A Target Based Analysis of Syllable Contact Sonority in Bashkir

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1 Introduction

Like many Turkic languages, the initial consonant in Bashkir suffixes is often subject to change depending on the immediately preceding segment. Unlike other Turkic languages where the alterations typically surface between two or three possible consonants, Bashkir consonants manifest as a four-way alternation. This larger-than-typical pool of alternation allows for unique patterns to be observed. Bashkir demonstrates a novel process of target maximization wherein a sonority fall of a particular size, not the largest jump possible, is prioritized.

The traditional Syllable Contact Law (SCL) (Murray 1983), as operationalized in OT by the Sonority Contact Scale (SCS) (Gouskova 2004), cannot account for the Bashkir data in its current form. The novel Bashkir data presented in this paper as well as the analysis provided will shed a light on further power of the SCS to describe and derive phonologies beyond the typologically typical.

This paper is divided into 6 sections. Section 2 discusses the Bashkir data central to this paper. Section 3 discusses the SCS as it is typically conceived as well as motivations from other languages for its internal mechanisms. Section 4 discusses how the Bashkir data cannot be modeled using the existing SCS as well as what modifications should be made to expand the power of the system to cover Bashkir. Section 5 will discuss further utilizations of the modified SCS within Bashkir and motivate the system through observations orthogonal to those discussed in previous sections. Section 6 concludes the paper with discussions of possible future directions.

2 Bashkir Data

Bashkir is a Kipchak Turkic language spoken by approximately 1.2 million people primarily in the Republic of Bashkortstan in The Russian Federation. It is a (C)V(C) language. Like its similar and closely related sister language Tatar and many other Turkic languages, the initial segment of most affixes in Bashkir varies depending on the segment immediately preceding it. This is crucially different from being sensitive to the final segment of the root. When a root has multiple suffixes, which happens frequently, the first suffix is sensitive to the root-final segment, the second suffix sensitive to the first suffix's final segment, and so on.

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(1) *erije.ler.ðɪŋ*
Box.PL.GEN
"boxes'"

In example 1, the [l] in the plural suffix surfaces as it does due to the [e] at the end of the root. The [ð] in the genitive suffix surfaces due to the [r] at the end of the plural suffix.[1]

These alternations in Bashkir typically host a 4-way alternation between /n,l/, /ð/, /d/ and /t/. Below is an example of various nouns and their alterations as it applies to pluralization and some cases represented in IPA. This is only a small example of the morphological environments where these alterations apply. Other cases such as verb endings like tense and more all behave in an identical manner when the suffix begins with one of these coronal consonants.

Noun	**Pl**	**GEN**	**LOC**	**DAT**	**Gloss**
/erije/	[ler]	[nɪŋ]	[le]	[ge]	*box*
/kyðgy/	[ler]	[nyŋ]	[læ]	[gæ]	*mirror*
/taw/	[ðar]	[ðɯŋ]	[ða]	[ɣa]	*mountain*
/salbar/	[ðar]	[ðɯŋ]	[ða]	[ɣa]	*pants*
/kol/	[der]	[dɪŋ]	[de]	[ge]	*lake*
/ʃem/	[der]	[dɪŋ]	[de]	[ge]	*candle*
/ɪt/	[ter]	[tɪŋ]	[te]	[ke]	*dog*
/bolaθ/	[tar]	[tɯŋ]	[ta]	[qa]	*rug*

Figure 1: Bashkir noun declension table

Figure 1 is read by combining the nouns in the first column with the appropriate suffix. As such "erijeler" can be glossed as 'box+PL' while "erijege" glosses as 'box+DAT'. The chart contains two examples for each of the four suffix-initial consonant realizations in order to begin to carve out the classes of phonemes that pattern together.

The final two words end in voiceless coronal obstruents [t] and [θ]. These two phonemes pattern together with all other voiceless obstruents such as [s], [p], and [q]. All of these voiceless obstruents take a [t]-initial suffix. The next two words above end in /l/ and /m/ and take [d] along with other nasal-final words. Next are /r/ and /w/ which, alongside other approximates, take [ð]. Finally, the top two words are vowel-final and take either [l] or [n] depending on the specific suffix.

The vowel-final words are unique as they are the only member of the paradigm which have two separate options for the suffix-initial consonant. This is the reason for including them as a pair when discussed above and for referring to the paradigm as containing four members rather than five. Section 5 will discuss these two consonants specifically, however for the purposes of the paper up until this point all that is relevant is that all vowel-final words pattern together. Never do we see some words followed by [l] with a particular suffix and other words followed by [n] with that same suffix.

Another notable alternation in the paradigm are dative suffixes which all begin with dorsal consonants unlike the coronal suffixes presented in other cases. Like the /l, n/ distinction mentioned above, Section 5 will model this specific behavior. The bulk of the paper, however, will discuss the coronal alterations.

Finally worth noting are the vowels within the suffixes which vary independently of any sonority-related processes discussed in this paper. Bashkir has three harmony systems: front/back vowel harmony, rounding vowel harmony, and CV harmony between the dorsal consonants and vowels. While an interesting system, it is not relevant to the consonant selection central to this paper.

3 Sonority Contact Scale

3.1 *Syllable Contact Scale* Paramount to understanding the active affix alternations in Bashkir is the Syllable Contact Law (SCL). The SCL is a general typological tendency to prefer falling sonority across

[1] The rest of the paper will only refer to this phenomenon as a suffix-initial consonant alternation due to the root final segment for ease of exposition.

syllable boundaries. Shades of this can already begin to be seen in the descriptive data above, as every root-final segment takes a stem-initial consonant of lower sonority whenever possible.

Gouskova 2004 spells out the syllable contact scale (SCS), a mechanism used to codify the SCL in the OT framework (Prince & Smolensky 1993). This is a scale used to determine the magnitude and sign of sonority change between a final coda and initial onset. In order to combine the two positions into a single number, and due to typological tendencies, the scale assumes a maximally unmarked coda to be a glide /w/ and maximally unmarked onset to be a voiceless stop /t/. The following is taken directly from that paper.

w.t ≻	w.s ≻	w.d ≻	w.z ≻	w.n ≻	w.l ≻	w.r ≻	w.w ≻	r.w ≻	l.w ≻	n.w ≻	z.w ≻	d.w ≻	s.w ≻	t.w
	r.t	r.s	r.d	r.z	r.n	r.l	r.r	l.r	n.r	z.r	d.r	s.r	t.r	
		l.t	l.s	l.d	l.z	l.n	l.l	n.l	z.l	d.l	s.l	t.l		
			n.t	n.s	n.d	n.z	n.n	z.n	d.n	s.n	t.n			
				z.t	z.s	z.d	z.z	d.z	s.z	t.z				
					d.t	d.s	d.d	s.d	t.d					
						s.t	s.s	t.s						
							t.t							
−7	−6	−5	−4	−3	−2	−1	0	+1	+2	+3	+4	+5	+6	+7

Figure 2: Sonority Contact Scale
(Taken directly from Gouskova 2004)

The numbers at the bottom of Figure 2 show a scale of sonority change, with -7 being maximal drop and +7 being maximal rise. Gouskova proposes that languages will tolerate a drop of only a certain size and anywhere to the left of it across syllable boundaries. If a language allows, for example, a rise of +4 across syllable boundaries, then one can expect to find any difference of +4 or lower all the way to -7 in the language. Crucially, one will not find a rise of +5 or higher. Similarly, if a language permits only a drop of -3, then only -3 through -7 may be found within the language.

Unlike previous attempts which gave a particular constraint or rule access to the entire scale and encouraged maximization therein, Gouskova adopts a stringency hierarchy of phonological constraints (De Lacy 2004). Each number at the bottom of Figure 2 corresponds to a constraint in a tableau. *DIST+7 receives one violation for every coda-onset pair of a voiceless stop and approximant (in that order), *DIST 0 receives a violation for coda-onset pairs with identical sonorities, *DIST -6 receives a violation of every coda-onset pair that has either an approximant and voiceless fricative or a rhotic and voiceless stop, so on and so forth.

The constraints are crucially ordered from highest to lowest, such that every language should have *DIST +7 ranked above *DIST 0 which is itself ranked above *DIST -7. The typology, then, comes out not from the ranking of these constraints but from which other constraints from other constraint families, in particular faithfulness, occur between.

An example of another Turkic language, Kazakh, is given in the original paper wherein suffix onsets do not alternate based on sonority so long as the onset is of lower sonority than its corresponding coda. In the cases where the pair are flat or of rising sonority, such that a constraint from *DIST 0 to *DIST +7 would be violated, the sonority alternates in a similar way to Bashkir. This allows for an elegant derivation where faithfulness to the suffix is given as a constraint ranked between *DIST 0 and *DIST -1. As such, a simple alternation can occur whenever the sonority rises.

(1) Kazakh- *Hand* + *plural*, Desonorisation for inputs with flat and rising sonority (adapted from Gouskova 2004)

/kol/ + /lar/		*DIST +3	*DIST +2	*DIST +1	*DIST 0	IDENT$_{Rt}$
a.	kol.lar				*!	
b. ☞	kol.dar					*

(2) Kazakh- *Cucumber + plural*, No alternation for inputs with flat and rising sonority (adapted from Gouskova 2004)

/kijar/ + /lar/	IDENT$_{Rt}$	*DIST -1	*DIST -2	*DIST -3	*DIST -4
a. ☞ kijar.lar		*			
b. kijar.dar	*!				*
c. kijar.nar	*!		*		

Tableau 1 and 2 are largely demonstrative of the typical usage of the SCS. The analysis in this state cannot, however, extend to the observed Bashkir data, in particular due to approximant and rhotic final roots yielding [ð] initial suffixes. An analysis further than root identity and crucially ordered *DIST constraints must be given.

4 Bashkir Syllable Contact Scale

Before demonstrating how Bashkir cannot be modeled in the current system, it is necessary to consider the sonority scale itself. Gouskova's scale is meant to be a general outline of sonority typologically. It could be argued that every phoneme in all of the world's languages has an inherent sonority and that a scale ought to be however many hundreds or thousands of phonemes long as to accommodate them all. Of course within an individual language there is no need to capture every phoneme in all the world's languages. Further, we may also group phonemes in typical categories that appear to behave the same in instances within the phonology where sonority is evoked. Vowels can be seen, for example, as existing in a sonority tier of their own in Bashkir purely due to how they pattern. As seen in Figure 1, all vowel-final words take suffixes beginning with [l, n].

We can extend this sonority binning into the Bashkir Syllable Contact Scale. This is a scale similar to the broader SCS which makes the sonority distinctions relevant to the particular language discussed in this paper.

V + T	V + S W/r + T	V + D W/r + S n/l + T	V + Z W/r + D n/l + S Z + T	V + n/l W/r + Z n/l + D Z + S D + T	V + W/r W/r + n/l n/l + Z Z + D D + S S + T	V + V W/r + W/r n/l + n/l Z + Z D + D S + S T + T
-6	-5	-4	-3	-2	-1	0

Figure 3: Bashkir Syllable Contact Scale

The scale provided does not include the positive sonority jumps, however one could easily recreate it as a reciprocal of the negative ones as is the case in the broader SCS. The phonemes are not moved out of the general typological sonority scale (Jespersen 1904), rather simply binned into the sonority categories relevant in the language. We can see, then, that vowels (V) behave together, as do nasals (N), voiceless stops (T), voiceless fricatives (S), voiced fricatives (Z), voiced stops (D), and approximates (W)[2].

With this scale tailored specifically for Bashkir, we can attempt to use an OT analysis similar to that of Kazakh to describe the data. Also at our disposal are other common constraints such as ID (place) and AGR (voice). These constraints will ultimately prove crucial to the analysis, yet even with these constraints, the current analysis consisting of *DIST +7 » *DIST +6 » *DIST +5, etc., it is still impossible to derive the correct output data.

[2] This archiphoneme notation will be used throughout the paper to designate any phoneme that belongs to a particular manner and voicing

(3) *Box + genitive,* Demonstrates incorrect result under Kazakh analysis [3] [4]

/taw/ + /nɯŋ/	AGR (voice)	ID (place)	*DIST +7 - +1	*DIST 0	IDENT$_{Rt}$	*DIST -1	*DIST -2	*DIST -4	*DIST -4 +
a. 💣 taw.nɯŋ						*			
b. taw.dɯŋ					*!			*	
c. taw.tɯŋ	*!				*				*
d. taw.ðɯŋ					*!		*		

As is clear in tableau 3, inserting ID$_{Rt}$ into the derivation in the same location as in Kazakh does not yield the intended results. This is an unsurprising outcome as every language may have a unique place for this faithfulness constraint. While it is ranked below *DIST 0 in Kazakh, Gouskova places it below *DIST -3 in Kirghiz. We can attempt to move this faithfulness constraint in Bashkir to the appealing spot after *DIST -2, yet the intended surface form is still not derived.

(4) *Box + genitive,* Demonstrates incorrect result with moved IDENT$_{Rt}$

/taw/ + /nɯŋ/	AGR (voice)	ID (place)	*DIST +7 - +1	*DIST 0	*DIST -1	*DIST -2	IDENT$_{Rt}$	*DIST -3	*DIST -4+
a. taw.nɯŋ					*!				
b. 💣 taw.dɯŋ							*	*	
c. taw.tɯŋ	*!						*		*
d. taw.ðɯŋ						*!	*		

The problem is between the forms that surface as [d] and those which surface as [ð]. With IDENT$_{Rt}$ placed where it is in tableau 4, the higher sonority jump *[taw.dɯŋ] would be derived. If IDENT$_{Rt}$ is moved between *DIST -1 and *DIST -2 the story would not change as both the real output form as well as the illicit form produced are equally unfaithful with one altered segment apiece. The only solution would be to arbitrarily assign the genitive case marking an underlying suffix-initial ð. This is unappealing as from a cross-Turkic perspective it seems well established that the underlying form is either /n/ or /l/. Beyond the sour taste that making that move may cause, that analysis would simply be impossible as it would, then, be unable to derive the lateral and nasal-final cases. Assuming maximizing sonority drop blocked by faithfulness, a form such as "salbar" would ultimately yield the same derivation as "taw" above. An unavoidable yet untenable outcome in the current system.

The system must not always maximize. This problem cannot be seen in other Turkic languages such as Kazakh or Kirghiz as only the three outcomes, /l, n/, /d/, /t/, occur. This puzzle in Bashkir pulls the system too far and makes a purely maximizing model impossible.

The solution, then, is to create a target maximizing model. Instead of wanting however big of a sonority drop as necessary and nothing more, Bashkir desires a sonority drop of specifically -2, no more and no less.

(5) *Box + genitive,* Demonstrates target maximization with *DIST -3 - -7 [5]

/taw/ + /nɯŋ/	AGR (voice)	ID (place)	*DIST -3 - -7	*DIST +7 - +1	*DIST 0	*DIST -1	*DIST -2	IDENT$_{Rt}$
a. taw.nɯŋ						*!		
b. taw.dɯŋ			*!					*
c. taw.tɯŋ	*!		*!					*
d. ☞ taw.ðɯŋ							*	*

The system proposed in tableau 5 takes the *DIST constraints -3 and lower out of the typological place dominated by higher *DIST and instead places it at the top of the tableau. This aggregated constraint, like the other members of its family, incurs one violation for each across-morpheme pair of segments with a -3 or lower sonority drop. This disqualifies all forms with too large of drop, while still allowing for a maximization of sonority drop to a given level, in this case a distance of -2.

[3] *DIST +7 - +1 in reality is seven crucially ordered constraints, but for reasons of clarity on the tableau they have been collapsed into a single constraint.

[4] *DIST -4+ similarly is a collapsed constraint of *DIST-4, *DIST-5, and so on.

[5] Unlike *DIST +7 - +1, *DIST -3 - -7 really is one constraint, demonstrating a static and even aversion to sonority jumps of -3 or higher.

Not every root-final consonant has a possible realization that allows a -2 drop. In particular since ID (place) and AGR (voice) are ranked above the relevant *DIST constraints, the system will more readily sacrifice the target sonority jump for appropriate voicing and place realization. While *DIST -3 through -7 have been ranked high in Bashkir, the stringency relationship between the *DIST constraints -2 and higher still remain architecturally identical to the SCS. As such, there is still a sonority jump maximizing force pulling for as negative a sonority drop as possible (up through -2).

This can be clearly seen in the treatment of S and T final roots. A sonority jump of -2 simply does not exist for these segments as the sonority of the root-final phoneme is already too low. S can be satisfied by merely sacrificing one sonority jump, leading to a [t] initial segment with a drop of -1. T being the minimal sonority class in the language must settle on a sonority plateau, surfacing a /t/+[t] sequence. A derivation of this process is provided below.

(6) *rug* + *locative*, Demonstrates maximizing towards -2 from below if -2 is unachievable.

/bolaθ/ + /na/	AGR (voice)	ID (place)	*DIST -3 - -7	*DIST +7 - +1	*DIST 0	*DIST -1	*DIST -2	IDENT$_{Rt}$
a. ☞ bolaθ.ta						*		*
b. bolaθ.na				*!				
c. bolaθ.da	*!			*				*
d. bolaθ.ða	*!			*				*
e. bolaθ.θa					*!			*
f. bolaθ.ka		*!				*		*

5 Further Benefits of the System

The picture painted in Section 4 is an idealized view of the phenomenon taking into account only the most basic of coronal alternations. As referenced in Section 3, there is a larger empirical space of data to cover with our analysis. All of this data, however, can be explained with the small tweaks to the formula presented in Section 4. This section discusses three such contributions of the analysis in turn.

5.1 *Dorsal Alternations* As can be seen in tableau 5, ID (place) is highly ranked. The common factor between the four-way alternation discussed up until this point is that the alternating segments are all coronal. This is not due to faithfulness to each other, but rather due to the underlying form of the suffix. Different Turkic literature varies on the underlying segments of many of these alterations, but here we assume all the cases where we see coronals surface are ones with coronal underlying representations as well.

In the dative case, as well as the final verb converb construction and likely other unexplored pockets of the grammar, the suffix always surfaces as dorsal instead of coronal. One can assume that this is reflective of the underlying form of the suffixes being specified for dorsal. Unlike the coronal place where a plethora of phonemes varying in sonority allows us to see the complex system discussed in the paper, the dorsal place only hosts a two-way distinction between /k/ and /g/. As such, the high ranking AGR (voice) and ID (place) constraints trivially return the correct form in dative alternations.

It is worth noting that in Figure 1 we see not two but four possible segments in the dative case. This is not due to differences in sonority or voicing, but rather the CV vowel harmony system. [k] and [g] surface when the word contains front vowels such as [e]. [q] and [ɣ] surface when the word contains back vowels such as [a]. The dorsal alternations regarding CV harmony and the alternations regarding the voicing of the suffix-initial segment are ultimately separate processes which do not interact (Kalin 2022).

5.2 */l/ - /n/ Alternations* The fact that /l/ and /n/ are the only two coronal suffix-initial segments that alternate with regards to one another also falls out nicely from the system discussed in this paper. Moving our attention from the left side of the + in Figure 3 to the right side, we can see the possible coronal consonants. In the case of approximants/rhotics and nasals/laterals there is only one segment that fits the criteria of +coronal, matching voicing, and having a -2 sonority drop. Even extending to the root-final voiceless consonants in -1 and 0 there is always one and only one correct outcome of the system. Vowel final words on the other hand do not have the luxury of trivial selection, instead both [n] and [l] fit all three criteria.

In a language like Kazakh all that needs to be tested in order to derive the correct suffix-initial consonant is if the underlying form would lead to a cross-syllable sonority rise. In cases where it doesn't and faithfulness is preserved, the identity of the suffix-intial consonant is merely representative of whether the suffix itself is underlyingly /l/ or /n/ initial. While it is still the case that we cannot ultimately derive which segment we will see based off phonological properties, it must simply be specified underlyingly, our system provides the freedom to surface both [n] and [l] without a hit to sonority maximization.

Given our current system with a relatively low ranked faithfulness to the root, any alternation other than one where the alternates are of the same sonority would be impossible. /n/ and /l/ are both the only coronal consonants that fit this criteria and the only segments we see in this alternating relationship.

(7) *Box* + *plural*, Demonstrates /l/, /n/ alternation through IDENT$_{Rt}$

/erije/ + /ler/		AGR (voice)	ID (place)	*DIST -3 - -7	*DIST +7 - +1	*DIST 0	*DIST -1	*DIST -2	IDENT$_{Rt}$
a.	erije.ter	*!		*!					
b.	erije.der			*!					
c. ☞	erije.ler							*	
d.	erije.ner							*	*!

This quirk of the system falls out of the sonority binning discussed above. The ultimate derivation of the sonority bins was not based on how the segments alternated (the right of the plus sign) but rather how they evoked alterations (the left of the plus sign). The fact that /l/ and /n/ appear in variation gives us yet another reason to believe that sonority is binned in a language only so far as it is useful to the systems that evoke sonority.

5.3 *Marginal Phonemes and [s]* Looking at the -2 column of Figure 3 we can see that there are five, not four, logical outcomes of the system. Up until this point I have not discussed any suffixes starting with [s], not because they surface in interesting situations but rather because they never surface. This again falls simply out of the system as Bashkir has a prohibition on root-final voiced obstruents. As this category is the one that would give rise to a suffix-final [s], it follows that that [s] is never seen.

If we could have a word-final voiced obstruent, [s] would still not surface as there is a voicing mismatch, a violation of the highly ranked AGR (voice) constraint. We would anticipate that in much the same way that S final roots maximize to the lowest sonority drop greater than -2 , so too would Z final roots. Our system predicts that a Z final root would surface with [d] as the suffix-initial counterpart.

While we cannot affirm this suspicion in the standard phonology of Bashkir, we can investigate it using loan words. Due to large contact with Russian as well as the fossilization of some names when /z/ was still allowed word-finally in older languages that led into modern Bashkir, there are some words that are /z/ final. For example the Turkic name /gylnaz/ is pronounced as such in Bashkir. Our system behaves exactly as anticipated, when one of these loans is put in genitive case it does in fact surface with the [d]-initial suffix. As such, a sentence evoking the genitive case marking on Gylnaz such as "This is Gylnaz's house" /gylnaz/ + GEN would surface as [gylnaz.dɯŋ]

6 Conclusion

This paper has set out to model the four-way alternation taken by suffix-initial coronal consonants in Bashkir. Crucially it has shown that languages need not maximize sonority fall across syllables. In cases such as Bashkir sonority is instead maximized to a particular target. While ultimately deriving the behavior of the alternation descriptively in the language, the insights learned from this alternation can be applied more broadly to sonority contact.

This project has multiple avenues available for future research. One such investigation could be a deeper investigation into the syllable contact sonority not just across morpheme boundaries but within roots as well. Another is a deeper look as to the underlying mechanisms of why the constraints and their ranking look the way they do, particularly as it applies to sonority. Finally, the analysis may be able to extend to languages other than Bashkir. This can be done both within languages which may already be explainable with the traditional SCS as well as languages with more unique consonant mutations in which the SCS has been found to be unsuitable.

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