Falling sonority onsets, loanwords, and Syllable Contact*

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1 Introduction

When CVC languages borrow loanwords with complex onsets, they often treat s-obstruent clusters differently from all others. In s-obstruent clusters, a vowel is inserted at the edge: English 'school' → Hindi [**ɪ**skul], but in rising sonority clusters, the vowel is inserted into the cluster, English 'fruit' → Hindi [f**ɪ**rut] (Broselow 1999). Previous analyses have attributed this split pattern to the different structure of s-obstruent clusters: they are complex segments and cannot be broken up by epenthesis (Broselow 1992). Fleischhacker (2000, 2001) focuses on the special perceptual properties of sibilant-initial clusters. I propose instead that the pattern is an effect of SYLLABLE CONTACT—the preference for sonority to fall across a syllable boundary (Murray and Vennemann 1983). While the epenthesis itself is driven by the prohibition on clusters, its site is determined by SYLLABLE CONTACT. Epenthesis in clusters is peripheral (CCV → VCCV) whenever C1 is of higher sonority than C2, but internal (CCV → CVCV) whenever C1 is of lower sonority than C2.

Key new evidence for this approach comes from Russian loanwords into Kirgiz. Russian has a wide variety of falling and flat sonority clusters, which are repaired in this split fashion in Kirgiz: by peripheral epenthesis in falling and flat sonority onsets, *zveno* 'link' → [**u**zvana], and by internal epenthesis in rising sonority onsets, *kvas* 'kvass'→ [k**ɯ**bas]. This shows that the purported limitation of the split pattern to s-obstruent clusters is an artifact of the source of the loanwords, English and French. The resistance of s-clusters to epenthesis is thus shown to arise from their sonority properties and from independently needed constraints rather than from a difference in structure or special perceptual properties.

2 Epenthesis Patterns in Loanwords

The split epenthesis pattern is pervasive in many unrelated languages, from Hindi to Wolof. In rising sonority clusters, a vowel is inserted between the two consonants of the onset (1). In falling sonority clusters, most notably s-obstruent clusters, the vowel is inserted before the cluster, as shown in (2).

(1) *Rising sonority: internal epenthesis*

		Gloss/source
Hindi	f**ɪ**rut	'fruit'
	p**ə**faizər	'Pfizer'

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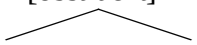
Bengali	g**e**laʃ	‘glass’
Central Pahari	s**i**let	‘slate’
Sinhalese	t**i**yage	tyage ‘gift’(Skt)
Wolof	k**a**las	‘class’
Uyghur	k**u**lub	klub ‘club’(Russian)

(2) *Falling or flat sonority: edge epenthesis*

		Gloss/source
Hindi	**ɪ**skul	‘school’
	isfiər	‘sphere’
Bengali	**i**ʃkul	‘school’
Central Pahari	**i**spiitʃ	‘speech'
Sinhalese	**i**stri	stri ‘woman’(Skt)
Wolof	**e**stati	‘statue’
Uyghur	**i**statistika	statistika ‘statistics’(Russian)

Broselow (1992) speculates that the difference between rising sonority clusters and s-obstruent clusters lies in their structure: s-obstruent clusters are complex segments and by their nature cannot be broken up by epenthesis.[1]

(3)



(structure from Selkirk 1982)

It is claimed that all languages adopt this representation and even impose it on loanwords. Speakers of CVC languages must be aware of this difference in the phonological representations, and respect it in their repair strategies.[2] In the following section, I propose an alternative that calls on the different sonority properties of the two types of clusters to explain their behavior. Section 4 presents new evidence for the sonority analysis—other falling sonority clusters pattern with s-obstruent clusters.

3 Analysis

I claim that there is no special structure associated with s-obstruent clusters that explains their resistance to epenthesis. The explanation for their perceived exceptional behavior is twofold. First, s-obstruent clusters are the only falling sonority clusters in English and French, the chief loanword sources for the languages in (1-2). Second, sonority sequencing constraints such as SYLLABLE CONTACT treat s-obstruent clusters differently from obstruent-sonorant clusters. SYLLABLE CONTACT determines the site of epenthesis when no other constraints can make the decision, either because SYLLABLE CONTACT is

high-ranked (as in Kirgiz and Bengali), or because its effects surface in the Emergence of the Unmarked schema (McCarthy and Prince 1994).

In all of the languages in (1) and (2), epenthesis is driven by the prohibition on tautosyllabic clusters (*COMPLEX), while SYLLABLE CONTACT (4) dictates the best site. The vowel is inserted into the position that yields the optimal sequence of consonants, that is, one with falling sonority.

(4) SYLLABLE CONTACT: Sonority must not rise across a syllable boundary. (Davis 1998, Hooper 1976, Murray and Vennemann 1983, Rose to appear, Vennemann 1988)

(5) *COMPLEX: No tautosyllabic consonant sequences.

In all of the languages with the split pattern of epenthesis, *COMPLEX must dominate DEP to cause epenthesis in clusters:

(6) *Epenthesis repairs clusters*

	/frut/	*COMPLEX	DEP
a.	frut	*!	
b.→	f**i**.rut		*

The vowel is inserted at the edge unless the CC sequence has rising sonority (***i**f.rut), in which case the effects of SYLLABLE CONTACT emerge and a vowel breaks up the cluster (f**i**.rut). Most onset clusters have the offending rising sonority profile and are broken up by internal epenthesis.

(7) *Rising sonority input: internal epenthesis*

	/frut/	SYLLABLE CONTACT	DEP
a.→	f**i**.rut		*
b.	**i**f.rut	*! (s.l)	*

S-obstruent clusters have falling sonority, so epenthesis at the edge is possible and preferred: **i**s.piitʃ≻s**i**.piitʃ. The crucial assumption here is that the default site of epenthesis in loanwords is at the edge. This needs to be justified—edge epenthesis violates NOCODA and ONSET, while the dispreferred internal epenthesis actually satisfies NOCODA, ONSET and SYLLABLE CONTACT. I claim that the constraint that prefers edge epenthesis is CONTIGUITY. (This point will be discussed further in section 6.)

(8) CONTIGUITY: elements adjacent in the input must be adjacent in the output.

This constraint ensures edge epenthesis when SYLLABLE CONTACT is not at stake: thus, between (a) and (b), (b) wins only because it keeps adjacent input elements together in the output.

(9) *Falling sonority input: edge epenthesis*

	/spitʃ/	CONTIGUITY	DEP
a.	s**i**.piitʃ	*!	*
b.→	**i**s.piitʃ		*

Rising sonority inputs show that CONTIGUITY must be ranked below SYLLABLE CONTACT to derive the split pattern. The opposite ranking allows only edge epenthesis, as in Iraqi Arabic (discussed below in section 6).

(10) *Rising sonority and CONTIGUITY*

	/frut/	SYLLABLE CONTACT	CONTIGUITY
a.→	f**i**.rut		*
b.	**i**f.rut	*!	

These are the two rankings necessary to derive the split epenthesis pattern:

(11) *Crucial rankings for the split epenthesis pattern:*
*COMPLEX >> DEP
SYLLABLE CONTACT >> CONTIGUITY

Finally, it is important that SYLLABLE CONTACT does not have to dominate DEP for the split epenthesis pattern to arise. Even in languages that do not use epenthesis to repair SYLLABLE CONTACT violations, it is the ranking SYLLABLE CONTACT >> CONTIGUITY that makes edge epenthesis the default (12). When SYLLABLE CONTACT is not violated, as in (13), CONTIGUITY ensures that edge epenthesis is optimal.

(12)

	/frut/	*COMPLEX	DEP	SYLLABLE CONTACT	CONTIGUITY
a.→	f**i**.rut		*		*
b.	**i**f.rut		*	*! (s.l)	

(13)

	/spitʃ/	*COMPLEX	DEP	SYLLABLE CONTACT	CONTIGUITY
a.→	**i**s.piitʃ		*		
b.	s**i**.piitʃ		*		*!

Though it is not necessary for SYLLABLE CONTACT to be active outside of the loanword epenthesis pattern, this is indeed the case in some of the languages in (1) and (2). It is very active in Bengali, regulating both the shapes of native roots and affixation processes (Christdas 1988). On the other hand, Egyptian Arabic has the split pattern but has no other SYLLABLE CONTACT effects.

This section has demonstrated that SYLLABLE CONTACT determines the epenthesis site: at the edge for falling sonority clusters, inside for rising sonority clusters. This outcome is ensured as long as SYLLABLE CONTACT is ranked above CONTIGUITY, although the ranking of it with respect to DEP is not crucial. This pattern can be an Emergence of the Unmarked effect, surfacing whether or not SYLLABLE CONTACT is otherwise active in the native grammar.

4 New Evidence

The SYLLABLE CONTACT analysis makes a prediction: all falling and flat sonority onset clusters should be repaired by edge epenthesis, not just s-obstruent clusters. As long as a consonant sequence has a sonority profile that would satisfy SYLLABLE CONTACT, such as #lbV → #**V**l.bV, epenthesis at the edge is preferred to a CONTIGUITY violation. This prediction must be tested on loanwords from a language that has a variety of such falling sonority onsets. Russian words are frequently borrowed into the Turkic languages of the former Soviet Union, which are CVC and many of which have attested SYLLABLE CONTACT effects (Baertsch and Davis, this volume, Sleptsov 1975, Ubriatova et al. 1982). Here, I will look only at loanwords and second-language data from Kirgiz, which exhibit the same split pattern with a larger range of clusters[3]:

(14) *Russian loanwords into Kirgiz--same split pattern:*

examples:	rt, lb, lv, st, stʃ, ʃt, ʃtr, zv, mn	kv, mr, sm, kn, pn, ʃl, fr, pr, pj
sonority:	Falling/ Flat	Rising
epenthesis:	Edge	Internal

(15) *Falling/flat sonority: edge epenthesis*

Russian	Kirgiz	Gloss
rtut'[4]	**u**r.tut	'mercury' AT
Lbovskij	**y**lbovskij	nonce last name AT
L'vov	**i**lvop	city name AT
stakan	**ɯ**s.takan	'glass cup' Y
stʃot	**ɯ**s.tʃot	'bill' Y
ʃtap	**ɯ**ʃ.tap	'headquarters' Y
ʃtraf	**ɯ**ʃ.tarap	'penalty' Y
zveno	**u**z.vana	'chain link' Y
mnemonicheskij	**y**mnemonicheskij	'mnemonic'AT

(16) *b. Rising sonority: internal epenthesis*

trupka	t**u**.rupke	'pipe' Y
plita	p**i**.lita	'stovetop' Y
ʃleja	ʃ**i**.lija	'breach-band' Y
kniʃka	k**i**neʃke	'book' Y
kvas	k**ɯ**.bas	'kvas' Y
Frunze[5]	B**o.**ronzo	'Frunze' EB
front	p**ɯ**ront	'front' Y
p'janitsa	p**ɯ**janketʃ	'alcoholic' Y
tr'ufeli	t**u**rufeli	'truffles' AT
pnevmatika	p**ɯ**nevmatika	'pneumatics' AT
Mrɯl'ov	m**ɯ**rɯlov	last name AT

The two hypotheses about the cause of the asymmetry make different predictions. The SYLLABLE CONTACT analysis predicts that epenthesis will not interrupt any falling and flat sonority clusters, whether or not they start with a sibilant. On the other hand, Broselow's complex segment hypothesis would have to be extended to clusters like /zv/, /rt/ and /stʃ/ to explain the split pattern. That would make the strange prediction that these clusters should have the phonotactic distribution of single segments, which is false.

In the most recent discussion of this problem, Fleischhacker (2000, 2001) rejected the SYLLABLE CONTACT analysis because her Farsi consultant did not produce the expected split pattern with hypothetical Russian loanwords. The data presented here lend additional support to the SYLLABLE CONTACT analysis, showing that sibilant-initial clusters are not exceptional. Unfortunately, a more complete discussion of Fleischhacker's analysis is beyond the scope of this paper.

To sum up, the new evidence shows that the purported limitation of the split pattern to s-obstruent clusters is an artifact of the source languages, English and French. Kirgiz treats falling sonority clusters on a par with s-obstruent clusters, as predicted.

5 Syllable Contact in the Native Phonology of Kirgiz

This section offers further support for the analysis—the effects of SYLLABLE CONTACT in the native phonology of Kirgiz. The native phonology patterns also shed some light on the nature of SYLLABLE CONTACT, which appears to be more than just a unitary constraint.

Kirgiz suffix onsets become obstruent after a root-final consonant in order to maximize the sonority distance between the root coda and the suffix onset. They surface faithfully only after a vowel:

(17) *Syllable Contact in Kirgiz (Hebert and Poppe 1964, Kasymova et al. 1991)*

	Objective /-nu/	Plural /-ler/	Gloss
too	too-nu	too-lar	'mountain'
aj	aj-**d**ɯ	aj-**d**ar	'moon'
kar	kar-**d**ɯ	kar-**d**ar	'snow'
rol	rol-**d**u	rol-**d**ar	'role'
atan	atan-**d**ɯ	atan-**d**ar	'gelded camel'
taʃ	taʃ-**t**ɯ	taʃ-**t**ar	'stone'
konok	konok-**t**u	konok-**t**ar	'guest'

This pattern suggests that the sonority requirements outrank the affix faithfulness constraints, and the sonority feature can be changed to achieve a better sonority profile. However, a single constraint that only requires sonority to drop does not get the correct results (18). The faithful candidate (a), *rol.nu*, already has falling sonority, and yet the actual surface form (b) is unfaithful.

(18) *A preliminary ranking*

	/rol-nu/	FAITH$_{ROOT}$[SON]	SYLLCONTACT	FAITH$_{AFFX}$[SON]
a.	rol.nu		l.n✓	
b.→?	rol.du		l.d✓	*

What makes *rol.du* better than *rol.nu* is that it achieves a greater sonority distance between the consonants. In Gouskova (in preparation), I argue that SYLLABLE CONTACT is a not a unitary constraint but a hierarchy. The hierarchy penalizes sonority rise and insufficient sonority fall: codas should be more sonorant than onsets, and the greater the fall, the better (Murray and Vennemann 1983, Vennemann 1988). A coda-onset sequence with a sonority rise of 6 points along the sonority scale, e.g. *as.wa*, violates *DISTANCE 6 and is therefore highly marked, while a sequence with a sonority fall of 6 points, *aw.sa*, violates *DISTANCE–6, and is therefore relatively unmarked.

(19) *The Syllable Contact Hierarchy*[6]

largest sonority rise, most marked ←←←← flat sonority→→→→ largest sonority drop, least marked

*DIS7>>*DIS6>>*DIS5>>*DIS4>>*DIS3>>*DIS2>>*DIS1>>*DIS0>>*DIS–1>>*DIS–2>>*DIS–3>>*DIS–4>>*DIS–5>>*DIS–6>>*DIS–7

The hierarchy can explain why Kirgiz is not content with a mere sonority drop, and why alternations maximize the difference in sonority. The following generalization holds of Kirgiz:

(20) Kirgiz requires the largest sonority drop between a root coda and a root onset that can be achieved without altering the root segment.

(21) *The Kirgiz ranking*

FAITH $_{ROOT}$ >> *DIST 7 >> … *DIST 1>> *DIST 0 >> *DIST –1…>>*DIST–7 >> FAITH $_{AFFIX}$ [SON]

This ranking allows us to understand Kirgiz sonority alternations. Whenever sonority is rising (22) or insufficiently falling (23), and it is possible to improve the sonority distance between two consonants, the affix onset becomes a stop, agreeing in voicing with the preceding consonant:

(22) *Rising sonority input: affix onset becomes a stop*

	/atan-lar/	*DIST 7	*DIST 1	*DIST 0	*DIST–2	FAITH $_{AFFIX}$ [SON]
a.	atan-lar		*!			
b.→	atan-dar				*(n.d)	*

(23) *Input with insufficiently falling sonority: affix onset becomes a stop*

	/kar-lar/	*DIST 7	*DIST 1	*DIST 0	*DIST–2	*DIST –4	FAITH $_{AFFIX}$ [SON]
a.	kar-lar		*!				
b.	kar-nar				*! (r.n)		
c.→	kar-dar					*(r.d)	*

Flat sonority is tolerated, because it is impossible to improve on it given this ranking, since deleting or changing the root segments is prohibited.

(24) *Why flat sonority is tolerated*

	/konok-lar/	FAITH $_{ROOT}$	*DIST 5	*DIST 0	*DIST–2	*DIST –4	FAITH $_{AFFIX}$ [SON]
a.	konok-lar		*!				
b.→	konok-tar			*			*
c.	konow-lar	*!			*(w.l)		
d.	kono-lar	*!					

Why isn't epenthesis used to break up illicit clusters in the native phonology?[7] The ranking of DEP above the Syllable Contact constraint *DISTANCE 0 (no flat sonority) ensures that the lowest ranked Faithfulness constraint, FAITH$_{AFFIX}$ [SON], is violated whenever possible, and that epenthesis is a last resort repair. When a loanword (root) is introduced, epenthesis will break up only clusters that have rising sonority.

(25) *Final Kirgiz ranking*

*CLUSTER, FAITH$_{ROOT}$ >> *DIST 7 >> …*DIST 1 >> DEP, CONTIGUITY >> *DIST 0 >>…*DIST–7 >> FAITH$_{AFFIX}$ [SON]

The effects of SYLLABLE CONTACT in the native grammar of Kirgiz support the analysis developed here: high-ranking sonority markedness constraints affect both native words and loanwords, but in different ways.

6 Further Predictions of the Syllable Contact Analysis

OT constraints are freely rerankable, so there should be languages that do not follow the pervasive split pattern. For example, all languages discussed so far have the crucial ranking of constraints against rising sonority over CONTIGUITY. If the opposite ranking obtains, all epenthesis should be at the edge. A language with this pattern is Iraqi Arabic, where onset sonority seems to be irrelevant.

(26) *Iraqi Arabic: Edge epenthesis* (Broselow 1992)

Rising sonority	Gloss	Falling sonority	Gloss
ʔifred	'Fred'	**ʔi**stadi	'study'

If other syllable structure constraints dominate CONTIGUITY, then all epenthesis should be internal. If NOCODA is ranked high, the effects of SYLLABLE CONTACT will never emerge. Japanese is an example of this pattern: all loanword epenthesis is internal.

Finally, something should be said about the preponderance of epenthesis as a repair of loanword clusters. Why aren't deletion or metathesis used more often? There are several issues here, which have to do with the relation of loanwords and faithfulness. First of all, deletion and SYLLABLE CONTACT would not really interact in the relevant way. If *COMPLEX >> MAX >> SYLLCONTACT, all illegal clusters should be resolved by deletion, regardless of their sonority shape. Other factors may determine which consonant is preserved from the cluster, but Syllable Contact will not be at play. Furthermore, there are languages that simplify clusters by deletion, for example, Finnish *skola* → *koulu*.

It is harder to explain the scarcity of metathesis—it would actually be ideal, but it is so rare even in native phonologies that the relevant data are missing. It is apparent, though, that epenthesis is cross-linguistically the repair of choice for loanwords and second-language acquisition (Fleischhacker 2000, Smolensky et al. 2001), especially when compared to first-language acquisition, where epenthesis is much less frequent than deletion (Joe Pater, p.c.).

Another, related issue is the role of CONTIGUITY in loanword phonology. A possible extragrammatical reason for this is that loanwords have a special status, and are treated exceptionally, with a different kind of faithfulness (Silverman 1992)—an effort is made to preserve all of the segments of the loanword in the pronunciation, and to keep them adjacent and in the right order. These considerations make epenthesis preferable to deletion, and explain why CONTIGUITY is so crucial and why metathesis is so rare.

7 Conclusion

I have shown that SYLLABLE CONTACT explains a pervasive pattern of asymmetric epenthesis in loanword phonology and second language acquisition, where falling and rising sonority clusters are treated differently. Evidence from Kirgiz shows that s-obstruent clusters behave just like other falling sonority clusters with respect to loanword epenthesis, and their resistance to epenthesis arises from the interaction of independently needed constraints such as SYLLABLE CONTACT and CONTIGUITY rather than from a difference in segmental structure.

Notes

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[1] This structure of s-obstruent clusters was proposed to explain their exceptional phonotactic distribution in English onsets and codas: they are the only instances of onsets where the second consonant is an obstruent, and of three-consonant onsets (Selkirk 1982). See also Lamontagne (1993).

[2] There are many problems with this explanation, not the least of which is its failure to explain why s-obstruent sequences are repaired in the first place—if they are complex segments, like affricates, then they should not violate any constraints on clusters. See (Fleischhacker 2000) for further discussion.

[3] The data were collected from native speakers (see acknowledgements), and from Yudakhin's (1965) Kirgiz-Russian dictionary. The initials of the consultants are indicated next to each datum.

[4] R-initial clusters are not very informative, since Kirgiz in general disallows r-initial words. Edge epenthesis here is probably due to this prohibition rather than to SYLLABLE CONTACT.

[5] Curiously, this is the former Russian/Soviet name for the capital of Kirgizstan, Frunze (now Bishkek), which is unpronounceable in Kirgiz without epenthesis.

[6] Sonority Scale assumed: glides_8 > rhotics_7 > laterals_6 > nasals_5 > $\text{voiced fricatives}_4$ > voiced stops_3 > $\text{voiceless fricatives}_2$ > voiceless stops_1, abbreviated as: w > r > l > n > z > d > s > t.

[7] Yakut is reported to employ epenthesis in medial clusters in loanwords, though it does not use epenthesis in native affixation: Russ. *vedro* → Yak. *biedere* (Sleptsov 1975).

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