On contrasts in the Persian vowel system*

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In this paper I address the controversy over the active feature of the Persian vowel system. I evaluate the evidence presented in the literature in this regard and show that it is inconclusive. I show that a phonological process of the language, vowel harmony, plays a decisive role, arguing for a feature-based analysis of the system. I further show that this feature is not height since it cannot account for the categorization of the vowels suggested by harmony. I suggest an analysis of the system based on tense/lax distinction, by which both harmony and categorization of the vowels are accounted for.

1. Introduction

The phonologically active feature of the Persian vowel system is a controversial issue in the literature on Persian vowels. While some studies consider the system to be quantitative, as the vowel system of Middle Persian was (e.g., Windfuhr 1979), most studies consider the system to have changed from the quantitative system of Middle Persian to a qualitative system (e.g., Pisowicz 1985). A synthetic analysis which considers both quality and quantity to be active in the current vowel system is also found in the literature (Toosarvandani 2004). The questions that I address here are: (i) what evidence are these claims based on?; (ii) what do phonological processes of the language say in this respect?

I review and evaluate the evidence presented in the literature for quality and quantity and show that it is not convincing. Following the view that in order to identify contrasts in a phonological system one needs to look at the phonological processes of the language under study as suggested by the framework of Modified Contrastive Specification, also known as the Toronto school of phonology (e.g., Avery and Rice 1989, Rice and Avery 1993, Walker 1993, Dresher, Piggott, and Rice 1994, Dresher 2003a, Dresher 2003b, Dresher 2003c, Rice and Avery 2004, Rice 1999, MacKenzie 2005, Rice 2007, Hall 2007, MacKenzie forthcoming, Dresher forthcoming), I suggest that such a phonological process exists in the phonology of Persian. This process is vowel harmony, which provides supports for a featural, or qualitative, analysis of the system assuming that harmony is feature based. I argue that this feature is not height as suggested by the literature which argues for quality. I show that Persian harmony patterns require a categorization of the vowels which is suggested in quantity-based accounts and cannot be accounted for by height. I argue that the contrasts in the Persian vowel system are based on tense/lax distinction. With this we can account for harmony, which requires a feature to be involved, as well as for a categorization of vowels which is not possible to explain by height.

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2. A Review of the Literature on the Persian Vowel System

Persian has a six-vowel system as follows:

(1) i  u  
    e  o  
    a  \alpha

The Modern Persian vowel system is generally considered to be a quality-based system in which quantity is non-contrastive. That is, as we see in the literature (e.g., Samareh 1977, Najafi 2001), in particular, the vowels \(a, \ i, \ u\) are considered to be non-contrastively long. However, contrary to this widespread idea, there are studies (e.g., Hayes 1979, Windfuhr 1979) which consider quantity to be the active feature in the system. In this view, \(a, \ i, \ u\) are phonologically long or bimoraic while \(a, \ e, \ o\) are phonologically short or monomoraic. There are also some studies which consider quality and quantity to be both active in the system (e.g., Toosarvandani 2004). In this view, a synthetic analysis which includes both quality and quantity is offered and the vowel system of Modern Persian is considered to be in a “transition state” between the purely quantitative system of classical Persian and the system of future Persian which will eliminate any phonological evidence for quantity altogether and keep quality as the only distinguishing feature.

Thus, in general, there are three views in the literature regarding the active feature of the Persian vowel system, as follows.

(i) In the view according to which quality is active and quantity is not phonologically relevant, the system is presented in the following way. As suggested in the literature (e.g., Samareh 1977, Pisowicz 1985), height is the qualitative feature involved.

(2) i  u
    e  o
    a  \alpha

It should be noted that following the framework of Modified Contrastive Specification adopted here, only two of the three height features observed above can be underlyingly present, and not all three of them. I leave this discussion aside for the moment. The point to note is that the vowels are distinguished from each other by height differences. Given the nature of the system, having only height is tenable.

(ii) In the view according to which quantity is active, the system is presented in the following way. The phonetic realization of each vowel is given below it.

(3) [short] [long] [short] [long]
    i  \textbar\textbar\ i  \textbar\textbar\ u  \textbar\textbar\ u
    [e]  [i]  [o]  [u]

    [short] a  \textbar\textbar\ [long]
    [a]  [\alpha]
Thus, the system is essentially a three-vowel system, plus a length contrast. Given the nature of the system, having only quantity in the system is tenable.

(iii) In the view according to which quantity and quality both are active, the system is presented in the following way.

(4)  [high], [long]  ī  ū  [high], [long]
     [mid], [short] e  o  [mid], [short]
     [low], [short] a  ā  [low], [long]

Assuming that features enter into a system to show contrasts, as suggested by the framework of Modified Contrastive Specification, in the Persian vowel system, if vowels are distinguished by quality, quantity is not required to be active and if they are distinguished by quantity, there is no need for quality to be present. Thus, given the nature of the system, under the theoretical assumptions of the adopted framework, having both quality and quantity is untenable.

The assumptions provide a research direction: if we assume that the view presented above in (iii) is not theoretically possible, are there arguments to distinguish between the views presented in (i) and (ii)? In the next section, I look at the evidence in the literature which argues for quality to be the phonologically active feature. I show that what are widely considered as arguments in favor of quality are, in fact, inconclusive. I also discuss evidence in the literature for Modern Persian being quantitative and show that this evidence cannot determine quantity as the active feature. I suggest that harmony in vowels plays a decisive role, providing strong evidence for quality.

3. An Evaluation of the Literature regarding the Active Feature

In this section, I look at the evidence presented in the literature regarding the active feature of the Persian vowel system. I first discuss the arguments in favor of quality. This will be followed by a discussion of the arguments in favor of quantity.

3.1 Arguments in the Literature in favor of Quality

The arguments for quality in the literature are phonetic measurements and stress. We first look at phonetics of the vowels. Stress will be discussed afterwards.

3.1.1 Phonetics of the Vowels

The literature on the Persian vowel system suggests that the common idea that the system is qualitative is based on phonetic studies on Persian vowels (e.g., Sokolova et al 1952 to which Windfuhr 1979 refers; Gaprindašvili and Giunašvili 1964 to which Kramsky 1966 refers).

These phonetic arguments, as we will see below, are based on the following observations: (i) the length distinction is neutralized in most contexts; (ii) the length distinction is contextual.

The phonetic studies show that the length distinction is neutralized in most contexts. That is, the so-called long vowels (a, i, u) are not phonetically longer than the so-called short ones (a, e, o) and even the so-called short vowels can be longer than the long ones. For example, in (5a) a in ɢam, a short vowel in the quantity-based analysis, has the same length as a in ɢam, a long vowel in that analysis. In (5b), o in axor, a short vowel in the quantity-based analysis, is longer than u in ɢub, a long vowel in that analysis (Gaprindašvili and Giunašvili 1964 cited in, e.g., Kramsky 1966).
These measurements are not conclusive for two reasons: (i) there is no systematic study of the length of the vowels in various environments; (ii) there is not agreement among the phonetic accounts presented in the literature on where we see a length difference in the vowels, as shown below.

According to one study the short vowels of the quantity-based analysis are realized as short only in open, non-final, unstressed syllables (Sokolova 1952 cited in Windfuhr 1979 and Toosarvandani 2004).

And also in vocative and imperative forms in open, non-final, stressed syllables (the same reference).

Another study, however, mentions that in a pair such as the following, *a* in *bar*, a long vowel in the quantity-based analysis, is longer than *a* in *bar*, a short vowel in that analysis (Samareh 1977).

Based on this study, then, in closed syllables a length distinction is observed. As we see these accounts contradict each other.

Regardless of their contradictory results, what these studies show is that phonetic measurements have received great attention in arguing for quality. The observation that the quantity distinction changes from context to context and is, in fact, observed only in limited environments (although there is no agreement on what environments), while the quality difference is always observed can explain why quality is widely considered to be the active feature in the Modern Persian vowel system.

The literature also suggests that the length of Persian vowels changes based on the structure they occur in. For example, as we see in (8a), the length of *e* in *ʧeʃm*, a short vowel in the quantity-based analysis, is the same as the length of *i* in *sib*, a long vowel in that analysis. Also the length of *a* in *dard*, a short vowel, is slightly more than the length of *a* in *gaz*, a long vowel, as shown in (8b) (Samareh 1985).

Also it is suggested that short and long vowels of the quantity-based analysis both are long before a consonant and very long before a consonant cluster. For example, in the three words in (9a), the vowel *u* is longer in *guʃt* than it is in *gu* and it is the longest in *guʃt*. The same happens in the three words in (9b). The vowel *a* is longer in the second word than in the first word and even longer in the third word (the same reference).

(5)  
\[ a. \quad \text{gAm} = 230 \text{ ms.} \quad \text{‘sorrow’} \quad \text{mAH} = 230 \text{ ms.} \quad \text{‘moon’} \]
\[ b. \quad \text{quivo} = 230 \text{ ms.} \quad \text{‘manger’} \quad \text{afub} = 190 \text{ ms.} \quad \text{‘riot’} \]

(6)  
\[ \text{ʤe.dur} \quad \text{‘wall’} \quad \text{bij.dud} \quad \text{‘oppression’} \]

(7)  
\[ \text{họ.sejn} \quad \text{‘Hosseyn!’} \quad \text{hụ:.ʃang} \quad \text{‘Hushang!’} \]

(8)  
\[ a. \quad \text{ʧeʃm} = 0.17 \text{ sec.} \quad \text{‘eye’} \quad \text{sib} = 0.17 \text{ sec.} \quad \text{‘apple’} \]
\[ b. \quad \text{dard} = 0.24 \text{ sec.} \quad \text{‘pain’} \quad \text{gaz} = 0.23 \text{ sec.} \quad \text{‘bite’} \]

(9)  
\[ a. \quad \text{gu, guʃ, guʃt} \quad \text{‘the present stem of goflan ‘to tell’, ear, meat’} \]
\[ b. \quad \text{na, naʃ, naʃrm} \quad \text{‘no, male, soft’} \]
If length distributions are purely contextual and predictable, then it might argue that length is not a phonological property. But again we need to carry out a systematic study of vowels and consonants and consonant clusters to understand the conditions under which the lengthening occurs.

I conclude that these phonetic measurements are not conclusive in arguing for quality being phonologically active in the system. Next we look at stress which is another argument presented in the literature for quality.

3.1.2 Stress

Stress, which is accounted for in Persian without referring to vowel quantity, is another criterion to which some literature refers in favor of quality (for stress in Persian see, e.g., Amini 1997, Kahnemuyipour 2003). For example, it is mentioned that “in a stressed position, which is particularly reliable in the matter of quantity, the length of all vowels is more or less identical and comparatively small” (Pisowicz 1985, p.12).

It is true that a frequent diagnostic for syllable weight is stress (e.g., Allen 1973). The fact that stress in a language does not refer to quantity, however, cannot be an argument for quality since there are quantitative languages whose stress systems do not refer to quantity (e.g., Livonian with stress on initial syllable, Piro with stress on penultimate syllable, see Hayes 1995 for more examples).

We saw that phonetic measurements and stress do not provide us with conclusive evidence for quality in the system. Next we look at quantity.

3.2 Arguments in the Literature in favor of Quantity

The arguments for quantity in the literature are versification and categorization of vowels based on phonotactic patterning. We first look at versification, which will be followed by a discussion on categorization of vowels.

3.2.1 Versification

Based on assigning metric positions, some literature considers \( i, u, a \) to be long and \( e, o, a \) to be short (e.g., Hayes 1979, Mahyar 1994). The evidence based on versification is not, however, conclusive due to the nature of Persian versification which we look at below. The question is that if Modern Persian is not a quantity-based system, why is a quantitative system used for its poetry?

It can be argued that the Modern Persian versification is a continuation of the Middle Persian versification, which is expected to be quantitative since the system was quantitative. However, it is claimed that Middle Persian poetry is not based on quantity (see Natel Khanlari 1966 for references). This is important to note for two reasons: (i) Modern Persian versification is not a continuation of Middle Persian versification; (ii) Middle Persian versification does not show quantity, as is argued, to be the active feature in its vowel system.

Middle Persian poetry is based on number of syllables and not on quantity according to the literature. What is also important to note is that folk poems of the present time in some parts of Iran still follow the same versification; that is, they are not based on quantity but rather on the number of syllables (see Natel Khanlari 1966 for references). There is also an account which considers stress to be the main factor in Middle Persian poetry (see the same reference). What is important for our
discussion is that all of these accounts agree that quantity was not the main element in versification of Middle Persian.

The Persian versification rules are from Arabic and so they are quantity based. The Iranians, who realized problems in following Arabic meters, adjusted the syllabic principles to quantitative Arabic meters (Natel Khanlari 1966).¹

If we argue for quantity in the modern system based on versification, then since in Middle Persian quantity was not used for versification, can we conclude that the Middle Persian system was not quantitative? If we cannot consider versification as an argument for quantity, then one of the strongest evidence in the literature for quantity in Modern Persian is not valid anymore.

3.2.2 Categorization of Vowels based on Phonotactic Patterning

A classification of a, e, o versus a, i, u is observed in the literature on Persian vowels. In those works in favor of quantity, it is mentioned that unifying a, e, o versus a, i, u in qualitative terms would be very complex, because there is no single or even a pair of features that can account for this distinction (Windfuhr 1979). The classification of a, e, o versus a, i, u is sometimes even observed in the literature which argue for quality, as follows.

Phonotactic constraints in some cases require a categorization of /a, e, o/ versus /a, i, u/. Samareh (1977) considers two functionally different groups of vowels with respect to possible following consonant clusters: /a, e, o/ and /a, i, u/. The first group can occur before all combinations of consonants as far as the first member of the cluster is concerned. The only exception is /e/, which cannot occur before clusters starting with /x/. The vowels of the second group have a very limited occurrence preceding consonant clusters. They cannot occur before those clusters whose first consonant is /q, ʔ, ǰ, z, h, m/. He adds /b, t, d, k, n, l, r/ which occur following the second group of vowels in a few loan words (e.g., kâbl ‘cable’, dubl ‘double’, rîm ‘rhythm’) and only three Persian words (i.e. bâng ‘shout’, dâng ‘share’, pârs ‘the name of a province in Iran’). Samareh continues that the vowels of the second group /i, â, u/ can precede /s, f, x/ combinations — the second consonant must be /t/ with a few exceptions. The consonant /š/ is permitted after /â, u/ but not after /i/. Here is a summary of these observations:

(10) a. / e, a, o/

No restriction on C₁ in C₁C₂

b. /i, â, u/

*/q, ʔ, ǰ, z, h, m/ as C₁ in C₁C₂

*/b, t, d, k, n, l, r/ as C₁ in C₁C₂

/ʃ, s, f, x/ as C₁ followed by /t/ as C₂ (with a few exceptions)

Afterwards, he mentions that ‘the most interesting fact is that these two groups correspond exactly to the traditional “short” and “long” vowels in Persian and although quantity is not the basis for contrast, since the behavior of “long” and “short” vowels are different before consonant clusters “the traditional labels “long” and “short” may justifiably be preserved for the two functionally different groups” (pp. 92 and 93).

¹ See Hanson and Kiparsky (1996) for a discussion on how Finnish metrics shows the interplay of linguistic and cultural pressures, and how borrowed Germanic meters were modified in Finnish.
Regarding the consonants that can follow /a, e, o/ and /ɑ, i, u/, Zolfaghari Serish and Kambuziya (2005) mention that in words with CVCC structure, the sonority sequencing principle is met when the vowel is /ɑ, i, u/ (e.g., mast ‘yoghurt’, bist ‘twenty’, pust ‘skin’), but it is not usually met when the vowel is /a, e, o/ (e.g., tabx ‘cooking’, zebr ‘rough’, sobh ‘morning’) – there are some exceptions with /a, e, o/, such as in monosyllabic words, the principle is met if the first consonant of the coda is /r, l, j, n/ and [w] or the second consonant of the coda is /d, ʔ, ʤ, ʃ/, k, g, t/. They mention that with respect to the sonority sequencing principle two natural classes of vowels are formed in Persian; these are /ɑ, i, u/ and /a, e, o/. They do not use any feature for these two classes so it is not clear how they treat these vowels with respect to their distinguishing feature. The point is that the categorization of former long vowels versus former short vowels is observed with respect to the sonority principle.

In another study, the vowels are categorized as “stable” and “unstable” rather than “long” and “short”. a, i, u are called “stable” vowels as they have a relatively constant duration and are not subject to change in quality\(^2\) as opposed to a, e, o which are called “unstable” vowels with variable duration and changes in quality (Lazard 1992).

It is apparent that some categorization between the historical short vowels (present a, e, o) and the historical long vowels (present ɑ, i, u) is still assumed in much of the literature on Persian vowels. I used “some” because there is no single interpretation of their status in the literature as we saw.

We looked at arguments in the literature for quantity. I argued that these arguments are not convincing.

4. Preliminary Summary

The active feature of the Persian vowel system is a matter of controversy in the literature on Persian vowels, as we observed above. I looked at the arguments which are presented in the literature for quality and quantity and argued that they do not provide strong support for the position they take. I summarize here the reasons for these arguments not being strong enough: (i) phonetic measurements do not strongly argue for quality because there is no thorough phonetic analysis of Persian vowels and the existing accounts contradict each other so even if these phonetic studies point to a direction in favor of quality we cannot argue for quality based on them. More importantly, under the assumptions here, in order to argue for phonological contrasts in a system we need to find evidence from phonological activities of the language under study. That is, phonetic arguments do not provide us with sufficient evidence with respect to the phonological active feature in the system; (ii) stress is not a conclusive argument for quality as it is not required that the stress pattern of a quantitative vowel system necessarily refers to quantity; (iii) versification does not argue for quantity since Persian meters are borrowed from Arabic and adjusted into the Persian system and therefore are not created based on Persian vowels. That is why, as mentioned in the literature, only Persian formal poetry, and not folk poetry, shows the quantitative system; (iv) categorization of vowels, which suggests a, e, o as a group versus a, i, u as another group is not a convincing argument for quantity either. The grouping seems appropriate but no real account is given in the literature for it. In the quality-based studies, no feature is introduced to distinguish a, e, o versus a, i, u, simply because we cannot explain this two-way distinction based on height. That is why these studies either consider the

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\(^2\) The exception is a before nasal consonants. Note that in Persian, the vowel a is raised to u before nasal consonants; for example, badum ‘almond’ is pronounced as badum, and xane ‘house’ as xune.
vowels to be “functionally” divided into these two groups—it remains a question as to what “functionally” means in phonological terms—or they consider the vowels to be “stable” and “unstable”—again it remains a question as to how these terms can be transferred into phonological features. In the quantity-based studies, this categorization is assumed to be necessarily based on quantity because according to these studies based on qualitative terms we cannot have a categorization of \( a, e, o \) versus \( a, i, u \). But it is unclear why this grouping must point to quantity. I will argue below that the grouping can be accounted for with quality.

Following the view that for recognizing the contrasts in a system, we should look at the phonological processes of the language under study, a common shortcoming of all of these arguments is that none of them refers to an active phonological process of Persian based on which we can draw a conclusion.

Having discussed the ambiguities and uncertainties about the active phonological feature in the Persian vowel inventory based on the literature, I suggest that harmony in vowels plays a decisive role in this regard, providing strong evidence for quality. I further show that instead of height, tenseness is the dimension of contrast, as it can account for both harmony and also the two-way categorization of vowels.

5. Vowel Harmony and a Featural Analysis for the System

Quality as the phonologically active feature in Modern Persian is strongly supported by raising harmony observed in the language. Persian shows several patterns of vowel harmony in all of which a mid vowel is raised to a high vowel. While all involve raising of mid vowels to high, there are slight differences depending upon domain, and I thus organize this section considering the domains in which vowel harmony takes place.

5.1 Harmony across Morpheme

Persian has a number of verbal prefixes as follows:

(11)

\[
\begin{align*}
\text{be-} & \quad \text{imperative and also subjunctive marker} \\
\text{na-} & \quad \text{negative marker} \\
\text{mi-} & \quad \text{indicative marker}
\end{align*}
\]

The prefix be- combines with the present stem of the verb to form the imperative. An example is given in (12):

(12) Imperative: prefix /be/ + the present stem of the verb

\[
\begin{align*}
e.g. & \quad x\alpha b & \quad \text{‘sleep’ (present stem)} \\
\text{be} & \quad x\alpha b \rightarrow \text{bex}\alpha b & \quad \text{‘sleep!’}
\end{align*}
\]

The prefix vowel /e/ may assimilate to the first vowel of the stem unless it is a low vowel.\(^3\) The forms in (13) through (15) present a schematic representation of this assimilation.

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\(^3\) I used “may” because the assimilation of the vowel \( e \) in prefix to a high vowel in the stem seems to be to a great extent influenced by sociolinguistic factors, in particular, if we compare it with the assimilation of the prefix vowel \( e \) to the vowel \( o \) in the stem (e.g., \( be + ro \rightarrow boro \text{ ‘go!’} \); \( be + xor \rightarrow boxor \text{ ‘eat!’} \)), which is very common.
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(13) e prefix……u stem → u prefix / o prefix (place – and height – assimilation)
    a. be + xun → bexun ~ buxun/boxun⁴ ‘read!’
    b. be + gu → begu ~ bugu/bogu ‘say!’

(14) e prefix……i stem → i prefix (height assimilation)
    a. be + gir → begir ~ bīgir ‘get!’
    b. be + jin → bejin ~ bījin ‘sit!’

(15) e prefix……o stem → o prefix (place assimilation)
    a. be + ro → boro ‘go!’
    b. be + xor → boxor ‘eat!’

Compare (13)–(15) with (16).

(16) e prefix……a/ɑ stem → e prefix (no assimilation)
    a. be + xar → bexar ‘buy!’ *baxar
    b. be + zar → bezar ‘put!’ *bazar

The main point here is raising of a mid vowel to a high vowel in the environment of a following high vowel. I mentioned the other cases in order to present the overall picture of this case of assimilation to which we will refer later. Next, we look at height harmony within stems.

5.2 Harmony within Stem

Persian shows a pattern of height harmony within the stem, as follows:

(17) o → u / — Cu
    a. sogut → suckut ‘falling’
    b. hozur → huzur ‘presence’
    c. füruf → furuf ‘selling’
    d. voջud → vudjud ‘existence’

(18) e → i / — Ci
    a. kelid → kīlid ‘key’
    b. sebil → sībil ‘mustache’
    c. gelim → gīlim ‘a kind of rug’
    d. zegil → zīgil ‘wart’

Evidence for the underlying presence of /o/ and /e/ (and not of /u/ and /i/) in the above forms (and so the occurrence of harmony and consequently raising of /o/ and /e/ to high vowels) is as follows: first, the existence of words with CuCu and CiCi in the language argues for /o/ and /e/ in the above examples. These words, some of which are given below, are never pronounced as CoCu and CeCi even in very formal speech. In their written forms they have the letters used for [i] and [u] which are pronounced in both formal and colloquial speech.

⁴ [ɑ] is commonly raised to [u] before nasals in Persian.
Thus surface C-highV-C-highV words have two sources: the vowels may be phonologically high, as in (19) and (20), in which case vowel height is invariant, or the first vowel may vary in its height between mid and high, as in (17) and (18). This varying vowel is phonologically mid under this height-based analysis. Second, the orthography of the language supports the presence of /o/ and /e/ in forms such as those in (17) and (18). In Persian /a/, /e/, and /o/ are represented by diacritics (which are not inserted in writing except in books for new-learners), and /i/, /i/, and /u/ by three letters of the alphabet. None of the words in (17) and (18) contain the symbols used for /i/ and /u/ for their first vowel in their written form. It is only in speech that [i] and [u] are pronounced. In (19) and (20), on the other hand, the vowels are both represented by the vowel symbols.

Within-stem height harmony does not occur in other sequences of vowels in a stem. No change is observed in, for example, pile ‘cocoon’, zinat ‘decoration’, kurof ‘a name’, rubah ‘fox’, pafe ‘mosquito’, furib ‘deception’, fjabok ‘fast’, zanu ‘knee’, pesar ‘boy’, sephah ‘army’, gonah ‘sin’, honar ‘art’. One case in which there is an eCo sequence needs comment. Recall that in prefix-stem vowel harmony in Persian imperatives discussed above the most frequent pattern is the change of /e/ to [o] (e.g., be + ro \(\rightarrow\) boro ‘go!’). This place assimilation is not as common within the stem. While there are cases such as \(\ddagger\)elo \(\sim\) \(\mathcal{f}\)olo ‘front’ and \(\ddagger\)elo \(\sim\) \(\mathcal{f}\)olo ‘steamed rice’ which might be taken as cases of /e/ to [o] assimilation within stems, there are cases such as dero ‘harvest’, kefo ‘drawer’ and senobar ‘black poplar’ which do not show any change in /e/ (*doro, *kofo, *sonobar) even in informal speech. Whether there is a pattern in this regard, what the underlying form is in the cases such as \(\ddagger\)elo \(\sim\) \(\mathcal{f}\)olo, and in general how CeCo words should be treated are questions for further research. Comparing the harmony within stems with the one across morphemes leads us to consider different domains in discussing harmony patterns. That is, although in the prefix-stem sequence, the change of /e/ to [o] is the most frequent pattern of harmony, in other words, place harmony is more frequent than height harmony, in within-stem harmony, height harmony (i.e. change of /e/ to [i] and also /o/ to [u]), and not place harmony, is the frequent one.

5.3 Harmony in Loan Words

Patterns of vowel harmony are also observed in English words that have been borrowed into Persian. Initial and medial consonant clusters are forbidden in Persian, and an [e] is inserted to break up these clusters. In words starting with sC, the epenthetic [e] is inserted at the beginning of the cluster. For example:

(21) | English    | Persian  |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. star</td>
<td>estar</td>
</tr>
<tr>
<td>b. small</td>
<td>esmal</td>
</tr>
</tbody>
</table>
In other cases, [e] is epenthesized between the two consonants as in felat for ‘flat’ and belak for ‘black’. The epenthetic [e] undergoes harmony in loan words to the following non-low vowel. Here are some examples:

(22) Assimilation of [e] to [i]

<table>
<thead>
<tr>
<th>English</th>
<th>Persian</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. freezer</td>
<td>firizer</td>
</tr>
<tr>
<td>b. grease</td>
<td>giris</td>
</tr>
</tbody>
</table>

(23) Assimilation of [e] to [u]

<table>
<thead>
<tr>
<th>English</th>
<th>Persian</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. blue</td>
<td>bulu</td>
</tr>
<tr>
<td>b. cruise</td>
<td>kuruzy</td>
</tr>
</tbody>
</table>

(24) Assimilation of [e] to [o]

<table>
<thead>
<tr>
<th>English</th>
<th>Persian</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. program</td>
<td>porogram</td>
</tr>
<tr>
<td>b. profile</td>
<td>porofal</td>
</tr>
</tbody>
</table>

(25) Failure of assimilation of [e] to [a] and [a]

<table>
<thead>
<tr>
<th>English</th>
<th>Persian</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. plan</td>
<td>pelan</td>
</tr>
<tr>
<td>b. class</td>
<td>klas</td>
</tr>
</tbody>
</table>

As in native words, in loan words, too, [e] changes its height and this happens only when the potential trigger is a high vowel. One might ask why I take [e] as the epenthetic vowel for loanwords in Persian, since we see different realizations of epenthetic vowels in the examples. In (22)-(24), there are some reasons to consider [e] as the epenthetic vowel in loan words, putting aside its similarity to some native process of assimilation. In the cases in which no harmony is seen —when the cluster precedes the low vowel— [e] is always observed in the epenthetic vowel position (see (25)). In addition, even in cases where harmony normally takes place, sometimes the foreign word with an [e] as epenthetic vowel can interchangeably be used, as in [firizer] and [ferizer] for freezer. Finally, the insertion of [e] at the beginning of sC clusters as the strategy of cluster-breaking (see (21)) also suggests the nature of the epenthetic vowel. In these words, there is no harmony, perhaps because of the existence of two consonants between [e] and the next vowel, and [e], as a default epenthetic vowel, always appears. Thus, in the absence of assimilation, the epenthetic vowel in Persian is [e].

5.4 Discussion

We looked at three patterns of harmony in Persian, in all of which a mid vowel is raised to a high vowel. Assuming that harmony is feature based (e.g., see van der Hulst and van de Weijer 1995, van Oostendorp 1995), if quality is considered as the basis for contrast in the system, these changes are easy to account for. Consider once more the representation of the system if quality is taken to be the contrastive feature.
Harmony patterns strongly support a featural analysis of the system: the feature [high] spreads from a high vowel to a mid vowel. Recall that as previously mentioned in the framework of Modified Contrastive Specification within which my analysis is presented we do not need three height features to be active in the system. Only two of them (along with a place feature) are enough to make the vowels distinguished from each other in the above system. The discussed harmony patterns suggest that [mid] is absent underlyingly assuming the structural markedness suggested by Modified Contrastive Specification. One of the criteria to identify the marked elements (present in underlying representation) from the unmarked ones (absent in underlying representation) is assimilation. Triggers of harmony are more complex structurally while targets of harmony are less complex. Thus in these cases of harmony observed in Persian, high vowels which are triggers of harmony are more complex because of having the feature [high], which spreads in the harmony patterns. The feature [mid], however, must be absent since mid vowels are targets in those harmony patterns. For a mid vowel to become high, it would obtain the feature [high] from a neighboring high vowel (Rohany Rahbar, to appear).

If quantity is taken to be active in the system, these harmony patterns are much more difficult to explain since quantity, occupying two positions, is not a feature and cannot spread (see van Oostendorp 1995 for discussion on this for Dutch).

We saw that low vowels do not participate in the harmony patterns discussed above. That is, they are neither triggers nor targets of harmony in interaction with non-low vowels. There is, however, an interaction between the two low vowels which we look at next.

5.5 Harmony in Low Vowels

The following harmony pattern is observed in low vowels in Persian:

\[(27) \quad a \rightarrow a / C\tilde{-}\tilde{\alpha},h\tilde{\alpha} \]

a. bahar → bahar ‘spring’
b. ḏāhan → ḏāhan ‘world’
c. maʔaʔ → maʔaʔ ‘livelihood’
d. saʔudat → saʔudat ‘happiness’

This process involves only low vowels. It also involves only laryngeal consonants; it does not occur across other consonants (e.g., tabar does not become tabar ‘lineage’; catar does not become catar ‘train’). One possible account is that laryngeals and low vowels both have the feature [low], and assimilation is possible in this environment. Whether Persian laryngeals bear the feature [low] or not remains to be investigated. The point relevant to our discussion about this process is the occurrence of harmony. We assumed that harmony is feature based. Therefore between height and length, the harmony pattern in non-low vowels argues for height. Considering the height-based vowel system, given above in (26), the harmony pattern observed in low vowels could not be a case of
height assimilation, but would rather represent a case of place assimilation: the place feature (i.e., [peripheral]\(^5\)) spreads from \(a\) to \(a\).

### 5.6 Harmony in Low and Non-low Vowels

The harmony patterns in non-low vowels discussed above can be treated as processes in which height is involved, and the harmony in low vowels as a process in which place is involved. But if we consider the patterns of harmony in low vowels and non-low vowels together, we observe the following pattern:

\[(28) \text{ targets } \rightarrow \text{ triggers} \]

\[
\begin{array}{c|c}
 a & \text{a} \\
 o & \text{u} \\
 e & \text{i} \\
\end{array}
\]

The triggers of harmony are \(a, i, u\), the long vowels of the quantity-based analysis, and the targets of harmony are \(a, e, o\), the short vowels of that analysis. Thus, a categorization of long and short vowels based on the patterning of these vowels in a phonological process such as harmony, which suggests a featural analysis for the system, is observed. Recall that a categorization of \(a, i, u\) versus \(a, e, o\) is the one suggested in quantity-based accounts of Persian vowels, but we already established based on harmony that quantity is not the dimension of contrast in the system assuming that harmony is feature based. The question, then, is: is there a feature by which both the harmony patterns in non-low vowels and the one in low vowels can receive a uniform account and therefore the categorization observed above in (28) can be retained? I suggest that there is such feature to account for harmony both in low and in non-low vowels and also for the categorization of \(a, i, u\) versus \(a, e, o\). We will discuss this feature in the next section.

### 6. Tense/Lax Distinction

So far I have argued that a quality contrast is required to account for harmony, but the contrast expressed in terms of height cannot account for the categorization of vowels into two groups. I suggest that there is a feature that can account for harmony and give the appropriate groupings of the vowels, namely [tense/lax]. Under this view, the system is represented as follows:

\[(29) \text{ [tense] } i \quad u \quad [\text{lax}] \quad e \quad o \]

\[
\begin{array}{c|c}
 a & \text{a} \\
\end{array}
\]

The tense/lax distinction categorizes the vowels into two groups: \(a, i, u\) as a group versus \(a, e, o\) as another group, as we see above. The harmony processes in low vowels and non-low vowels involves tense harmony. That is, the feature [tense] spreads from \(a, i, u\) to \(a, e, o\). Thus, by appealing to tense/lax distinction, we are able to account for harmony, since [tense] is a feature and can spread, and at the same time, we can put \(a, i, u\), the triggers of harmony, into one group as opposed to \(a, e, o\), the targets of harmony, which form another group. The fact that [tense] (and not [lax]) is the feature

\(^5\) I use [peripheral], following Rice (1995, 2002), to replace the features [back] and [round] in vowels.
which spreads shows that [tense] is underlyingly present as opposed to [lax] which is underlyingly absent. Represented structurally, this can be captured as follows:

(30) \[ \begin{array}{c}
\text{V} \\
\text{- - -} \\
\text{[tense]} \\
\text{V}
\end{array} \]

With this analysis, the categorization of vowels into two groups based on phonotactic patterning (such as the restrictions on following consonants) and versification, which is not possible by height and which is therefore the reason some literature considers quantity to be active in the system, is made possible with a feature.

7. The Epenthetic –e in Suffixation: a Challenge to the Quality Analysis?

In Persian, consonant clusters created in suffixation may be broken up by the epenthetic /e/. Whether epenthesis occurs or not depends on the structure of the root.

**First group**  The structure of the root: CV\text{lax}C; no epenthesis

(31) a. zar + gar → zar.gar ‘goldsmith’ *za.re.gar
b. dar + ban → dar.ban ‘doorkeeper’ *da.re.ban
c. del + gir → del.gir ‘gloomy’ *de.le.gir
d. gol + dan → gol.dan ‘vase’ *go.le.dan

**Second group**  The structure of the root: CV\text{tense}C; epenthesis is possible

(32) a. kar + gar → ka.re.gar / kar.gar ‘worker’
b. pas + ban → pa.se.ban / pasban ‘police officer’
c. ruz + gar → ru.z.e.gar / ruz.gar ‘times’
d. šad + man → ša.de.man / šad.man ‘happy’

This process suggests a categorization of a, i, u vs. a, e, o, which cannot be accounted for by a feature-based analysis. This appears to support the presence of quantity in the system, suggesting the following prosodic structure, which I will reject, as we will see below.

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6 There are cases in which the root has the CV\text{tense}C structure but epenthesis is not allowed (e.g., kar + gah → kargah ‘workshop, atelier’ (*ka.re.gah)). Why is there a difference between the bases with the same structure in these suffixation cases? Is it only the phonology or the morphology involved too? I leave these questions for future research.
Epenthesis can be quite readily accounted for under the quantity hypothesis. While details of syllabification in Persian remain to be developed, the following is the outline of an account. The long vowels are bimoraic and the short vowels monomoraic. Assuming that a syllable can accommodate two morae, the postvocalic consonant following the short vowel can receive a mora, and is thus prosodically licensed in this way. Following the long vowel, on the other hand, the consonant is not moraic. While it can be licensed by associating to the prosodic word when it is final, when a suffix is present, the consonant syllabifies as an onset, with epenthesis.

We now face a dilemma. While the patterning of epenthesis leads us towards a quantity-based analysis, harmony patterns lead us towards a quality-based analysis. If we adopt the quantity-based prosodic structure presented in (33), with paired vowels differing by mora count but not by feature, we will face difficulty in accounting for the harmony processes. I already suggested that [tense] is the feature involved in the harmony processes. That is, tense vowels, being the triggers of harmony, are structurally more complex than lax vowels in Persian. Considering the categorization of vowels a, e, o versus a, i, u, we observe that all the vowels which are considered as long in quantity-based accounts are tense in the tense-based account suggested here. These vowels can be either long or tense in their underlying representation and not both, given the theoretical assumptions of Modified Contrastive Specification, because if we distinguish them by quantity, there is no need for [tense] anymore and if they are distinguished by [tense], quantity does not need to be present. The underlying presence of quantity is ruled out because it cannot account for harmony. Tenseness, therefore, must be the feature involved in the epenthesis in suffixation. The question is: how can epenthesis be accounted for under the tense/lax hypothesis?

In order to account for the suffixation in (31) and (32) based on the tense/lax distinction, I suggest to follow the direction of an analysis according to which features play a role in projecting syllable structure (see van Oostendorp 1995 for discussion). Quantity is not underlying, but vowels with the feature [tense] project two morae unlike lax vowels which project one mora. A syllable is bimoraic only if the vowel has the feature [tense]. That is, [tense] is underlying and tense vowels are redundantly bimoraic. Thus, the representation in (33) is possible but it does not mean that quantity is underlying. Only quality is.

8. Conclusion

In this paper I looked at a controversial issue in Persian phonology, namely the active feature of its vowel system. I reexamined the arguments for quality and quantity in the literature and showed that they are not conclusive. I suggested that patterns of vowel harmony in Persian argue for quality to be active in the system. Thus between quantity and quality, the dimension of contrast is based on
quality. I, however, argued that, contrary to what is suggested in the literature, the qualitative feature active in the system is not height since it cannot account for the categorization of vowels which is suggested by harmony in the language. I suggested a featural analysis for the system based on tense/lax distinction. I further showed that epenthesis in suffixation, which seems to be problematic for a quality-based account, can be explained by considering the underlying presence of the tense/lax distinction from which quantity redundantly follows.

References


