

# International Journal of Multicultural and Multireligious Understanding

http://ijmmu.com editor@ijmmu.com ISSN 2364-5369 Volume 10, Issue 2 February, 2023 Pages: 617-626

# Study of Conversion Process of the /R/ Phoneme in the Bonabi Variety of Azerbaijani Based on Psychological Variables (Age and Education)

# Yousef Hazrati

Assistant Professor, Department of Linguistics, Faculty of Humanities, Payam Noor University, Tehran, Iran

Email: hazratiyousef@pnu.ac.ir

http://dx.doi.org/10.18415/ijmmu.v10i2.5445

#### Abstract

Bonabi variety of Azerbaijani is one of the important varieties of Turkish in the northwest of Iran. This variety of Azerbaijani, has special characteristics and features. One of them, is conversion of /r/ to [j] in speech. The purpose of the present study is the study of conversion process of the /r/ phoneme in the initial place of the first syllable of girl and boy names in the Bonabi variety of Azerbaijani based on psychological variables. The research method is descriptive-analytical and data were collected through interviews. The participants introduced themselves in a spoken and casual style and their interviews were recorded and studied. The number of participants in this study is 40 people. 20 males and 20 females. They are 70 years old and over 70 years old and their average age is 73.55. The participants in this study were illiterate and illiterate people. The data research were analyzed by means of column charts. After studying and analyzing the data, it was found that the conversion process happen a lot in representation of phoneme /r/ in the initial place of the first syllable of girl and boy names in the Bonabi variety of Azerbaijani in the age of 70 and over. Also can be concluded that in the Bonabi variety of Azerbaijani in the initial place of the first syllable of names using of phoneme /r/ at this age is impossible and people use from [j] instead of / r /.

Keywords: Bonabi Variety of Azerbaijani; Conversion Process; Psychological Variables

# Introduction

Many linguists believe that Azerbaijani Turkish language is the language of the people of the Azerbaijan region of Iran and the official language of the Republic of Azerbaijan. It is also common as a spoken language in the eastern regions of Turkey and southern Georgia and Dagestan.nowadays in Iran, Azerbaijani Turkish language has different dialects and accents. Such as Turkmen, Khorasani, Kazakh, Khalji, etc, but the largest number of its speakers are the dialects of the northwestern region of Iran, such as Tabrizi, Ardabili, Urmiai, Qara Daghi, Zanjani, Hamdani, etc. (Yaqoubi, 1395: 1-10).

Bonabi variety of Azerbaijani is one of the important varieties of Azerbaijani Turkish that is spoken in Bonab. It is located in the northwest of Iran and the southwest of East Azarbaijan province. Benab is limited by Maragheh from the east, Ajab-Shir from the north, Malkan from the south, and Lake

Urmia from the west. This twon is about 120 kilometers away from the provincial capital, Tabriz city, and is one of the industrial cities of East Azerbaijan province.

Benabi variety belongs to the South Azerbaijan language group and phonologically it has 23 consonants and 9 vowels. The consonants and vowels of Azerbaijani Turkish language are as follows Razi Nejad (5:1381-30).

row	consonant	example	row	consonant	example
1	/b/	/bal/	13	/s/	/su/
2	/c/	/ciʃi/	14	/1/	/lumu/
3	/h/	/heiva/	15	/r/	/arpa/
4	/ <b>j</b> /	/jay/	16	/x/	/xæzæl/
5	/p/	/piʃic/	17	/ <b>J</b> /	/ <del>J</del> ælin/
6	/ <b>f</b> /	/fil/	18	/tʃ/	/tʃælic/
7	/g/	/garga/	19	/dʒ/	/dzeiran/
8	/v/	/vermæc/	20	/γ/	/yayiʃ/
9	/m/	/maral/	21	/3/	/zaket/
10	/n/	/nar/	22	/ʃ/	/ʃiʃ/
11	/t/	/tit∫an/	23	/ <b>z</b> /	/zæmi/
12	/d/	/damar/			

Table No. (1) Consonants of Azerbaijani Turkish language

Table No. (2) Vowels of the Azerbaijani Turkish language

row	vowel	example
1	/e/	/ev/
2	/ø/	/børc/
3	/i/	/it/
4	/y/	/tyrc/
5	/w/	/jalylɯ/
6	/u/	/udza/
7	/o/	/odun/
8	/æ/	/æl/
9	/a/	ata

As can be seen in the phonetic system of the Azerbaijani Turkish language, the phoneme /r/ is one of the phonemes of this language. There is also this phoneme in the Banabi type of Azerbaijani Turkish language, but in spoken and colloquial form, it becomes [j] in different positions, sometimes becomes [i] together with [j], i.e. [ij], and in rare cases becomes [i]. And it completely depends on people's conditions, such as: social status, age, gender, and spoken, formal, and written language. Therefore, in this research, the process of phoneme conversion /r/ in the initial position of the first syllable of girls' and boys' names in the Azerbaijani Turkish Banabi variant is investigated based on psychological variables in speech and conversational style. The main goal of this research is to find an answer to this question: How does the phoneme conversion process of /r/ occur in the initial position of the first syllable of girls' and boys' names in Azerbaijani Turkish Banabi variety based on psychological variables in speech and colloquial style. In other words, how the phoneme /r/ is represented in the names of Benabi variety of Azerbaijani Turkish language.

#### Research Literature

In the field of phonetics, phonology and phonemic processes of the Benabi variety of the Azerbaijani Turkish language few studies have been done, however, many researches have been carried out in different varieties of the Azerbaijani Turkish language and each of these researches in some way have investigated a part of phonology, phonetics and phonemic processes.

Razi Nejad and Kolahdozipour (2017: 81-92) investigated the representation of phoneme /r/ in the Turkish accent of Ajab-Shiri in the framework of the optimality theory and they stated that the phoneme /r/ turns into the phoneme /j/ at the beginning and end of the syllable, This means that in this accent, in these phonemic conditions, the limitation of the non-vibration sign is active and it is in a higher rank than the final limitation of the same vibration characteristic, also if /r/ is the first member of the final consonant cluster and has the characteristic syllable vowel [+ back], the consonant /r/ will be omitted, But if it has a characteristic [-back] vowel in the same position, the consonant /r/ will change to /j/.

Ahmadkhani and Rashidian (2015) investigated the phonological and morphological construction of loanwords in Azerbaijani Turkish. And it was found that among phonemic processes, the process of vowel harmony has the highest frequency and the lowest frequency is related to the assimilation process. In the morphology field, the highest frequency is related to derivation and the lowest frequency is related to compounding.

Kord ZafaronLo kambuzia and Razaviyan (102:1384-1389) studied some phonological processes in Bijar Turkish based on the language type of the village of "Ochgonbad Sultan" and they stated that rules such as vowel harmony and assimilation of consonants with vowels are among the most frequent processes in the Turkish language. Also, Bijar Turkish has a specific and regular position in dealing with loanwords like other languages, also when the borrowed words enter the Turkish language, they adapt themselves with the syllabic structure of the Turkish language and accept the syllabic arrangement of this language.

Hesabgar (1371) in a research investigated the phonetic system of Turkish-Azeri language based on generative phonology and in the section related to phonetic harmony, two types of phonetic harmony have been considered, which are: 1- harmony between vowels and consonants and 2- harmony between vowels. Also (Alai, 2012) has investigated the process of vowel harmony in Mughan Azari Turkish.

Izanlou (2018:261-284) in a very extensive article has studied the communicative function of the phonetic changes of two-part borrowed first names in Esfidani Turkish and also Asiai and Rahandaz (2017: 66-77) in an article studied the effect of social variables of age, education and style on the phonetic representation of the phoneme /r/ in the Gogani accent and they stated that Gogani Azeri Turkish is one of the varieties of Azeri Turkish in Iran. One of the interesting features of this species is the conversion of the phoneme /r/ to [j] in speech. They stated that the purpose of the current research is to investigate the effect of social variables of age, education and style on the phonetic representation of the phoneme /r/ in the framework proposed by Labov (1966 and 2006). After analysis of the data and using the chi-square test, they concluded that the effect of age, education, style and phonetic environment on the phonetic representation of the /r/ phoneme was significant and in fact, the phonetic representation of this phoneme in this species is a function of the interaction of social variables and the variable of the phonetic environment.

In an article, Monsef and Kord zaffronLu kambozia (123:1394-105) investigated some phonemic processes in Qashqai Turkish. They concluded that the processes of assimilation, insertion and harmony of vowels are active processes in this type of language.

#### Theoretical Framework

#### **Definition of Phonemic Process**

Any kind of change in the type of place and number of phonemes or syllable structure is called phonemic process (Bagheri, 1380: 114). The most important phonemic processes are:

#### 1- Conversion

Sometimes in a word, one phoneme changes into another phoneme without being able to find a justification for it within the framework of Dissimilation or assimilation processes. For example, changing /d/ to /e/ in the words: "mad"-"mah", "sepad"-"sepah", or changing /y/ to /r/ in the word: "juy"-"jur", or changing /u/ to /g/ in the word: vishtasb-ghostasb (Bagheri, 1380:120). In the Azerbaijani Turkish language, like most languages, above phonemic processes occur. Among the processes that are common in this language is the conversion process. The conversion process occurs when one phoneme is converted into another phoneme, as in the example below:

Phonemic form	Phonetic form	The word in Persian form
/ræzi/	/jæzi/	razi

In the above example, the phoneme /r/ has been converted into the phoneme /j/ and there is no semantic difference between them, so the conversion process has occurred. In this research, we seek to describe and investigate the process of phoneme transformation /r/ in the initial position of the first syllable of girls' and boys' names of Azerbaijani Turkish Banabi variety.

## 2- Assimilation

If two phonemes, either a vowel or a consonant, or a vowel and a consonant within a syllable or a word, influence each other and become assimilate, assimilation occurs. In other words, if a phonetic unit undergoes changes due to its proximity to another unit, and moves towards similarity with it, then the phonetic unit undergoes a process called assimilation. For example: in the word "eztevaj", the phoneme /z/ has an effect on the phoneme adjacent to it, i.e. /t/, which is voiceless, and makes it phonetic like itself, so /t/ turns into /d/. "eztevaj" - turns into "ezdevaj"

#### 3- Dissimilation

In the dissimilation, two identical phonemes in one syllable or in one word become two dissimilar phonemes as a result of coexistence. This process is sometimes called transformation or divergence. Example: the word "moshkel" with two phonemes /sh/ and /k/ are both voiceless, but they are converted to their vowel form, i.e. the phoneme /g/ and pronounced as "moshgel" (Siami, 2016: 6).

#### 4- Insertion

If one or more phonetic features are added to the phonetic elements of the language, the process of insertion has occurred. In phonology, insertion is a process during which a new phonetic element is added to a word (Crystal, 2008). Example: "sport" – "esport"

#### 5- Vowel Harmony

Vowel harmony is a phonemic process in which the vowels of a word are harmonized with each other in one or more phonemic characteristics. Features such as raised or fallen, back or front, round or broad, nasalization, etc., which are used to distinguish between vowels, can participate in the harmony process (Kenstevich, 1994).

#### 6- Metathesis

If two phonemes, whether far or close to each other, exchange their places in a word, the process of metathesis occurs. The metathesis process is of two types. A- Far heart and B- Near metathesis. In the near metathesis, two phonemes are next to each other, but in the far metathesis, the two phonemes are far from each other (Bagheri, 1380: 116).

Example of a close metathesis: "ghofl"- "gholf" Example from far metathesis: "vahar"-"bahar"

#### 7- Deletion

In the process of deletion, one or more phonetic features are deleted in a specific position. Deletion occurs when phonemes that do not have a distinguishing meaning are removed from words. Phoneme deletion happens as follows. A- At the beginning of the word B- In the middle of the word and C- At the end of the word.

# Research Methodology

In this research, the purposeful sampling method was used. People who had the following conditions were selected as samples. 1- They were natives of Benab and 2- The names of these people were among the names whose initial syllable starts with /r/.

The research method is descriptive-analytical and the data were collected through interviews. In this way, the participants whose own names were among the investigated names were asked to introduce themselves. The participants introduced themselves in a conversational style and their interview was recorded and analyzed. In this research, 40 names were collected from the interviews of 40 native language speakers of the Banabi variety. That is, the number of participants in this research is 40 people. 18 men and 22 women. Their age is 70 or more and their average age is 73/55. The participants in this research were illiterate people (people who are not literate at all) and low-literate people (people who finally have a fifth grade degree). Table number (3) shows the level of education, the number of participants and the number of names.

Table number (3). Age, level of education, number of participants and number of names in the research

Level of	Age of participants	Number of persons	Total number	Total number of
Education		for each noun	of names	pronounced names
illiterate and low-literate	70 and above	1	40	40

Due to the illiteracy of the participants, only the conversational style is studied. The research data will be analyzed by means column charts.

## **Data Analysis**

In order to answer the research questions, the conversion process of phoneme /r/ in the initial position of the first syllable of 40 nouns was investigated. And the following information was obtained from the participants 'interviews regarding the representation of the phoneme /r/.

Table number (4). Representation of phoneme /r/ in the initial position of the first syllable of 40 nouns

row	nouns	Number of	Phonemic form	phonetic form	Phonetic	
		participants of the noun		of the noun	representation of /r/	
					1	
1	runak	1	runak	junac	/j/	
2	rozita	1	rozita	juzita	/ju/	
3	roghayeh	1	rogije	jugijæ	/ju/	
4	rumina	1	rumina	jumina		
5	ramesh	1	rameſ	jame∫		
6	reyhaneh	1	reihane	jeihanæ		
7	raheleh	1	rahele	jahilæ		
8	raziyeh	1	razije	jazijæ		
9	ramak	1	ramæk	jamæc	/j/	
10	runika	1	ronika	runica	/ju/	
11	robabeh	1	robabe	jubab	/ju/	
12	rostam	1	rostæm	justæm	/ju/	
13	rahimeh	1	ræhime	jæhimæ	/j/	
14	ruzbahan	1	ruzbæhan	juzbæhan	/j/	
15	roya	1	roja	joja	/j/	
16	rasa	1	ræsa	jasa	/ja/	
17	rezvan	1	rezvan	jezvan	/ <b>j</b> /	
18	roshanak	1	ro∫ænæc	jo∫ænæt∫	/ <b>j</b> /	
19	raha	1	ræha	jæha	/ <b>j</b> /	
20	rakhshandeh	1	ræx∫ænde	jæx∫ændæ	/ <b>j</b> /	
21	rudabh	1	rudabe	judabæ	/ <b>j</b> /	
22	ruzbeh	1	ruzbeh	juzbæ	/ <b>j</b> /	
23	rambod	1	ranbod	janbud	/ <b>j</b> /	
24	razi	1	ræzi	jæzi	/ <b>j</b> /	
25	rana	1	ræna	jæna	/ <b>j</b> /	
26	rahim	1	ræhim	ijæhim	/ij/	
27	rayan	1	rajan	jajan	/ <b>j</b> /	
28	rajab	1	ræðæb	jædzæb	/ <b>j</b> /	
29	ramazan	1	ræmæzan	ijæmæzan	/ij/	
30	reza	1	reza	iza	/ <b>i</b> /	
31	rashid	1	ræ∫id	ijæ∫id	/ij/	
32	rahman	1	ræhman	ijæhman	/ij/	
33	rahmat	1	ræhmæt	ijæhmæt	/ij/	
34	ramin	1	ramin	jamin	/ <b>j</b> /	
35	ramtin	1	ramtin	jamtin	/ <b>j</b> /	
36	rokhsana	1	roxsana	juxsanæ	/ju/	
37	roksana	1	rocsana	jucsanæ	/ju/	
38	rasul	1	ræsul	jæsul	/ <b>j</b> /	
39	rad	1	rad	jad		
40	rkhsareh	1	roxsare	juxsajæ	/ju/	

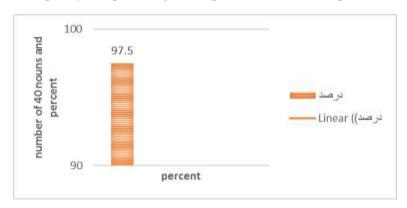
The results obtained from the phoneme conversion process /r/ in the initial position of the first syllable of 40 nouns according to table number (4) are as follows:

Table number (5). Frequency and percent of phoneme conversion /r/ in the initial position of the first syllable of 40 nouns

row	Number of names	age	education	percent	number	Kind of conversion
				97/5	39	conversion
1	40	70 and more	illiterate and low-literate			

The frequency and percent of the conversion process and phoneme /r/ in the initial position of the first syllable of 40 nouns using a column chart are as follows.

Chart 1. Frequency and percentage of /r/ phoneme conversion process in names



Based on the information obtained from table number (5) and chart (1), in the age group of 70 years and older, the use of j instead of r is very high among illiterate and low-literate people. That is, 39 of the 40 participants used [j] and only one person used [i]. In other words, about 97.5% of people used the conversion process and only 2.5% used the r phoneme deletion process. That is, in the initial position of the first syllable of names, the conversion process has occurred much more.

Also, the results obtained from the process of conversion the phoneme r to [ij], [j] and [i] in the initial position of the first syllable of 40 nouns according to table number (4) are as follows.

Table number (6). The frequency and percent of the process of conversion the phoneme /r/ to [ij], [j] and [i] in the initial position of the first syllable of 40 nouns

row	Number of names	age	education	percent	number	phonetic form of /r/
1	40	70 and more	illiterate and low-literate	12,5 85	5 34	[ij] [j]

Based on the description and results obtained from table number (6) the frequency of representation of the phoneme /r/ in the age group of 70 years and older shows that in 40 participants in the illiterate and low-literate group, 5 participants out of all the participants in this group, i.e. 12.5%, have represented the phoneme /i/ as [ij]. Also, 34 people i.e. 85% have pronounced it as [j] and finally 1 person

i.e. 5.2% have represented the phoneme /r/ as [i]. The results of changing the vowel /o/ to [u] and the vowel /e/ to [a] after the phoneme /r/ in the initial position of the first syllable of 40 nouns according to table number (4) are as follows.

Table number (7). Frequency and percent of vowel change after phoneme /r/ in the initial position of the first syllable of 40 nouns

row	Number	age	education	percent	number	The phonetic form of the
	of names					vowel after the phoneme /r/
				12,5	5	unchanged
1	40	70 and	illiterate and	85	34	Changing the vowel /o/ to [u]
		more	low-literate			
				2,5	1	Changing the vowel /æ/ to [a]

According to the information obtained from the table number (7), in some words, in addition to changing the /r/ phoneme to [j], the vowel after it also changes. In the names of "Rokhsareh", "Rokhsana", "Roksana", Robabeh", "Rostam", "Roghayeh", "Rozita" and "Ronica", the syllable /ro/ becomes [ju]. In the noun "Rasa", the syllable /rae/ changes to the syllable [ja]. In other words, in this name, first the phoneme /r/ becomes [j] and the vowel /ae/ becomes [a].

Based on the results obtained from the analysis and description of research data, the frequency and percentage of the phoneme /r/ conversion and representation process in all illiterate and low-literate people is as follows.

Table number (8). The frequency and percentage of conversion and deletion processes and representation of the /r/ phoneme in all illiterate and low-literate people.

row	Number of names	age	education	phonetic form of /r/			conversion process	percent	number	
					/j/	/i/	/ij/	conversion process	97,5	39
				percent				Deletion process	2,5	1
1	40	70 and more	illiterate and low-literate	number	1	34	5	unchanged	0	0
					2,5	85	12,5			

According to table number (8), in the whole illiterate and low literate group, it was found that in 40 nouns, 5 people used [ij], 34 people used [j], and 1 person used [i] instead of the /r/ phoneme. Also, out of the 40 measured names, 39 people used the conversion process and 1 person used the deletion process.

## Discussion and Conclusion

Bonabi variety is one of the most important varieties of Azerbaijani Turkish in Iran. This type of Azerbaijani Turkish has special features and characteristics. One of them is the conversion of the phoneme /r/ in the initial position of the first syllable of nouns to [j] in speech and colloquial style. This action can be done by means of different phonemic processes. One of the most important effective

processes in this case is the conversion process. Therefore, the aim of the present study is to investigate the process of phoneme conversion /r/ in the initial position of the first syllable of girls' and boys' names based on psychological variables in the Benabi variety of Azerbaijani Turkish.

After studying and analyzing the data, it was found that the conversion process in the representation of the /r/ phoneme occurs a lot in the initial position of the first syllable of girls' and boys' names in the Azerbaijani Turkish Benabi variety. Based on the results obtained from the study of illiterate and low-literate people, it was determined that people tend to use the conversion process in this position. According to table number (5), out of 40 illiterate and low-literate people, 39 people used [j] and 1 person used [i] instead of /r/ phoneme. This shows that illiterate and low-literate people tend to use [j] instead of /r/ in the initial position of the first syllable of nouns in Azerbaijani Turkish Banabi. In other words, they are not tended to use the phoneme /r/ itself. Therefore, it can be concluded that it is impossible to use the /r/ phoneme in the beginning position of the first syllable of the Azerbaijani Turkish Benabi variety, and more people use [j] instead of /r/. That is, it can be said that in this type, no noun begins with the phoneme /r/ in the spoken and colloquial style.

Based on the results obtained from the study of illiterate and low-literate people, it was found that these people want to use [j], [ij] and [i] instead of phoneme /r/ respectively. According to table number (6), out of 40 illiterate and low-literate people, 34 people used [j], 5 people used [ij] and 1 person used [j] instead of /r/ phoneme. This shows that in the initial position of the first syllable of some nouns in this type, the combination [ij] is used instead of the /r/ phoneme. If we pay more attention, we will realize that there is also [j] in this composition.

Also, based on the results obtained from table number (7), we notice that in the names of "Rokhsareh", "Rokhsana", "Roksana", "Robabeh", "Rostam", "Roqiyeh", "Rozita", and "Ronica", the syllable /ro/ turns into the syllable [ju]. That is, in these names, first the phoneme /r/ becomes [j] and then the vowel /o/ becomes [u]. In the noun "Rasa", the syllable /ræ/ changes to the syllable [ju]. In other words, in this name, first the phoneme /r/ becomes [j] and then the vowel /æ/ becomes [a]. So it can be concluded that in most cases the vowel /r/ does not change in any way but in some cases the vowel after it changes.

## Reference

Ahmadkhani, Mohammad Reza and Rashidian, Diana (2015). "Phonological and Morphological Analysis of Loanwords in Azerbaijani Turkish", Journal of Cognitive Language, Humanities and Cultural Sciences Research Institute, No. 1, 1-15.

Alai, Bahlul (2012). "Investigating the process of vowel harmony in the Azeri Turkish language of Moghan region from the point of view of the phonology of the unit", Journal of Linguistic Research, University of Isfahan, Volume 5, Number 8, 31-48.

Asiyabi, Maral, and Rahandaz, Saeed (2017). "The influence of social variables of age, education and style on the phonetic representation of the phoneme /r/ in the Gogani dialect", Journal of Sociology of Language, Payam Noor University, No. 2, 66-77.

Bagheri, Mehri (1380). Introduction to Linguistics, Tehran, Qatre.

Crystal, David. (2008). The Cambridge encyclopedia of language, New York: Cambridge university press.

- Izanlou, Ali (2018). "Communicative function of phonetic changes of first two-part borrowed names in Esfidani Turkish variety", Journal of Linguistics and Dialects of Khorasan, Ferdosi University, Mashad, No. 20, 284-261.
- Hesabgar, Hossein (1371). "Phonetic system of the Turkish-Azeri language", Master's thesis, Faculty of Humanities, Allameh Tabatabai University, Tehran.
- Heyat, Javad (1380). Study in the history of Turkish language and dialects, Tehran, Peykan.
- Kenstovicz, Michael. (1994). Phonology in Generative Grammar, Oxford: Blackwell.
- Kurd Zaffronlu Cambogia, Aliye and Razaviyan, Seyyed Hossein (2004). "Some Phonemic Processes in Bijar Turkish", Journal of Language and Linguistics, Humanities and Cultural Sciences Research Institute, No. 2, 210-89.
- Munsef, Maherakh and Kurd Zaffronlou Kambozia, Aliye (2014). "Some Phonetic Processes in Qashqai Turkish", Journal of Literature and Local Languages, Islamic Azad University, Yasouj Branch, Volume 5, Number 4, 105-123.
- Razi Nejad, Seyyed Mohammad (1381). "Phonology of Meshkin Shahr Dialect", Master's Thesis, Faculty of Humanities, University of Tehran.
- Razi Nejad, Seyyed Mohammad, and Kolahdozi, Aysan (2017). "Representation of phoneme /r/ in Ajab-Shiri dialect within the framework of the theory of optimality", Journal of Language Studies and Dialects of Western Iran, Kermanshah University, No. 22, 92-81.
- Rezai Bagh Bidi, Hassan (2010). "Introduction of Iranian Languages and Dialects", Persian Language and Literature Academy, Tehran, Iran, Shahrivar, 1380.
- Yaqoubi, Shahla (2015). "Azerbaijani Turkish language and its dialects in Iran", International Congress of Language and Literature, Mashad, Iran, September 2015.

## **Copyrights**

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (http://creativecommons.org/licenses/by/4.0/).