

Final Consonant Clusters in Azeri Turkish

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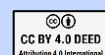
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ABSTRACT

This article focuses on the analysis of final consonant clusters in Azeri. By consulting two Turkish-Persian dictionaries containing over 100,000 words, the study identifies words with consonant clusters in their syllable structure, specifically (C)VCC or CVCVCC. The research addresses two main questions: the composition of consonant clusters in a syllable coda and the vowels used as the nucleus in (C)VCC structures in Azeri. The data reveals that /æ/ is the predominant vowel in the nucleus of (C)VCC syllables, while /r/ emerges as the most common initial consonant in final clusters. Notably, /t/ is frequently found in post-final positions within the coda. Key findings include the prevalence of /æ/ as the primary vowel in (C)VCC syllables, with /a/, /i/, and /y/ following. Loanwords predominantly feature /e/ in conjunction with /j/ clusters, while /œ/ and /e/ are less prevalent as nucleus vowels. Consonant clusters like /r/, /l/, and /n exhibit versatility with various vowels, whereas other clusters are more selective. The study underscores the unique order of consonant occurrence and combination in the final cluster of (C)VCC syllables in Azeri, highlighting /æ/ as the most active nucleus vowel. Additionally, it emphasizes the mutual relationship between the nucleus and coda in (C)VCC syllables.

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1. Introduction

One of the major goals in phonological studies is found to be the distribution of segmental elements in the language's representations. In other words, the sequential arrangement of possible phonological units in a language is called phonotactics. In English, for instance, the initial cluster of /spr-/ is a possible phonotactic sequence, whereas /spn/ is not.

All languages commence with a CV1 core syllable and mostly allow the CV to expand to include also CVC sequences. Many languages, such as Turkish, extend the syllable template to (C)VCC; however, there are severe limitations on the particular consonants that may combine in the coda. For instance, while [-rd] may cluster together in the post-vocalic coda, such as [mzrd], the inverse cluster [-dr] is impossible in this

position, therefore loan words such as /ã`cq/ change to [ã`chq], and they are pronounced as two syllables in Azeri.

All languages are subject to the phono-tactic constraints that determine the permissible strings of phonemes, hence there exist strict conditions on the order and type of speech sounds that can appear. In the Azeri language consonant clusters are not allowed to occur in the position of the initial syllable, however, consonant clusters of two segments occur in the final syllable.

This paper describes the structure of final consonant clusters and the constraints on the (C)VCC syllable in Azeri, therefore, two dictionaries of Turkish-Persian with more than one consonant (C) are taken to represent consonantal units, V vowel units, and () optional units.

100'000 entries were looked up in the vocab with consonant clusters in their coda. Both native Azeri bases and also the loan words were looked up and identified. The total number of words found in afore-mentioned dictionaries with such a syllable was no.135, while 46 words out of the whole were native Azeri and 89 words were loan words. The words were classified according to the position of the first and second syllables of the coda. To approach a clear analysis and conclusion two major questions have been answered:

- 1) Which segments come together as consonant clusters in a coda of (C)VCC syllable?
- 2) Which vowels are used as the head of (C)VCC syllables in Azeri?

2. The Syllable Structure in Azeri

Azeri or Azerbaijani Turkish is considered the official language of the Republic of Azerbaijan. Some dialects of this language are spoken in vast areas of Iran, notably in the north-western areas, known as Iranian Azerbaijan, as the dominant language and lingua franca for minority languages in the area including Kurdish and Taleshi. Iran is the homeland of the majority of Azeri speakers in the world. This language is also spoken in Russia's republic of Dagestan, south-east of Georgia and north of Iraq, and east of Turkey. It is estimated that there are up to 30 million native Azeri speakers. (<http://en.wikipedia.org/wiki/Azerbaijani> language. 29.3.2006)

Azeri is a member of closely related Turkic languages. Turkic languages belong to the Altaic branch of the Uralic-Altaic language family. (Öztaner, 1996, p. 38). Azeri is a Turkic language of the Oghuz branch, closely related to Turkish. Reza'i Baghbidi (2001, pp. 8, 9) classifies Turkish languages existing in Iran into five branches.

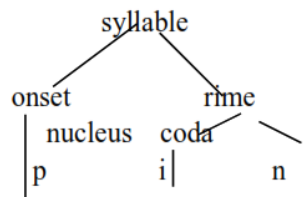
"Azeri is historically influenced by Persian and Arabic languages. Pahlavi and Persian loan words are numerous in Azeri. Arabic became the primary language of religion and religious law, while Persian had been the language of art, literature, and diplomacy. Azeri borrowed expressions and syntactic structures from Arabic and Persian, too."

(<http://en.wikipedia.org/wiki/AzerbaijaniLanguage>. 29.3.2006).

In terms of word formation, Azeri is considered an agglutinative language (Katamba, 1993:57); morphemes are identifiable in the makeup of the word.

The syllable has traditionally been considered to contain an obligatory nucleus preceded by an optional consonantal onset and followed by an optional consonantal coda. It means that a syllable consists of at least one nucleus. The nucleus plus coda is

called rhyme (or rhyme). The nucleus plus coda forms a tighter bond than the onset plus nucleus. The constituents of the traditional syllable are shown in 2a.



(Kenstowicz, 1994, p. 253)

The number of consonants existing in the onset and coda is different from one language to the other. (Kambuziya, 2003, p. 125). Syllables in Azeri range from one single vowel or one vowel plus one consonant up to three consonants.

So, the structure of the syllables can be formulated as (C) V(C(C)). Therefore, we can predict six syllable types in Azeri:

2-1- V: A syllable type containing a single vowel that occurs in a few mono-syllabic words, and in the first syllable of poly-syllabic words beginning with a vowel, e.g. the syllables /o/ and /a/ in words like /o/ 'he' and /a-na/ 'mother'.

2-2 VC: A syllable type containing a vowel followed by a consonant that occurs in monosyllabic words, e.g., /ad/ 'name'. It also appears in the initial position of polysyllabic words beginning with a vowel, e.g. /al.ma/ 'apple' and also in suffixes such as [-um].

2-3-CV: A syllable containing a consonant followed by a vowel that occurs in monosyllabic words, e.g., /su/ 'water' and also in different positions of polysyllabic words, e.g., /ba. xwɟ/ 'attitude'.

2-4-CVC: A syllable containing a consonant followed by a vowel and a single consonant that occurs in mono-syllabic words, e.g., /baɟ/ 'head', and also in different positions of polysyllabic words, e.g., /ɟar.daɟ/ 'brother'.

2-5- VCC: A syllable containing a vowel followed by two consonants that appear in many monosyllabic words, e.g., /alt/ 'under' and in some polysyllabic words syllable-initially, e.g., /ært-mec/ 'to close'.

2-6- CVCC: A syllable containing a consonant followed by a vowel and two consonants. This type of syllable occurs in mono-syllabic words. e.g., /bærc/ 'hat', and also in different positions of poly-syllabic words, e.g., /bo. ɟalt/ 'make empty'.

In this paper, the purpose is to study VCC and CVCC syllables in Azeri words that contain consonant clusters.

On the syllable structure in the Azeri language, giving some examples, Farzaneh (1992, pp. 65, 66) and Maryami (1995, pp. 85, 86) have introduced syllable types briefly in two pages. Farzaneh introduces open and closed syllables and six syllable types followed by a few examples. Maryami also introduces syllable types in Azeri and divides final consonant clusters into four groups. He believes that only /m, n, r, l, s/ can occupy pre-final consonantal positions (the same, P. 85), however after reading the present research, the reader would conclude another result based on the statistics.

It has been known for over a century that the construction of complex onsets and codas is guided by the Sonority Sequencing Principle (SSP) that requires onsets to rise in sonority toward the nucleus and codas to fall in sonority from the nucleus.

Phonologists agree that the entire class of speech sounds can be scaled as in (1), with the vowels as the most sonorous and the obstruents as the least.

- (1) *vowels*
 glides
 liquids
 nasals
 obstruent's (stops, fricatives, affricates)

The least sonorous segments are the oral stops such as [p, t, k] and the most sonorous segment is the open back vowel [ɑ], with other segments arranged between according to the scale in (1). The sonority of the syllable thus peaks at the nucleus and descends towards the margins.

Kambaziya and Razavian (2005, p.97) have studied the constraints of final consonant clusters in loan words in Bijar Turkish (a branch of Azeri) according to SSP. They concluded that whenever the arrangement of the final consonant cluster of the loan words is according to SSP, it enters the Turkish language in its original structure, but whenever the arrangement does not correspond with SSP, a vowel will be inserted between two consonants. For instance, //tæbɪl/ 'drum' is a re-constructed pronunciation of the Persian word /tæbl/ .

Deguchi (2008) examines certain consonant cluster alternations in Pawnee and proposes an Optimality-theoretic account. The alternations discussed in the work involve many distinct phonological processes. He argues that, while they are diverse in quality, these alternations are triggered for the same reason: to optimize syllable contact.

Másdóttir et al (2021) investigated Icelandic-speaking children's acquisition of singleton consonants and consonant clusters. Participants were 437 typically developing children aged 2;6–7; and 11 (years; months) acquiring Icelandic as their first language. Single-word speech samples of the 47 single consonants and 45 consonant clusters were collected using Málhljóðapróf þM (þM's Test of Speech Sound Disorders). The percentage of consonants correct for children aged 2;6–2;11 was 73.12 (*SD* = 13.33) and increased to 98.55 (*SD* = 3.24) for children aged 7;0–7;11. Overall, singleton consonants were more likely to be accurate than consonant clusters. The earliest consonants to be acquired were /m, n, p, t, j, h/ in word-initial position and /f, l/ within words. The last consonants to be acquired were /x, r, ʀ, s, θ, ŋ/, and consonant clusters in word-initial /sv-, stl-, str-, skr-, θr-/, within-word /-ðr-, -tl-/, and word-final /-kʲ, -xt/ contexts. Within-word phonemes were more often accurate than those in the word-initial position, with the word-final position the least accurate. Accuracy of production was significantly related to increasing age, but not sex. The findings align with trends for other Germanic languages; however, there are notable language-specific differences of clinical importance.

Wulfert et al (2022) tried to determine the extent to which frequency and sonority distance of consonant clusters predict production difficulties. They used a tongue twister paradigm to elicit speech errors on syllable-initial German consonant clusters and investigated the relative influences of cluster frequency and sonority distance between the consonants of a cluster on production accuracy. Native speakers of German produced pairs of monosyllabic pseudowords beginning with consonant clusters at a high speech rate. They showed that error rates decreased with increasing frequency of

the consonant clusters. A high sonority distance, on the other hand, did not facilitate a cluster's production, but speech errors led to optimized sonority structure for a subgroup of clusters. In addition, the combination of consonant clusters in a stimulus pair has a great impact on production accuracy. These results suggest that both frequency of use and sonority distance codetermine production ease, as well as syntagmatic competition between adjacent sound sequences.

Consonant clusters occur in the coda of a syllable, and initial consonant clusters do not exist in Azeri. Of course, when there exist two adjacent CVC syllables in one word, a consonant cluster appears, but it is not tauto-syllabic. In other words, consonant clusters mean the sequences of consonants to occur in initial or final syllables. For example, both /pl/ and /nt/ are consonant clusters in the word "plant", because they occur in the same syllable, however, the sequence /p-l/ in "stop-light" is not called a consonant cluster, because the sequence crosses a syllable boundary: /p/ is the final consonant in the first syllable and /l/ is the initial consonant in the second syllable. It must be mentioned that there are six syllable types, twenty-two consonants, and nine vowels in Azeri. In the following section, after the presentation of data, the constraints imposed on final constant clusters in the Azeri syllables will be analyzed.

3. Method

This article outlines the organization of final consonant clusters and the limitations on the (C)VCC syllable in Azeri. To investigate this, two Turkish-Persian dictionaries containing over 100,000 entries were consulted to identify words with consonant clusters in their coda. Both native Azeri words and loan words were examined, resulting in a total of 135 words with such syllable structures, with 46 being native Azeri and 89 being loan words. The words were categorized based on the position of the consonants in the coda. The data specifically focuses on Azeri words with (C)VCC syllable structure, with examples drawn from the 135 native Azeri words. The data is presented in two main categories: first, based on the consonants in the first and second slots of the coda, and second, based on the vowel in the nucleus of the syllable. It is important to note that the consonants in the onset of the syllable are not considered in this classification.

4. Data presentation and analysis

In this part, the required data which are Azeri words with (C)VCC syllable structure are presented. The examples are selected from 135 native Azeri words and generally, the data are divided into two categories: First, the data are presented based on the consonants which occupy the first and the second slot of the coda. Second, the data is presented based on the vowel filling the nucleus of the syllable. It must be mentioned that consonants of the syllable's onset are of no relevance in this categorization.

3a.

Consonant cluster	Turkish example	English meaning
bt	ræbt	relation
bz	gæbz	bill
tɟ	notɟ	speech
tf	lytf	kindness
tm	xætm	end
dɟ	sidɟ	truth
dl	ædl	justice
cs	æcs	picture
ɟt	væɟt	time
ɟd	næɟd	cash
ɟf	sæɟf	ceiling
ɟz	ɑɟz	mouth

Based on the data in 3a, the distribution of consonants in pre-final and post-final positions in final two-term consonantal clusters is shown in Table 3b. In this table, the consonants in the vertical row occur in the pre-final slot and the consonants in the horizontal row occur in the post-final slot.

3b.

	p	b	t	d	c	ɟ	g	f	v	s	z	ʃ	ʒ	χ	h	tʃ	dʒ	m	n	l	r	j	
p																							
b			x								x												
t								x										x					
d							x														x		
c										x													
ɟ																							
g			x	x				x			x												
f			x							x	x									x			
v																							
s		x	x	x														x			x		
z				x				x										x		x			
ʃ			x		x		x													x			
ʒ																							
χ			x																				
h																		x		x	x		
tʃ																				x	x		
dʒ																							
m	x										x												
n			x	x		x	x			x								x					
l	x	x	x	x	x		x	x					x		x				x				
r	x	x	x	x	x		x	x		x	x	x		x		x	x		x				
j		x						x											x		x	x	

According to Table 3b, phonemic arrangement and the relationship between consonants in the final (pre-final and post-final) position can be explained as the following:

3-1- The consonants: /p,j, v,ʒ, tʃ, dʒ/ never occur as the first consonant in consonant clusters of (C)VCC syllable in Azeri.

3-2- the consonants: /v,ʒj,h/ never occur in post-final slot in consonant clusters.

3-3- /r/ is the most active consonant in the construction of consonant clusters of the coda, either in the first slot or in the second one. The above data confirms that /r/ constructs clusters with stops, fricatives, affricates, and nasals. /l/ and /n/ are after /r/.

3-4- Clusters are not made up of two identical consonants in Azeri. So, clusters such as /bb/, /tt/, etc. do not appear in (C)VCC in Azeri. Of course, there is germination in the syllable boundary, e.g., in the word /χær.ræ/ 'black mud'.

3-5- Except for /ɑgʒ/ 'mouth' as an original Azeri word, all words containing stops in the pre-final slot are loan words, therefore, stops do not appear in the pre-final position of (C)VCC syllable in original Azeri syllables, hence, those words containing stops in the first slot of the coda such as /bt/, /bz/, /tG/, /tf/, /tm/, /dG/, /dl/, /cs/, /Gt/, and /Gf/ in consonant clusters are loanwords.

3-6- Except for /pyʃc/ 'ballot' and /yst/ 'above' all words containing fricatives in the pre-final slot are loanwords. So, the examples containing fricatives in the first slot of the coda such as /ft/, /fs/, /fz/, /fn/, /sb/, /sd/, /sm/. /sl/, /zd/, /zG/, /zm/, /zn/, /ʃt/, /ʃn/, /xt/, /hm/, /hn/ and /hl/ in consonant clusters are loanwords. Affricates do not occur in the first slot of the coda and appear as the second member of the coda with /n/, /l/, /r/.

3-7- /m/ as the first member of consonant clusters occurs only in loanwords and the examples containing /mp/, /ms/, /mn/, and /ml/, are not original Azeri words.

3-8- /j/ in the pre-final slot occurs in loanwords, too, however, the examples containing /jb/, /jf/, /jm/, /jl/, and /jr/ are loanwords.

3-9- Most original Azeri words containing consonant clusters have /r/, /l/, and /n/ as the first member of their clusters. 63 percent of the original Azeri words containing (C)VCC syllable have /r/, 13 percent have /l/ and 15 percent have /n/ in their first slot of the coda. These three consonants indicate more tendency to occur in the first slot of a consonant cluster of the coda such as / ɣurs / 'heavy', / œltʃ / 'measure' / dænɟ / 'tired'.

3-10- /r/ except for /xejr/ 'welfare' never occupies a post-final consonant slot.

3-11- /t/ is seen in the post-final slot more than the other consonants.

3- 12- /χ / only constructs a cluster with /t/.

Before presenting the next collection of data the table of Azeri vowels has been shown.

		front		back	
		unrounded	rounded	unrounded	rounded
high		i	y	ɯ	u
mid		e	æ		o
low		æ		ɑ	

nucleus	final consonant		Azeri example	English meaning	
	first member	second member			
i	d	g	sidg	truth	
	f	z	hifz	protection	
	z	g	rizg	daily bread	
	χ	t	rixɫ	mien	
	n		j	dinj	the sound of door
			s	dʒins	kind
			dʒ	dindʒ	cosy
	l		t	e.jilt	curve
			d	dʒild	cover
			c	milc	land
			f	dʒilf	frivolous
			m	ilm	science
	r		t	ji-dirt	feed
			c	tʃirc	dirt
			s	hirs	greed
			χ	nirχ	price
e	n	j	jenj	other	
	j		b	ejb	defect
			f	cejf	opiate
			m	dejm	produced by dry
			l	mejl	desire
			r	xejr	welfare
æ	b		t	ræbt	relation
			z	gæbz	bill
	t		g	fætɡ	hernia
			m	xætm	end
	d	l	ædl	justice	
	c	s	æcs	picture	
	g		t	vægt	time
			d	nægd	cash
			f	sægf	ceiling
	f		t	næft	oil
			s	næfs	passion
			n	dæfn	burial
			b	tʃæsɓ	glue
			t	mæst	intoxicated
		D	gæsd	intention	

	s	m	ræsm	custom
		l	næsl	generation
	z	d	jæzd	Yazd(a city in Iran)
		m	næzm	discipline
		n	væzn	weight
	ʃ	t	tæʃt	flat wash-tub
		ɣ	mæʃɣ	homework
		n	dʒæʃn	party
	χ	t	bæxt	luck
	h	m	fæhm	comprehension
		n	ræhn	mortgage
		l	dʒæhl	ignorance
	m	s	læms	paralysis
		n	æmn	safe
		l	ræml	sand
	n	ʃ	dænj	tired
		dʒ	jændʒ	treasure
	l	b	ɣælb	heart
		t	dy-zælt	build
		ɣ	tæɣ	isinglass
		χ	bæɣχ	a city in Afghanistan
	r	b	tʃærb	oily
		t	cært	small stream
		d	jærd	powder
		c	bærc	hard
		ɣ	bæɣɣ	electricity
		f	særf	benefit
		s	dærs	lesson
		ʃ	færʃ	carpet
		χ	ærx	stream
		dʒ	χærdʒ	expense
		m	ʃærm	shame
y	t	f	lytf	kindness
	f	t	myft	free of cost
	s	t	yst	over
	ʃ	t	ab-ʃyʃt	broth
		c	pyʃc	ballot
	χ	t	lyχt	naked
	m	s	xyms	one fifth
n	d	cynd	blunt	
		ʃ	cy.lynj	pick
	r	t	syrt-mec	to rub
		d	cyrd	a Kord person
		c	hyrc-mec	to be scared
		z	jyrz	mace
		ʃ	tyrʃ	sour
		tʃ	cyrtʃ	brooding-hen

œ	l	tʃ	œltʃ	measure	
		t	œrt	close	
	r	d	dœrd	four	
		c	bœrc	hat	
u	n	dʒ	ba.luundʒ	pillow	
	l	t	χult	sputum	
		p	turp	radish	
		t	tʃur.ta.tʃurt	start to crack	
		d	a.jurd	wake up	
		χ	gurχ	forty	
		tʃ	gurtʃ	the sound of	
a	c	s	vacs	shoe-polish	
	g	z	agz	mouth	
	χ	t	saχt	structure	
	m	p	lamp	light-bulb	
	n	t	sant	centimeter	
		d	and	swear	
		c	banc	bank	
		s	ʃans	chance	
		dʒ	sandʒ	sting	
	l	t	alt	under	
		χ	χalχ	others	
		r	p	ʃarp	splash
	t		ja.ʃart	make wet	
	d		ard	back	
	c		pare	jar	
	tʃ		martʃ	the sound of kissing	
	u	n	d	a.χund	theologian
dʒ			gundʒ	elbow	
l		p	gulp	handle	
r		p	jurp	a loud sound	
		t	ju.durt	cause to wash	
		d	gurd	wolf	
		s	gurs	heavy	
		χ	burχ	bend	
o		dʒ	burdʒ	month	
	t	g	notg	speech	
		s	gosl	ceremonial washing	
		z	mozd	wage	
	n	dʒ	go.londʒ	colic	
		r	t	χort	once
			χ	ʃorχ	fear
dʒ			bordʒ	debt	

Considering the data in 3c we can the relationship between the nucleus of the syllables may be analyzed, this relation which in the Azeri language, is always a vowel, and two consonants exist in the final cluster. Samareh (1999, p. 145) believes that this

relationship is mutual and the selection of a vowel as a nucleus of the syllable determines the selection of the following final consonant clusters and vice versa.

According to the presented data, the following facts are concluded:

- 1- /æ/ is the most active vowel used in (C)VCC syllable type. /ɑ/, /i/ and /y/ are the next ones. 35 percent of the Azeri words containing (C)VCC syllable have /æ/, 14 percent have /ɑ/, 13 percent have /i/ and 11 percent have /y/ as their nucleus.
- 2- All the words containing /e/ are loan words. /e/ except for / jent/ 'other' is merely used with /j/ clusters.
- 3- /œ/ and /e/ participate less than the other vowels in (C)VCC syllable. Only 12 out of 135 words have / / and /e/ as the nucleus of their syllables.
- 4- /r/, /l/, and /n/ clusters, which, are used as the first member, form a collocation with almost all the vowels, while the other clusters construct (C)VCC syllables with a few certain vowels. The data in 3c confirms this conclusion. For instance, /r/ as the first member of the consonant cluster is used with /i, æ, y, œ, u, a, u, o/.

5. Conclusion

In the Azeri language consonant clusters never appear in word-initial or syllable-initial position however two-term consonantal clusters occur word-finally and syllable-final. The data in 3a and 3c shows that consonant occurrence and combination in the final cluster of (C)VCC syllable in Azeri, follow a special order. /æ/ was identified as the most active vowel used in the (C)VCC syllable type, i.e., it is the most active nucleus of the syllable in Azeri.

In consonant clusters, /r/ is the most frequent consonant as the first member of the final cluster, and /t/ is the most frequent consonant in post – the final slot, furthermore it may be concluded that the relationship between the nucleus and the coda of a syllable in (C)VCC syllables is found to be mutual.

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