Syllable Structure in Old, Middle and Modern Persian: A Contrastive Analysis

Aliyeh Kord Zaferanlu Kambuziya
Assisstant Professor,
Tarbiyat Modares University
akord@modares.ac.ir

Firoozeh Eslami
Ph.D Candidate,
PayameNoor University
firoozeheslami@yahoo.com

Abstract

Evolution of languages has always been of interest to linguists. In this paper we study the natural progress of the syllable structure from Old Persian(O.P)to MiddlePersian (Mi.P) and up to the Modern Persian(Mo.P). For this purpose all thewords containing consonant sequences are collected from specific sources of each of theselanguages, and thenanalysed according to the syllabification principles. Pulgram (1970) distinguishes three principles for this matter which is stated in Hyman (2003, p. 279).The first one, is the maximum open syllable principle, the second, the minimum coda and maximum onset principle and the last one is the irregular coda principle. In addition,to find the syllable structure of the words,phonological rules are also applied. Greenberg (1978) suggests a number of rules specifying the collocation constraint of phonemes and phonological structure of the word, which are: Obligatory Contour Principle (OCP), Sonority Sequencing Principle (SSP) and Syllable Contact Law (SCL). On basis of these rules and principles the clusters are separated from sequences, and the syllable structure of each language is acquired. Finally the progress of the syllable structure change is studied through representing the data from all three languages, and investigating the process taken for clusters to reach the present time. As the data exhibits, in O.Pinitial consonant clusters are frequently observed and also, through syllabification, some final syllable clusters will be obtained. In Mi.P also both initial and final clusters fully exist, with growing number of final ones. Initial consonant clusters are completely omitted in Mo.P and only final clusters remain. Deletion and vowel insertion are the two most occurring processes in these processes.

Keywords: Phonotactics, Consonant Cluster, Sequence, Syllable Structure, Old Persian (OP), Middle Persian (Mi.P), Modern Persian (Mo.P).

Received: February 2014; Accepted: January 2015

1. Introduction

Old Persian (OP) is the name applied to the Persian language used in the cuneiform inscriptions of the Achaemenian dynasty (600BC). It can be localized as the language of south western Persia, or Persis in the narrower sense, and was the vernacular of the Achaemenian rulers. Linguistically, OP belongs to the Iranian branch of the main divisions of the Indo-European family of languages (Kent, 1953, p. 6). OPis an inflectional language whichhas three genders, three numbers and five declination types for nouns and adjectives, four tenses, three different voices, five moods, three persons, and three numbers for verbs. OP's scripts have a syllabary alphabet which is of the cuneiform type. As this language, like most other ancient Indo-European languages, is an inflectional one, words have morphological endings, which prevent final consonant clusters. Initial consonant clusters however, are very common in OP. This language has a (c)(c)(c)v(c)(c) syllable configuration (Eslami, 2009). The main reference for the OP transcription in this research is Kent (1953).

Mackenzie (1974) and Farahvashi (1976) were considered the main source for Pahlavi transcription in this paper. Although they were rich sources from the lexical point of view, they didn't pay any attention to phonotactics of this language.

Modern Persian (Mo.P), the official language of Iran, is an analytic language which dates back to 900 A.D onward. Its greatest monument is the national epics of Persia, the ShāhNāmeh "or Book of Kings" composed by Ferdausi about the year 1000(Kent, 1953:7).

2. Review of Literature

Evolution of languages has always been of interest to linguistics researchers. Persian was among languages that have been given a particular attention because of the ancient civilization and the vast territory of its ruling dynasties.

But decipherment of OP's 3000 year old cuneiform goes back to about 200 years ago and there is still controversy about its correctness.

Many books and papers have been studied about Old, Middle and Modern Persian for this paper, and as this study is about the phonotactics of these languages, phonological aspects of language has been also in the focus of the investigation. Some are written on phonology and phonotactics of languages as a whole like: Hyman (1975c), Arlotto (1981). Some are written on a special era of Persian language like Kent (1953) or sharp(1966) which are about Old Persian. Mackenzie(1971), Farahvashi (1976) &Amoozgar (1996) are written particularly on Middle Persian and Peisikov(1960), Mahootian(1997), Alamolhoda(2000), Kambuzia(2006) and ZolfaghariSerish(2004) are on Modern Persian. There are also other types of literature that have comparatively studied all three periods of Persian language among those Hubschmann (1895), Oranskij (1963) & (1979), Samare(1999), Abolghasemi (2001) &(2006), are to mention. Neither of these references has studied the phonotactics of these languages except zolfaghariSerish(2004) which is about the phonotactics of Modern Persian.

3. Methodology

In order to study the consonant clusters of OP, Mi.P and Mo.P, the data were collected as follows: for OP the main reference isKent(1953) and the glossaries

on the internet[1]. For Mi.P Mackenzie(1974) and Farahvashi(1976) are studied, andthe major reference for Mo.P, except from informants, is Samare(1999), Peisikov(1960) and also zolfaghariSerish(2004). For this purpose all the words containing consonant sequences were collected and thenanalysed to find the consonant clusters in a syllable. Analysis was based on syllable contact law and also three phonotactical principles that Pulgram stated which are: "maximum open syllable principle, maximum onset principle and irregular coda. Then after distinguishing the clusters, theywere compared in all three languages to see the process which is taken to reach the present time. Several different phonological processes like consonant deletion and vowel insertion have functioned on the clusters to either alter those or eliminate them.

4. Data Presentation and Analysis

In this part data from each language will be presented separately andeach language will be studied in a different section.

4.1. Old Persian

All the OP words containing consonant sequences were collected and consonant sequences has been detected. Then these sequences were analysed to see which belong to a cluster in a syllable. According to this study we will have these sets of clusters in Old Persian: (In data presentations, the symbols usedhere are the ones used in the reference books, which is not IPA.)

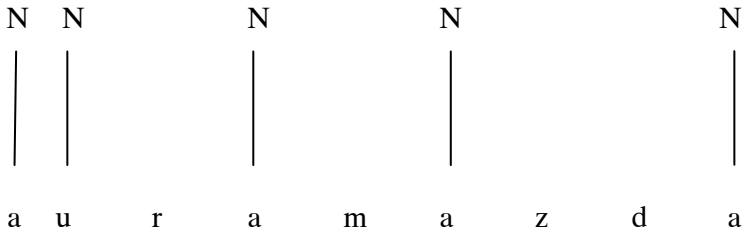
[1]**An introduction to old Persian**. Prods OktorSkjærvø www.fas.harvard.edu

cluster	word	meaning
[#br-]	brātā	brother
[#dr-]	draya	sea
[#fr-]	fratara	better
[#gr-]	graɵitā	composed
[#hy -]	hya	(relative pronoun)
[#sp-]	spāɵmaiday	camp
[#sk-]	skauɵim	poor
[#st-]	stūnā	column
[#tr-]	U_1vax$ʃ_2$**tra**$_3$	(proper name)
[#ty-]	tya	(conjunction)
[#zr-]	zrakā	Drangiana
[#xʃ-]	xʃapava	night
[#xr-]	xraɵum	wisdom
[#ʃk-]	ʃkaurim	poor
[#ɵr-]	Mi_1ɵra$_2$	Mitra
[# xʃy-]	xʃyaɵiya	king
[#xʃn-]	xʃnuta	pleased
[-rʃ-]	arʃtiʃ	spear
[-xt-]	Bāxtriā	Bactria
[-xʃ-]	U_1**vaxʃ**$_2$tra$_3$	(proper name)

Most clusters are initial ones which are represented with a (#) sign at the beginning of cluster and the final clusters have the same sign at the end of the cluster. The medial ones are accompanied with a (-) at both sides of the cluster.

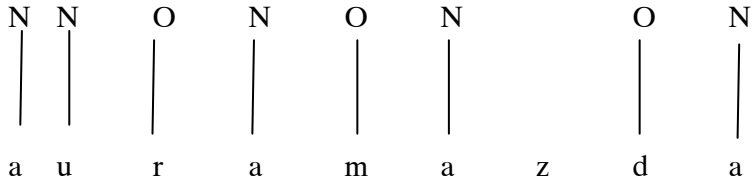
Old Persian scripts contain about 49885 words which among them 94 different consonant sequences either initial or medial exist. These sequences were analysed to see which belong to a cluster in a syllable.We will syllabify a

word in order to find the clusters in a syllable according to Ewen and Van der Hulst (2001, p. 142). The first step is to find the nucleus of the syllables. For example auramazda(the wise God) is syllabified here:



So there would be five nucleus as it has five vowel (here N means the nucleus of the syllable).

The second step is to form the onsets. According to the maximum onset principle the non-nucleus elements are put in the onset except when an impermissible onset is formed. So it goes as follows:



Now regarding syllable contact law, "z" can't be in the same onset as "d" because "z" is more sonorous than "d". Then the syllabification of this word would be: # $a_1u_2ra_3maz_4da_5$#

A problem rises in the syllabification of the word Uvaxʃtra (a proper name) which is the longest consonant sequence between two vowels in Old Persian.

As we saw before, it should be syllabified as follows: #$U_1va_2xʃtra_3$#. But Pulgram (1970)[2] confirms that a syllable structure is very similar to a word's,and whatever is allowed in the beginning or the end of a word it would

[2]Hyman (2003, p.279)

be allowed in the beginning or end of the syllable and there is no word starting with such a consonant cluster as (xʃtr) in OP.

Syllable contact law (SCL) which has its roots in prosodic phonology is a tendency to keep similar articulatory features in distinctive positions (Roca & Johnson, 1999, pp. 273-279).

According to SCL and maximum onset principle there would be three different assumptions. The first hypothesis is that four consonants (xʃtr) form a cluster. The second hypothesis is that, from these four, one will join the previous syllable for a coda. Therefore only three remains to form an onset for the last syllable. The third assumption is that two of these consonants will join the previous syllable for a coda and only two will form an onset for the last syllable.

For the first hypothesis we can refer to two of Pulgram's principles: the maximum onset principle and maximum open syllable, which will justify the four consonant sequences. But we can find no word starting with four consonants in OP language therefore the first consonant is transferred to the previous syllable for a coda. According to this view we will have: #U_1vax_2ʃtra$_3$#. But still there is no other word containing such a three consonant sequence in this language, therefore another consonant is transferred to the previous syllable so it would syllabify as:#U_1vax$ʃ_2$tra$_3$#

But as OP is an inflectional language, and the entire suffixes end in a vowel, there is no word ending in a consonant cluster. Based on Pulgram's "principle of the irregular coda", the burden of irregularity must be borne by the coda rather than the following onset (Goldsmith, 2009).

Although there is still no word starting with a "tr" sequence but we have many similar sequences in the beginning of OP words like br- ,dr- ,gr- , fr-. Also in similar languages like English "tr" is a permissible consonant sequence in

words like "track" ,"train" ,"try" etc. therefore we have enough evidence to syllabify the word as #U_1vax$\int_2$tra$_3$#. On the basis of this analysis we can gather all the consonant clusters in the three languages O.P&Mi.P&Mo.P.

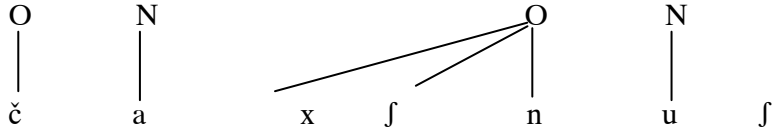
After representing the data from all three languages, we will investigate the process taken for clusters to reach the present time. Deletion and vowel insertion are the two most occurring processes.

4.2. Middle Persian

The same analysis which was done on O.P will be carried outon Mi.P words collected from Farahvashi (1976) & Mackenzie (1974) to determine the clusters in that language. In this section we will choose a word from Mi.P and syllabify it to show the same process taken to indicate the clusters in O.P. Here we will choose one of the words with the longest medial consonant sequence: "čax∫nu∫" (a proper name).

First we indicate the nucleus of the syllables. We have two vowels so we will have two syllables:

The next step is to form the onsets. According to the maximum onset principle the non-nucleus elements are put in the onset except when an impermissible onset is formed. But as we can see in the data there are words beginning with a three consonantal cluster of x∫n so we have no difficulty to put the same cluster in the onset of the second syllable. So it goes as follows:



The last step is to identify the role of the remaining consonant which is ʃ and it will be the coda for the second syllable. So we have $\check{c}a_1xʃnuʃ_2$ .The study resulted in these sets of consonant clusters (those marked with asterisk * were found only in Mackenzie)

Middle Persian consonant clusters (2)

cluster	word	meaning
[#br-]	brāt	brother
[#dr-]	drōg	lye
[#dv-]	dvār	door
[#dw-]	dwāriʃn	to run
[#fr-]	frōxtan	to sell
[#fʃ-]	fʃag	chain
[#gr-]	grah	knot
[#gy-]	gyāk	plant
[#hr-]	hrōm	Greece
[#hv-]	hvarʃēt	sun
[#nm-]	nmānāy	domestic
[#sn-]	snahr	snow
[#sp-]	spēt	white
[#sr-]	srāy	inn
[#st-]	stahmb	oppression
*[#sy]	syā	black
[#ʃk-]	ʃkaft	astonishing
[#ʃm-]	ʃmāh	you
[#ʃn-]	ʃnaftan	to hear
[#ʃt-]	ʃtāftar	follower
[#tr-]	truftan	to steal
[#xr-]	xrad	wisdom
[#xv-]	xvartan	to eat
[#xʃ-]	xʃēn	dark blue

[#zr-]	zrēh	armour
*[#zy-]	zyān	damage
[#mrnǰ-]	mrnǰēniʃn	destroy
[#dry-]	dryōʃ	poor
[#gry-]	gryān	crying
[#ʃkr-]	ʃkravītan	walking
[#xrv-]	xrvīk	cruel
[#xʃn-]	xʃnūtan	make satisfied
[-br#]	abr	cloud
[-dr#]	mudr	city
[-fd#]	afd	interesting
[-fʃ#]	kafʃ	shoe
[-fr#]	zafr	snout
[-ft#]	haft	seven
[-gr#]	tigr	arrow
[-hl#]	hamāl	pal
[-hk#]	panāhk	shelter
[-hm#]	sahm	share
[-hn#]	pēhn	food
[-hr#]	gōhr	jewel
[-hv#]	pihr	fat
[-mb#]	namb	damp
[-mr#]	xumr	sleep
[-nd#]	hāvand	similar
[-ng#]	gung	mute
[-nǰ#]	ranǰ	suffering
[-nk#]	afrank	beautiful
[-nt#]	kant	city
[-pr#]	stapr	sturdy
[-rč#]	varč	glory

[-rd#]	zard	yellow
[-rf#]	**nirf**$_{l}$sītan	to cut
[-rg#]	gurg	wolf
[-rɣ#]	murɣ	chicken
[-rǰ#]	arǰ	worth
[-rk#]	hūčārk	having a way to do things
[-rm#]	kirm	worm
[-rp#]	karp	form
[-rs#]	tars	fear
[-rʃ#]	vizarʃ	a demon
[-rt#]	kurt	Kurdish
[-rv#]	harv	worm
[-rw#]	Gandarw	a demon
[-rz#]	Gūdarz	a name
[-rž#]	arž	worth
[-sk#]	nask	holy book
[-sm#]	ēsm	name
[-sp#]	hūasp	good horse
[-sr#]	pusr	son
[-st#]	hamist	all
[-tr#]	mitr	(a goddess)
[-vn#]	rōvn	oil
[-wd#]	awd	interesting
[-wr#]	gawr	tomb
[-wt#]	pōlāwt	steel
[-zd#]	hormazd	Ahuramazda
[-zg#]	mazg	brain
[-zm#]	nazm	fog
[-zr#]	varz	mace
[-zt#]	dūzt	thief

[-ʃd#]	siʃd	freed
[-ʃk#]	huʃk	dry
[-ʃm#]	heʃm	anger
[-ʃn#]	bāliʃn	pillow
[-ʃt#]	haʃt	eight
[-xl#]	bālx	a city
[-xm#]	zaxm	wound
[-xn#]	rēxn	capital
[-xr#]	suxr	red
[-xt#]	hūāmōxt	well thought
[-xv#]	axv	master
[-xʃ#]	maxʃ	fly(insect)
[-žd#]	xružd	strong
[-žm#]	pažm	suffering
[-ɣn#]	rōɣn	oil
[-hmb#]	stahmb	oppression
[-nsr#]	mānsr	revelation
[-rʃt#]	arʃt	spear
[-xʃn#]	tuxʃn	power
[-str#]	vastr	pasture

As we can see from the data, three consonant clusters both initial and final, are common in Mi.P. So we can indicate the syllable type in Mi.Pas (c)(c)(c)v(c)(c)(c) which can be elicited from the data above.

4.3. Modern Persian

In Mo.P initial consonant clusters are completely eliminated and only final two consonantal ones are found. The syllable type in Mo.P is (c)v(c)(c)(Kambuzia, 2006).The number of these two slot final clusters is so great that representing an example from each of them would be too time-consuming. ZolfaghariSerish

(2009, 27-45) has studied all these two consonantal clusters and has listed them as below (an example is given for each group):

[-bs#](habs= prison) [-bz#] [-bʃ#] [-bt#] [-bk#] [-bʔ#] [-bl#] [-bg#] [-bh#] [-br#] [-bx#] [-bd#]

[-mr#](amr=order) [-mn#] [-mʔ#] [-ml#] [-md#] [-mz#] [-ms#] [-ms#] [-mg#] [-mʃ#]

[-ft#](dʒoft=pair) [-fz#] [-fs#] [-fn#] [-fj#] [-fv#] [-fʃ#] [-fx#] [-fʔ#] [-fg#]

[-dh#](madh=compliment) [-ds#] [-dv#] [-dr#][-dg#]

[-nd#](pand=advise) [-nb#] [-nf#][-nz#] [-ns#] [-ng#] [-nx#] [-nʔ#] [-ndʒ#]

[-st#](mast=drunk) [-sx#] [-sr#] [-sl#] [-sk#] [-sg#] [-sf#] [-sb#] [-sm#] [-sʔ#] [-sn#] [-sd#] [-sdʒ#]

[-zr#](nazr=vow) [-zd#] [-zm#] [-zn#] [-zb#] [-zf#] [-zg#] [-zʔ#] [-zv#]

[-rb#](darb=door)[-rs#] [-rʃ#] [-rh#] [-rʔ#] [-rm#] [-rt#] [-rd#] [-rd#] [-rf#][-rg#] [-rk#] [-rx#] [-rg#] [-rn#] [-rdʒ#]

[-lʔ#](balʔ=swallowing) [-lx#] [-lg#] [-lv#] [-lb#] [-lt#] [-ls#] [-lh#] [-lk#] [-ld#] [-lm#] [-lf#]

[-dʒb#](hodʒb=modesty) [-dʒz#] [-dʒd#] [-dʒm#] [-dʒv#] [-dʒr#]

[-ʃk#](kaʃk=sour cream) [-ʃg#] [-ʃj#] [-ʃr#] [-ʃm#] [-ʃn#] [-ʃt#] [-ʃf#] [-ʃd#] [-ʃv#]

[-jl#](mejl=desire) [-jn#] [-jk#] [-js#] [-jr#] [-jf#] [-jd#] [-jm#] [-jx#] [-jʔ#][-jʃ#] [-jz#] [-jt#] [-kl#] [-kr#] [-km#] [-kn#] [-ks#]

[-xt#](saxt=hard) [-xm#] [-xs#] [-xz#] [-xr#] [-xl#] [-xʃ#]

[-Gb#](naGb=burrow) [-Gs#] [-Gʃ#] [-Gl#] [-Gt#] [-Gf#] [-Gm#] [-Gd#][-Gr#] [-Gv#] [-Gh#]

[-hs#](bahs=debate) [-hz#] [-hm#] [-hn#] [-hr#] [-hl#] [-hv#] [-ht#] [-hd#][-hʃ#] [-hj#]

[-ʔt#](naʔt=praise) [-ʔd#] [-ʔs#] [-ʔz#] [-ʔz#] [-ʔm#] [-ʔn#] [-ʔb#] [-ʔf#] [-ʔr#] [-ʔl#] [-ʔj#] [-ʔʃ#]

A table from Samare (1999) will be used here to show the number of consonant occurrences in Mo.P words.

(Table no.3)

consonant	number of occurrences in the beginning of syllable	number of occurrences in the beginning of cluster	number of occurrences in the end of syllable	sum of the three occurrences
p	21	_	_	21
b	42	36	27	105
t	38	27	122	187
d	28	9	81	118
k	33	11	27	71
g	15	_	29	44
ɣ	41	22	26	89
ʔ	55	24	25	104
f	29	43	28	100
v	23	37	12	72
s	62	62	41	164
z	32	30	35	97
ʃ	27	49	18	94
ž	2	_	_	2
x	24	41	11	76
h	38	42	15	95
č	16	_	4	20
ǰ	35	11	20	66
m	45	20	47	112
n	42	67	31	140
l	21	30	45	96
r	47	119	73	239
y	7	43	6	56

These data show that in OP words, only initial consonant clusters exist.But as we go further in Mi.P with the deletion of inflectional endings, final consonant clusters are also showing up. In Mo.P initial consonant clusters are completely eliminated and only final two consonantal ones are found. The syllable type changes from (c)(c)(c)v(c)(c) in OP to (c)(c)(c)v(c)(c)(c) In Mi.P and then to (c)v(c)(c) inMo.P.

5. Cluster Modifying Processes

There are different processes which act to change the consonant clusters of OP to the ones in Mi.P and then to Mo.P. These processes are investigated in these sections.

5.1. Consonant Deletion

The most important change happening here is the deletion of consonants in initial clusters. Although the data from OP is so limited we still can find some evidence up to the present. There are much more data in Pahlavi but only a limited number are presented in this table. We can have two different kinds of deletions: the deletion of first consonant and deletion of the second or maybe third consonant. First we investigate first consonant deletion process. As the table below shows mostly the initial [x] is deleted from the cluster.

Initial consonant deletion(4)

OP	Mi.P	Mo.P	English
xʃapa	ʃab	ʃab	night
xʃnāsa	xʃāxtan	ʃenāxtan	know
xʃāyaθiya	ʃāh	ʃāh	king
xʃaça	ʃahr	ʃahr	town
a-xʃnau	ʃnaviʃn	ʃenidan	to hear
-	hrōm	rom	Greece
-	nmānāy	māny	stay

But in Mi.Pusually the second consonant after [x] is omitted (more evidence on that is available).

Second consonant deletion(5)

OP	Mi.P	Mo.P	English
ʃyaw-	ʃaw	ʃo	be
sparda	sard	sard	sardis
-	xvāb	xāb	sleep
-	xvāhiʃn	xāheʃ	desire
-	xvartan	xordan	eat

There is still evidence of deletion of [v], in last three data, in Modern Persian writing.

5.2. Vowel Insertion

Major changes have occurred with inserting a vowel between the consonants in a cluster.

Vowel insertion (6)

OP	Mi.P	Mo.P	English
xraəu	xrat	xerad	wisdom
xʃnav-	xʃnōmand	xoʃnud	satisfied
grab-	griftan	gereftan	take
spāda	spāh	sepāh	army
drayā	drayā	daryā	sea
fra-	fra-	farā-	in front of
fraʃa-	frāʃm	deraxʃān	brilliant
framātar	framādar	farmānde	commander
brātar	brādar	barādar	brother
sta^{m}b	stahm	setam	rebel
stā-	stēndag	istādan	stand
stūnā	stūn	sotun	column
drauga	drōɣ	doruɣ	lie
ʃkauəi (weak)	ʃkōh (weak/magnificence)	ʃokuh	magnificence
-	fʃag	feʃang	bullet
-	gyāh	/geyāh/→[giyāh]	plant
-	spahr	sepehr	sky
-	graw	gereh	knot
-	friʃtak	fereʃte	angel
-	gristan	geristan	cry
-	xrōs	xorus	rooster

The type of the vowel inserted depends on the next syllable'svowel. As it appears, if the next vowel is a round one, the inserted vowel will be a round one and in the other cases the nearest short vowel is selected. As mentioned in Hubschmann(1895)"none of the words in new Persian starts with consonant cluster. But as these kinds of clusters were common in old times, adding a

vowel to the beginning of the word or between the consonants in a cluster is used to make Mo.P words. The kind of vowel depends on the adjacent consonants and vowels."

The data below show that final clusters, where exist, stay almost the same.

Final consonant clusters(7)

OP	Mi.P	Mo.P	English
vark-	gurg	gorg	wolf
čarm-	čarm	čarm	leather
iʃt-	xiʃt	xeʃt	brick
dast-	dast	dast	hand
asp-	asp	asb	horse
čaʃm-	čaʃm	čeʃm	eye
maʃk-	maʃk	maʃk	sheep skin
taxm-	tahm	taham	hero
pavast-	pōst	pust	skin
mart-	mard	mard	man
uʃk-	huʃk	xoʃk	dry

Hubschmann(1895) notes that the phoneme [k], after a voiced consonant at the end of the word, either changes in to [g] or is deleted like: vark- (OP) = gurg(Mi.P) = gorg (Mo.P)

6. Conclusion

6.1. Old Persian, an inflectional language changes to Mo.P, an analytical language.

6.2. All initial consonant clusters change in to consonant + vowel utilizing vowel insertion or consonant deletion.

6.3. Final consonant clusters remain almost the same in all three languages.

6.4. A (c)(c)(c)v(c)(c) syllable form language, Old Persian, changes in to a Mi.P(c)(c)(c)v(c)(c)(c) and then to (c)v(c)(c) syllable configuration in Mo.P.

6.5. Initial consonant deletion is one of the steps taken to eliminate consonant clusters and form consonant + vowel sequences, like: xʃapa →ʃab(night).

6.6. Second consonant deletion is accounted as another way to change consonant clusters in to cv sequence, example: ʃyaw→ʃaw→ʃo(be).

6.7. The last and the most important process is vowel insertion. It is the most frequent process taken to eliminate consonant clusters and make cv sequence. Stūnā→stūn→ sotun(column).

References

Abolghasemi, M. (1994). *The History of Persian Language*, Tehran: SAMT.

Abolghasemi, M. (1996). *The Historical Grammar of Persian Language*, Tehran: SAMT.

Alamolhoda, S.M. (2000). *Phonostatistics and Phonotactics of the Syllable in Modern Persian*, Finnish Oriental Society.

Amoozgar, J &Tafazzoli, A. (1996). *Pahlavi Language: Literature, Grammatical sketch, Texts and Glossary*, Tehran, Moin Publishing Co.

Anderson, Stephen.R. (1985). *Phonology in the Twentieth Century: Theories of Rules and Theories of Representation*, University of Chicago Press,Chicago & London.

Anderson, Stephen. R. (1974). *The Organisation of Phonology,* Academic Press,Inc. New York.

Arlotto, A. (1981). *Introduction to Historical Linguistics*, 2nd. Edition, New York: University Press of America.

Burquest, D. A. (1993). *Phonological Analysis: a functional approach,* SIL international.Dallas.Texas.

Butskhrikidze, M. (2002). *TheConsonant Phonotactics of Georgian,* LOT.

Carr, P. (1993). *Phonology*. The MacMillan Press LTD.

Catford, J. C. (2003). *A Practical Introduction to Phonetics,* OxfordUniversity Press: New York.

Crystal, D. (2003). *A Dictionary of Linguistics and Phonetics,* Fifth edition. Blackwell Publishing: Oxford.

Durand, J. & Katamba, F. (1995). *Frontiers of Phonology: Atoms, Structures, Derivations,* Longman LTD,London &NewYork.

Eslami, F. (2009). *A Phonotactical Analysis of Old Persian*, Tehran, TarbiyatModaress University.

Ewen, C., & Van der Hulst. (2001). *The Phonological Structure of Words (an introduction),* Cambridge University Press.UK.

Farahvashi, B. (1973). *Pahlavi Dictionary*, Tehran, Tehran University Press.

Greenberg, Joseph H. (1978). *Some Generalizations Concerning Initial and Final Consonant Sequences,* In Joseph H. Greenberg (ed.), *Universals of human language*, vol. 2 (*Phonology*), 243-279. Stanford University Press.

Goldsmith, John A. (Ed). (1999). *Phonological Theory*, the essential reading Blackwell Publishers.

Gussman, E. (2002). *Phonology Analysis and Theory,* Cambridge University Press.UK.

Hudson, G. (2000). *Essential Introductory Linguistics,* Blackwell Publishers LTD,UK.

Hubschmann, H. (1895). *PersischeStudien*, Strassburg: Verlag Von Karl J. Trubner.

Hyman, L. M. (c1975). *Phonology Theory and Analysis*, Holt, Rinehart and Winston, New York.

Jakobson, R. & Halle, M. (2002). *Fundamentals of Language,* Mouton de Gruyter, Berlin.New York.

Jensen, John T. (2004). *Principles of Generative Phonology: An Introduction,* John Benjamins Publishing Company: Amsterdam.

Katamba, F. (1989). *An introduction to Phonology,* Longman Group Limited, London.

Kent, Roland G.(1935). Old Persian, Grammar, Texts, Lexicon, second edition – revised, American Oriental Society.

Kenstowicz, M. (1994). *Phonology in Generative Grammar,* Blackwell publishing: Oxford.

Kord Zaferanloo Kambuziya, A. (2006). *Phonology: Rule based Approaches & Their Applications in Persian*, Tehran, SAMT.

Kord Zaferanloo Kambuziya, A. (2006). A Critical Analysis and Correction on E.Ternes & M.Majidi Paper, Language & Linguistics, second year, first edition, 109-118.

Lass, R. (1984). *Phonology an Introduction to Basic Concepts,* Cambridge University Press.

Mackenzie, D. N. (1971). *A Concise Pahlavi Dictionary*, London.

Oranski, I. M. (1977). *Les LanguesIraniennes*, traduit par Joyce Blau, Paris Librairie C. Klincksieck.

Peisikov, Lazar. S. (1960). *TegeranskiiDiialekt*, Moskva: IMO.

Roca, I. & Johnson, W. (1999). *A course in Phonology,* Blackwell publishers LTD. Oxford.

Roca, I. (1997). *Derivations and Constraints in Phonology*, Clarendon Press Oxford.

Samare, Y. (1999). *Phonetics of Persian language*, seventh edition, Tehran, Central University Press.

Spencer, A. (1996). *Phonology*, Blackwell publishing, oxford, Uk.

Van der Hulst, H. & Ritter, Nancy. A (Eds.) (1999). *The Syllables Views and Facts*. Mouton de Gruyter.

ZolfaghariSerish, M. (2004). *Phonological Analysis of consonant clusters in Persian*, Tehran,TarbiyatModaress University.

"An introduction to old Persian". www.fas.harvard.edu.

"Cluster Phonotactics and the Sonority sequencing principle":http://roa.rutgers.edu./

"Does Sonority have a phonetic basis? Comments on the chapter by Bert Vaux": http://nickclements.free.fr.

"Lexical references of the syllable contact law": www.personal.umich.edu.

"Obligatory contour principle": www.vanoostendorp.nl.

"Old Persian": www.news.uchicago.edu.

"Phonological encoding of single words": http://www.psychology.unimass.nl./

"Relational Hierarchies in optimality theory: the case of syllable contact"http://homepages.nyu.edu.

"Sonority Sequencing, Phonological Scales,and Russian Word Edges"http://people.ucsc.edu./