International Journal of English Linguistics; Vol. 2, No. 5; 2012
ISSN 1923-869X E-ISSN 1923-8703
Published by Canadian Center of Science and Education

The Sonority Sequencing Principle in Sanandaji/Erdelani Kurdish

An Optimality Theoretical Perspective

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Received: June 27, 2012 Accepted: July 25, 2012 Online Published: September 26, 2012

doi:10.5539/ijel.v2n5p72 URL: http://dx.doi.org/10.5539/ijel.v2n5p72

Abstract

The aim of this article is to study Sanandaji consonant clusters in relation with their conformity to the principle of sonority sequencing. Analyzing the data provided in this paper, we found out that, of the three kinds of consonant clusters existing in all languages, only core clusters—clusters that conform to the sonority sequencing principle (SSP)—are found in Sanandaji, and therefore the arrangement and combination of segments to make syllables in this dialect of Kurdish is absolutely governed by the SSP. Applying principles of Optimality Theory on the data, the relative ranking of syllable structure constraints is determined, the outcome of which is deriving surface phonotactic patterns through the interaction of markedness and faithfulness constraints.

Keywords: consonant cluster, sonority, optimality theory, Sanandaji/Erdelani Kurdish

1. Introduction

Sonority has been subject to many studies for more than a century. Despite giving various, different definitions for it, most linguists agree on the important role of sonority in syllable structure (Morelli, 2003). A generalization, known as the Sonority Sequencing Principle/Generalization, states that in all languages, vowels and consonants that are combined to form syllables, are arranged so that sonority is the highest in the peak of the syllable and decreases as we move away from the peak towards the margins (Clements, 1990). However, in many languages the SSP is not absolutely followed and violations of it are attested; a reason for some to regard the SSP more as a universal tendency than an absolute generalization (Morelli, 1999: 23). The purpose of this paper is to apply the SSP to data from Sanandaji Kurdish and to see to what extent it is followed and/or violated in this dialect of Kurdish.

The rest of the article is arranged as follows. In part 2 the dialect under study is introduced briefly. Part 3 is devoted to sonority and the SSP, and part 4 focuses on clusters, different kinds of clusters and their classification. The provided data is analyzed in part 5, and in part 6 the principles of Optimality Theory is applied on the data. Finally, in part 7, a summary is given of the conclusions derived by the study.

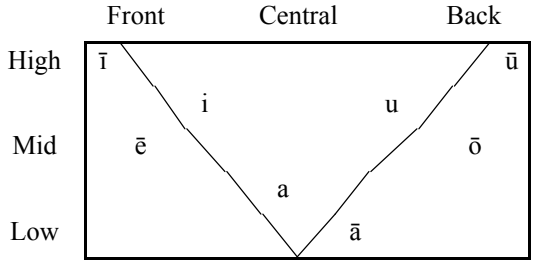
2. Sanandaji/Erdelani Dialect

Kurdish is an Indo-European language that belongs to the Western Iranian group of the Indo-Iranian branch of the family. There are three main dialect groups: Northern, Central, and Southern. The Northern group, also called Kurmanji, is the most common Kurdish vernacular, spoken by over half of all Kurds (15 to 18 million including Dimli or Zaza speakers), mainly in Kurdish speaking parts of Turkey, Syria, Armenia, Azerbaijan and northern Khurasan in Iran. The Central group, also called Sorani, is spoken by most Kurds in Iraq and Iran (10 to 12 million speakers). The Southern group (also called Gorani) includes Hawrami, Kalhori and Laki and is spoken in southern parts of Kurdistan in Iran and Iraq (about 2 million speakers), (Thackston, 2006: vii-viii) and (Marchal, 2007: 14-23). Sanandaji (Kurdish: Senayi) or Erdelani is a Central Kurdish subdialect spoken mainly by people who live in Sanandaj (Kurdish: Sena), a city in and the capital of Kurdistan Province ,one of the 5 provinces (Kurdistan, Kermanshah, Ilam, West Azarbaijan in western Iran, and Northern Khorasan in north-eastern Iran) with a majority of Kurdish residents.

2.1 Segments

Sanandaji phoneme inventory is made up of twenty seven consonants, two glides, and eight vowels, (Rezaei 1996: 14; Karimi Doostan, 1991).

Table 1. Sanandaji vowels



Among the vowels, *i*, *a* and *o* are short but, *ī*, *ē*, ā, *ō*, and *ū* are long.

Table 2. Sanandaji consonants

	Bilabial	Labio-Dental	Dental-Alveolar	Alveolar	Alveo-Palatal	Velar	Uvular	Pharyngal	Glottal
Stop	p		t			k	q		ʔ
	b		**d**			**g**			
Affricate					č				
					ĵ				
Fricative		f	s	š			x	ħ	h
			z	**ž**			**ɣ**	ʕ	
Nasal	**m**		**n**			**ŋ**			
Lateral				**ɬ** **l**					
Vibrant				**r̄** **r**					
Glide	**w**					**y**			

Note: Segments printed in bold-type are voiced.

2.2 Syllable Structure

The combination of vowels and consonants to form syllables, in any language, is driven by rules and principles of that language. The maximum syllable in Sanandaji is CCVCC, i.e. it allows, at most, two consonants to fill both onset and coda slots. While onsets are obligatory in syllable structure of this dialect of Kurdish, codas are not, and CCV or CV syllables are abundant. All consonants can appear in the onset and coda slots however, as shown in (1), there are some phonotactic constraints that restrict the permissible contents of onset, nucleus, and coda slots.

(1) Phonotactic Constraints in Sanandaji:

Although /ŋ, r, ɬ/ do not come at the beginning of words, they can appear in syllable onsets. Whereas words like /ja.ŋaɬ/ "jungle", /ka.ra/ "butter", and /ki.ɬāw/ "hat", whose second syllables begin with one of these three segments, are abundant, no word can be found whose first syllable begins with /ŋ, r, or ɬ/.

In syllables that begin with two consonants in the onset, only /x, g, k/ can be the first and /w/ the second member (see Table 3 below).

In syllables that begin with two consonants in the onset, only /*ē*, a, ā/ can appear in the nucleus (see Table 3

below).

3. The Syllable, Sonority and the Sonority Sequencing Principle

3.1 The Syllable

In spite of the fact that almost everybody can intuitively identify syllables and knows how many syllables a word has, no one can give a definition of the syllable. It does not have a unified and accepted definition among linguists either (Ladefoged, 2002: 226). This is due to the fact that the syllable has different structures in different languages; it is not a sound/phone but, an essential abstract unit in phonology that has no clear and unified phonetic counterpart, (Kenstowicz, 1994: 250); and "…the syllable is primarily defined over sequences of discrete phonological segments rather than over phonetic primes as such. At this level of abstraction, few constructs have direct phonetic definitions" (Clements, 2005).

Different theories have been presented to define the syllable and account for its features: the pulse theory (put forward by the psychologist R. H. Stetson) which studies the syllable from a phonetic point of view, defines it based on chest pulses, so that the number of syllables in this theory is the same as the number of chest pulses. In auditory/perceptual theories the syllable is defined based on sounds sonority feature. Here, the vowels, which are the most sonorous language sounds, always occupy the nucleus or peak of the syllable so, the number of syllables is supposed to be equal with the number of vowels. In phonological theories the focus is on the ways vowels (V) and consonants (C) are combined to form sound sequences (Crystal, 2008: 442). Therefore, language sounds are considered to be building blocks of the syllable structure and are divided into two main groups: the first group which includes vowels, nasals, and liquids are all [+sonorant] and can occupy the peak of the syllable; the second group is made up of all the other sounds of language which have the common feature of [-sonorant] and can only come in the margins of the syllable (Chomsky & Halle, 1968: 354-355).

In this way, vowels and consonants make up the structure of the syllable. However, the combination of vowels and consonants to form syllables does not take place haphazardly, but follows strict orders dictated by syllable structure of languages, and units formed in this way have their own internal structure and distribution, and are governed by their own rules. The syllable structure (as shown in figure 1 below) includes two parts: the onset (O) and the rhyme or rime (R) which, in its turn, is divided into the nucleus (N) and the coda (C). The nucleus is generally the domain of vowels, but, in some cases it can be occupied by sonorant consonants, which are /l/, /m/, /n/, and /r/ in English (MacMahon, 2002: 104-105).

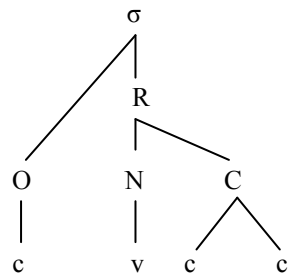


Figure 1. Syllable structure

The syllable is a universal phonological unit of language (Fudge, 1969). In fact, syllables of different languages are similar in that their nucleus position is filled with a vowel (although, it is possible for the nucleus to be filled with more than one vowel, as shown by Pike and Pike (1947) in their study on the syllable structure in Mazateco language). What makes syllable structures different, in different languages, is the number of consonants and the way they are combined to form onsets and specially codas. The syllable structure of English, for example, is (C)(C)(C)V(C)(C)(C)(C), while in Kurdish it is (C)CV(C)(C)(C) (Kalbasi, 1983: 4; Karimi Doostan, 2002). The universal, basic syllable type is CV, because all known languages allow this type of syllable, and no language has been reported that allows codas but rules out onsets.

3.2 Sonority

Like syllable, there has been little agreement among linguists on the definition of sonority and, different phoneticians have suggested different parameters to characterize it. Some linguists, such as Sievers (1881), and Heffner (1950) relate it to audibility, in the sense that more audible sounds are more sonorous (Clements, 2005).

Selkirk defines it in terms of degree of opening, in the sense that the opener a sound, the more sonorous it is. So vowels, that are the highest sounds, are the most and stops are the least sonorous ones (Selkirk, 1984). MacMahon talks of sonority as a notion that differs sonorants and obstruents in that, sonorants have "greater carrying power" due to their acoustic features and hence, more sonorous (MacMahon, 2002: 107). Ladefoged equates sonority with acoustic energy, and defines it based on the loudness of a sound "relative to that of other sounds with the same length, stress, and pitch" (Ladefoged, 2001: 227).

Because of this lack of "a fixed, physical basis for characterizing sonority in language-independent terms", it has not been possible to "explain the nearly identical nature of sonority constraints across languages" (Clements, 2005). However, most phoneticians and phonologists agree on a universal sonority scale in which low vowels are the most sonorous segments, followed in decreasing sonority by mid vowels, high vowels, glides, liquids, nasal stops, fricatives, and oral stops (Clements, 1990; Butt, 1992; Belvins, 1995). In this paper, we adopt the universal sonority scale as represented in (2).

(2) Universal Sonority Scale

stops > fricatives > nasals > liquids > glides > vowels

3.3 Sonority Sequencing Principle

In relation with sonority, it is said that across languages, there is a strong tendency for syllables to follow a certain pattern and form a curve of sonority: The nucleus constitutes the sonority peak of the syllable with all other segments organized around it, in such a way that the most sonorous segments are closer to the peak and the least sonorous ones are farthest away from it so that, they form a sonority curve like Figure 2 (Carnie, 1994). In a Sanandaji syllable like xwārd (I/you/she/he/it/we/they ate…), segments are syllabified in such a way that sonority increases from the margin to the peak, so that the consonants at the beginning of the onset and at the end of the coda, that are at the bottom end of the sonority scale, are the outermost segments while less marginal consonants, that are adjacent to the vowel, are also closer to the vowel in sonority. This tendency is generalized in Sonority Sequencing Principle (SSP) or Sonority Sequencing Generalisation (SSG).

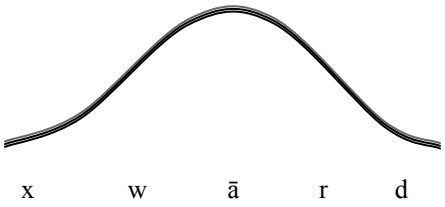


Figure 2. Sonority curve

(3) Sonority Sequencing Principle (SSP) (Morelli, 2006)

Sonority increases from the syllable margins towards the syllable peak and decreases from the syllable peak towards the syllable margins.

The principle implies that [tr] and [dw] are possible but, *[ks] and *[pn] impossible onset clusters. In the same way, [st] and [lk] are possible while *[pl] and *[sr] impossible coda clusters. In all languages, syllables that allow a single consonant to precede and/or follow the nucleus (e.g. CV, CVC syllables), the SSP is obeyed but, in languages where it is possible for syllables to begin or end in a consonant cluster, adherence to it is less regular, and violations are attested across languages.

Different strategies have been presented to account for surface violations of the SSP, and maintain its universality, for example introducing semisyllables that is, syllables with no coda, no nucleus, and no stress that are found only at the edges of morphemes (Cho & King, 2003); treating offending consonants as segments that are licensed prosodically by larger units like foot ,word or phrase (Wiltshire, 2003); and regarding common violations such as s+Stop clusters as special instances that do not really constitute violations of the SSP (McMahon, 2002: 109).

In spite of these strategies, preserving universality of the SSP is a great challenge for theories in which constraints are not violable, so that it sounds more like a universal tendency than an absolute generalization of segment organization. But the issue does not arise within Optimality Theory (OT) because constraints are violable in OT and, whether a grammar allows violations of the SSP or not depends on the ranked ordering of constraints (Prince & Smolensky, 2004: 207).

As stated before, across languages, the SSP is preserved in syllables that allow a single consonant to precede and/or follow the nucleus but, it may be violated in syllables that begin or end in a consonant cluster, so the domain of this study is limited to CCV, CCVC, CCVCC, or CVCC syllable types only (exemplified in Tables 3, 4, and 5), which means syllable types that begin and/or end with a consonant cluster.

4. Data

4.1 Consonant Clusters

Consonant clusters, according to (Clements, 1990), are divided into three main kinds, namely, core clusters: clusters that follow the SSP; sonority reversals: clusters that violate the SSP; and sonority plateaus: clusters in which the two members belong to the same sonority scale and have no difference in sonority. Based on his sonority scale of major classes of segments (O < N < L < G), he classifies two-member clusters as in (4).

(4)

a. Core Clusters

onset	coda
OG	GO
OL	LO
ON	NO
LG	GL
NG	GN
NL	LN

b. Sonority Reversals

onset	coda
GO	OG
LO	OL
NO	ON
GL	LG
GN	NG
LN	NL

c. Sonority Plateaus

onset/coda
GG
LL
NN
OO

4.2 Onset Clusters

Examples represented in (Table 3) are syllables that begin with a cluster in the onset. They are all native Kurdish words and no borrowed word could be found having a CCV, CCVC, or CCVCC syllable type and, no instance was found among them violating the SSP. In all these syllables, the only segment that can fill the place of the second member of the onset cluster, is the glide /w/. Glides (as stated in (2) above) are the most sonorous segments after vowels so, all onset clusters in this dialect form the sonority curve in Figure 2, and conform to the SSP.

Table 3. Syllable type exemplification (onset clusters)

CCV		CCVC		CCVCC	
/xwē.īī/	idle	/xwaɬ/	soil	/xwand/	I/You/He/She/It/We/They read …
/xwā.yiš/	request	/xwaš/	well	/xwēnd/	I/You/He/She/It/We/They read …
/xwa.rišt/	stew	/xwaz.ga/	wish	/xwārd/	I/You/He/She/It/We/They ate …
/xwa.na.wār/	literate	/xwēn/	blood	/xwāst/	I/You/He/She/It/We/They married …
/xwa.ra.tāw/	the sun	/kwēr/	blind	…	
/xwa.šī/	happiness	/gwēz/	walnut		
/kwē.ri/	blindness	/gwēč.ka/	ear		
/gwē.ra.ka/	calf	/xway.šik/	sister		
…		…			

4.3 Coda Clusters

Table 4 and Table 5 exemplify CVCC syllables. In all these syllables, sonority rises as we move from margins to the peak, and falls as we move from the peak towards margins, so they conform to the SSP and hence, are core clusters. Examples in Table 4 are native Kurdish words while those in Table 5 are borrowed words. Potentially, all consonants can be used (both as the first and the second member of the cluster) in onset and coda slots of this

kind of syllable.

Table 4. Syllable type exemplification (native words)

CVCC		CVCC		CVCC	
/ʔasp/	horse	/gišt/	all	/qors/	heavy
/panǰ/	five	/qinǰ/	straight	/xołk/	invite
/barx/	lamb	/finǰ/	name of a bird	/tīsk/	soft hair
/task/	narrow	/ziłq/	a kind of vegetable	/ka.nīšk/	daughter
/dałp/	loose (clothing)	/xirt/	round	/ʔārd/	flour
/gawǰ/	fool	/čirč/	wrinkle	/pārč/	pitcher
/sałt/	single(person)	/ǰift/	plough	/bāwk/	father
/čaft/	tilted	/ɾižd/	stingy	/dāyk/	mother
/marǰ/	bet, condition	/nā.rinǰ/	sour orange	/pi.lūsk/	downspout
/naft/	oil	/limt/	ooze	/ti.rūsk/	shine
/hałm/	steam, warmth	/ʔā.łišt/	exchange	/bi.rūsk/	shooting pain, flash
/hawr/	cloud	/mišk/	mouse	/gōšt/	meat
/pird/	bridge	/wirč/	bear (animal)	/gōrd/	match (matchbox)
/bilč/	wild plum	/nā.poxt/	ugly	/qōrt/	hump
/dirz/	crack	/kord/	Kurd	/gēsk/	nanny goat
/kirž/	nimble	/gorǰ/	nimble	/kaw.rēšk/	rabbit
…		…		…	

Table 5. Syllable type exemplification (borrowed words)

CVCC		CVCC		CVCC	
/part/	far away	/harz/	vain	/ħizb/	(political) party
/barq/	electricity	/xałk/	people	/jins/	goods
/tark/	leave, stop (doing)	/ʔayb/	defect	/bānd/	band
/dars/	lesson	/ǰawr/	suffering	/pārk/	park
/kayk/	cake	/ɾanǰ/	suffering	/lāmp/	lamp
/ganǰ/	treasure	/lanǰ/	obstinacy	/qołf/	lock
/qaīrn/	century	/marz/	border	/dīsk/	diskette
/farš/	carpet	/wazʔ/	situation	/ɾīsk/	risk
/sawt/	sound	/zayn/	mind	/pōst/	post
/zawq/	talent,eagerness	/ʔišq/	love	/rā.pōrt/	report
/šawq/	eagerness	/birǰ/	month	…	
/ħawz/	pool, pond	/do.rišt/	large		

5. Data Analysis

Even though violations of the SSP are abundant across languages, in this dialect of Kurdish it is absolutely preserved and, no instances could be found violating the principle, neither among native Kurdish words nor among borrowed words. Therefore, all two-member coda clusters in Sanandaji Kurdish are core clusters (4a), and the other two types are not found in this dialect of Kurdish.

In relation with foreign words, two main strategies are adopted to treat words that contain a CVCC syllable structure and violate the SSP in the language or languages from which they have been borrowed. First, and foremost, the syllable structure is broken down by means of inserting the vowel /i/ so that, a monosyllabic word with a CVCC structure is divided into a bisyllabic word with a CV.CVC structure, as shown in Table 6.

Table 6. Foreign word resyllabification examples

CVCC→CV.CVC			CVCC→CV.CVC			CVCC→CV.CVC		
/ʔaql/	/ʔa.qiɬ/	wisdom	/fikr/	/fi.kir/	thought	/naqš/	/na.qiš/	drawing, role
/ʔasl/	/ʔa.siɬ/	origin	/satl/	/sa.tiɬ/	bucket	/nazr/	/na.zir/	vow
/ʔaǰr/	/ʔa.ǰir/	recompense	/hazm/	/ha.zim/	digestion	/nazm/	/na.zim/	principle
/ʔamr/	/ʔa.mir/	command	/ħatm/	/ħa.tim/	certainty	/wasl/	/wa.siɬ/	attach, join
/dafn/	/da.fin/	burry	/ħokm/	/ħo.kim/	command	/wasf/	/wa.sif/	description
/kasr/	/ka.sir/	shortage	/ʕamr/	/ʕa.mir/	age	/zabt/	/za.bit/	record (voice)
/kofr/	/ki.fir/	blasphemy	/ʁaqs/	/ʁa.qis/	dance	/sabt/	/sa.bit/	write
/qabz/	/qa.biz/	receipt	/ʁaħm/	/ʁa.ħim/	mercy	/nafs/	/na.fis/	desire
/qadr/	/qa.dir/	value	/lotf/	/lo.tif/	favor	…	…	…
/qasr/	/qa.sir/	castle	/makr/	/ma.kir/	trick			
/fasl/	/fa.siɬ/	season	/mobl/	/mo.bil/	sofa			

Second, some of the words presented in (Table 6) have more than one pronunciation, for example */qabr/:/qawr/, /qabz/:/qawz/, /qadr/:/qayr/, /qadr/: /qaɹr/*(Note 1)*, /sabt/:/saft/, /zabt/:/zaft/, /naqd/:/naxt/, /naqš/:/naxš/, /ʕaks/: /ʕask/, /ʔask/, /lotf/:/lift/, /qofl/:/qoɬf/.*

These words can be arranged in three groups as in (5).

(5) a. /qabr/:/qawr/, /qabz/:/qawz/, /qadr/:/qayr/

b. /qadr/: /qaɹr/, /sabt/:/saft/, /zabt/:/zaft/, /naqd/:/naxt/, /naqš/:/naxš/

c. /ʕaks/: /ʕask/, /ʔask/, /lotf/: /lift/, /qofl/: /qoɬf/

As it is seen, in (5a) a stop consonant (/b/ or /d/) is replaced with a glide (/w/ or /y/); in (5b) a stop consonant (/b/, /d/ or /q/) is substituted with a fricative (/f/ or /x/) or an approximant (/ɹ/). Despite their differences, (5a and b) are both instances of the phonological process of lenition or weakening while (5c), in which two segments have changed their places, exemplifies metathesis. We can possibly conclude, based on these observations, that these foreign words are adjusted with the SSP through phonological processes of lenition and metathesis (Note 2). In order to see what all these mean in OT terms; an Optimality theoretic analysis of the data is presented in the next part.

6. Discussion

At the beginning of this section, basic syllable constraints required to erect basic syllable structure in OT are presented and ranked. Clements and Keyser, based on a generalization by Jakobson, stating that languages neither forbid onsets nor require codas, suggest that, across languages, the primary set of core syllable types includes CV, V, CVC and VC, the least marked of which is CV (Clements & Keyser, 1983). CV, according to Prince and Smolensky, is the universally optimal syllable and, no language may forbid this kind of syllable. The

basic constraints that govern syllable structure, and are required to optimize the CV syllable type, are divided into two groups of markedness and faithfulness. Markedness constraints (6) refer only to output form, and require it to fulfill certain well-formedness criteria, while faithfulness constraints (7) refer to both input and output, and require the output to keep the features of the input (Prince & Smolensky, 2004: 106).

(6) Markedness Constraints

a. ONSET (ONS): Syllables must have onsets.

b. NOCODA: Syllables may not have codas.

c. NOCOMPLEX: No more than one C or V may associate to any syllable node.

(7) Faithfulness Constraints

a. DEP: Output segments may have input correspondents. (no insertion)

b. MAX: Input segments may have output correspondents. (no deletion)

In order to determine the status of these constraints, we should first see whether onsets are required and/or codas are prohibited or not. This will help us rank markedness constraints with respect to faithfulness constraints. Then, we should find out how this onset requirement and/or coda prohibition is enforced in the language to be able to decide the ranking of DEP and MAX. To do so, we begin with examples in (8).

(8) a. /mā.sī/ "fish", /bi.rā/ "brother", /zū/ "early"

b. /mā.sī/+/ū/ (bū) "was" → [mā.sī.yū] "It was a fish",

/birā/+/i/→ [bi.rā.yi] "brotherhood",

/zū/+/a/ "is"→ [zū.wa] "it is early"

As (8a) shows, the onset position in Sanandaji syllables is obligatorily filled with a consonant which means that ONS dominates both DEP and MAX. (8b) indicates that onset is enforced by insertion, so DEP should be the lowest of these three constraints (though, determining the exact ranking relation between MAX and DEP needs more data, and is left open here).

(9) ONS >> MAX, DEP

Furthermore, (as Table 3 shows) syllable onsets may be complex and in fact, they are used, along with codas, quite frequently; therefore NOCOMPLEX and NOCODA are dominated by DEP and MAX constraints. But how are NOCOMPLEX and NOCODA ranked in relation to each other? To find out, since interaction of NOCOMPLEX and NOCODA is bound to occur word-medially, let us consider the following examples that contain word-medial consonant clusters.

(10) a. /hāw.sā/ "neighbor", /tīk.la/ "pot", /bar.zī/ "height", /daw.rī/ "plate"

b. /na.xwaš/ "sick", /bō.xwaš/ "fragrant", /sū.xwar/ "usurer"

Based on (10a), onsets are not maximized which means that NOCOMPLEX dominates NOCODA, as the evaluation of /hāw.sā/ in (10a) indicates. But, examples in (10b) show the other way round and, as illustrated by the evaluation of /na.xwaš/ in (11b), the correct output is chosen when NOCODA is ranked higher than NOCOMPLEX. This entails that both orders are possible in Sanandaji and none of them outranks the other.

(11) a.

/hāw.sā/	NOCOMPLEX	NOCODA
→a.[hāw.sā]		*
b.[hā.wsā]	!*	

b.

/na.xwaš/	NOCODA	NOCOMPLEX
→a.[na.xwaš]	*	*
b.[nax.waš]	*!*	

So, the following relative ranking is proposed for constraints presented so far:

(12) Relative Ranking of Basic Syllable Constraints

ONSET >> MAX, DEP >> NOCOMPLEX, NOCODA

Having determined the relative ranking of basic syllable structure constraints, we turn now to the role of sonority in the arrangement of consonants in CC clusters and the status of the SSP – taken as a markedness constraint – as stated in (3) above.

The data presented in Tables 3, 4 and 5, exemplify common onset and coda clusters. The two consonants do appear in various configurations, the most frequent of which are fricative + glide (xw) and stop + glide (kw, gw) for onset clusters, and liquid + stop (łt, łp, lč, łk, łq, rt, rč, rǰ, rd, rq, rk, rg), fricative + stop (sk, sp, št, šk, šq, zʕ, zb, žd, ft, xt), glide + stop (wǰ, wk, wt, wq, yk, yg, yb), liquid + fricative (rx, rs, rz, rž, rš, łf), nasal + stop (nǰ, nd, mč, mt, mp) etc. for coda clusters. In onset clusters, the more sonorous member of the cluster is the second consonant; while in coda clusters, it is the first member of the combination that has a higher sonority, which means that all configurations of consonants in both onsets and codas observe the SSP. This is true for words that are borrowed from other languages, and these words are also required to conform to the SSP; so that words, such as those in Table 5, that observe the SSP are adopted almost without changes in their structure. But words, like those in Table 6, that violate the SSP undergo structural changes. The vowel /i/ is inserted between the two consonants of the cluster and the words go under resyllabification, so that a monosyllabic word with a CVCC syllable structure is resyllabified as a bisyllabic word having a CV.CVC syllable structure. In OT terms, this means that the SSP dominates DEP so, we replace the ranking given in (12) with (13) bellow.

(13) Relative Ranking of Syllable Structure Constraints (Revised)

ONSET>> SSP>> MAX, DEP>> NOCOMPLEX, NOCODA

The following evaluation tableaus indicate the ranking in (13).

(14)

/task/	ONS	SSP	MAX	DEP	NOCOMPLEX	NOCODA
→a.[task]					*	*
b.[taks]		*!			*	*
c.[ta.sik]				*!		*
d.[tas.ik]	*!			*		**
e.[tas]			*!			*

Candidate (a) is an example of a cluster that obeys SSP, and is selected as the correct output in spite of violating two constraints. All the other candidates lose the competition due to violating higher-ranked constraints. In tableau (15), the faithful candidate (a) incurs a fatal violation of SSP and loses the competition. The optimal candidate (b) observes SSP at the cost of violating DEP. Candidate (c) is penalized for being onsetless and (d) for deleting a segment, by higher ranked constraints of ONS and MAX respectively.

(15)

/fasl/	ONS	SSP	MAX	DEP	NOCOMPLEX	NOCODA
a.[fasl]		*!			*	*
→b.[fa.siɬ]				*		*
c.[fas.iɬ]	*!			*		**
d.[fas]			*!			*

In addition to vowel-insertion, applied as the main strategy to avoid SSP violation, it is possible for some forms (exemplified in 5) to optionally undergo phonological processes of lenition and metathesis. In the following, along with a brief introduction of lenition and metathesis, an explanatory account is provided of these two processes.

Lenition refers to changes in sounds that involve a "reduction in the degree of constriction or duration of a consonant" (Kirchner, 2004). The term does not refer to a single process and covers a range of separate processes including *degemination, flapping, spirantisation*, *debuccalisation*, *elision,* and *voicing*. (Honeybone, 2007). These processes can all be categorized under two broad types: "neutralization-to-the-unmarked lenition", and "sonority-increasing lenition" or sonorization. The first type is generally found in codas and occurs in syllable-final or word-final positions, while the second type commonly affects intervocalic or intersonorant positions and involves an increase in sonority (Smith, 2007). One of the most common motivations for sonority-increasing lenition is assimilation. When a less sonorous segment comes between two segments with higher sonority, the situation leads to an increase in its sonority (Bye, 2008). Examples in (5a and b) are all instances of spirantisation, that is reduction from an occlusive (stop or affricate) to a continuant (fricative, approxiomant or glide) with a sonority motivation. In order to account for this kind of lenition in OT, we should first see what constraint or constraints we do need. Since, as stated in previous lines, the motive behind the process is increasing sonority, the markedness constraint motivating it is SSP which bans low sonority consonants in a V-C # environment in Coda position. The SSP militates against a faithful constraint that penalizes mismatches in Manner features (in this case Continuant) between input and output forms, and is modeled, following McCarthy and Prince (McCarthy & Prince, 1995), as an IDENT constraint in (16).

(16) IDENT[Contin]

Corresponding input and output segments agree in their [continuant] feature specification.

For lenition to take place, it is necessary for IDENT[Contin] to be ranked below other faithfulness constraints (Max & Dep). But, as pointed out above, because in Sanandaji the lenition process is optional, an input such as /qabz/ can have two optimal outputs: [qa.biz] and [qawz]. This implies that IDENT[Contin] and DEP do not follow a fixed order. If IDENT[Contin] dominates DEP, the winner will be [qawz], but if DEP outranks IDENT[Contin], [qa.biz] is selected as the optimal output. This is shown in evaluation tableaus in (17).

(17) a.

/qabz/	SSP	DEP	IDENT[Contin]
a.[qabz]	*!		
b.[qa.biz]		*!	
→ c.[qawz]			*

b.

/qabz/	SSP	IDENT[Contin]	DEP
a.[qabz]	*!		
→b.[qa.biz]			*
c.[qawz]		*!	

In both tableaus, the faithful candidate (a) loses the competition due to incurring a fatal violation of SSP. In (17a), DEP dominates IDENT[Contin] and this causes the candidate (c) to win, because of violating the lower ranked IDENT[Contin]. Contrary to (17a), in (17b) IDENT[Contin] outranks DEP, and this causes the candidate (b) to win for the same reason.

Just like lenition, metathesis too, is an optional process, which means that we will have two optimal forms whose selection, in each context, depends on the relative ranking of constraints governing the process. The markedness constraint motivating metathesis in the examples in (5c) is the SSP since, in these instances too, the motive behind the process is increasing sonority. The SSP militates against a faithfulness constraint that is defined based on the definition given for metathesis. Metathesis is taken to mean variation in the linear ordering of segments or features within the phonological string (Blevins & Garrett). The faithfulness constraint aims at preserving the linear order of a string of segments or features, hence called LINEARITY and is stated in (18). LINEARITY penalizes any mismatch in linear ordering relations between a string of segments in the input (S1), and the corresponding string in the output (S2).

(18) LINEARITY: "No Metathesis" (McCarthy & Prince, 1995)

S1 is consistent with the precedence structure of S2, and vice versa.

The following tableaus indicate the status of LINEARITY in relation with the SSP and DEP. Here too, the faithful candidate (a) in both (19a and b), incurs the fatal violation of SSP and is put aside from the competition. In (19a), the optimal candidate is (c), since its competitor violates the higher ranked constraint DEP, but in (19b), candidate (b) is selected for the same reason.

(19) a.

/qofl/	SSP	DEP	LINEARITY
a.[qofl]	*!		
b.[qo.fił]		*!	
→ c.[qołf]			*

b.

/qofl/	SSP	LINEARITY	DEP
a.[qofl]	*!		
→b.[qo.fił]			*
c.[qołf]		*!	

It is clear from tableaus (17) and (19) that both IDENT[Contin] and LINEARITY constraints are ranked below SSP, but their interaction with DEP does not follow from a fixed ranking order. Furthermore, the data presented here does not inspire a ranking relation between IDENT[Contin] and LINEARITY. So, the ranking in (20) is presented as the final ranking of syllable constraints in the Kurdish dialect of Sanandaji.

(20) Relative Ranking of Syllable Structure Constraints (Final Revision)

ONSET>> SSP>> MAX, DEP, IDENT[Contin], LINEARITY >> NOCOMPLEX, NOCODA

7. Concluding Remarks

In Sanandaji Kurdish, consonant clusters are allowed both in onset and coda slots, however the two members of the clusters are arranged in such a way that, in all cases, the SSP is preserved. Among borrowed words, those that conform to the SSP, are mostly taken and used without changing their syllable structure, but words violating the SSP are broken down by inserting the vowel /i/, and resyllabified in order to preserve the SSP. Other strategies, in addition to vowel insertion, used to repair syllable structures are consonant lenition, and metathesis that have been defined as faithfulness constraints. The interaction of markedness and faithfulness constraints, following the order established for ranking the constraints, leads to the selection of the most harmonious outputs in different environments. The ranking order established for constraints in Sanandaji is as follows:

ONSET>> SSP>> MAX, DEP, IDENT[Contin], LINEARITY >> NOCOMPLEX, NOCODA

Finally, an advantage of studying the SSP in the framework of OT is that its universality remains unquestioned. As a violable markedness constraint, the SSP is ranked differently in different languages, and its violability depends on its position in the ranking order of the constraints of a language.

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Notes

Note 1. /ɯ/ is the IPA symbol for the palatal approximant which in this dialect appears as an allophone of /t, d, g/ as in [pāt]→ /pāɯ/: your foot, [sad]→ /saɯ/: one hundred, [sag]→ /saɯ/: dog.

Note 2. It should be noted that there are some instances in which borrowed words do conform to the SSP in the foreign language yet, they undergo resyllabification, for example: film →fī.lim "film", zolm: zi.ɬim"oppression".