LOW VOWELS BLOCK DORSEY'S LAW IN FARSI LOANS

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This paper investigates vowel epenthesis patterns in English loanwords and proper nouns in Farsi within the framework of Optimality Theory. In Farsi, there are no syllable-initial consonant clusters; therefore, loanwords with syllable-initial consonant clusters are modified to conform to the syllable structure in Farsi. In CCV syllables, if the vowel is either high or mid, Dorsey's Law is used in which the epenthetic vowel is a copy of the following vowel. If the vowel is low or there is an S-obstruent consonant cluster, /e/ epenthesis is used.

1. INTRODUCTION. In the native vocabulary of Farsi, there are no words that start with two consonants; therefore, syllable-initial consonant clusters in loanwords are separated by vowel epenthesis. In the case with English loanwords, the inserted vowel may be realized as a copy of the following vowel (e.g., /kilinik/ 'clinic'), or as /e/ (e.g., /kelɑsik/ 'classic', /eski/ 'ski').[1]

According to Shademan (2002), if the vocalic features spread from one vowel to another and a consonant's features are compatible with the features being spread, the epenthetic vowel is a copy of the following vowel. Otherwise, the epenthetic vowel is /e/. She argues that feature compatibility depends on the consonant's place of articulation, the spreading vocalic features,

[1] In Farsi /æ/ is rarely borrowed; therefore, the sound /æ/ in borrowed words is usually realized as [ɑ].

vowel rounding, and consonant duration.

In this study, I argue that only vocalic features and the direction of spread from right to left affect the quality of the epenthetic vowel. Therefore, if the features of vowel spread from right to left, the inserted vowel follows Dorsey's Law, which requires the epenthetic vowel to mirror the following vowel (e.g., /kilik/ 'click'). However, Dorsey's Law is blocked by low vowels and SC clusters, which leads to the insertion of the default vowel /e/ (e.g., /geræm/ 'gram', /eskeit/ 'skate').

Since the vocalic features spread from right to left in CCV syllables with high and mid vowels, the epenthetic vowel follows Dorsey's law (e.g., /teredmil/ 'treadmill', /pirint/ 'print'). On the other hand, the vocalic features do not spread in CCV syllables with either a low vowel or S-obstruent cluster, which leads to the insertion of the mid vowel /e/ (e.g., /terɑfic/ 'traffic', /eski/ 'ski').

The focus of this paper is to investigate the case of epenthesis in English loanwords and proper nouns in Farsi within the framework of Optimality Theory (OT).[2] This theory is based on constraint dominance to select the optimal output from a set of violable ranked constraints (Prince & Smolensky 1993).

[2] Since English loanwords and proper nouns in Farsi undergo the same process, from this point on only the term loanword is used which covers both loanwords and proper nouns.

The organization of this paper is as follows: in section 2, I present the sound inventory in Farsi. In section 3, I discuss the syllable structure in Farsi. In sections 4 and 5, I present the OT analysis of well-formed syllable structures in Farsi and of English loanwords in Farsi, respectively. In section 6, I focus on the analysis of English loanwords with syllable-initial consonant clusters using OT analysis. In section 7, I provide a general discussion and conclusion.

2. SOUND INVENTORY.

2.1. CONSONANTS. There are twenty three consonant phonemes in Farsi (Mahjani 2003, Hall 2007, and Windfuhr 1979). The description of consonants occurring in Farsi, adopted from Yarmohammadi (1969), is presented in 1.

(1) Consonant Chart

		Bi labial	Labio dental	Dental alveol	Alve olar	Alveo Palata	Velar	Uvular	Glottal
Stops	Voiceless	p		t		ʧ	k		ʔ
	Voiced	b		d		ʤ	g	q	
Fricatives	Voiceless		f	s		ʃ		χ	h
	Voiced		v	z		ʒ			
Sonorants	Nasals	m		n					
	Lateral			l					
	Trill				r				
	Semi vowel				j				

All of the consonants in the inventory shown in 1 can occur in onset positions, except /w/. Consonant /ʒ/ at the onset position occurs only in proper nouns such as: /ʒɑ.leh/ ‘Zhaleh’, /ʒi.lɑ/ ‘Zhila’, /ʒɑ.pon/ ‘Japan’.[3]

(2)	gætl	‘murder’
	pæ.tu	‘blanket’
	fu.rux.tæn	‘to sell’
	li.vɑn	‘glass’
	rɑh.næ.mɑ	‘guide’
	ʧærm	‘leather’
	vær.zeʃ	‘sport’
	xɑ.hær	‘sister’
	ho.leh	‘towel’
	ʔɑ.li	‘excellent’

All of the consonants shown in 1 can occur in the coda position except /v/; however, /ʒ/ occurs only in loanwords.

(3)	sæg	‘dog’
	gɑ.rɑʒ	‘garage’
	ɑ.roɣ	‘burp’
	ruz	‘day’
	tof	‘spit’
	lɑl	‘mute’
	de.fɑʔ	‘defend’

In the sequence /VʔC/ and /VʔV/, the preceding vowel is lengthened (Hodge 1957).

(4)	sɑ:.ʔæt	‘watch/time’

[3] /./ represents syllable break.

mo:ʔ.ʤe.zeh	‘miracle’
e:ʔ.ti.jɑd	‘addiction’
sor.æ:ʔt	‘speed’

2.2. VOWELS. Farsi has six vowels, three long /u, i, ɑ/ and three short /e, o, æ/, (Mahjani 2003) as shown in 5 and a set of examples is given in 6. There is a disagreement among researchers to determine if the contrast in the Farsi vowel system is related to quality (Samareh 1977, Najafi 2001) or quantity (Windfuhr 1979). According to Toosarvandani (2004), neither the length nor the quality of the vowels in Farsi can be ignored; therefore, he presents the synthetic vowel system, which integrates both quality and quantity. On the other hand, both traditional grammarians and modern linguists suggest that Farsi tense vowels are longer than lax vowels, and that there are no vowels that contrast only in length (Comrie 1987, Samareh 1977).

(5) Vowel Chart

Height	Front	Back
High	i	u
Mid	e	o
Low	æ	ɑ

(6)

æsb	‘horse’
eʃg	‘love’
zi.bɑ	‘beautiful’

ɣu.rub	‘sunset’
o.mid	‘hope’
ɑ.se.mɑn	‘sky’

Farsi also has two diphthongs (ei, ou).

(7)

mei.xɑ.neh	‘bar’
rei	‘Rey’
dei	‘Dey’
fer.dou.si	‘Ferdosi’
xod.rou	‘vehicle’

3. Syllable structure in Farsi.

3.1. The basic syllable structures: V, CV, CVC, and CVCC.[4] According to Yarmohammadi (1969) and Hall (2007), the syllable structure in Farsi is CV(C)(C), which means that a syllable has an onset and there cannot be a syllable with only a nucleus and a coda. However, the examples provided in 8 indicate that the basic syllable structure in Farsi is (C)V(C)(C); therefore, a syllable does not always have an onset.

(8)

ɑ.mæd	‘came’
es.tex.dɑm	‘employment’
i.ʃɑn	‘they’
æb.ru	‘eyebrow’
os.to.xɑn	‘bone’

[4] /C/ and /V/ represent consonant and vowel respectively.

Final –CCC clusters are rare in Farsi and they only occur in the sequence /-mbr/ in borrowed words. However, in casual speech, the /b/ is deleted which reduces the three consonants to the usual two consonant clusters (Nye 1954).

(9) tæmbr ‘stamp’
sep.tɑmbr ‘September’

3.2. SYLLABLES WITH MEDIAL CONSONANT CLUSTERS: VCCV. Syllables are generally organized in a manner in which consonants follow increasing sonority in syllable onsets and form a curve of sonority. This principle is known as the Sonority Sequencing Principle, which argues for languages’ preference against rising sonority from the peak to the edge of word (Jesperson 1897-1899, 1904 in Engstrand & Ericsdotter 1999). However, Engstrand & Ericsdotter (1999) observe that syllables do not always obey the Sonority Sequencing Principle. This is the case in Farsi as shown in 17.

The sonority hierarchy proposed by Clements (1990) is presented in 10. In this hierarchy, the divisions are based on major features of consonants. This ordering shows the degree of ability of a segment to form a syllable peak or margin. The examples provided in 11 show falling sonority at the edge of the words.

(10) The sonority hierarchy

More sonorous ⟷ less sonorous

vowels glides liquids nasals obstruents

The following monosyllabic examples follow the Sonority Sequencing Principle; sonority rises at the onset and falls at the coda creating a curve.

(11)	tof	'spit'
	kur	'blind'
	nɑn	'bread'
	sæd	'hundred'

The Sonority Sequencing Principle also applies to consonants at boundaries of adjacent syllables (e.g. VC.CV). Based on the Syllable Contact Law (Murray & Vennemann 1983), the sound ending a syllable should be more sonorous than the sound at the beginning of the following syllable. However, Farsi does not always follow the Syllable Contact Law and thus the sonority sequencing of the consonants in VC.CV syllable in Farsi can be falling as in 12, rising as in 13 or equal as in 14.

In the following examples, C_1 is more sonorous than C_2:

(12)	dox.tær	'daughter'
	mæn.fi	'negative'
	ʃæl.vɑr	'pants'

kær.dæn	‘to do’
paj.mɑl	‘trodden’
gej.mæt	‘price’

In the following words, C_2 is more sonorous than C_1:

(13)

æb.ru	‘eyebrow’
lok.næt	‘stutter’
moh.læt	‘deadline’
mx.rut	‘cone’
xæt.neh	‘circumcision’
or.jon	‘mumps’
ger.jeh	‘cry’

In the following set of data, $C_1$and C_2 have the same level of sonority:

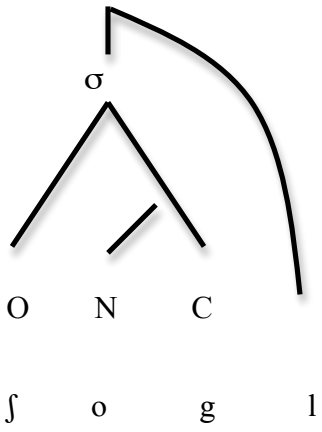
(14)

mel.læt	‘nation’
el.læt	‘reason’
seh.hæt	‘health’
mæk.tub	‘written’
kæf.fɑʃ	‘shoemaker’
æm.meh	‘aunt’
mæm.nu	‘forbidden’
ɣor.reʃ	‘roar’

3.3. SYLLABLES WITH FINAL CONSONANT CLUSTERS: CVCC. Consonant clusters in Farsi occur just in word final position where the second consonant is not part of the syllable. Based on the Prosodic Licensing Principle, every segment must be dominated by a higher-level prosodic constituent: onset/coda/foot/syllable/mora/prosodic word (Itô 1986). Therefore, in

CVCC syllables, the second consonant in the coda is not part of the syllable; but rather it is part of the prosodic word. The example 15 shows the syllabification of a word like /ʃogl/ ‘job’ in which /ʃ/ is the onset, /o/ is the nucleus, /g/ is the coda, and /l/ is part of the prosodic word rather than the syllable.

(15) PWd



As mentioned earlier, based on the Sonority Sequencing Principle, sonority should not rise from the peak to the edge of word. However, the following data indicate that Farsi sometimes violates the Sonority Sequencing Principle. Consonants in word final position (e.g., (C)VCC#) in Farsi can have either falling or rising sonority as shown below.

In the following examples, the coda has falling sonority.

(16)	æsb	‘horse’
	æʃk	‘tear’
	ræft	‘went’

qælb	‘heart’
kɑrd	‘knife’
loxt	‘naked’
bo.zorg	‘big’
ze.reʃk	‘kind of berry’
tæ.meʃk	‘raspberry’

The coda has rising sonority in the following monosyllabic words.

(17)

æxm	‘frown’
mætn	‘text’
gætl	‘murder’
mægz	‘brain’
gæsr	‘palace’
dæfn	‘bury’
pæʃm	‘wool’
sægf	‘ceiling’
ʃogl	‘job’
æbr	‘cloud’

3.4. SYLLABLES WITH INITIAL CONSONANT CLUSTERS: CCVC. The data presented in this paper show that there are no initial consonant clusters in Farsi. Consequently, loanwords with syllable initial consonant clusters are modified to conform to the phonological features of Farsi. Two possible strategies are by employing either Dorsey’s Law, where the epenthetic vowel is a copy of the adjacent vowel, or the epenthetic vowel /e/, as shown in 18. [5]

[5] The English transcriptions have been checked with the *Oxford English Dictionary*.

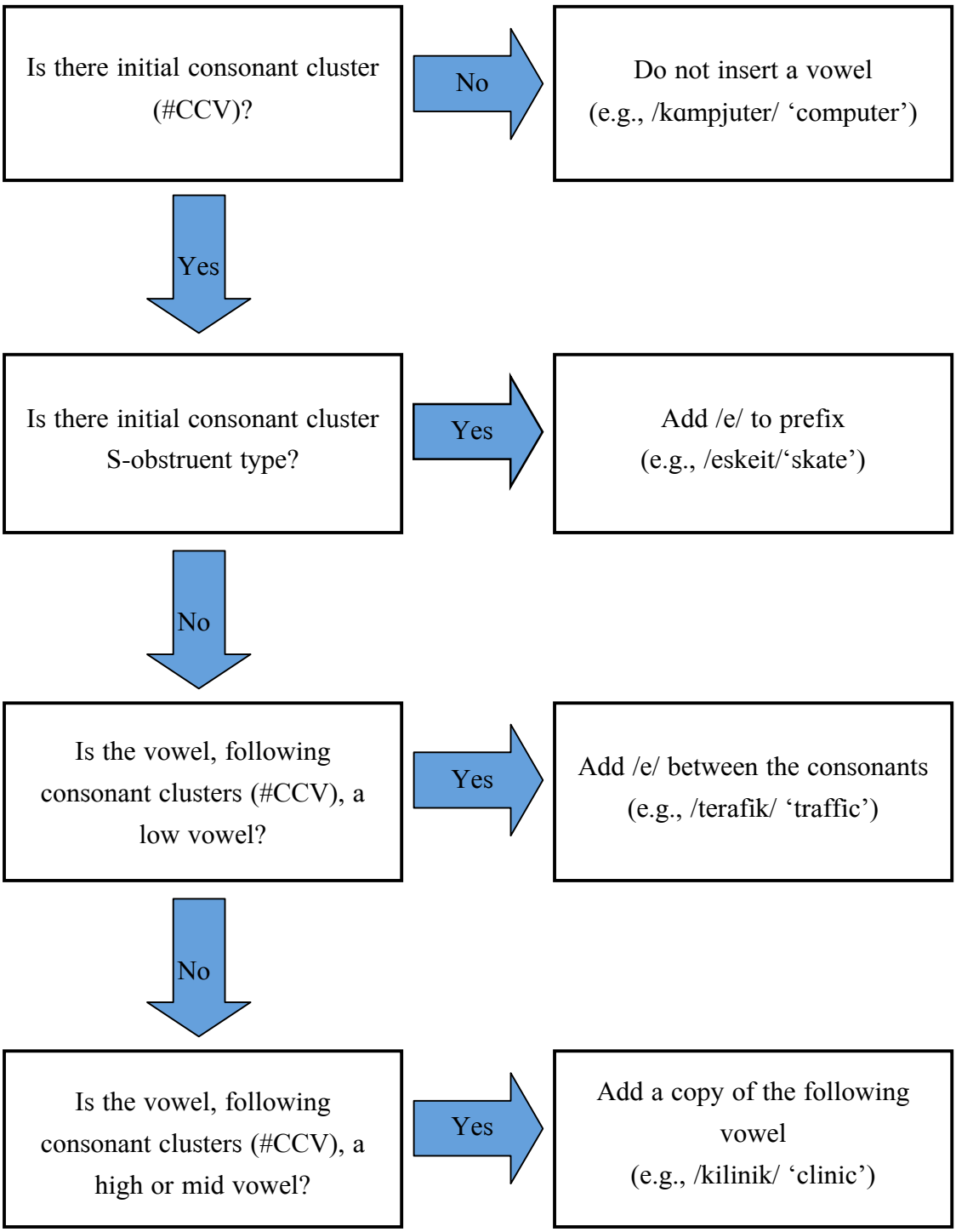
(18)

Farsi	English	Gloss
gi.ris	gri:s	‘grease’
bu.lu.tus	blu.tuθ	‘Bluetooth’
ke.lɑs	klæs	‘class’
es.ki	ski:	‘ski’

4. ANALYSIS. The basis for the analysis of loanwords is the observation of four native speakers of the standard spoken variety of Tehrani Farsi. All of the subjects have received their MA degree from University of Tehran. Since they have learnt English formally at school, they are familiar with phonetic symbols and phonetic transcriptions. The participants received the loanwords presented in this study through email. They were provided with the loanwords along with transcriptions of how they are pronounced in Farsi (e.g. /te.rɑ.fik/ ‘traffic’). They were asked to make sure that the loanwords in Farsi are pronounced as they were transcribed. Otherwise, they were instructed to make any changes they consider appropriate.

4.1. ANALYSIS OF THE EPENTHESIS PATTERN. The data indicates that the vocalic features and the direction of the spread have an important role in inserting the epenthetic vowel. If the features of vowel spread from right to left, the inserted vowel is a copy of the following vowel. If the features of vowel do not spread from right to left, the default vowel /e/ is inserted. The figure in 19 shows epenthesis pattern in loanwords.

(19) Epenthesis patterns in loanwords



4.2. ANALYSIS OF THE EPENTHESIS PATTERN BASED ON DORSEY'S LAW. Dorsey (1885) noticed that in the Chiwere-Winnebago group of American Indian languages, the sequence of CCV is realized as CVCV in which both vowels are identical. Wolff (1950) called the process of separating consonant clusters by inserting a copy vowel *Dorsey's Law*. He found this epenthesis phenomenon to also occur in Proto-Siouan languages.

Dorsey's Law also applies to English loanwords in Farsi. In syllable-initial consonant clusters (C_1C_2V), Dorsey's Law occurs when the vowel is either high (i, u) or mid (o, e), and when C_1 is an obstruent and C_2 is a sonorant. In this case, the backness, roundness, and height (mid/high) features of the vowel spread from right to left. The epenthetic vowel, inserted between C_1 and C_2, is realized as a copy of the following vowel. The examples provided in 20 show the application of Dorsey's Law in CCV syllables with either high or mid vowel. [6]

(20)	Farsi	English	Gloss
	ki.li.nik	klɪn.ɪk	'clinic'
	pi.rint	prɪnt	'print'
	ko.lo.vis	kləʊ.vɪs	'Clovis'
	fu.lut	flu:t	'flute'
	gu.ruh	gru:p	'group'
	ki.ris.mæs	krɪs.məs	'Christmas'
	ki.li.ʃe	kli.ʃe	'cliché'
	ki.ris.to.fer	krɪs.tə.fər	'Christopher'

[6] Only one of the participants said that 'Christmas', 'cliché', and 'Christopher' can also be pronounced as /kerismæs/, /ke.li.ʃe/, and /ke.ris.to.fer/, respectively.

fe.rez.no	frez.no	‘Fresno’
fi.ri.zer	fri:.zər	‘freezer’
ki.li.neks	kli:.nɛks	‘kleenex’
in.gi.lis	ɪŋ.glɪʃ	‘English’
ki.lik	klɪk	‘click’
gi.rin.lænd	gri:n.lənd	‘Greenland’
gi.rin.vitʃ	grɪ.nɪtʃ	‘Greenwich’
ki.lin.ton	klɪn.tən	‘Clinton’
bi.rit.ni	brɪt.ni	‘Britney’
e.lek.ti.ri.si.te	ɛ.lɛk.trɪs.ɪt.ɪ	‘electricity’
eks.pe.res	ɛks.prɛs	‘express’
fe.rend	frɛnd	‘friend’
pe.res	prɛs	‘press’
ki.ris.ti	krɪs.tɪ	‘Kristi’
te.red.mil	trɛd.mɪl	‘treadmill’
fe.red	fred	‘Fred’
bu.lu.tus	blu:.tuθ	‘Bluetooth’
bu.rus	brus	‘Bruce’
pe.res.tiʒ	prɛs.ti:ʒ	‘prestige’
ke.re.dit	krɛ.dɪt	‘credit’

The only exception to the pattern shown in 20 is the word ‘Florida’; subjects in this study and in Shademan’s (2002) study pronounce this word as /felorida/.

In loanwords with diphthong, the first vowel gets copied.

(21)

Farsi	English	Gloss
po.ro.se	proʊ.sɛs	‘process’
pe.lei	pleɪ	‘play’
be.reik	breɪk	‘break’

Some loanwords are pronounced based on their spelling.

(22)	Farsi	English	Gloss
	ku.lup	klʌb	‘club’
	bo.ronz	brɒnz	‘bronze’
	po.ro.tes.tan	prɒ.tɪ.stənt	‘protestant’
	e.lek.to.ro.nik	ɛ.lɛk.trɒn.ɪk	‘electronic’
	e.lek.to.ron	ɪ.lɛk.trɒn	‘electron’
	ko.ro.mo.zom	krəʊ.mə.səʊm	‘chromosome’
	e.lek.to.rod	ɪ.lɛk.trəʊd	‘electrode’

4.3. /E/ EPENTHESIS PATTERN.

4.3.1. /E/ EPENTHESIS PATTERN IN SYLLABLES WITH LOW VOWELS /æ, ɑ/. In syllable initial consonant clusters, CCV, if the following vowel is low, /e/ epenthesis is used because the low feature of height never spreads. Therefore, it is necessary to choose /e/, the least marked vowel, over other vowels when the epenthetic vowel is non-harmonic. It should also be mentioned that the low vowel /æ/ is rarely borrowed; therefore most loanwords with /æ/ are changed into /ɑ/. The examples provided in 23 show the /e/ epenthesis pattern, which is inserted between the consonants, in CCV syllables with low vowels.

(23)	Farsi	English	Gloss
	pe.lan	plæn	‘plan’
	pe.rak.ti.kal	præk.tɪ.kəl	‘practical’
	pe.rag.ma.tik	præg.mæt.ɪk	‘pragmatic’
	ge.ra.mer	græm.ər	‘grammar’
	san fe.ran.sis.ko	sæn fræn.sis.ko	‘San Francisco’

ge.rɑnd kɑ.ni.jon	grænd kæn.iən	‘Grand Canyon’
te.rɑ.ʒe.di	trædʒ.ɪ.dɪ	‘tragedy’
be.ræn.di	bræn.dɪ	‘brandy’
be.rɑd	bræd	‘Brad’
te.rɑ.vel tʃek	træv.əl tʃɛk	‘travel check’
de.rɑ.mɑ.tik	drə.mæt.ɪk	‘dramatic’
te.rɑ.fik	træf.ɪk	‘traffic’
pe.lɑs.tik	plæs.tɪk	‘plastic’
fe.lɑʃ	flæʃ	‘flash’
ge.lɑ.di.ɑ.tor	glæd.ɪ.eɪ.tər	‘gladiator’
fe.rænk	fræŋk	‘Frank’
pe.rɑjd	praɪd	‘pride’
pe.lɑ.kɑrd	plæk.ɑ:d	‘placard’
ke.lɑ.sik	klæs.ɪk	‘classic’
fe.lɑsk	flæsk	‘flask’
ge.ræm	græm	‘gram’

4.3.2. /E/ EPENTHESIS IN SYLLABLES WITH S-OBSTRUENT CLUSTERS. In CCV syllable, /e/ epenthesis is used with s-obstruent clusters, which is modified by adding /e/ at the left edge of the word because the vowel features cannot spread past [s].[7] The examples given in 24 show the /e/ epenthesis pattern in S-obstruent clusters and insertion of the epenthetic vowel at the left edge of the word.

(24)	Farsi	English	Gloss
	es.ki	ski:	‘ski’
	es.keit	skeɪt	‘skate’
	es.tɑr	stɑ:r	‘star’

[7] The only exception is ‘Sri Lanka’ [seri lanka].

es.tep	stɛp	‘step’
es.te.res	strɛs	‘stress’
es.pe.rɑit	spraɪt	‘sprite’
es.tɑd.jom	steɪd.i.əm	‘stadium’
es.kɑ.ler.ʃip	skɑl.ə.ʃɪp	‘scholarship’
es.tei.ʃen	steɪ.ʃən	‘station’
es.tiv	sti:v	‘Steve’
es.kɑt.lænd	skɒt.lənd	‘Scotland’
es.pe.rei	spreɪ	‘spray’
es.teit	steɪt	‘state’
es.kæn	skæn	‘scan’
es.lo.vɑk	sləʊ.væk	‘Slovak’
es.tɑp	stɒp	‘stop’
es.port	spɔ.ət	‘sport’
es.pi.erz	spɪərz	‘Spears’
es.mit	smɪθ	‘Smith’
es.ke.let	skɛl.ɪt.ən	‘skeleton’
es.te.rɑ.te.ʒi	stræt.ɪ.ʤɪ	‘strategy’
es.te.retʃ	strɛtʃ	‘stretch’
es.ku.ɑʃ	skwɒʃ	‘squash’
es.tɑn.dɑrd	stæn.dəd	‘standard’
es.tɑ.tik	stæt.ɪk	‘static’
es.tod.jo	stju:.dɪəʊ	‘studio’
es.ter.jo	stɛr.i:.əʊ	‘stereo’
es.til	sti:l	‘steel’
es.te.ril	stɛr.ɪl	‘sterile’
es.tɑrt	stɑ:t	‘start’
es.pæm	spæm	‘spam’
es.mɑl	smɔ:l	‘small’

5. OT CONSTRAINTS ON SYLLABLE STRUCTURES IN FARSI. As mentioned earlier, the basic syllable structure in Farsi is (C)V(C)(C). In order to analyze the syllable structure in Farsi, OT

constraints are applied to the Farsi syllable structure as follows:

(25) ONSET: Every syllable has an onset.

(26) *COMPLEX ONSET: There are no complex onsets.

(27) * COMPLEX CODA: There are no complex codas.

6. OT CONSTRAINTS ON ENGLISH LOANWORDS IN FARSI. In this section, I focus on the analysis of English loanwords with initial consonant clusters and the OT constraints applying to them. Then, I provide constraint ranking in Farsi which shows why the epenthetic vowel is either a copy vowel or /e/.

There are no syllable-initial consonant clusters in Farsi; consequently, a vowel is inserted between the consonant clusters (e.g., /keredit/ 'credit') or at the left edge of the word (e.g. /esport/ 'sport'). English loanwords in Farsi are modified to conform to the phonological constraints and syllable patterns of Farsi. The following constraints apply to all loanwords in Farsi with syllable initial consonant clusters.

(28) ANCHORL: A word initial consonant in the input should be the same in the output.

(29) DEP: No insertion.

(30) DEP (low vowel): No insertion of low vowels.

(31) DEP (high/round vowel): No insertion of high or round vowels.

(32) ANCHORL (high/low/back): No insertion of high, low, or back vowel at the left edge of the output.

(33) DORSEY'S LAW: A vowel should look like the adjacent one to the right (Dorsey 1885).

The table in 34 shows the constraint ranking in Farsi, exemplified by the word /flut/ which surfaces as /fulut/.

(34) *COMPLEX ONSET > > DEP (low) > > DORSEY'S LAW > > ANCHORL (high/ low/back) > > DEP (high/round) > > DEP

/flut/	*COMP ONSET	DEP (low)	DORSEY'S LAW	ANCHORL (high/low/back)	DEP (high/ round)	DEP
☞ a. fulut					*	*
b. uflut				*!	*	*
c. felut			*!			*
d. filut			*!		*	*
e. fɑlut		*!	*			*
f. flut	*!					

Candidate b loses because its violation of ANCHORL constraint is fatal. Candidates c and d lose because they incur fatal violations of DORSEY'S LAW constraint. Candidate e loses because the inserted vowel /ɑ/ is a low vowel; its violation of DEP (low) is fatal. Candidate f loses because it has complex onset; it incurs fatal violation of *COMPLEX ONSET constraint. Candidate a incurs only violation of the low ranked constraint, DEP (high/round) by inserting a

high, round vowel; however, it does not violate any of the higher ranked constraints; thus, candidate a is chosen as the most harmonic candidate.

When the vowel is low (æ, ɑ), the inserted vowel is the mid vowel /e/ as shown in 35. The table in 35 presents the constraint ranking in Farsi, exemplified by the word /træfik/ which surfaces as /terɑfik/.

(35) *COMPLEX ONSET > > DEP (low) > > DORSEY'S LAW > > ANCHORL (high/ low/ back) > > DEP (hi/ round) > > DEP

/træfik/	*COMP ONSET	DEP (low)	DORSEY'S LAW	ANCHORL (high/low/back)	DEP (high/round)	DEP
☞ a.terɑfik			*			*
b.tirɑfik			*!		*!	*
c. ɑtrɑfik		*!		*		*
d. tɑrɑfik		*!				*
e.tærɑfik		*!	*			*
f. trɑfik	*!					

Candidates c, d, and e lose because of insertion of low vowels (ɑ, æ); their violation of DEP (low) is fatal. Candidate f loses because it violates the highest ranked constraint; its violation of *COMPLEX ONSET is fatal. Candidates a and b violate DORSEY'S LAW. Candidate b violates three constraints while candidate a violates only two constraints. Therefore, candidate a is chosen as the optimal candidate.

Unlike the examples provided in this section so far (/fulut/ ‘flute’ and /terɑfik/ ‘traffic’), S-obstruent consonant clusters cannot be separated. According to the OT constraint shown in 36, the adjacent S-obstruent at onset position in English loanwords is retained in Farsi and the epenthetic vowel is added at the left edge of the word (e.g., /espæm/ ‘spam’).

(36) IO-CONTIGUITY-SC: S-obstruent consonant clusters that are adjacent in the input must be adjacent in the output.

S-obstruent clusters cannot be separated; therefore, the epenthetic vowel /e/ is inserted at the left edge of the word. The table 37 presents constraint ranking in Farsi, exemplified by the word ‘skate’ which surfaces as /eskeit/.

(37) IO-CONTIG-SC, *COMPLEX ONSET > > DEP (low) > > DORSEY’S LAW > > ANCHORL (high/low/back) > > DEP (high/round) > > DEP

/skeit/	IOCONTIG-SC	*COMP ONSET	DEP (low)	DORSEY ’S LAW	ANCHORL (low/high/ back)	DEP (high/round)	DEP
☞a eskeit							*
b. iskeit				*!	*	*	*
c. oskeit				*!	*	*	*
d. skeit		*!					
e. sekeit	*!						*
f. sikeit	*!			*		*	*
g. sɑkeit	*!		*	*			*

Candidates b and c incur a fatal violation of DORSEY'S LAW by inserting a vowel which is different from the adjacent vowel to its right. Candidate d loses because its epenthetic vowel breaks up the contiguity of the root [skeit]. Candidates e, f, and g lose because their violation of IO-CONTIG-SC constraint is fatal; the contiguity of the S-obstruent cluster in the output is broken by inserting a vowel. Candidate a wins because it does not violate any high-ranking constraint and its violation of DEP, the lowest ranked constraint, is not fatal.

7. CONCLUSION. In Farsi, there are no syllable-initial consonant clusters; thus, loanwords with syllable initial consonant clusters are modified to conform to the phonological features of Farsi. The data indicates that the direction of spread of vocalic features has an important role in the epenthetic vowel. If the features of the vowel spread from right to left, the inserted vowel is a copy of the following vowel. If the features of the vowel do not spread from right to left, the default vowel /e/ is inserted.

In syllables with initial consonant clusters, Dorsey's Law applies when the vowel is either high or mid (i, u, o, e), in which case the backness, roundness, and height (mid/high) features spread from right to left. /e/ epenthesis takes place when either the vowel is low (ɑ, æ), because the vowel feature of height never spreads, or when there is S-obstruent cluster, because vowel

features cannot spread past [s].

The analysis given in this study provides a more straightforward account compared to Shademan's (2002) analysis for the quality of the epenthetic vowel in Farsi loanwords; only the vocalic features and the direction of spread from right to left affect the quality of the epenthetic vowel.

REFERENCES

CLEMENTS, GEORGE. N. 1990. The sonority cycle and syllable organization. In Luschützky, D. & Rennison, Pochtrager. 1988. Phonologica: proceedings of the 6th international phonology meeting, 63-76. Cambridge: Cambridge University Press.

COMRIE, BERNARD. 1987. The world's major Languages. New York: Oxford University Press.

DORSEY, JAMES. O. 1885. On the comparative phonology of four Siouan languages. Annual Reports of the Board of Regents for the year 1883, Smithsonian Institution. U.S.Govt. Printing Office, 919-29.

ENGSTRAND, OLLE. & ERICSDOTTER, CHRISTINE. 1999. Explaining a violation of the sonority hierarchy: stop place perception in adjacent [s]. Retrieved on June 2, 2009, from: www.ling.su.se/fon/perilus/1999_07.pdf

HALL, MAHNAZ. 2007. Phonological characteristics of Farsi speakers of English and L1 Australian English speakers' perceptions of proficiency. Retrieved on July 10, 2009, from: http://www.asian-efl-journal.com/Thesis-M-Hall.pdf

HODGE, CARLETON. T. 1957. Some aspects of Persian style. Language, 33, 3, 355-369.

ITÔ, JUNKO. 1986. Syllable theory in prosodic phonology. Retrieved from Dissertations and Theses database. (AAT 8701171)

JESPERSEN, OTTO. 1897-1899. Fonetik. En systematisk fremstilling af l4ren om sproglyd. In Engstrand, Olle. & Ericsdotter, Christine. 1999. Explaining a violation of the sonority hierarchy: stop place perception in adjacent [s]. Retrieved on June 2, 2009, from: www.ling.su.se/fon/perilus/1999_07.pdf

JESPERSEN, OTTO. 1904. Phonetische Grundfragen. In Engstrand, Olle. & Ericsdotter, Christine. 1999. Explaining a violation of the sonority hierarchy: stop place perception in adjacent [s]. Retrieved on June 2, 2009, from: www.ling.su.se/fon/perilus/1999_07.pdf

MAHJANI, BEHZAD. 2003. An instrumental study of prosodic features and intonation in modern Farsi. Retrieved on March 2, 2009, from: http://www.timasearch.com/bm/edinburgh/behzad_mahjani.pdf

MCCARTHY, JOHN. J. & PRINCE, ALAN. S. 1995. Faithfulness and reduplicative identity. Rutgers Optimality Archive ROA-60.

MURRAY, ROBERT, W. & VENNEMANN, THEO. 1983. Sound Change and Syllable Structure i Germanic Phonology. Language, 59, 3, 514-528.

NAJAFI, ABOLHASSAN. 2001. Mabani-y-e Zabanshenasi. Tehran: Niloufar Press.

NYE, GERTRUDE. E. 1955. The phonemes and morphemes of modern Persian: a descriptive study. Retrieved from Dissertations and Theses database. (AAT 0011333)

PRINCE, ALAN. & SMOLENSKY, PAUL. 1993. Optimality theory: constraint interaction in generative grammar. RuCCS technical Report 2. Piscataway, NJ: Rutgers Center for Cognitive Science, Rutgers University, and Boulder, CO: Department of Computer Science, University of Colorado.

SAMAREH, YADOLLAH. 1977. The arrangement of segmental phonemes in Farsi. University of Tehran Press.

SHADEMAN, SHABNAM. 2002. Epenthetic vowel harmony in Farsi. Retrieved on March 2, 2009, from: http://www.linguistics.ucla.edu/people/grads/shademan/ShademanThesis.pdf

SIMPSON, JOHN. A. & WEINER, EDMUND. S. C. 1989. The Oxford English Dictionary (Second Edition). Oxford: Clarendon Press; New York: Oxford University Press.

TOOSARVANDANI, MAZIAR. 2004. Vowel length in Modern Farsi. Journal of the Royal Asiatic Society, 14, 241-251.

YARMOHAMMADI, LOTFOLLAH. 1969. English Consonants and Learning Problems for Iranians: A Contrastive Sketch. TESOL Quarterly, 3, 3, 231-236.

WINDFUHR, GERNOT. L. 1979. Persian grammar. History and state of its study. Trends in Linguistics 12. Mountain Publishers.

WOLFF, HANS. 1950. Comparative Siouan III. International Journal of American Linguistics, 16, 4, 168-178.