SONORITY VIOLATIONS IN SLAVIC LANGUAGES: BULGARIAN, RUSSIAN, AND POLISH

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INTRODUCTION

In this paper we will look at consonant clusters in three Slavic languages: Bulgarian, Russian, and Polish. More specifically, we will examine the consonant clusters, in the word initial position in these three languages for adherence to the sonority hierarchy. When we find violations, and we believe these languages have many, we will attempt to explain why these apparent violations occur without disputing the sonority hierarchy theory. For example, English consonants adhere quite nicely to the sonority hierarchy in both onsets and codas except for occurrence of the consonant /s/. However, this violation of the consonant /s/ is explained by the theory of extrasyllabicity.

The reason we chose these three languages is because they represent the southern (Bulgarian), eastern (Russian), and western (Polish) Slavic languages. We are curious to see if the consonant violations are similar in occurrence and are dealt with in a similar method. Our claim is that even though the Slavic languages may have many consonant cluster combinations that violate the sonority hierarchy, these languages follow universal principles of grammar and phonology. We will show that most, if not all, of these apparent violations exist in their underlying representation, but are not violations of the sonority hierarchy at the phonetic level.

To assist us in making some of our judgements regarding the pronunciation of the words in these languages, we had native speakers pronounce the words in the respective appendixes. The Bulgarian and Polish native speakers used carrier phrases in their pronunciation of those respective languages. However, the Russian native speaker did not use carrier phrases. All of the native speakers were recorded at normal pronunciation speed, and then recorded a second type using slower, more careful pronunciation.

REVIEW OF PRINCIPLES/RULES

Sonority Scale. Clements (1992) defines the sonority scale as consisting of four natural classes of sounds: obstruents, nasals, liquids, and glides. Unlike others who have proposed a five member scale, Clements chose to combine stops and fricatives into the obstruent group, as shown in (1) below. Therefore, under Clements' classification for sonority, stops and fricatives are treated equally with regard to the sonority hierarchy and consonant clusters.

(1)   least   most
                obstruent < nasal < liquid < glide < vowel
        sonorant   sonorant

Other theorists, Carr (1993), prefer to separate stops and fricatives as shown in (2). According to Carr, stops are the least likely segments to occupy the nucleus because they have the highest degree of blockage of the airstream during pronunciation. This blockage makes stops the least sonorant segments.

(2)   1   2   3   4   5   6
         stop < fricative < nasal < liquid < glide < vowel

Carr agrees with Eckman & Iverson (1993) in that voicing also plays a role in the sonority scale. According to these theorists, voiceless stops are less sonorant than voiced stops, and voiceless fricatives less sonorant than voiced fricatives. This is shown in (3) below.

(3)   least   most
              voiceless   voiced   voiceless   voiced
              stops   stops   fricatives   fricatives
         sonorant   sonorant

Sonority Sequence Principle. According to this principle, segments can be ranked along a "sonority scale" in such a way that segments ranking higher in sonority stand closer to the center of the syllable and segments ranking lower in sonority stand closer to the margin. This principle expresses a strong cross-linguistic tendency, and represents one of the highest - order explanatory principles of modern phonological theory.

Clement's provisional version of the Sonority Sequencing Principle: Between any member of a syllable and the syllable peak, only sounds of higher sonority rank are permitted.

Under this principle, syllables of the type tra, dva, sma, mra are permitted, while syllables like, rta, vda, msa, mla are excluded. Crosslinguistic comparison supports the view that clusters conforming to the Sonority Sequencing Principle are the most commonly occurring, and are often the only cluster types permitted in a given language.

Minimal Distance Constraints. Clements' proposed sonority Dispersion Principle, in particular, characterizes as least complex those syllable types whose onsets show a sharp and steady rise in sonority proceeding from the margin to the peak. Accordingly, obstruent-glide onsets emerge as more complex, or more marked, than obstruent-liquid onsets, because the rise in sonority from obstruent to liquid to vowel makes a steadier progression than does the initially sharp, then nearly flat, increase from obstruent to glide to vowel. On this basis the occurrence in many languages of apparent minimal distance constraints relative to sonority in syllable onsets in fact does derive from markedness considerations. Thus, if a language has onsets with a gradual or irregular rise in sonority (obstruent/glide/vowel) it implies the existence of a sharp and steady rise in sonority (obstruent/liquid/vowel).[1]

Under Clements' notions of core syllabification, then, the markedness of obstruent-glide onsets relative to obstruent-liquid onsets is predicted. A further consequence of this prediction is that no language should have obstruent-glide onsets unless it also has obstruent-liquid onsets.[2]

Minimal Sonority Distance (MSD) Parameter. According to Eckman & Iverson (1993), "Languages that require a greater difference in sonority between adjacent segments will have fewer kinds of consonant clusters in the onset, and languages that allow a smaller minimal difference between adjacent consonants will have more."[3] In example 5 below, Eckman describes the *Markedness Relationship*.

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[1] Eckman, Fred R., and Iverson, Gregory K. 1993. Sonority and Markedness among Onset Clusters in the Interlanguage of ESL Learners. *Second Language Research* 19: pp 248-249.
[2] Ibid, pp 249
[3] Ibid, pp. 235.

(4)   Markedness Relationship (Eckman et al 1993)
      Marked   relative to   Unmarked
      a) Fricatives   Stops
      b) Voiced stops   Voiceless stops
      c) Voiced fricatives   Voiceless fricatives

(5)   Sequential markedness principle:
      *For any two segments A and B and any given context X_Y, if A is less marked than B,
      then XAY is less marked than XBY.*

Based on the Markedness Relationship and Sequential markedness principle, since voiced [b] is a
marked segment relative to voiceless [p], by the principles above, [b] will still be marked relative
to [p] when it is in the word-initial position before [r] - hence [br] clusters are more marked than
[pr] clusters, and are predicted to cause more IL difficulty than to [pr] clusters. Similarly, initial
sequences with the fricative [f] plus a consonant represent structures which, following the
hierarchy in (3) and (4) and the principle in (5), are more marked than initial sequences of [p]
plus a consonant. Hence, [fr] is predicted to cause more IL difficulty than [pr].[16] The
Markedness Relationship also argues against Clement's sonority hierarchy scale which lumps
stops and fricatives under the heading of "obstruent", example (1), and offers a valid reason to
separate the stops and fricatives as in the scale in example (2).

Maximum Onset Principle. Under this principle, VCV is preferably syllabified V-CV, not
VC-V, since V is a simpler final demisyllable than VC, and CV is a simpler initial demisyllable
than V. This account extends to VCCV sequences as well. For example the preference for the
syllabification V-OLV instead of VO-LV owes to the fact that V is a simpler final demisyllable
than VO. Thus V-OLV is a simpler sequence that VO-LV by virtue of the crosslinguistic
preference for open syllables. The syllabification V-CCV will be preferred to VC-CV just in case
CCV is an admissible core demisyllable type in the language in question.

Extrasyllabicity. According to Clements (1992), consonants that violate the Sonority
Principle usually do so on what Clements referred to as the "edges" of syllabification domain, or
in other words at the beginning of an onset cluster.[17] The term "extrasyllabic" means the
segment beginning the cluster may exist in the underlying (UR) representation as part of the
syllable which contains the consonant cluster but is not part of the same syllable in it's phonetic
representation (PR). It seems this notion of "extrasyllabicity" cuts across many languages and is
used to explain violations of the sonority scale.

SLAVIC LANGUAGES

The Slavic languages currently spoken, according to their genetic relations within Slavonic are:
South Slavonic: Bulgarian, Macedonian, Serbo-Croat, Slovene; West Slavonic: Czech, Slovak,
Polish, Upper and Lower Serbian (Lusatian); East Slavonic: Russian, Ukrainian, Belorussian
(White Russian) (Comrie 1990). In phonological and morphological structure the Slavonic
languages are very close to one another, more so than the Romance languages.[18] There are two

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[16] Eckman Ibid
[17] Clements, G.N. 1990. The Sonority Cycle and syllable organization. In W. Dressler, H. Luschutzky,
O. Pfeiffer, and J. Rennison (eds.) *Phonologica* 1988. Cambridge: Cambridge University Press.
[18] Comrie, Bernard (1990). The Worlds Major Languages. Oxford University Press.

main sets of sound changes that separate Proto-Indo-European from Common Slavonic. One if the tendency for sounds within the syllable to a be arranged in order of increasing sonority (i.e. obstruents, then liquids and semi-vowels, then vowels). The second major set of sound changes is a series of palatalization. By the first palatalization, /g/, /k/, /x/ become, respectively, [ʒ], [tʃ], [ʃ] before original front vowels. By the second platalisation, the same three consonants become, respectively, [ʒ] (a voiced alveopalatal fricative), subsequently de-affricated to /z/ in most languages), /c/ (voiceless dental affricate) and /s/ (but š in West Slavonic) before front vowels[19] newly arisen from monophthongisation.[20]

One major innovation of the early literary period that unites the Slavonic languages in type but divides them in detail is the subsequent development of the jers. In all Slavonic languages, a distinction is made between strong and weak jers, where in general a weak jer is one in word-final position or in a syllable preceding a full vowel, while a strong jer is one in a syllable preceding a weak jer. Weak jers are lost, while strong jers are strengthened to full vowels, but the precise full vowel to which each of the two jers is strengthened varies from language to language. The loss of the jers has a major effect on the phonological structure of words in Slavonic languages, since it leads to consonant clusters that were previously impossible: thus Common Slavonic [gədʌŋəskə] is contracted from four syllables to one in Polish gdańsk[21].

Another phonological development that characterizes much of the Slavonic domain, especially East Slavonic and Polish, is the further development of a systematic opposition between plain and palatalized consonants.

In some Slavic languages the initial consonant clusters consists of:
a) group of consonants, inherited from old Slavic language
b) new groups of consonants, which emerged from the loss of weak reduced vowels and the following phonetic processes.
c) groups of consonants occur in words borrowed after the loss of weak reduced vowels.
d) Groups of consonants with j.

Bulgarian Introduction. Bulgarian Language, official language of Bulgaria spoken by about 8.5 million inhabitants of the country. Together with the closely related Macedonian language, it forms the eastern group of the South Slavic branch of the Slavic languages. Bulgarian uses the Cyrillic alphabet, as do the Russian, Serbian, and Macedonian languages.[22]

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[19] Ibid
[20] According to Trask, R. L., monophthongisation is an obsolete term for "phone" or "segment".
[21] Comrie, Bernard (1990). The Worlds Major Languages. Oxford University Press.
[22] Microsoft Encarta 97 Encyclopedia. 1993-1996. Bulgarian Languages.

Table 1. Chart of the Bulgarian consonants.

	labial	alveodental	alveopalatal	palatal	velar
stops voiceless	p ^{23}p^j	t t^j		k^j	k
voiced)	b b^j	d d^j		g^j	g
nasals		m m^j	n n^j		
fricatives	f f^j	s s^j	ʃ 3		X
	v v^j				
affricates		ts ts^j	tʃ dʒ		
liquids lateral		l l^j			
trill	r r^j				
glides			j		

Note 2: In the Bulgarian consonantal chart, the IPA fricative [3] is written as ɘ.

Consonant Cluster Violations & Analysis. The following analysis attempts to point out consonant cluster violations of the sonority hierarchy in the onsets of Bulgarian words and what we believe are reasons for those violations. This section looks at extrasyllabicity, morphology, epenthesis, deletion, complex clusters, and other. The entire body of consonant cluster violations data considered for this analysis is located in Appendix A. The following section uses only representative samples for analysis in this paper.

Extrasyllabicity. Consonants violating the sonority principle usually occur at the edges of the syllabified domain, where they can plausibly be analyzed as extrasyllabic. In the root word samples in section (1) below, all of the word initial consonant clusters violate the sonority principle. However, we believe these are examples of extrasyllabicity, and therefore acceptable consonant clusters. This theory of extrasyllabicity is used to explain this phenomenon which is seen in many languages throughout the world. Examples (6a) and (6b) are two consonant cluster onsets which no longer violate the sonority principle once the theory of extrasyllabicity for /s/ is applied.

(6)

		UR	PR	Gloss
	a.	spádam	spádam	"to fall/go down"
	b.	stekɘ	stekɘ	"to flow down"

In examples (6c) through (6g), we have word initial three consonant clusters. The initial segment of these clusters begin with alveodental and alveopalatal fricatives; a stop, /m/, or /x/ medially; and a liquid. Once the /s/ segment is considered extrasyllabic, there is no longer a violation because the remaining consonants follow the sonority principle.

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[23] In Bulgarian, the apostrophe following the following consonants, except bi-labials and liquids, indicates the palatalized sound of that consonant.

	UR	PR	Gloss
c.	spláv	spláf	"alloy"
d.	straná	straná	"country side"
e.	sprĭxav	sprĭhaf[24]	"quick tempered"
f.	smrád	smrát	"stench"
g.	ʃtedər	ʃtedər	"generous"

Epenthesis. The following samples are root words which appear to violate the sonority principle in their written form. However, when listening to a native speaker pronounce these words, we believe there is vowel epenthesis occurring to break up the consonant clusters. We found no other examples of epenthesis in our data, thus, for Bulgarian, a rule can be written as in 7c in which epenthesis occurs to break up a voiced labial fricative and a voiced alveodental stop.

(7)		UR	PR	Gloss
	a.	vdləbvam	vədləbvam	"to make concave"
	b.	vdʲávam	vədʲávam	"to thread a needle"
	c.	$\emptyset \to /ə/$ $\big/$ $/v/ \to \to /d/$		

Consonant Deletion. In the Bulgarian language, words beginning with three consonants which violate the sonority hierarchy are sometimes dealt with via consonant deletion. One case in point is demonstrated in (8) below in which the fricative/stop initial consonant which may be explained through extrasyllabicity incurs no alteration of the initial cluster (8a). However, this word has a written variant form (8b) in which the phonological representation results in deletion of the second /t/.[25]

(8)		UR	PR	Gloss
	a.	ʃteslaven	ʃteslaven	"vain" (adj)
	b.	tʃteslaven	tʃeslaven	"vain" (adj)

Morphology. Some of the word initial two consonant clusters beginning with /f/, /v/, and /z/ are morphologically derived. The prefixes /v/ and /z/ in the Bulgarian language turn to /f/ and /s/ before voiceless consonants in keeping with the rule of voice assimilation rule with consonants. In situations in which we have morphological prefixes, the prefix is a single consonantal segment, we see violations of the sonority principle. In these situations, it appears that epenthesis and extrasyllabicity can be used to explain the apparent violations. In (9a and 9b), the addition of the prefix /v/ results in a schwa being epenthesized between the prefix and the word initial consonant. This then breaks up the initial CCC consonant cluster [fricative/stop/fricative] to CV CC, or [fricative/vowel] [stop/fricative], and the violation of the sonority principle no longer exists. In addition, the prefix in (9a) assumes the voiceless feature of the following consonant. In (9c and 9d), the prefix /s/ can be considered extrasyllabic just as

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[24] The IPA velar fricative /h/ is written as an /x/ in Bulgarian.

[25] Aronson, Howard I. 1968. *Bulgarian Inflectional Morphophonology.* pp. 33-38. According to this author, /tst/ occurs in Slavic languages, p.38.

in section (6) above. In (9c), the prefix is followed by a voiced bilabial stop and assimilates the voiced feature of this consonant resulting in it being pronounced as a /z/.

(9)

	UR	PR	Gloss	Prefix	Stem
a.	vtvərdʲə́	fətverdʲə́	"to harden"	/v/	"tvərd" "hard" (adj)
b.	vglédam	vəglédam	"to stare at"	/v/	"gledam" "to look"

Other. In some words, we find examples, 10a and 10b, of the segment /h/ occurring as the second consonant in a word initial three consonant cluster. The rule in Slavic languages regarding the /h/, is that /c/ and /h/ have voiced allophones [ʒ] and [ɣ] but only before voiced obstruents (except /v/) (Scatton 1975).

(10)

a.	sxvánə	shfánə	"understand"
b.	sxlúpen	shlúpen	"tumble down"

Russian Introduction. Russian Language, official language of Russia. Russian was the lingua franca of the Russian Empire and the Soviet Union; it is still used as a second language in the other former Soviet republics. It is also known as Great Russian and forms, with Belarussian and Ukrainian, the eastern branch of the Slavic languages. Russian includes three groups of dialects: northern, southern, and central, the last named a transitional group combining northern and southern features. The southern and central dialects are distinguished by the so-called *akan'je*, coalescence of certain vowels outside of stress. The standard Russian is based on a central dialect of Moscow. It is one of the five official languages of the United Nations. The Russian language uses the Cyrillic alphabet; it has 33 letters. Spelling is basically, though not completely, phonetic, and the rules of pronunciation are few and simple. A typical feature of Russian vocabulary is large families of words derived from the same root by means of various prefixes and suffixes.

Table 2. Chart of Russian consonants.

	bilabial	labio dental	dental	alveolar	alveo palatal	velar
stops voiced	b b^j		d d^j			g g^j
voiceless	p p^j		t t^j			k k^j
nasals	m		n			
	m^j		n^j			
fricatives						
voiced				z z^j	ʒ^j	
voiceless				s s^j	ʃ	X
affricates			ts		tʃ	
lateral			l l^j			
trill				r r^j		
semi vowel					j	

Consonant Cluster Violations & Analysis. The following analysis attempts to point out consonant cluster violations of the sonority hierarchy in the onsets of Russian words and what we believe are reasons for those violations. This section looks at extrasyllabicity, epenthesis and morphology. The entire body of consonant cluster violations data considered for this analysis is located in Appendix B. The following section uses only representative samples for analysis in this paper.

Extrasyllabicity. Consonants violating the sonority principle usually occur at the edges of the syllabified domain, where they can plausibly be analyzed as extrasyllabic. In the samples in section (6) below, all of the word initial consonant clusters violate the sonority principle. However, we believe these are examples of extrasyllabicity, and therefore acceptable consonant clusters. This theory of extrasyllabicity is used to explain this phenomenon which is seen in many languages throughout the world. Examples (11a) and (11b) are two consonant cluster onsets which no longer violate the sonority principle once the theory of extrasyllabicity is applied. We believe example (11c), the voiced counterpart of the /s/ also demonstrates extrasyllabicity word initially in Russian.

(11) | | **UR** | **PR** | **Gloss** |
|---|---|---|---|
| a. | stih | stih | "verse" |
| b. | skorost | skɔrast | "velocity" |
| c. | zdravi | sdravi | "healthy" |

In examples (11d) through (11e), we have word initial three consonant clusters Once the /s/ segment is considered extrasyllabic, there is no longer a violation because the remaining consonants follow the sonority principle.

	UR	PR	Gloss
d.	straʒ	straʒə	"guard"
e.	skripka	skripka	"violin"

Epenthesis. In the examples (12a) through (12c) root words appear to violate the sonority principle in their written form. However, when listening to a native speaker pronounce these words, we believe there is epenthesis occurring to break up the consonant clusters. In 12a and 12b, we have epenthesis before the liquid which serves to form a VC syllable to break up the violation. This seems to occur when the liquid is followed by a [-cont] consonant. In 12c, the epenthesis occurs after the liquid, again forming a syllable to break up the violation, but in this case, the epenthesis forms a CV rather than VC. We believe the epenthesis in these cases occurs to break up two [+cont] consonants. The rules for these two cases appear in 12d and 12e.

(12)

	UR	PR	Gloss
a.	lba	əæba	"forehead"
b.	lgun	əlgun	"liar"
c.	rvanya	rəvanəya	"torn"

d. $\emptyset \rightarrow$ /ə/ / #__liquid C V
$$\qquad\qquad\qquad\qquad\qquad\text{[-cont]}$$

e. $\emptyset \rightarrow$ /ə/ / liquid ___ C V
$$\qquad\qquad\qquad\qquad\qquad\text{[+cont]}$$

Morphology. Some of the word initial two consonant clusters beginning with /f/, /v/, and /z/ are morphologically derived. The prefixes /v/ and /z/ in the Bulgarian language turn to /f/ and /s/ before voiceless consonants in keeping with the rule of voice assimilation rule with obstruents. In situations in which we have morphological prefixes, the prefix is a single consonantal segment, we see violations of the sonority principle. In these situations, it appears that extrasyllabicity and place assimilation can be used to explain the apparent violations. In (13a and 13b), the prefix /s/ can be considered extrasyllabic just as in section (1) above. The example in (13c) demonstrates a prefix which consists of two segments /vs/. This prefix changes voicing to match the following consonant. In (13d), the prefix is /vz/ and no voice assimilation change is required. While the written form appears to show two segments, we believe they sound like one sound and could be a case of extrasyllabicity. This follows from the fact that the /s/ or /z/ is a coronal and assumes the place of articulation of the preceding labial (Paradis & Prunet 1991). Thus, instead of having two consonants precede the root initial consonant, phonologically there is only one segment.

(13)

UR	PR	Gloss	Prefix	Stem/Gloss
a. spustitsya	spustitsia	"to lower"	/s/ "down"	pustit/"to let go"
b. spustit	spustitɪ	"to release"	/s/ "away"	pustit/"to let go"
c. vskriknut	fskriknut	"to utter a sudden shriek"	/vs/ "intensity"	kriknut/"to shriek"
d. vzboltajut	vzboltajut	"to shake-up"	/vz/ "suddeness"	boltajut/"to shake"
e. vstroinni	fstroinni	"built into"	/v/ "into"	stroit/"to build"
f. vstupit	fstupit	"enter into"	/v/ "into"	stupit/"to step"

Polish Introduction. The Polish Language is a member of the Western group of the Slavic branch of Indo-European languages and thus closely related to Czech, Slovak, and the Serbian language found in Germany. It is the language spoken by most of the inhabitants of Poland and by several million native speakers in the United States; Russia and the other successor states of the Union of Soviet Socialist Republics (USSR); Canada; and elsewhere. Polish dialects include Little Polish and Silesian (spoken in the south) and Mazovian and Great Polish (spoken in the north). Kashubian, or Cassubian, also heard in the north, is often treated as a dialect of Polish, although it evolved as a separate West Slavic language. Contemporary Polish has 7 vowel sounds and 35 consonant sounds, depicted by a modified Latin alphabet. Sounds that are not represented by the alphabet are indicated by diagraphs such as *sz* and *cz* (resembling English *sh* and *ch*) and by diacritics such as *!* and *ß* (resembling *zh* and a soft *sh*), derived from Czech. Unique to Polish is the *l* (resembling English *w*). As in the case of Russian, the richness of the consonant system is striking. However, certain Russian oppositions between palatalized dentals (t:t^j, d:d^j, r:r^j) have no counterpart in Polish. On the other hand, Polish has an additional type of opposition, vis. that between tʃ and tc, tʒ and dz, ʃ and c, ʒ and z. In the course of its evolution, Polish lost the distinction between long and short vowels, and word accent became fixed on the next-to-last syllable. Polish is the only Slavic language with nasal vowels (*a* and *e*), which are derived from Old Slavic nasal vowels. Of the original singular, dual, and plural, the dual has disappeared (as in most Slavic languages).[26]

Table 3. Chart of Polish consonants

	bilabial	labio dental	dental	alveolar	pre palatal	post palatal	velar
stops voiceless voiced)	p p^j b b^j		t d			k^j g^j	k g
nasals	m m^j		n		n^j		
fricatives voiceless		f f^j	s	ʃ	s^j		X
voiced)		v v^j	z	ʒ	z^j		
affricates			ts dz	tʃ dʒ	tš dž		
lateral			l				
trill				r			
semi vowel	w				j		

[26] "Polish Languages", Microsoft Encarta 97 Encyclopedia. 1993-1996 Microsoft Corporation. All rights reserved.

Consonant Cluster Violations & Analysis. The following analysis attempts to point out consonant cluster violations of the sonority hierarchy in the onsets of Polish words and what we believe are reasons for those violations. This section looks at extrasyllabicity, morphology, epenthesis, metathesis, complex clusters, and other. The entire body of consonant cluster violations data considered for this analysis is located in Appendix C. The following section uses only representative samples for analysis in this paper.

Extrasyllabicity. Consonants violating the sonority principle usually occur at the edges of the syllabified domain, where they can plausibly be analyzed as extrasyllabic. In the samples in section (10) below, all of the word initial consonant clusters violate the sonority principle. However, we believe these are examples of extrasyllabicity, and therefore acceptable consonant clusters. Examples 14a through 14d are two consonant cluster onsets which no longer violate the sonority principle once the theory of extrasyllabicity is applied.

(14)		**UR**	**PR**	**Gloss**
	a.	zbadać	zbadatʃ	"to examine"
	b.	stop	stop	"to stop"
	c.	sklep	sklep	"store"
	d.	stwór	stʃór	"a creature"

Epenthesis. In the examples (15a) through (15f) these root words appear to violate the sonority principle in their written form. However, when listening to a native speaker pronounce these words, we believe there is epenthesis occurring to break up the consonant clusters. In (15a), the epenthesis occurs before the liquid to break up the CC cluster by creating a VC syllable. In (15b) through (15e), there is epenthesis occurring after the word initial fricative, nasal, and liquid. In these cases, the epenthesis serves to break up a CC cluster by creating a CV syllable, thus modifying the word initial cluster from CCV to CVCV. We believe the epenthesis in (15b) through (15e) serves to break up two [+cont] consonants. Example (15f) does not follow the previous two situations so we are opining that the liquid /r/ in this environment is [-cont]. The rules for the epenthesis are in 15g and 15h.

(15)		**UR**	**PR**	**Gloss**
	a.	lgnąć	əlgnantʃ	"to be attracted to"
	b.	szkola	ʃəkola	"school"
	c.	msza	mɛZa	"church mass"
	d.	rwać	rəvatʃ	"to tear"
	e.	chce	χətsɛ	"to want"
	f.	rdza	rɛdza	"rust"

g. $\emptyset \rightarrow /\varepsilon/ \ / \#\_\_$ liquid C V
                         [-cont]

h. $\emptyset \rightarrow /\varepsilon/ \ /$ liquid $\_\_\_$ C V
                         [+cont]

Metathesis. In listening to the Polish data that was recorded, we believe we found one word in which metathesis occurs in a word with an initial onset of four consonants. In example 16 below, there is one apparent and one potential violation of the sonority hierarchy. First, the consonant cluster initial /s/ appears to be a violation but this is covered by the theory of extrasyllabicity. The potential violation would be the liquid /r/ preceding the consonant /v/ in the phonetic representation. However, you'll notice that in the phonetic representation, the /r/ replaces the second underlying /w/, and one of the /w/s gets deleted.

(16)

UR	PR	Gloss	Prefix/Gloss	Stem/Gloss
skrwawić	skvaritʃ	to be bloody	/s/ "closure"	"to bleed"

Morphology. Some of the word initial two consonant clusters beginning with /f/, /v/, and /z/ are morphologically derived. The prefix /v/ and /z/ in the Polish language turn to /f/ and /s/ before voiceless consonants in keeping with the rule of voice assimilation. In situations in which we have morphological prefixes, and the prefix is a single consonantal segment, we see violations of the sonority principle. In examples such as (17a) through (17c) below, we have the combination fricative [+cont] followed by a stop. This combination could be explained via the theory of extrasyllabicity. If the initial [+cont] segment is considered extrasyllabic, there is no longer a violation of the sonority hierarchy since the stop is followed by a less sonorant consonant. However, in examples (17d) and (17e), the cluster initial fricative is followed by a coronal. We believe this combination can be explained by the fact that the coronal fricative [+cont] is underspecified for place (Paradis & Prunet 1991), although not completely. Therefore the cluster initial fricative combines with the coronal fricative to form a complex syllable which negates the sonority violation at the phonetic representation. Then, both segments together would be considered extrasyllabic. In the case of (17d), the /z/ is epenthesized to keep the /v/ and /b/ from becoming a complex consonant because they share the same place of articulation.

(17)

	UR	PR	Gloss	Prefix	Stem/Gloss	
a.	wdrapać	vdr	to climb	/v/ "on top"	drapać	"to scratch"
b.	wklejać	fkl	glue something in	/f/ "in"	klejac	"to glue"
c.	zblednąć	zbl	to pale	/z/ "inclosure"	blednać	"gradual pale"
d.	wzbogacić	vzb	to enrich	/v/ "in"	bogacić	"get rich"
e.	wskrobać	fskr	to climb up (animals who use nails)	/f/ "on"	skrobać	"to scratch"

Complex Consonant. The following words have apparent violations of the sonority principle due to the second segment. However, as in (17d) and (17e) above, these segments are coronals which are underspecified for place and therefore form a complex consonant or the equivalent of an affricate with the preceding stop. This then negates the sonority violation at the phonetic representation.

(18)   **UR**   **PR**   **Gloss**

   a.   bzdura   bzdura   "silliness"

   b.   brwi   brvi   "eyebrow"

   c.   drwal   drval   "lumberjack"

   d.   trwać   trfatS   "to last over time"

CONCLUSION

We believe most of the apparent violations that appear in word initial onset clusters at the underlying representation level in these Slavic languages can be explained in several ways at the phonetic level. Our study indicates that these three languages deal with these violations using similar universal methods observed throughout the world's languages.

The first explanation we used to explain violations of the Sonority Principle in Bulgarian, Russian, and Polish is through the notion of extrasyllabicity. This notion of extrasyllabicity is one way in which the apparent consonant cluster violations in two and three consonant clusters in the onset positions are explained not only in these three Slavic languages, but a way in which it is explained for most languages of the world. In these three languages, we believe that not only the consonant /s/, but also the segments /v/ and /z/ are considered extrasyllabic at the phonological level. In Polish, we believe there are cases in which a second is a coronal that assimilates place with the preceding consonant to form a complex consonant and this complex consonant then becomes extrasyllabic.

In addition to extrasyllabicity, we discovered all three languages using epenthesis as a method to overcome apparent violations of the Sonority Principle. However, some of the environments are different.

We have observed that epenthesis occurs in Polish when the word initial consonant is a liquid. The epenthesis occurs before the word initial liquid to form a VC if the following consonant is [-cont] but the epenthesis occurs after the liquid if the following consonant is [+cont].

Another universal method observed in Polish to avoid a violation of the Sonority Principle is metathesis. This was observed in a four consonant onset cluster in which a liquid /r/ would have followed a voiced fricative labial as the third and fourth consonants in the cluster.

One observation about these languages, is the fact that the minimal distance allowed in the consonant clusters is zero (Eckman & Iverson 1993). According to The Minimal Distance Constraints principle, and given the data we acquired for this study, we believe it can be said that the Slavic languages allow very slight differences in sonority in their consonant clusters.

In conclusion, based upon our findings and data, we believe these three Slavic languages, Bulgarian, Russian, and Polish adhere to the Sonority Principle in most of the consonant clusters found in the word initial onset position.

REFERENCES

Archangeli, D. 1988. Aspects of Underspecification Theory. Phonology 5: 183-207.
Aronson, Howard I. 1968. *Bulgarian Inflectional Morphophonology*. 33-38.
Bulgarian/English Dictionary 1975. Sofia: Naouka and Lzkoustvo.

Carr, Philip. 1993. *Phonology.* The MacMillan Press LTD.

Clements, G.N. 1990. The Role of the Sonority Cycle in Core Syllabification. In J. Kingston and M. Beckman (eds.), *Papers in Laboratory Phonology I: Between the Grammar and the Physics of Speech.* Cambridge: Cambridge University Press [also in Working Papers of the Cornell Phonetics Laboratory 2, April 1988].

Clements, G.N. 1992. The Sonority Cycle and syllable organization. In W. Dressler, H. Luschutzky, O. Pfeiffer, and J. Rennison (eds.) *Phonologica 1988.* Cambridge: Cambridge University Press.

Comrie, Bernard 1990. The Worlds Major Languages. Oxford University Press.

De Bray, R. G. A. 1980. *Guide to The West Slavonic Languages.* 229-328.

Dobrogowska, K. 1995. The Occurance of the Consonants in Polish (language: Polish). *Polonica,* v16, 1-35.

Eckman, Fred R., and Iverson, Gregory K. 1993. Sonority and Markedness among Onset Clusters in the Interlanguage of ESL Learners. *Second Language Research* 19: 234-252.

Gladney, F.Y. 1994. Polish syllables: A Review Article. *Slavic East European Journal.* 149-159.

Malochko, G.A. 1978. *Modern Russian Language: Word Formation* (Russian Language) Cambridge:Slavica.

Microsoft Encarta 97 Encyclopedia. 1993-1996. Bulgarian Languages.

Microsoft Encarta 97 Encyclopedia. 1993-1996. Polish Languages.

Microsoft Encarta 97 Encyclopedia. 1993-1996. Russian Languages.

Microsoft Encarta 97 Encyclopedia. 1993-1996. Slavic Languages.

Paradis, C. and J. F. Prunet. 1991. Introduction: Asymmetry and Visibility. In C. Paradis and J-F Prunet, (eds.) *Phonetics and Phonology 2: The Special Status of Coronals.* San Diego: Academic Press.

Puppel, Stanislaw 1988. *Papers and Studies in Contrastive Linguistics.* 22: 39-49.

Rice, Keren D. 1992. On deriving sonority: a structural account of sonority relationships. *Phonology* 9 62-99.

Scatton, Ernest 1975. *Bulgarian Phonology.* 59-67. Cambridge: Slavica.

Sperber, V. 1982. Groups of Consonants at the Beginning and at the End of Words in Slavic Languages (Language: Russian). *Zeitschrift Fu→r Slawiskik.* Berlin: Akademie - Verlaq. 740-750.

The Oxford Russian Dictionary (enlarged format: 1995). Oxford University Press 1984.

Townsend, Charles E. 1975. *Russian Word Formation.* Cambridge: Slavica.

Trask, R.L. 1996. *A Dictionary of Phonetics and Phonology.* New York.

Tropf, H. 1986. Sonority as a Variability Factor in Second Language Phonology. In A. James and J. Leather (eds.), *Sound Patterns in Second Language Acquisition.* Dordrecht: Foris.

Appendix A

BULGARIAN DATA

UR	PR	GLOSS
st ′ ágamse	st ′ágamse	to gather up
zgaštam	sgaʃtəm	corner, trap
ftasam	ftasəm	to rise (i.e. dough)
spómn′ ə	spómn′ ə	to recall
štastie	ʃtastie	happiness
spláv	spláf	alloy
straná	straná	country side
sprixav	sprihaf′ [1]	quick tempered
stvol	stvol	trunk
skvéren	skəvéren	obscene
skrómen	skrómen	modest
sklád	sklád	warehouse
špríc	ʃpritz	squirt
štrakám	ʃtrákəm	snap
zdráv	zdráf	healthy
ždrélo	zdrélo	gorge
spletə	spletə	braid
správka	spráfka	verification

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[1] The IPA velar fricative (h) is written as an (x) in Bulgarian.

spr′áx	spr′áh	stopped[2]
smračáva	smraʦávə[3]	to darken
strésnə	strésnə	scare
str′áskvam	stir′áskvam	startle
skl′účə	skl′účə	conclude
skrijə	skrijə	hide
sdružə	zdruʒə	unite
sglédə	zglédə	to visit the house of a prospective bride
sgrápčə	zgrápʦə	clutch
sgr′ávam	zgr′ávam	heat
vpr′ág	fpr′ág	team of horse
vtrísə	ftrísə	to have a fever
vklešt′ə	fkléʃt′ə	to wedge in
vkl′účə	fklu′úʦə	to include
vkrátce	fkrátce	loan word borrowed from russian
sxlúpen	shlúpen	tumble down
sxvánə	shvánə	understand
sxrúskam	shrúskam	crunch
smrád	smrát	stench

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[2] This is the past tense form of *spirám* "to stop".

[3] The character c from the Bulgarian consonant chart is the character tʃ **from the IPA chart.**

UR	PR	GLOSS	PREFIX	STEM	STEM GLOSS
vtvərd′ə	ftvərd′ə	to harden	(v)	tvərd	hard (adj.)
vpletə́	fpletə́	to weave into	(v)	plet ə́	to knit
vpredə́	fpredə́	to spin into	(v)	predə́	to spin
skovə́	skovə́	to hammer together	(s)	kovə́	to hammer
spádam	spádam	to fall down	(s)down	pádam	to fall
stekə́	stekə́	to flow down	(s) down	tekə́	to flow
sced′ə́	sced′ə́	drain	(s)down	ced′ə́	to squeeze
sblíjə́	zblíʒjə	to bring together	(s)	blízo	near (prep)
zbívam	zbivam	to get into a fight	(s)	bi′ə	to fight
zdávam	zdávam	to return	(s)	dávam	to give
včepen′ə	ftsepenya	to go numb	(v)	čepen′ə́	to grow stiff
vkáram	fkárəm	to drive in	(v) in	karəm	to drive
vstrást′ə	fstrást′ə	to become infatuated	(v)	strast	passion (noun)

UR	PR	GLOSS	PREFIX	STEM	STEM GLOSS
vslúšvam	fslúʃvəm	to listen closely	(v)	sluʃəm	to listen
vsmúkam	fsmúkam	to suck in	(v)	smutʃə	to suck
vbivam	vbivəm	wedge in	(v) in	bi′ə	to wedge
vzr′əse	vzryase	to peer into	(v)into	reyase	to wander

vglédam	vglédam	to stare at	(v)	gledəm	to look
vgrad'ə	vgrad'ə	to build in	(v)	grad'a	to build
vgnezd'ə	vgenzd'ə	to nest in	(v)	gnezd'a	to nest
vgorčə	vgortʃə	to make bitter	(v)	gorčiv	bitter (adj.)
vdləbvam	vdləbvam	to make concave			
vd'ávam	vd'ávam	to thread a needle			

Appendix B

RUSSIAN DATA

UR	PR	GLOSS
vdoh	vdoh	to inhale
stih	stih	verse
skot	skot	cattle
skorost	skorast	velocity
splav	splav	alloy
sprava	sprava	straight
straž	straʒə	guard
skripka	skripka	violin
vdrugə	vdrugə	suddenly
zdravi	zdravi	healthy

UR	PR	GLOSS
sputnik	sputnik	fellow traveler

lba	əl' ba	forehead
lgun	ʔlgun	liar
rvanya	rvanəya	torn
vglyadetsya	vgliadestya	peer at
vspolox	fspoloh	an alarm

vstupit	fstupit	to enter into	(v)	stupit	to step
vstroinni	fstroinni	built into	(v)	stoit	to build
vtroe	ftroe	three times (adj.)	(Note "troe" is a noun that means "three" of something)		
vsplesk	fsplesk	splash (noun)			

UR	PR	STEM	PREFIX	STEM /GLOSS
vpolgoləsa under ones breath	fpolgoləsa	goləsa	(v) into	voice
vtridaroga triple the price	ftridaroga	daroga	(v) into	expensive
vskriknut to utter a sudden shriek	fskriknut	kriknut	(vs) intensity	to shriek
vzboltajut to shake up	vzboltajut	boltajut	(vz) suddeness	to shake
vzdumajutsia to think up suddenly	vzdumajutsia	think up	(vz) suddeness, suddenly	to think about
spustitsya to lower	spustitsia	pustit	(s) down	to let go
spustit to release	spustit	pustit	(s) away	to let go

Appendix C

POLISH DATA

UR	PR	GLOSS
skwar	skʃar	extreme heat
sprzataċ	spʃatatʃ	to clean
stwór	stʃór	a creature
stop	stop	to stop
sklep	sklep	store
splot	splot	method of twining

UR	PR	GLOSS	PREFIX	STEM	GLOSS
wdrapaċ	vdrapatʃ	to climb	(v) on top	drapaċ	to scratch
wglad	vglad	to look into	(v) into	ogladac	to look at
wglebiċ	vglenbitʃ	examine deeper	(v) in	wgloboki	deep
wgniesċ	vgɲieʃtʃ	to make inprint	(v) in	gniesc	to knead
wklejaċ	fkleyatʃ	glue something in	(f)	klejac	to glue
wkladaċ	fkvadatʃ	put into	(f)	k'lašċ	put into
wplesċ	fpleʃtʃ	to braid in	(f)	plesċ	braid
wtracaċ	ftrontsatʃ	to interrupt something	(f)	tracacaċ	bump
zblednaċ	zblednontʃ	to pale	(z) closure	blednaċ	gradual pale
zbladzic	zblondʒitʃ	to get lost	(z)		
zbroja	zbroya	armor	(z)		

zdjecie	zdentʃie	photograph	(z)	
zdrowy	zdrovi	healthy	(z)	
zglosić	zgvoʃitʃ	to report	(z)	
zgnoić	zgnoitʃ	to criticize	(z)	
zgnic	zgŋitʃ	to rot	(z)	
wprzód	fpʃod	to the front	(f) in pazód	front
wskoczyć	fsko	to jump on something	(f) in skoczyć	to jump
wspak	fspak	exact opposite	(f)	
wstawić	fstavitʃ	put in	(f)	
wzbogacić sie	vzbogaʃitʃ	to enrich	(v) in bogacić	get rich
wzdichać	vzdihatʃ	to sigh	(v) in dychać	breath
wskrobać	fskrobatʃ	to climb up (animals who use nails)	(f) on skaobać	to scratch
wzabronić	vzbronitʃ	to prohibit	(v) in bronić	to defend
wzdluz	vzdvuʒ	along	(v) in (root) dluz	long
wzdrygnać sie	vzdrignontʃom	to shutter	(v) in involuntary	slight movement
wzglad	vzglad	to consider	(v) in glad	to look at (root) used w/pre/suf
wskrzesić	fskʃesitʃ	to spark	(v) in skrzesić	spark
wstrzelić	fstʃelitʃ	shoot into	(v) in strzelic	to shoot
skrwawić	skvaritʃ	to be bloody	(s) krwawić	to bleed

UR	PR	GLOSS
szkola	ʃəkola	school
szpada	ʃəpada	type of sword
sztorm	ʃətorm	sea storm
zbadać	zəbadatʃ	to examine
lgnać	əlgnantʃ	to be attracted to...
lgnie	əlgɲie	to be attracted to...
lgać	əlgatʃ	to lie
mgielka	məgielka	little fog
mgnienie	məgɲienie	blink momemnt
mknać	məknontʃ	move very fast
mknie	məkɲie	to move very fast
msza	məʒa	church mass
lkać	əlkatʃ	to sob
rdza	rədza	rust
rtec	rədentʃ	mercury
rwać	rəvatʃ	to tear
chce	χətse	to want
cztery	tʃətɛri	four
czkać	tʃəkatʃ	to hickup

dzban	dzəban	vase
dzgać	dzəgatʃ	to stab
szczapa	ʃtʃapa	kindling
scena	stsɛna	movie scene