto-Turkic exist, such as those by Doerfer (1976) and Johanson (1986), they do not differ on the underlying assumption of Tekin's (1975) work. It can therefore be said that in this area, Tekin's work represents orthodoxy, and is a fair starting point for a discussion of whether or not these Proto-Turkic reconstructions accord with phonetically-based explanations for similar sound changes cross-linguistically.

3. Review of Tekin's work

Tekin (1975) considers that stem-final voiced plosives in Oghuz languages, such as in the Azerbaijani examples in Table 2, which have cognate forms with long vowels, reflect an emergence of contrastive voicing from a historical contrast of vowel length. He dedicates considerable space to examples of this phenomenon, which he terms *final consonant voicing* ("son-sesteki ünsüz ötümlüleşmesi"). For Oghuz languages, he describes the process thus:

> While the voiceless plosive consonants /p/, /t/, /č/, and /k/ after a short vowel at the end of Proto-Turkic monosyllabic words are preserved in Oghuz dialects, after a (primary) long vowel they undergo voicing and become the series /b/, /d/, /j̃/, /ɣ/ and /y/.[3]

However, he must qualify this rule by stating that in Oghuz varieties other than Azerbaijani, this voicing is not observed in the "bare case" of the noun. The actual determining factor for voicing variation of word-final stops in Oghuz is whether or not they are intervocalic. However, this is not a simple case of intervocalic voicing, as other nouns with similarly surface stem-final voiceless stops are not subject to this rule. Compare Turkmen "fire" (a) and "grass" (b) in Table 3.

	Gloss	Proto-Turkic (Tekin 1975)	Alternative proposal	Turkmen (Tekin 1975)[4]	Azerbaijani	Turkish
a	'fire'	*ōt	*od	ōt, ōd-ï	od, od-u	od, od-u
b	'grass'	*ot	*ot	ot, ot-ï	ot, ot-u	ot, ot-u
c	'back [part]'	*ārt	*ard	ārt, ārd-ï	ard	art, ard-ï
d	'home'	*yūrt	*yurd	yūrt, yūrd-ı	yurd	yurt, yurd-u
e	'bottom'	*dūp	*düb	düyp, düyb-i	dib	dip, dib-i
f	'blue/green', 'sky'	*gōk	*gög	gōk, gōg-i	göy	gök, gög-ü/göy-ü
g	'force/strength'	*gūč	*güj̃	güyč, güyj̃-i	güč	güč, güj̃-ü

Table 3. Examples of final voiced stops in Oghuz and their relationship with word-final position and vowel length

3 "Ana Türkçede tek heceli kelimelerin sonundaki ötümsüz patlayıcı *p, t, ç*, ve *k* ünsüzleri, Oğuz grubu Türk lehçelerinde, kısa bir ünlüden sonra kendilerini korudukları halde (aslî) uzun bir ünlüden sonra ötümlüleşerek sırasiyle *b, d, c, ğ* ve *ğ(y)* olmuşlardır."

4 As Turkmen is agreed to have contrastive vowel length of the type Tekin indicates, his transcription system is used. However, standard written Turkmen does not generally indicate this contrast.

Tekin's description does not adequately account for these forms. His assumption that pre-Oghuz had contrastive length in the roots in question, which all ended in fortis stops, should be explained by a sound change something like this, with a word-final devoicing rule applying synchronically:

(1) *T > D / V: ___

Even a word-final devoicing rule cannot rescue Turkish, which presents problems for any simple analysis if one examines forms such as "od, odu" ((a) in Table 3), a form Tekin himself volunteers. This is a word-final voiced stop which does not undergo final devoicing in the "bare case"; i.e., Turkish phonology shows us a pattern Tekin ascribed only to Azerbaijani within Oghuz, while elsewhere in Table 3, Turkish does indeed behave like Turkmen, per Tekin's description. This is a complication beyond the scope of this paper. In fact, inherited Turkish stem-final stops are of three types: those which are invariably voiceless, those which are invariably voiced, and those which undergo what can synchronically be described as intervocalic voicing or final devoicing when a vowel-initial suffix is attached.

4. Johanson, Kabak

Johanson is an important contributor to the literature on correspondences between reconstructed Proto-Turkic long vowels and laryngeal contrasts in attested Turkic varieties (Johanson 1986). Like Tekin, he assumes a Proto-Turkic vowel length distinction, with laryngeal alternations emerging in consequence. In his 1986 *Zur Konsonantenstärke im Türkischen* ("On Consonant Strength in Turkic"), he proposes that Proto-Turkic possessed a distinction between fortis and lenis stops (whose exact phonetic qualities are debated, see Róna-Tas 2004), but that the lenis stops underwent further lenition, and this distinction was lost. The lenition is meant to account for post-vocalic correspondences between Yakut /t/ and /j/ in the rest of Common Turkic, which reportedly surfaced as *ð at an earlier stage of Common Turkic development (Anderson 1998). Cognate sets for this reconstruction are shown in Table 4.

	Gloss	Proto-Turkic (Dybo 2006)	Common Turkic (Anderson 1998)	Turkish	Turkmen (Tower of Babel Database[6])	Yakut (Anderson 1998)
a	'name'	*āt	*āt	ad	ād	āt
b	'horse'	*at	*at	at	at	at
c	'to send'	*ī̈d-	*ī̈ð-		ïj-	ī̈t-
d	'smell'	*yïd	*yïð			sït
e	'moustache'	*bïdïk	*bïðïk	bïyïk	mïyk	bïtïk
f	'thirty'	*otuź	*otuz	otuz	otuz	otut

Table 4. Roots displaying proposed Proto-Turkic lenes in medial and root-final positions, with various lengths, along with (f) 'thirty' as an example to demonstrate that all post-vocalic coronals can merge with /t/ in Yakut

Subsequently, the primary fortis stops became lenis after historical long vowels in many varieties (see 'name' in Table 4). Kabak (2004) summarizes the sound changes demonstrated above (referencing both Johanson and Tekin), starting with the proposed frication of primary lenis stops, proceeding through to the lenition of stops after long vowels, and concluding before the loss of contrastive vowel length in languages such as Turkish (Table 5, taken from that work).

	"Ancient Turkic"[5]	Stage I: Spirantization	Stage II: Voicing
Long vowels:	V: ___ T	V: ___ T	V: ___ D
	V: ___ D	V: ___ ð	V: ___ ð
Short vowels:	V ___ T	V ___ T	V ___ T
	V ___ D	V ___ ð	V ___ ð

Table 5. Sound changes leading from "Ancient Turkic" to Proto-Common Turkic

From the summary in Table 5, we are to conclude that Proto-Turkic had minimal quadruplets contrasted by both vowel length and the fortis/lenis distinction in oral stops. I am unaware of any reconstructed example of a minimal quadruplet. Indeed, when we take examples such as the pair (a),(b) from Table 4 (cf. all the various examples from Tables 2 and 3), we see that Turkmen and Yakut, two of the most widely-cited Turkic languages which are held to preserve Proto-Turkic vowel length, match our expectations (as do both with the voicing in Azerbaijani, also in Tables 2 and 3). However, taking an example of a long vowel succeeded by one of Johanson's (1986) lenis stops ('to send', example (c) in Table 4), we see that Turk-

5 A postulated era more or less corresponding to "late Proto-Turkic", this represents the period in which dialectal divisions began to emerge.

men fails to match up with Yakut in terms of preserving the long vowel. Therefore, not only are minimal quadruplets difficult to locate, the only consistent source of minimal pairs distinguished by contrastive vowel length appears to be from examples reconstructed with primary fortis stops, i.e., those pairs which surface as voiced/voiceless pairs in Azerbaijani. Indeed, these are the examples most commonly cited by Turcologists when summarizing reconstructed Proto-Turkic vowel length.

If, as is proposed, Proto-Turkic had contrastive length as a general rule, we ought to expect it not only before obstruents, but before sonorants (which lack laryngeal contrasts) as well. This is difficult to reconcile with the fact that almost all examples of contrastive length that can be uncontroversially reconstructed in works such as Tekin's (1975) come before a stop or affricate (fricatives pattern with sonorants in this area). The length contrasts which occur before fricatives and sonorants in Turkmen, or before sonorants and oral stops which are purportedly descended from Proto-Turkic lenis stops in Yakut, are not uniform between the two languages (see Table 6, also cf. (c) in Table 4).

	Gloss	Proto-Turkic	Turkmen	Yakut
a	'level ground'	*ala-n	āla	alās
b	'back'	*ărka	arka	arɣā
c	'variegated'	*āla	āla	ala
d	'moon', 'month'	*aŋ	āy	ïy
e	'intelligence'	*āŋ	āŋ	aŋ
f	'close to', 'side'	*dūĺ	dūš	tus
g	'salt'	*dūŕ	dūz	tūs
h	'dream'	*dūĺ	dūš	tūl

Table 6. Roots with reconstructed long vowels without a succeeding stop or affricate. All data taken from the Tower of Babel Database (Dybo 2006). Reconstruction seems to be predominantly based on Turkmen.

Turkmen long vowels seem to be the base of Dybo's (2006) reconstructions seen in Table 6. Note examples (g) and (h), wherein Yakut does have long vowels which correspond to the reconstructed Proto-Turkic. However 'salt' (g) forms a minimal pair with 'side' (f), when the two ought to have the same vowel length. This change appears more or less random. Further, 'dream' (h), while it does have a long vowel as predicted, also has an irregular final /l/ (Proto-Turkic *Í/š ought to be /š/ in Common Turkic in general, /s/ in Yakut), which implies it may be an early loan from an Oghur Turkic variety, either directly or through an intermediary regional language with which Yakut had contact. In brief, we have very little direct evidence for contrastive vowel length across Turkic before sonorants or fricatives.

Looking at the "primary lenis stops" referred to by Kabak (2004) and accepted by the predominant scholarship in this field (including Tekin 1975 and Johanson 1986), it must be noted that they are supposed to have undergone fortition in Yakut and lenition in almost all other Turkic varieties. This sound change is regular with the coronals and labials (see Table 7), but with dorsals we see the opposite pattern (examples g-k). Additionally, the examples of reconstructed long vowels preceding reconstructed coronals and labials, like sonorants, fail to correspond with consistent preservation of long vowels (see examples b, e, and f). Note example (f), wherein the diphtong "üö" corresponds to the usual treatment of long /ö/ in Yakut (see Table 11, example (e), 'lake').

	Gloss	Proto-Turkic	Turkmen	Yakut
a	'foot'	*adak	ayak	atax
b	'to sleep'	*ū-dï, *ū-dï-k-la	ūkla-	utuy-
c	'tail'	*kudruk	guyruk	kuturuk
d	'to twist'	*čebir-	čöwrül-	sebiriy-
e	'to chew'	*gēb	g̃āwü-š [cud]	kebī-
f	'sharp'	*sībri	süyri	üörbe
g	'fat', 'oil'	*yāg	yāg	sïa
h	'mountain'	*dāg	dāg	tïa
i	'mouth', 'lip[s]'	*agïŕ	agïz	uos
j	'rain'	*yagmur	yagmïr	samr̃
k	'family', 'relatives'	*urug	urug	urū

Table 7. Roots with reconstructed lenis stops. Proto-Turkic reconstructions and vowel lengths for Turkmen taken from the Tower of Babel Database (Dybo 2006).

For the dorsal examples (g-k), the pattern is that reconstructed long vowels tend to correspond to Turkmen long vowels, while Yakut near universally converts any Vg sequence to V̄. Example (j), 'rain' may differ due to the sequence *gC motivating shortening (coda + second syllable).

Regardless, these items do not provide us with evidence of regular correspondences of long vowels across Turkic varieties in the way that the examples in Table 3 do. As already noted, neither they nor the sonorants are noted for especially consistent realization of vowel length in the immediately preceding vowel across Turkic (see Table 6). Whatever form they took and whatever they are contrasted with, they represent something like the laryngeal series of Proto-Indo-European, something which cannot be directly observed in any modern language, but whose existence is evidenced by secondary patterns across the family, along with some ancient textual evidence.

It must be conceded that unlike the reconstructed lenes, contrastive vowel length appears to be recorded as such across the Turkic language family from rather early, and continues to play a contrastive role in several languages to this day.

The strongest guarantee of agreement between Turkic varieties on contrastive vowel length is whether or not the vowel in question occurs before a reconstructed Proto-Turkic fortis stop (which itself guarantees that voicing contrasts may occur in Oghuz Turkic varieties).

Kabak (2004) goes on to state that part of the reason to prefer a reconstruction where primary vowel length motivates a secondary laryngeal contrast, rather than a primary laryngeal contrast motivating secondary vowel length, is that this hypothesis: "makes the prediction that in languages where contrastive vowel length was preserved, post-vocalic stops took a different developmental path. Indeed, this is what we observe."

Of course, as we have already seen in Table 3, Turkmen oral stops are very similar to those in Azerbaijani or Turkish. Therefore, Kabak notes that "perhaps the case of Turkmen long vowels can be evaluated through other phonological processes that may have contributed to the maintenance of long vowels in Turkic."

In South Siberian Turkic varieties such as Tuvan or Western Yugur, Johanson (1986) posits secondary fortition emerged after short vowels, as secondary lenition emerged after long vowels in other varieties. Rather than having fortition interpreted as tenuis and the secondary lenis interpreted as voiced, as in Oghuz, the secondary lenis was interpreted as tenuis, in opposition to fortis stops with other laryngeal distinctions (see Table 8, a modified version of Table 2 to include South Siberian varieties).

	Gloss	Proto-Turkic (Tekin 1975)	Alternative Proposal	Tuvan (Dwyer 2000)	Western Yugur (Roos 2000)	Turkmen (Tekin 1975)	Azerbaijani	Yakut (Straughn 2006)
a	'horse'	*at	*at	a^{ʔ}t	a^{h}t	at, at-ı	at	at
b	'name'	*āt	*ad	at	at	āt, ād-ı	ad	āt
c	'grass'	*ot	*ot	o^{ʔ}t	o^{h}t	ot, ot-ı	ot	ot
d	'fire'	*ōt	*od	ot	ot	ōt, ōd-ı	od	uot

Table 8. Laryngeal contrasts in South Siberian varieties compared with Oghuz, Yakut, and Proto-Turkic reconstructions (cf. Table 2)

This is of course another instance in which we may repeat the problem Kabak (2004) posed: Either we are faced with a primary laryngeal distinction, which at some stage gave rise to contrastive vowel length, with different surface laryngeal contrasts emerging in Turkic varieties in which it survived, or else there was a pri-

mary vowel length distinction (as is generally assumed), which gave rise to laryngeal contrasts in various Turkic varieties.

5. An alternative proposal: Secondary emergence of vowel length contrasts

The analysis common to Turcologists such as Tekin (1975), Johanson (1986), etc. is one in which Proto-Turkic was a language with contrastive vowel length, leading to the secondary emergence of fortis/lenis distinctions of final stops in several Turkic languages. This in turn necessitates our understanding of final voiced stops in Oghuz languages as having emerged later, that is, that they are the product of *final voicing*. Is final voicing of stops after long vowels a natural sound change that we may expect Turkic to have undergone at some point in the family's history? Cross-linguistically, there are no clear examples of final stop–voicing (Blevins 2006). There are a few cases which on the surface *resemble* final stop voicing, but none make for perfectly analogous cases. The most similar-looking cited by Blevins (2006) is that of Welsh as described by Wells (1979), wherein final stops may either be fortis or lenis, and fortis stops follow short vowels. One problem is that the Welsh words in question are all "old borrowings", whereas the pattern in Turkic, no matter how similar looking, is not a feature of loanword phonology. Further, the Welsh case of final voicing does not appear to have anything to do with phonemic vowel length at any stage of Welsh. Native coda oral stops all merged and were interpreted as "voiced", and the voicing effect (see section 5) created longer vowels, while old borrowings with final stops could be interpreted as voiceless and therefore be immune to the voicing effect, but not apparently because of a pre-existing vowel length contrast. Finally, while Wells (1979) does not analyze the minimal pairs in question as having vowel length emerging from underlying voicing per se, he still puts the motivating contrast on oral stops, suggesting that the contrast is between geminates and singletons, with voicing and vowel length following as secondary features.

For cases of more "natural" development of final voicing-like changes, contrastive vowel length is generally not implicated in the process, as it is in Turkic, and the changes in question are not actual cases of final-voicing. For example, Somali has a pattern which has been claimed to resemble final voicing (Saeed 1999), but Ehret (1980) reconstructs the oral stops in question as having been historically inter-vocalic, a context which could motivate voicing. Edmonson, Esling & Harris (2004) note that final oral stops in casual Somali speech are voiceless, while in careful speech, the voiced stops surface with a schwa offglide (cf. Conway's 2008 finding that Somali speakers had difficulty voicing final /-d/ in English). In other words, the sound changes held to have produced a "final voicing" pattern in Somali are:

T > D / V___V

Followed by:
V > Ø / D___

But it appears that even in contemporary Somali, deletion of the final vowel fully (rather than a slight articulation as a schwa offglide) results in a voiceless articulation, suggesting final devoicing:

D > T / ___#

	Gloss	Proto-Turkic (Tekin 1975)	Alternative proposal 1	Alternative proposal 2	Turkmen (Tekin 1975)	Yakut (Straughn 2006)	Chuvash[6] (Clark 2004)
a	'four' ('fourth')	*dȭrt	*dörd	*dörtV̆	dȭrt, dȭrd-ünji	tüört, törd-üs	tăva(t)t(ă), tăvattă-meš
b	'ten' ('tenth')	*ōn	*on	*onV̆	ōn, ōnunjï	uon, uon-us	vu(n)n(ă), vunnă-meš
c	'name' ('name-3SG.POSS')	*āt	*ad	*atV̆/ad (???)	āt, ād-ï	āt, āt-a	yat, yač-ĕ

Table 9. Two numbers with consistent long vowels between Turkmen and Yakut whose origins may be compensatory lengthening as evidenced by Chuvash

Final obstruent voicing sound changes of the Somali type are rare, and they do not provide us with a process of "final voicing" that we may apply analogously to Turkic, even if we were to reconstruct the roots in question as having had final vowels, something which Tekin (1975) and Johanson (1986) do not appear to do, and would be difficult to defend based on available evidence, except potentially in a small number of examples such as (a) and (b) in Table 9. It is possible that these items represent a separate source of long vowels across the Turkic languages, separate from those of the type (c).

There are four main possibilities for the emergence of contrastive length. One is that contrastive vowel length was already a feature in the proto-language and has been preserved in some languages faithfully, while others have more or less lost it, with some residual features evidencing its prior existence. Despite its general acceptance at present in mainstream Turcological studies, it is deficient for the reasons already stated. There are three other possible explanations for the existence of this feature in Turkic languages:

(1) V + V: Two adjacent vowels merge into one longer vowel. There is no reason to suppose this explanation in the case of Turkic.

6 All of the first ten Chuvash numerals have at least two forms: "Basic" (with a singleton consonant) and "emphatic" (with a geminate final consonant, used for the ordinal forms). Those with a final reduced vowel also have a "clipped" form (without the final reduced vowel *or* the geminate consonant).

(2) "Compensatory lengthening". Here we assume a final vowel, now lost, which was reduced. While present, this would explain the voicing of the stops in question, as intervocalic voicing is common cross-linguistically. This is not explored in this work, but is possible; see Table 9 (in particular "Alternative proposal 2").

Based on available evidence, this paper proposes that the most convincing explanation for the observed patterns is:

(3) The "voicing effect". Observed vowel length distinctions in Turkic languages, particularly well-attested and evidenced ones such as those seen in Table 8, are the result of a primary laryngeal contrast which, through the cross-linguistically common "voicing effect", caused vowel lengthening.

Assuming that the roots in question were consonant-final in Proto-Turkic (as they are in both the laryngeally contrasting varieties and the length-contrasting varieties), this third explanation seems more appropriate.

The first point that bears emphasizing is that in general, cross-linguistically, vowels will be pronounced longer before a voiced consonant than a voiceless one (Chen 1970). This provides a means by which vowel length may have emerged as a secondary feature in Turkic in the pairs seen in Table 8, provided that voiced stops were primary, rather than secondary, as is commonly assumed. Of course, this would still leave two means of distinguishing the minimal pairs in question, vowel length and voicing. Reanalysis would therefore be possible, and if this change was followed by word-final devoicing, the primary voicing contrast would be obscured, replaced by a vowel length contrast.

Unlike word-final voicing, word-final devoicing is common across the world's languages, with examples including Russian (Padgett 2002), Georgian (Butskhrikidze 2002), Maltese (Borg 1975), and Armenian (Dum-Tragut 2009), and many Turkic varieties as well. Stem-final voiced stops in Arabic loanwords undergo what can diachronically be viewed as final devoicing in many Turkic varieties, regardless of whether it would be analyzed *synchronically* as intervocalic voicing in the Turkic variety in question: Turkish *kitap*, *kitab-ım*, < Arabic *kitāb*.

Phonetic motivations exist to explain this common and widely attested phenomenon. Blevins (2006) theorizes that final devoicing is common cross-linguistically, among unrelated languages, because there are phonetic features of human language which facilitate the possibility of these sound changes occurring. (Blevins 2004). Many phrase-final laryngeal gestures exist which might obscure a voicing contrast in final position, and phrase-final gestures can be generalized to become word-final during the process of phonological acquisition by young children who are exposed to a large number of single-word utterances (Brent & Siskind 2001). Common phrase-final gestures might include the spreading of the larynx, or the closure of the larynx, both of which might inhibit voicing from being realized. Additionally, phrase-final lengthening is a common gesture which can lengthen final consonants as well as vowels (Berkovitz 1993). Because, in general, voiced stops are shorter

than voiceless ones, and voicing is difficult to maintain for the duration of a longer stop, lengthening of the voiced stops word-finally (generalised from the cross-linguistically common phrase-final change) could lead to voicing becoming obscured in that context, or in other words, the loss of voicing for historical voiced stops in that context (Ohala 1983).

6. The Voicing effect

In spite of the fact that primary long vowels are "considered to be a scientific fact proven by many circles in Turkology" (Eker 2005), there exist no mainstream phonological treatments of the phonetic feasibility of the sound changes implied by them. On the other hand, the "voicing effect" is widely observed in living languages today. Chen (1970) describes this effect, by which a longer phonetic realization of vowels tends to occur before voiced obstruents than voiceless ones. The voicing effect is common (Hussein 1994), and in some languages, such as Standard German or some Northern Italian Romance varieties, this voicing effect has led to the evolution of a vowel length distinction. It has also been suggested that the fortis quality of underlying voiceless obstruents inhibits vowel lengthening (Leer 1985) or even "appears to induce final shortening" (Gordon 1998). None of these observations are incongruous with the observed facts about Turkmen. If an obstruent voicing contrast is reconstructed for Proto-Turkic, this might provide a phonetically plausible explanation for the relationship between voicing and vowel length in Turkmen. If an earlier stage of Turkmen with word-final voicing distinctions like that of Azerbaijani (cf. Azerbaijani and "Alternative proposal" in Table 8) is assumed, which then developed word-final devoicing, this would produce single-word utterances devoid of final voicing contrast. If the vocalic lengthening present from the underlying voicing were still salient, these lexical items would resemble those of Yakut, or at an intermediary stage, Turkmen. A similar pattern is observed in many commonly studied languages with final obstruent devoicing, such as Northern Italian Romance varieties (Repetti 1992) and (at least historical or literary varieties of) German (Fourakis & Iverson 1984), whereby the originally voiced obstruents are voiceless in coda position, but have measurably longer preceding vowels, similar to the case in Turkmen.

7. Contrastive vowel length as a secondary development

If we assume that laryngeal contrasts were primary, what sound changes do we expect to have taken place along the course of Turkic history? We expect first that the voicing effect produced non-phonemic length differences quite early, and that in some varieties devoicing caused these differences to be reinterpreted as phonemic. In Yakut the fact of a phonemic vowel length contrast is uncontested. On the other hand, Turkmen may be viewed as an "intermediary" case. While it does not conform to Kabak's (2004) expectations of a divergent development of languages that maintain primary vowel length distinctions, from the perspective of the voicing effect it

fits our expectations quite neatly. Indeed, it resembles the current situation in many varieties of English, wherein actual voicing of final voiced stops is absent, but preceding vowel length allows the contrast to be maintained. Without any succeeding vowel for which VOT may distinguish voiced from voiceless stops, the only remaining acoustic cue may be the length of the preceding vowel. If we are to assume that Turkmen vowel length contrasts are secondary to underlying voicing distinctions, then the orthography is mostly comparable to that of General American English, where speakers frequently fail to produce perceptible voicing for stops (Smith 1997). That is, while vowel length may be the most consistent acoustic cue for distinguishing minimal pairs historically associated with voicing, the orthography still reflects a minimal pair contrast of contrastive voicing more consistently. In Table 10, we see that Turkmen orthography fails to distinguish this phonetic length at all, as does English orthography. As for voicing, English orthography indicates it consistently, as it is the historically contrasting phonemic feature, if not the most acoustically salient in all contexts (a,b). Turkmen orthography, however, indicates neither of the possible contrasts (neither the proposed historical distinction of voicing nor the presently acoustically salient vowel length) in the pair a,b, however, it distinguishes voicing and not length in the orthography of c,d.

		English orthography	General American pronunciation (Smith 1997)	Turkmen orthography	Turkmen pronunciation according to Tekin (1975)
a	-VD	<phase>	[feɪːʐ]	<at> (‘name’)	āt
b	-VT	<face>	[feɪs]	<at> (‘horse’)	at
c	-VDV	<phase-s>	[feɪːzəʐ]	<ad-yň> (‘name-GEN’)	ād-ïŋ
d	-VTV	<face-s>	[feɪsəʐ]	<at-yň> (‘horse-GEN’)	at-ïŋ

Table 10. Illustration of Turkmen and English orthography and pronunciation for fortis/lenis obstruents in final versus intervocalic position

Tekin (1975) chooses not to analyze the fortis-lenis contrast in South Siberian Turkic varieties (see Table 8), but later studies such as Johanson (1986) mention it as one of the realizations of the secondary fortis-lenis contrast. The Turkic varieties which distinguish these minimal pairs based on glottalization or aspiration are clustered in the East Asian area, in close proximity to languages such as Chinese and Korean, which also distinguish fortis-lenis stops thus (Dwyer 1996, 2000). By contrast, those Turkic languages with a final voicing contrast for stops are areally distributed near other languages with a voicing distinction more normative for the West of “the Eurasian continent”.

If we were to assume that the more Western Turkic languages are more innovative, and a non-voicing laryngeal contrast such as that seen in Tuvan or Western Yugur is more conservative, would primary vowel length contrasts be easier to defend phonetically? Is there any attested pattern, cross-linguistically, of an association between short vowels and consonantal aspiration or glottalization? One possible parallel might be the so-called "ballistic" syllables of Jalapa Mazatec, which are generally shorter than other syllables (Silverman et al. 1995), and are accompanied by "a fortis release [...] culminating in a weakened breathy release". As a parallel, it is not ideal, as Jalapa Mazatec syllable structure lacks codas, while our Siberian Turkic parallels are based entirely upon coda obstruents. However, if this parallel were to be used analogously, we would be forced to note that vocalic length is not reconstructed for Proto-Oto-Manguean (Rensch 1977), such that these "ballistic" syllables motivated the emergence of vowel length, much as voicing does. It would appear that, based on our knowledge of the phonology of other language families, reconstructing contrastive length in Proto-Turkic fails to explain the emergence of any laryngeal distinction, be it voicing, constricted glottis, or spread glottis.

8. The problem of the "primary lenis stops"

An obvious problem with proposing that the "secondary lenis stops" were indeed the primary lenis stops is that mainstream Turcology already proposes the existence of primary lenis stops. The lack of minimal quadruplets may cast doubt on the current reconstruction of Proto-Turkic phonology, but surely the correspondences seen in Tables 4 and 7 show the need for the reconstructed stop system?

While this paper is primarily concerned with the feasibility, in terms of phonetics and cross-linguistic typology of sound change more generally, of reconstructing vowel length distinctions for Proto-Turkic, this problem is nonetheless worth addressing. One solution might be that the lenis phonemes shown in Table 7 represent a set of third phonemes after the voiced/voiceless distinction proposed here. The evidence from Yakut (cf. c and f from Table 4) suggests that any coronal obstruent, not only a voiced stop, could potentially undergo fortition to become /t/ in that language. Therefore there may be some cause to assume that a historical set of fricatives (*ð, *β, and *ɣ) may be responsible for this pattern. Alternatively, it may be the case that Proto-Turkic possessed a three-way distinction of laryngeal contrasts in its stop series, not unlike that proposed for Proto-Indo-European and observed in some Indo-European languages (Armenian, Kurmanji Kurdish, Punjabi), or in other unrelated languages spoken across the Eurasian continent (Korean, Georgian). While the former proposal suffers from the lack of a contemporary Turkic language which distinguishes a /ð/ phoneme from both /d/ and /z/, the latter proposal is in line with Kallestinova's (2004) analysis of Turkish (although there is no diachronic evidence that this feature is inherited, even if the analysis is correct). However, even if both of these explanations fail to explain the observed patterns, the mainstream reconstruction equally fails, as reconstructed lenes have universally merged with an-

other phoneme in the language (or disappeared entirely), and we lack any minimal quadruplets even in reconstruction.

9. Conclusion

In light of the analogous cross-linguistic examples presented here, there is good reason to question the viability of contrastive vowel length as a reconstructed feature of Proto-Turkic. It is proposed as an alternative that the cases which are ascribed to historical lenition of primary fortis stops (see Table 11) are actually the result of primary lenes motivating vowel lengthening through the voicing effect, obscured later by final devoicing.

	Gloss	Proto-Turkic (Tekin 1975)	Alternative proposal	Kazakh	Turkish	Turkmen (Tekin 1975)	Yakut (Straughn 2006)	Chuvash (Clark 2004)
a	'name' ('name-3SG.POSS')	*āt	*ad	at, at-ï	ad, ad-ï	āt, ād-ï	āt, āt-a	yat, yač-ĕ
b	'horse' ('horse-3SG.POSS')	*at	*at	at, at-ï	at, at-ï	at, at-ï	at, at-a	ut, uč-ĕ
c	'four' ('fourth')	*dō̆rt	*dörtV̆	tört, tört-inši	dört, dörd-üncü	dō̆rt, dō̆rd-ünǰi	tüört, törd-üs	tăva(t)t(ă), tăvattă-meš
d	'ten' ('tenth')	*ōn	*onV̆	on, on-ïnšï	on, on-uncu	ōn, ōnunǰï	uon, uon-us	vu(n)n(ă), vunnă-meš
e	'lake'	*kō̆l	*kölV̆	köl	göl	kō̆l	küöl	külĕ

Table 11. Two possible routes for the emergence of long vowels

The cross-linguistically common rules responsible for the changes in Yakut or Turkmen would be:

V > V: /__D

Which would be followed by:

D > T /__#

In the case of Yakut, this sound change led final stops to be reanalyzed as voiceless in all contexts. In a language such as Kazakh, it is entirely possible that the devoic-

ing rule preceded a reanalysis based on the voicing effect, causing the minimal pairs in question to be rendered homophonous in all contexts.

Vowel length is a difficult issue due to the correspondences in question, which clearly relate to laryngeal properties of subsequent stops in some way, but not all candidates may have the same origin. The different treatment of the numeral examples in Table 11 (note especially the intervocalic voicing in Yakut and the final vowel in Chuvash) may indicate a final vowel such as the one seen in contemporary Chuvash which survived longer in Yakut than contrastive voicing did (see "Alternative proposal" in Table 11). It is already accepted that multiple series of contrastively long vowels may have emerged at different stages in Turkic history (Kabak 2004), which may be seen in the case of lenition of intervocalic /g/ in Tuvan, or /g/ in any post-vocalic context in Kyrgyz (cf. a with b and c in Table 12).

	Gloss	Proto-Turkic (Tekin 1975)	Turkmen	Tuvan	Kyrgyz
a	'mountain'	*dag	dag	dag	tō
b	'mouth'	*agïŕ	agïz	ās	ōz
c	'enemy'	*yagï	yagï	čā	ǰō

Table 12. /g/-lenition resulting in a long vowel in Kyrgyz and Tuvan

However, just as few minimal pairs result from /g/-lenition in modern Turkic varieties, so too is it difficult to locate many *minimal pairs* in reconstructed Proto-Turkic which are not associated with primary fortis stops. The fact is that there are multiple paths to the creation of long vowels, some of which are still observed in contemporary Turkic varieties (loan vocabulary, /g/-lenition). This should lead us to investigate other potential sources for long vowels in contemporary Turkic varieties where we encounter examples not explainable by the voicing effect.

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