

## **HIATUS AND CONSONANTAL EPENTHESIS IN PERSIAN**

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### **Abstract**

The present study is a research about the hiatus of vowels and the epenthesis consonants in Persian language. Up to now, different linguistics such as Smamre (1998), Haghshenas (2001), Sadeghi (2002), Parmon (2002) and Kordzaferanloo Kambuzia (2003) and Kambuzia (2003). All except Parmoun (2002), studied the classical style. The results of these studies are different. In this study it is tried to deal with the issue from acoustic view. So the acoustic features of epenthesis consonants are studied. In this research 3 questions are mentioned: 1) is the consonant inserted in vowel combination (hiatus) in formal and non-formal dialects? 2) If yes, what is the acoustic feature of the inserted vowel in hiatus context? 3) If no, what is the role for constructing the Persian syllable? The related hypotheses include: 1) the consonant is inserted in formal and non-formal language, in hiatus context of the vowels, 2) in case of hiatus the inserted consonants show different acoustic features and 3) generally by inserting the consonant and preventing the hiatus, three patterns of Persian syllables are insured. PRAAT software is used in the present study. In each style, 36 words related to six contexts are selected. These words are read by a female narrator and recorded and analyzed by PRAAT software. Based on the study of Sadeghi (2002), four vowels of [w,ʔ,h,j] are studied as the epenthesis vowels. Two vowels of [j,w] are studied by inferential studies of Kent Varid (1996) and about [h,ʔ] it is concluded that changes in structure of epenthesis consonant and the vowels around it are studied. Generally, the following results are obtained : a) the consonant [j]: it is observable in formal style in context of [o-e] ,[i-e] ,[i-o] and [i-a] and in informal style this consonant is inserted in all the contexts of the [i] vowel except in [i-i] context, b) the consonant [w] : in formal style it is not found in any context and in conversational style the consonant is inserted in the context of all the vowels of [o] and [u] except the context of [o-o]. c) the epenthesis [h] is not seen in formal style and in conversational style it is only seen in context [a-a] as voiced and in [e-e] an voiceless, d) the epenthesis [ʔ] is seen in all expected cases.

### **Key words:**

**Hiatus:** putting the vowels beside each other so that the first one comes at the end of the previous phonemes and the second comes at the beginning of the next phonemes.

**Acoustic phonology:** is a subset of linguistics which deals with the physical aspects and features of the sounds.

### **Introduction and statement of the problem**

Although various studies have been done up to now about the hiatus of the vowels and epenthesis consonant specially the glottal consonants but no study has been done in the field of acoustic features of epenthesis consonants. On the other side, all the studies only investigated one style. Here, we study two styles of formal and conversational (informal) from acoustic point of view to have more opinions about the existence of absence of epenthesis consonants and the acoustic features of them.

### **Research objectives**

The main goal of the present study is to have a unique conclusion about the existence or absence of epenthesis consonants and more importantly the glottal stop epenthesis consonants and understanding the features of these consonants and studying the syllable structure of Persian language.

### **Research questions**

1. Is there consonant insertion in hiatus of formal and non-formal speech?
2. If yes, what is the acoustic feature of the inserted consonants in the hiatus?
3. If no, what is the determination for syllabus structure of the Persian language?

### **Research hypotheses**

1. Consonant is inserted in hiatus of formal and non-formal speech.
2. In hiatus of Persian language the inserted consonants show different acoustic features.
3. Generally, by inserting the consonants and preventing hiatus, three patterns of Persian language is insured.

### **Methodology**

The literature was gathered in library and field data collection method was used. In this research, two types of formal and informal speech was taken into account and the recorded speech of an educated person was used in way that she repeated the words four times and then her speech was recorded. Finally the data were analyzed by Praat software.

According to the nature of this research, two category of variables are considered:

1. Speech style: formal and non-formal styles are studied.
2. Phonetic context: in selecting the words, six context of Persian language are taken into account.

### **Background**

**Haghshenas (2001)** in the article titled as “ Tittle in Persian language and writing’ states that according to the author the fact is that the term tittle in Persian phonology does not indicate a unique phonetic reality but it is an umbrella term for a collection of phonological phenomenon. By studying the tittle in Persian phonology, following results were obtained according to Haghshenas (2001):

1. If the tittle at the beginning of the word id written as the vowel /æ/ it is not allowed to combine, for example in the hemistich “/æz//æli/ /Λmu:z/ /əkhlasə/ /æmœl/ “ omitting tittle in /æli/ is not allowed.
2. After tittle in the words with Arabic origin, the phonetic value is in three positions.
3. In originally non-arabic words the tittle appears in following conditions:

- a. At the beginning of the word such as the words “/andishe/” and “/aab/ “. In this place by entering the word to a bigger construct the consonant replaces tittle and the tittle itself is omitted in certain condition but its place is not empty but it replaces with consonant such as [bæ.dæn.dij].
- b. Tittle in the middle of the common Persian words such as : theater, video and neon
- c. Tittle appearing in the boarder of the words which ends in the vowel and definitional term which is started by tittle. This definitional elements are three types:
  - Inflectional suffix such as combination or unknown “/ei/”
  - Attachment such as the second singular person attachment
  - The end of the verb such as the end of the second singular person

In addition to what is said up to now, tittle exists in the middle position of some originally Persian words such as /paieez/, /paieen/ in arbitrary form. But these words are a few and it is possible that they are not historically simple but are residuals of old word making processes which are worn out now.

Haghshenas (2001) concludes that:

1. The beginning tittle in the originally Arabic words is not omitted in no structural condition and at that position creates contrasts with other consonants and so it is considered as a Persian phonemes but its usage is limited to Arabic words.
2. The beginning tittle I originally a non-Arabic word is omitted in specific condition and then replaces but any other consonant (whether final or epenthesis) without changing a word to another one. So it does not contrast with any other consonant and cannot be considered as Persian phoneme. But it cannot be denied that the beginning tittle of the Arabic word has the phoneme place of the words and plays the structural role and do not have structural value but it is like a structural element that is called the Firth structure and prosodic element.

The same conclusion is true about the loan words of the Persian language and about the border among the words ending with vowel and the inflectional elements of beginning with tittle. But the tittle in phonic system plays two different structural roles:

- Contrast role or phoneme for displacement and in loan words of the Arabic
- The contrastive or prosodic role for displacement axis and only in originally Arabic words.

### **Sadeghi (2002)**

Since no syllable of Persian language starts with vowels, the discussion of epenthesis vowels is not applicable in this language except in following cases, Sadesghi (2002):

1. Existance of phonemes such as –i and ast and other pronouns and inflectional and derivational suffixes such as –a plural and relative –I, additive –e and others which always start with vowels due to independence to the words before.
2. Removal of the beginning tittle as the second component of the combination in some of them if the vowel is started to this removal causes contrast of two vowels.
3. Omitting a consonant from among a morpheme based on linguistic change and so creation of hiatus.

In all these cases, language or using an epenthesis consonant removes the hiatus. Generally, the nature of the epenthesis consonants depends on one of these conditions.

A: phonetic condition of the vowels next to each other

B: inflectional-phonetic condition of involved morphemes

The inflectional condition of involved morphemes

Various contexts and using the epenthesis consonants based on the study of Sadeghi (2002) are considered as below:

1. If the first vowel is /i/ in most cases the epenthesis consonant –j- is omitted.
2. If the first vowel is /e/ the consonants –h- , -ʔ- , -j- , -w are used:

About the context of e-I some exceptions exists such as: /khanevadegi/, /khanegi/, /hamegi/, /hamishegi/ and others which depend on inflection and pronunciation of epenthesis consonant is weak in these contexts.

Using -ʔ in contexts of e-o is for European loan words such as: -ʔ-ori vide-ʔ-o /

3. Contexts in which the first vowel is /æ/ . in modern Persian language, it is rare and except the morpheme /næ /, another word which ends in vowel /æ/does not exist. This word when accompanied by conjunction is pronounced as næ-w-onu in which the epenthesis –w- is used with them.
  4. If the first vowel is /u/, the epenthesis consonants of -w- , -ʔ- , -j are used.
  5. If the first vowel is /o/, the epenthesis consonants of -w- , -ʔ- or -j are used.
  6. If the first vowel is /a/, the epenthesis consonants of -w- , -ʔ- , -j or –h- is used.
  7. The contexts in which the first vowel is /ow/, they have a special condition that is when it comes before another vowel, it is mostly divided into two part and the second part is the epenthesis in first part and the beginning vowel at the beginning of the next syllable is used as epenthesis consonant. In most of the contexts instead of –w-, the consonant –v- can be used. In some cases, the second part is deleted and –j- replaces it.
  8. The cases in which the beginning tittle remains are in three forms:
    - a) In all cases that the morphemes of the language are for building the bigger units than the word are in inflectional combination (group, clauses and others) stay along each other and tittle remains: such as : ba ʔu
    - b) In cases which two morphemes make a combinational word, the tittle remains: such as bi – ʔædæb
    - c) After the verbal affixes of /be/and /næ/ and before the verbs which start with the vowel /i/, tittle remains such as: næ -ʔistad
    - d) When tittle is omitted:

Omitting the tittle happens when the pre-fix of the verb /be-/ and the negation sign of /næ-/ before the verbs which start with the vowels /o/, / æ/, /a/ and /ow/. The consonant that is used as the epenthesis is –j- which is has the inflectional and phonological aspect. næ-j-amæd
  4. After the component /mi-/ the tittle is omitted or remains but in most cases it is omitted and –j- is used instead of it. The forms in which tittle remains are classical:

mi-ʔamæd                      mi-j-amæd

And before the verbs which start with /i/ tittle always remains:

mi-ʔ-istad

Parmoun (2002) first introduced the epenthesis consonants as ][ʔ,h,v,w,j quoted from Sadeghi. (2002) and then he expressed his ideas about epenthesis consonants:
- [ʔ, h, w] have not been observed at all.
  - [v] is less frequent.

Parmoun (2002) believed that the sound [fi] ( the voiced allophone of h) is frequently seen in Persian as an epenthesis consonant. According to Parmoun [h , ʔ] does not exist in informal Persian. [ʔ] only exists in some artificial styles and [h] only exists in some inflectional cases such as be+ h+eʃ in most cases it can be replaced by [fi]. About [w] he does not agree with Sadeghi that it is an epenthesis. He believes that what Sadeghi has

suggested as *zawu* for the word /*zauw*/ is completely wrong and should be written as *za+fi<sup>w</sup>+u*. Parmoon says that [fi] when replaced by [ʔ] is a whisper voice and when it replaces [h] it is an aspirational voice. Finally the results of the study by Parmoon are presented in the following (2002):

- a) Flap /j/ plays the role of an epenthesis when at least one of two previous vowels or the vowel after it is /i/. there are two exceptions:
  - The epenthesis of this flap between the nouns ended in vowel and added /e/ after that
  - The epenthesis of this flap between the negation prefix of /næ/ and the verbs that start with vowels.
- b) Voiced glottal fi has non-exceptionally the potential to play the role of an epenthesis between both vowels.

## **Methodology**

### **Data**

Since our discussion is on hiatus so in order to get the results, the words are taken into account which ends in vowels and the morpheme added to them starts with a vowel. In selecting the words, it has been tried to consider all six vowels of Persian language. Selecting the vowels is based on formal and informal speech. In cases that there is no example of special hiatus in Persian, the examples of Sadeghi (2002) of the loan words with epenthesis is used.

Finally in each style, 36 combinations are selected and only on formal style was not found. It was the word ending in /æ/ and the morpheme after it should start with the vowel /u/. in informal style the word that ends in vowel /i/ and the morpheme that starts with /u/ and also the word that ends in /æ/ and the next morpheme starts with vowel /u/, is not found.

So, 35 combinations in formal and 34 combination in informal style were selected.

### **Analysis**

After selecting the related words, these words are read by a female narrator and recorded. Recording the data was done by PRAAT software. After that, the recorded data were analyzed by the PRAAT software.

### **Measuring method**

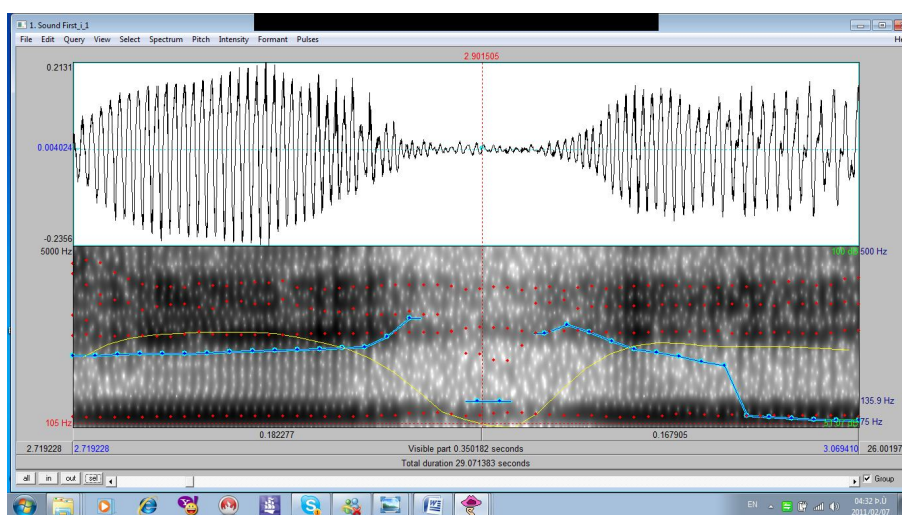
In data analysis, the last vowel of the first word and the first vowel of the second morpheme and also the epenthesis between these two vowels ( in case of presence) were analyzed.

Since the article of Sadeghi (2002) mentioned the epenthesis of [h, w, j, ʔ], the aim of these measurements was the presence/absence of these consonants between two vowels. Then since in some sources (Parmoon, 2002), different features were mentioned for these consonants, the aim was to determine the acoustic features in case of observance. So, the intensity, delay and modulation of the epenthesis and the vowels around it were measured by intensity track and pitch track. The curve of intensity was used to obtain the number of modulation intensity for the first vowel by clicking on the peak of the vowel. These numbers were done for the second and epenthesis consonant. Finally, the sound wave between the vowels is magnified and the length of the epenthesis was measured.

In the figure below, the dotted red lines show the structure. The vowels and consonants (semi-vowels) including the nasals, flaps and trills. But the constructs are related to the darkest and more continuous than others. It should be noted that darkness or lightness of the constructs is related to intensity. That is as the oral canal is open in producing a sound

the sound will be more intensified and vice versa. So the intensity of the consonants is less compared to the vowels. The curve of the intensity is shown by the color yellow and the intensity of the produced phone is shown based on desi-bell.

Now we deal with the modulation of the sounds. Modulation has a direct relationship with the vibration of vocal cords. The blue line in the figure of modulation shows the vibration of the cords. So, there are blue lines in each figure we face a voiced vowel and not seeing the blue lines show the existence of a voiceless sound. Modulation unit is Hertz.



Wave form, spectrograph, modulation and intensity of i,i continuation in the word [kafi?i].

## Data analysis

### Presence/absence of epenthesis

Sadeghi (2002) considers the presence of the epenthesis certain in Persian and introduced 4 vowels of [j, w, h, ?] as epenthesis. He believes that the consonant [h] is always used in complete form and is used as phoneme. The consonants [j] is pronounce completely but two consonants of [w] and [?] are pronounced so weak that some writers ignore it and show its spectrograph in case of vocal cord vibration.

Kordzaferanloo (2003) believes that in case of hiatus, a glottal stop is inserted as the epenthesis and after the derivational consonant of [mi-] if the used stems start with vowels, a glottal stop is inserted but in informal speech the consonant [j] is inserted between two vowels.

Parmoon (2002) believes that the consonants [?, h, w] is not seen as epenthesis and the consonant [v] has low frequency. According to Parmoon [j] only plays the role of the epenthesis when one of the vowels before and after that is the vowel [i]. He adds that the voiced glottal [ɦ] is non-exceptionally the potential to be inserted between two vowels as the epenthesis. Since the [h] is inflectional according to Parmoon, so it is not studied as the epenthesis. But since the discussion that these consonants are voiced is mentioned here, so the acoustic features are studied too.

In this part, the context of each consonant of [?, h, w, j] in recorded data is studied separately:

**Consonant [j]**

Among the recorder data, it is expected in informal style, that in 10 words, in formal style in 4 words, the epenthesis [j] is seen. As it is seen in section three, in perceived researches it is known that if the length of the structure is more that 40-60<sup>th</sup> thousands in seconds and less that 0.0001 seconds, a flap is heard between two vowels and if this number is more than 100, the combination of vowel-vowel is understood (Kent and Reid, 1996). So, the following results are obtained:

The context of transition duration in vowel [i] context in milliseconds in informal style.

average	repetition4	repetition 3	repetition2	repetition 1	context The conversational style
-	-	-	-	-	i-i
<b>49</b>	47	50	50	50	i-e
<b>32</b>	-	38	52	40	i-æ
<b>46</b>	48	44	51	44	i-o
<b>61</b>	48	50	59	87	i-a
<b>40</b>	-	61	38	63	e-i
<b>41</b>	54	45	35	31	æ-i
<b>33</b>	-	33	54	48	u-i
<b>60</b>	53	57	68	62	o-i
<b>47</b>	-	55	65	68	a-i
<b>41</b>					<b>average total :</b>

In informal speech the construct transition is not seen in [i-i] since both vowels have same features and the flap [j] is not recognized in this context. But in other context the vowel [i], transition is seen with 41 millennium seconds and if the hearing criteria is considered, it is flap.

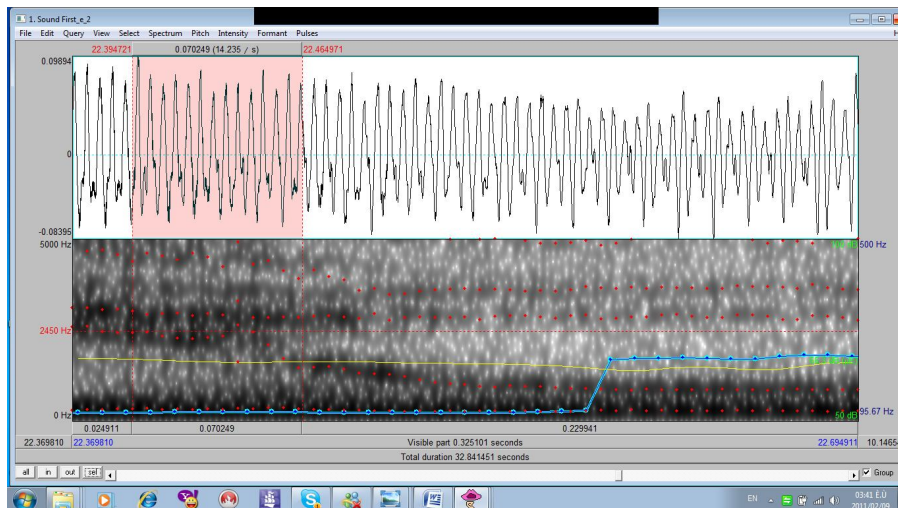
Duration structural transition in the context of vowel [i] milliseconds in a formal style

average	repetition4	repetition3	repetition2	repetition1	context
<b>49</b>	47	50	50	50	i –e
<b>51</b>	50	69	56	30	i –o
<b>34</b>	47	36	25	30	i –a
<b>59</b>	63	63	55	57	o –e
<b>48/2</b>					<b>average total :</b>

As can be seen in four contexts, the [j] is inserted.

**Consonant [w]**

According to Sadeghi (2002), insertion of the flap [w] is not seen in any official context but it is seen in informal speech in the context in which one of two vowels are [o] or [u]. In recorded data, it is expected that in 12 words in informal speech, the insertion of [w] is seen. Based on this, the research of Kent and Reid (1996) are used and it is concluded that:



Wave for, spectrograph and intensity of e and u in the word [gerjew].

Transition in vowel context of [o] and [u] based on millennium seconds in informal style

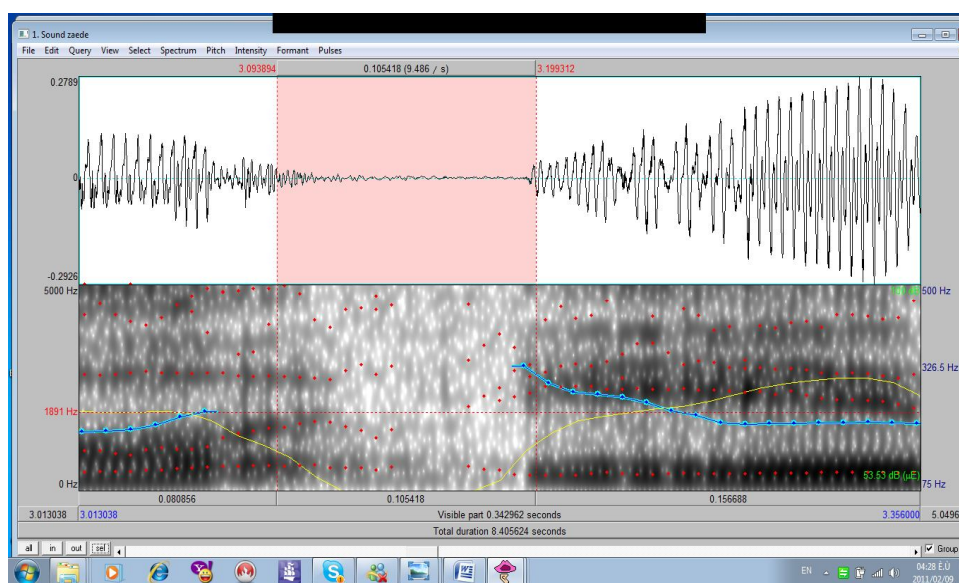
average	repetition4	repetition 3	repetition2	repetition 1	Context in informal style
58/2	65	68	42	58	e –o
79	75	90	79	72	e -u
60/5	67	64	58	53	æ - o
58/5	66	63	62	43	u -e
60/5	68	65	58	51	u -æ
49	-	49	-	49	u -o
64/6	58	71	65	-	u -a
54/6	69	62	33	-	
-	-	39	58	53	o -æ
80/3	45	53	143	-	o -u
-	-	-	-	-	o -o

<b>58/5</b>	53	-	64	-	o
<b>52</b>					-a
					<b>average total:</b>
					<b>a</b>

In Persian the transition is not seen in context of [o, o] since both vowels have the same feature and the flap [w] cannot be recognized in this context (continuance of [u, u] necessitated the presence of epenthesis [w] which does not exist in Persian.

**Consonant [ʔ]**

In all the recorded data, it is expected that in formal style in 23 words and in informal speech in 12 words, the glottal stop is inserted. First the words are studied in this term to see if a real glottal stop is inserted or not.



Wave form and spectrograph of the e and a in the word [zaʔede]

In all cases that it is expected to have glottal stop, the wave was disordered and less intensified.

These results are based on studying the intensity of vowels around and the intensity of the epenthesis.

**Intensity of the first and second vowels of the epenthesis [ʔ] in formal style**

<b>intensity of the epenthesis</b>	<b>intensity of second vowel</b>	<b>intensity of first vowel</b>	<b>context</b>
57/5	73	76	i – i
67	69	70	i – æ
57/5	70/5	75	e – i
72	73/5	73	e – e
68/5	69/5	72/5	e – æ

58	70	71	e- u
69	76	73/5	e – o
62	67	68	æ – i
69	66	68	æ – e
64	65/5	67	æ – æ
60	69/5	76	u – i
62	73	74	u – e
60	65	72	u –æ
62/5	72	78	o – i
67	68	72/5	o – æ
64	73	77	o – u
54	71/5	76	a – i
57/5	73/5	71	a – e
55	66/5	72	a – æ
59	74	72	a – u
59	76/5	80	a – o
<b>62</b>	<b>70</b>	<b>73</b>	<b>average total</b>

As the data shows, the intensity of the produced vowels between is 62 Desi bell in average in which 11 Desi bell is less than first vowel and 8 Desi bell less than second vowels.

The intensity of the first and second epenthesis [ʔ] in informal style

<b>intensity of the epenthesis</b>	<b>intensity of second vowel</b>	<b>intensity of first vowel</b>	<b>context</b>
70	69	72	e-æ
66	78	70	e-u
68	67	72	u-e
68	80	71	u-æ
69/5	68	69	u-o
69	69	69	o-æ
69	72	75	o-u
68/5	66	72	o-o

68	69	67	o-a
72	69/5	73	a-e
71/5	69	73	a-æ
<b>69</b>	<b>70/5</b>	<b>71</b>	<b>average total</b>

In informal style, the average of the sound intensity between two vowels is less than 2 desi bell less than the first vowel and 1.5 desi bell less than second vowel.

**Consonant [h]**

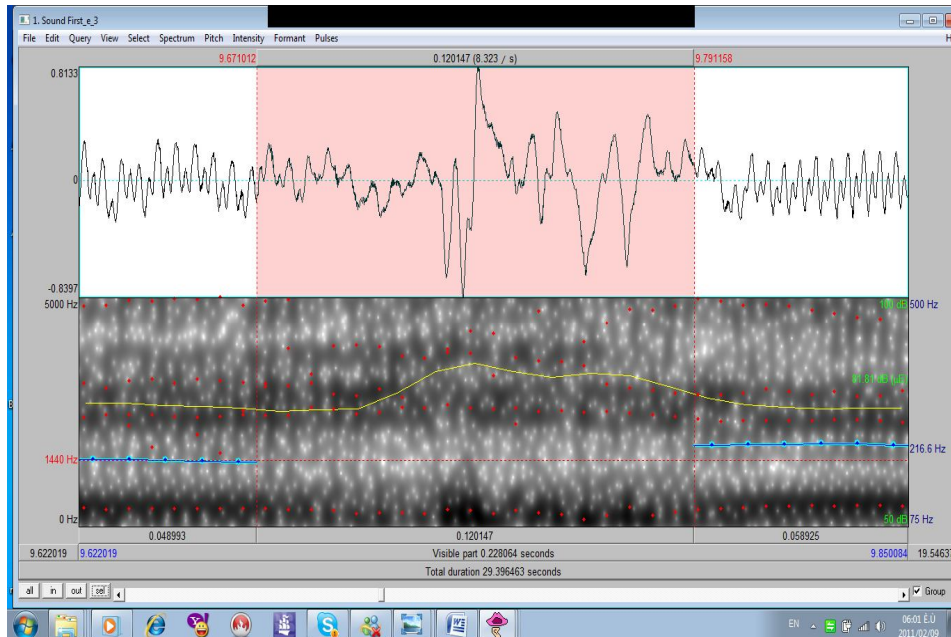
In recorded data in formal style [h] is not seen at all but in informal speech in the vowel the [h] is expected. As it is known, in Persian [h] is voiceless but the spectrograph of this phone shows vibration of vocal cords in one case. So, the allophone [ɦ] is seen in this word. In the charts, both vowel and wave are seen but the related wave is not simpler than the vowels around and only the intensity of the wave is less than the vowels around.

The intensity of the first and second vowel and epenthesis [h] in informal speech

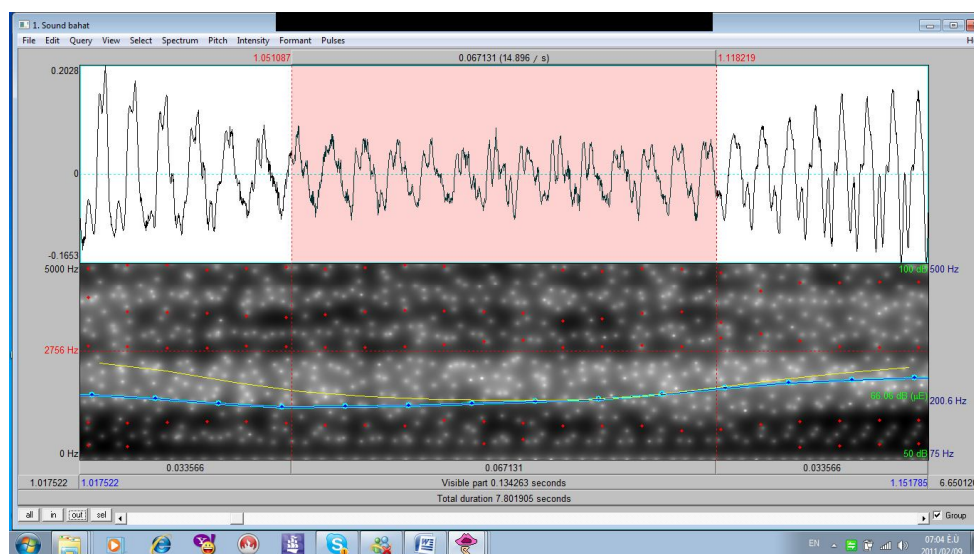
voice	intensity of epenthesis	intensity of second vowel	intensity of first vowel	context
voiceless	72	73/5	73	e-e
voiced	70	69	72	a-a

So the aspirational voice between two vowels are not found in the given data and only the intensity of the sound is reduced that can be attributed to vowels.

In context [e-e] in all the repetitions, the voiceless fricative is produced:



The wave form and spectrograph and modulation curve of e,e in the word /behet/ In context a-a in all repetitions [h] is seen as voiced and with ordered wave.



Wave form, spectrograph and modulation in [a,a] in the word [bahat]

### Conclusion

3 question and 3 hypotheses were suggested. The first question was “if an epenthesis occurs in hiatus of informal and formal speech?”

The related hypothesis was that the epenthesis happens in formal and informal speech.

Sadeghi (2002), four vowels of [w,i,h,j] are studied as the epenthesis vowels. Two vowels of [j,w] are studied by inferential studies of Kent Varid (1996) and about [h,ʔ] it is concluded that changes in structure of epenthesis consonant and the vowels around it are studied.

Parmoon [h , i] does not exist in informal Persian. [j] Only exists in some artificial styles and [h] only exists in some inflectional cases such as be+ h+eʃ in most cases it can be replaced by [h̄].

Kordzaferanloo (2003) believes that in case of hiatus, a glottal stop is inserted as the epenthesis and after the derivational consonant of [mi-] if the used stems start with vowels, a glottal stop is inserted but in informal speech the consonant [j] is inserted between two vowels.

Parmoon (2002) did not a study about informal style and it should be mentioned that in informal Persian the epenthesis [i] is inserted when the first and second vowel or both are [i] or the consonant [w] is inserted when the o and u context exists. In some context, the possibility of having glottal stop as the epenthesis exists and about [h] it should be mentioned that this consonant is not conditional.

The second question was that “if yes, what is the acoustic feature of the consonant in the hiatus?”. The hypothesis related to it is that in hiatus in Persian, the inserted consonants have different acoustic features. The results of the study about presence or absence of the epenthesis consonants [i,j,h,w] and acoustic features show that :

- Stop glottal consonant [i]

In the recorded data, it was expected that in formal style in 23 words and in informal style in 12 words, this phone is inserted. Only in one case the glottal stop is seen (the word zaʔede) that is the context of [a-e]. in other cases in both styles, in the place that is

expected, the glottal stop causes disordered wave and less intensity. Since this wave is disordered, according to Ladefoged (2003), the produced vowel is whisper.

- Fricative glottal consonant [h]

In recorded data it is not seen in formal speech but in informal speech it is seen in 2 contexts as conditional inflectional. Since, the related wave in this context is not simpler than the vowels around; the aspirational voice is not seen.

- Labio-alveopalatal [w]

According to Sadeghi (2002), insertion of the flap [w] is not seen in any official context but it is seen in informal speech in the context in which one of two vowels are [o] or [u]. In recorded data, it is expected that in 12 words in informal speech, the insertion of [w] is seen. Based on this, the research of Kent and Reid (1996) are used and it is concluded that the transition happens in 51.9 seconds and only the context of [o,o] does not have transition and [w] was unrecognized.

- Palatal flap [j]

In informal style, that in 10 words, in formal style in 4 words, the epenthesis [j] is seen. As it is seen in section three, in perceived researches it is known that if the length of the structure is more than 40-60<sup>th</sup> thousands in seconds and less than 0.0001 seconds, a flap is heard between two vowels and if this number is more than 100, the combination of vowel-vowel is understood (Kent and Reid, 1996).

The third question was that “If the answer to no, what is the determination for syllabus structure of the Persian language? it is assumed that general by inserting the consonant (epenthesis) and preventing hiatus, three patterns are insured in Persian Syllable.

Syllables of Persian language include: CV,CVC ,CVCC. In Iran and outside Iran, most people including Kramsky (1939), Nye (1954), Jazayeri and Paper (1961), Samare (2002 and 1977), Alamolhoda(2000), Biji Khan (2008), Esmaili (2008), Build (2008) studied the syllable of Persian language (Zohrevandi, 2011).

As the name of the researchers mentioned above shows, all agreed on CVCC, CVC, CV in formal style. But the present study concluded that a different structure exists. That is a structure which can begin by vowels. Although in some of the words studied in this research, the combination of VV has been observed which can be interpreted as the existence of the structure VCC, VC,V but decisive opinion is not given here.

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