

On stress in Persian*

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This paper explores the patterns of stress assignment in Persian under the rule-based metrical theory and optimality theory. To account for the two opposite headedness observed in the stress system of Persian, I develop one type of foot and directionality but different word layer construction rules, i.e., End Rule Left and End Rule Right, which are sensitive to lexical categories. However, End Rule Left makes incorrect predictions for even-syllable words. Persistent footing is here applied as a repairing strategy requiring the unfooted syllable be adjoined to existing feet if the result is wellformed. Additionally, optimality theory can consistently account for the patterns of stress assignment in Persian. The constraints standing in the analysis are linearly ordered but all ranked over Non-Finality. In both metrical and optimal treatments, extrametricality makes possible a simple account of how prominence relations among feet are established for exceptional cases.

A Metrical Approach to Persian Stress

Orientation

Though Persian¹ has a rich derivational and inflectional morphology, word stress is simply predictable regardless of the apparent structure of the word. No matter whether a word is simple or complex (or in a compound combination), the dominant stress can be mainly recognized by the type of lexical category and the subordinated stresses by counting syllables from a specific direction.

The patterning of stress in Persian includes simple words, complex words, compounds, phrases, clauses and sentences. The survey here concentrates on simple words, compounds and compounds. The data² elaborated here mainly presents standard Persian which is the language of the mass media. Of course, colloquial Persian used in informal situations and family net is not completely neglected.

Stress on Simple Words³

A simple word pronounced in isolation has the greatest stress on the last syllable; the rest would remain less stressed that can be called secondary and tertiary stresses. The group of simple words includes words of one-syllable up to five syllables. Though the position of stress in words of

*I wish to express my appreciation to Prof. John T. Jensen for his invaluable comments and insights that greatly helped me in developing and writing this paper. Appreciation is also extended to Prof. Akbar Mirhassani for his valuable input.

¹Persian is the official, spoken and literary language of Iran.

²Mention should be made that the data presented in this paper is mainly based on Ferguson (1957) and Hayati (1989). Ferguson has a descriptive analysis of word stress in Persian. Hayati (1989) also has a contrastive analysis of English and Persian stress.

³A simple word is a free morpheme which cannot be analyzed into smaller units.

one-syllable is noncontrastive, but such words, as Ferguson (1957) maintains, have word stress on their only syllable. See (1).

- | | | |
|-----|--------------------|-----------------|
| (1) | a. mú | 'hair' |
| | b. xúb | 'good' |
| | c. ráft | 's/he went' |
| | d. sábr | 'patience' |
| | e. je.hát | 'direction' |
| | f. ša.níd | 's/he heard' |
| | g. xan.díd | 's/he laughed' |
| | h. taq.dím | 'presentation' |
| | i. es.táxr | 'pool' |
| | j. xoš.báxt | 'lucky' |
| | k. hâ.fe.zé | 'memory' |
| | l. mob.ta.kér | 'innovative' |
| | m. bu.qa.la.mún | 'turkey' |
| | n. mo.jas.sa.mé | 'statue' |
| | o. mo.to.vas.se.te | 'intermediate' |
| | p. mo.ta.far.re.qé | 'miscellaneous' |

Based on the examples provided above, the following conclusions are drawn:

- i. Stress on simple words is on the rightmost syllable.⁴
- ii. The patterning of stress is not sensitive to syllable weight; regardless of whether the final syllable is light (ending in a vowel as in /hâ.fe.ze/ 'memory'), or heavy (ending in a consonant as in /taq.dím/ 'presentation'), or superheavy (ending in two consonants or more as in /es.táxr/ 'pool' or /sep.tâmbɾ/ 'September'), the dominant stress falls on the rightmost syllable of the word.
- iii. The patterning of stress is independent of the number of syllables; it does not matter whether a word is two syllables (e.g., /je.hat/ 'direction') or five syllables (e.g., /mo.to.vas.se.te/ 'intermediate'), the rightmost syllable attracts the main stress.

Stress on Complex Words⁵

As illustrated above, simple forms have final stress. Interestingly, when they are inflected, stress again falls on the last syllable of the word.⁶ The following affixes when added to simple words do not make a shift in the regular pattern of stress placement.

(2) Plural Markers: '-hâ', '-ân', '-gân'

- | | | | | |
|--------------|--------|---|---------------|------------|
| a. deráxt | + -hâ | ⇒ | deraxthâ | 'trees' |
| b. maríz | + -ân | ⇒ | marizâ'n | 'the sick' |
| c. nevisandé | + -gân | ⇒ | nevisandegâ'n | 'writers' |

⁴There are some exceptional cases to the right headedness of simple words that will be considered in Exceptions.

⁵A complex word consists of a stem and one or more affixes.

⁶Note that the behaviour of complex verbs is different from complex nouns and adjectives (see Exceptions).

- (3) Comparative and Superlative Markers: '-tar' and '-ta.rin'
- a. gerâ'n + -tar $\Rightarrow$ gerântár 'more expensive'
b. gerâ'n + -ta.rin $\Rightarrow$ gerântarín 'most expensive'
- (4) Markers of Ordinal Number: '-om' and '-omin'
- a. sizdáh + -om $\Rightarrow$ sizdahóm 'thirteenth'
b. sizdáh + -omin $\Rightarrow$ sizdahomín 'thirteenth'
- (5) Positive Adjectival Prefixes: 'bâ-' and 'be-'
- a. bâ- + xerád $\Rightarrow$ bâxerád 'wise'
b. be- + nâ'm $\Rightarrow$ benâ'm 'famous'
- (6) Negative Adjectival Prefixes: 'bi-', 'nâ-', 'lâ-'
- a. bi- + gonâ'h $\Rightarrow$ bigonâ'h 'innocent'
b. nâ- + omíd $\Rightarrow$ nâomíd 'disappointed'
c. lâ- + ?elâ'j $\Rightarrow$ lâ?elâ'j 'incurable'

The following conclusions are extracted for the derived words:

- Stress on derived words is on the rightmost syllable.
- The regular pattern of stress does not show any sensitivity to syllable weight.
- The number of syllables does not affect the regular pattern of stress.

Stress on Compounds

Similar to the stress pattern of simple and complex words, stress of different types of compounds, as shown below, is ordinarily on their rightmost syllable.⁷

(7) Nominal Compounds

- a. gól + xâné $\Rightarrow$ golxâné
'flower' 'house' 'greenhouse'
b. kâ'r + xâné $\Rightarrow$ kârxâné
'work' 'house' 'factory'

(8) Connective Compounds

- a. kâ'r + o + kargâr $\Rightarrow$ karokargâr⁸
'work' and 'worker' 'work and worker'
b. šáb + i + xún $\Rightarrow$ šabixún
'night' 'blooding, bloodshed' 'surprise attack'
c. bâ'r + â + bâ'r $\Rightarrow$ bârâbâ'r
'side' 'side' 'side by side'

⁷It should be mentioned that multi-syllabic words as well as compounds have also secondary stress which can be counted from the direction of stress.

⁸Examples 8a and 9 (a, b) are from Hayati (1989).

(9) Adjectival Compounds

a. jafâ'	+	kâ' r	⇒	ĵafakâ' r
'cruelty'		'doer'	⇒	'cruel'
b. ráng	+	ráng	⇒	rangráng
'color'		'color'		'colorful'

(10) Subjective Adjectival Compounds

a. âmâ' r	+	šenâ' s	⇒	âmâršenâ' s
'statistics'		'one who knows'		'statistician'
b. bâtrí	+	sâ' z	⇒	bâtrisâ' z
'battery'		'maker'		'battery maker, battery technician'
c. giyâ' h	+	xâ' r	⇒	giyâhxâ' r
'plant'		'eater'		'herbivore'
d. soxán	+	gú	⇒	soxangú
'speech'		'teller'		'speaker'
e. dást	+	âmúz	⇒	dastâmúz
'hand'		'trained'		'tame'

With regard to the data presented above, it is concluded that the dominant stress in compounds is on the rightmost syllable; it is also insensitive to syllable weight and the number of syllables. The stress rule below seems to be compatible with the conclusions drawn so far.

(11) Stress Rule:

Stress the rightmost syllable of the word (or compound).

The stress rule does provide correctly an account for main stress in Persian. However, since the stress rule builds an unbounded tree and since in the unbounded tree the head governs the entire sequence of units, other stresses are unaccounted for. Recall that Persian is a language which gives different levels of prominence to syllables. In addition to main stress, secondary and tertiary stresses are also distinguished. Therefore, because of the necessity of the foot construction, the stress rule resulting in unbounded feet cannot fully account for all aspects of Persian stress. We leave this problem temporarily aside and look at the behaviour of complex verbs in Persian.

Stress on Complex Verbs

As illustrated in (1), simple verbs, i.e., verbs which do not have overt affixes are final-stress bearer (e.g., /pa.rid/ 's/he jumped'). Since Persian verbs carry aspect, tense and agreement, we usually find them with inflectional suffixes and prefixes.⁹ Overall, there are four verb prefixes in Persian: 'mi-', 'be-', 'na-' and 'ma-'. These affixes, as exhibited below, make a shift in the regular stress pattern.¹⁰

⁹A verb in Persian has six possible forms, three singular and three plural indicating different types of subject. With the exception of third person singular form, the remaining forms are all assigned overt inflection.

¹⁰There are also some verb suffixes that when added to the simple verb do not attract the main stress (see Exceptions).

- (12) Progressive Marker: 'mi-'
 a. mi- + ráft ⇒ míraft 's/he was going'
 b. mi- + ravád ⇒ míravád 's/he goes'
- (13) Negative Markers: 'na-' and 'ma-'
 a. na- + šín ⇒ nášin 'don't sit'
 b. ma- + gú ⇒ mágu 'don't say' (literary)
- (14) Positive Marker of Potential Moods and Imperatives: 'be-'
 a. be + šín ⇒ béšin 'sit'
 b. be + ravád ⇒ béravad 'that s/he go'
- (15) Combination of Markers: 'na-' + mi-'
 a. na- + mi- + dānēst ⇒ nāmidānest 's/he did not know'
 b. na- + mi- + šuyád ⇒ nāmišuyad 's/he does not wash'

The following conclusions are drawn from the data presented on verbs:

- i. Stress on simple verbs is on the rightmost syllable.
- ii. Weight syllable plays no role in the pattern of stress assignment.
- iii. The addition of prefixes to the simple verb changes the pattern of stress from the rightmost syllable to the leftmost one.

Comparing nouns and verbs, one can see that the stress of verbs is reversely assigned. To account for this mirror image, we might propose a left headed stress rule. However, we will confront the same problem as we did for the rule in (11). Therefore, the patterning of stress in Persian is not solved by the left/right headed rule alone.

To extract the system of stress assignment in any language, some parameters are to be determined. These parameters proposed throughout the literature and listed by Hayes (1995:54) are:

- a. Size of foot, i.e., the foot is maximally unary/binary/ternary/unbounded.
- b. Quantity sensitivity, i.e., heavy syllables may/may not occur in weak position of a foot.
- c. Labelling, i.e., feet have initial/final prominence.
- d. Obligatory branching, i.e., the head of a foot must/need not be a heavy syllable.
- e. Direction of parsing: direction of parsing is left to right/right to left.
- f. Iterativity, i.e., foot construction is iterative/only once.
- g. Location: location creates new metrical layer/applies on existing layer.

The most crucial parameter, as Hayes (1995) maintains, is the basic foot shape that a given language allows. In bounded systems of stress, there are three basic foot types available in the literature: Syllabic Trochees, Moraic Trochees and Iambs. In the Iambic system, the foot template allows at most two syllables of which the rightmost syllable is strong. The Moraic Trochee consists of two moras, of which first is stronger. Palestinian Arabic is a language which respects Moraic Trochees (see, e.g., Kenstowicz and Abdul-Karim 1980, Abu-Salim 1980). The relevant syllable types in Palestinian, as in other dialects of Arabic, are light (/CV/), heavy (/CVC, CV:/) and superheavy (/CVCC, CV:C/). In final position, superheavy syllables attract stress.

Similar to Arabic and its pertinent dialects, Persian has light (V, CV), heavy (CVC, VC), and

superheavy (CVCC, CVCCC) syllables.¹¹ Unlike Arabic, Persian stress does not show any sensitivity to syllable weight. Instead stress seems to be sensitive to the category of words. By determining the type of syntactic category and by counting syllables, we can respectively determine the prominent and less prominent stresses (see 18 and 19).

Though heavy syllables in Persian do not play any role in stress attraction, we need a foot form similar to Iambs that can be called the Syllabic Iamb. The only motivation for changing the name from the 'Iamb' to the 'Syllabic Iamb' is that the foot template simply counts syllables ignoring their internal structures. Degenerate-size words in Persian gives further support to our foot type selection.

According to McCarthy and Prince (1986), in various languages, a minimum is imposed on the size of a word. In metrical/grid theory, every word is required to have at least one foot suggesting that every word must undergo parsing. Persian words, nevertheless, present a serious violation of word minimum. A lot of words (e.g., /mu/ 'hair') consist of just one syllable, a fact which obligatorily requires them to be parsed and footed.¹² Therefore, since Persian allows degenerate size-words, degenerate feet can be assumed for this language.¹³ With regard to this point, the Syllabic Iamb adopted for Persian system of stress requires degenerate feet, as in 16.

(16) Syllabic Iamb: Form (. X); otherwise form (X).¹⁴

As exhibited earlier, all simple words are finally stressed. Similarly, all complexes and compounds receive stress on the rightmost syllable. While prefixed verbs are initially stressed, the suffixed verbs are finally stressed (see 17).

- | | | |
|------|-----------------|----------------------|
| (17) | a. ráft-am | 'I went' |
| | b. šaníd-and | 'they heard' |
| | c. jangíd-im | 'we fought' |
| | d. mí-raft | 's/he was going' |
| | e. námi-raft-id | 'you were not going' |

Overall, two opposite headedness, i.e., right and left headedness, can clearly be observed in the stress system of Persian. To account for this situation, the most economic and consistent way would be to have one type of foot and directionality but different word layer construction rules, i.e., End Rule Left and End Rule Right, which are sensitive to lexical categories. While End Rule Left results in left headedness, End Rule Right leads to right headedness. With regard to the considerations so far, the following patterns of stress assignment are proposed for Persian.

¹¹At this point, it should be mentioned that there is no consensus among linguists as to the types of syllable structure in Persian. Some believe that no syllable can begin with a vowel (see e.g., Samareh 1977, 1985, Scott 1964). Others hold the view that vowels can also make syllables (see e.g., Nye 1954 mentioned in Scott 1964). I have adopted the latter view and supported it with some evidence in Amini (1996).

¹²See optimality account of Persian where Ft-Bin is shown to be low ranked.

¹³As Hayes (1995) maintains, languages seem to have banned degenerate feet according to different degrees of severity: the ban may be absolute, i.e., absolutely prohibited (e.g., Cairene Arabic), or may be weak, i.e., allowed only in strong positions (e.g., Auca). In Persian, degenerate feet are found at the left edge of the prosodic word to preserve the position of either main or secondary stress.

¹⁴'X' shows a stressed syllable and '.' shows a syllable with very low stress.

(18) Patterns of Stress Assignment in Persian

a. Foot Construction

Parse words into Syllabic Iambs going from right to left

b. Word Layer Construction

End Rule Left

End Rule Right

(19) Examples:

(X)	(X)
(X X)	(X X)
(X) (X)	(X) (X)
mi.xo.rad	hâ.fe.ze

However, End Rule Left makes incorrect predictions for even-syllable words such as /mitavânest/ in (20).

* (20) (X)
 (X X)
 (X) (X)
 mi.ta.vâ.nest

To solve this problem, we first assume that a syllabic iamb is built at the right edge of PWd. Then, a single syllabic iamb is built on the left edge of PWd which receives main stress by End Rule Left. The remaining syllables are iambically footed. In the example above two adjacent monosyllables are constructed. Here the stress clash is resolved by destressing rule and the intermediary monosyllabic foot is unfooted. This can be made clear by (21).

(21) a. (X)	b. (X)
(X X X)	(X X)
(X) (X) (X X)	(X) X (X X)
(mi)(ta)(vâ.nest)	(mi)ta(vâ.nest)

After removing the secondary stress beside the main stress, Persistent Footing (see Hayes 1995) applies. We consider Persistent Footing as a repairing strategy in Persian requiring the unfooted syllable be adjoined to existing feet if the result is wellformed. Here /ta/ cannot adjoin to the right foot because the result is an unacceptable trisyllabic foot. Therefore, /ta/ adjoins to its left monosyllabic foot and the correct output form is derived, as in (21c).

(21) c. (X)
 (X X)
 (X X)(X X)
 (mi.ta)(vâ.nad)

Now we have a brief look at compounds in order to see how patterns in (18) apply. For prosodic structures of compounds in Persian, three basic possibilities can be assumed: (a) Compound Layer Hypothesis: each simple word has its own word layer with an additional higher compound layer, (b) Word Layer Hypothesis: all the constructed feet are joined together under a

single word layer (see Hayes 1995 for further illustration), and (c) the words are joined together and constitute a single prosodic unit that I call it Plus Word Layer Hypothesis. These hypotheses are illustrated below by the simple words /gól/ 'flower' and /xané/ 'house' making up the compound /golxané/ 'greenhouse'.

- (22) a. Compound Layer Hypothesis
 (X) Compound Layer
 (X) X) Word Layer
 (X) (. X) Foot Layer
 [gol][xâne]

- b. Word Layer Hypothesis
 (X) Word Layer
 (X) (. X) Foot Layer
 [gol][xâne]

- c. Plus Word Layer Hypothesis
 (X) Word Layer
 (X) (. X) Foot Layer
 [golxâne]

In the case of Compound Layer Hypothesis, we simply form a new layer on the top of what we already have and assign it End Rule Right. In other cases, there is no extra top layer. Indeed, (22b) and (22c) are the same with the exception that in the latter the two words combine from the very beginning and form a single prosodic unit. Recall that compounds (as well as complexes) behave in such a way as if they were simple words, as such stress falls on the rightmost syllable and it is insensitive to the syllable weight. Accordingly, it is not strange that they are all treated like morphologically simple words. As the result, the correspondence between morphological structure and PWd structure in Persian would be assumed as in (23). For the sake of clarity we mark affixes and word boundaries in the morphological structure by '-' and '#', respectively.

- | | |
|---------------------------------|------------------|
| (23) a. Morphological Structure | b. PWd Structure |
| {sâzmân} 'organization' | [sâzmân] |
| {sâzmân-hâ} 'organizations' | [sâzmânâ] |
| {nešast} 's/he sat' | [nešast] |
| {mi-nešast} 's/he was sitting' | [minešast] |
| {gol # xâne} 'greenhouse' | [golxâne] |

Thus, morphologically simple and complex words as well as compounds are all treated in the same manner. In other words, we see no morphologically driven interference in the alignment of morphology and prosody in Persian.¹⁵

¹⁵Though I do not have any argument against the Compound Layer and Word Layer Hypotheses, economy, unity and productivity involve selecting the Plus Word Layer Hypothesis over the two others.

Exceptions

There are some exceptions to the general right headedness of nouns and left headedness of complex verbs. To begin with, a limited number of particles have nonfinal stress which can be categorized as: (a) lexical exceptions: words meaning 'yes/no', words meaning 'but', words meaning 'perhaps' and words meaning 'wish'; (b) ordinal adverbs; (c) miscellaneous; (d) minimal pairs; (e) vocative words; and (f) clitics: unstressed suffixes.¹⁶

(24) Lexical Exceptions

i. Words Meaning 'Yes/No'

a. á'ri	'yes'	(literary)
b. á're	'yeah'	(informal)
c. bále	'yes'	
d. báli	'yes'	
e. xéyr	'no'	
f. náxeyr	'no'	

ii. Words Meaning 'But'

a. ámmâ	'but, however'
b. bálke	'but also, but even, on the contrary'
c. éllâ (élâ)	'except'
e. lâ'ken	'but, however'
f. váli	'but, however'
g. válikan	'but, however'

iii. Words Meaning 'Perhaps'

a. bálke	'perhaps'
b. gúyâ	'perhaps, it seems'
c. mítavân	'it is possible'
d. némitavân	'it is not possible'
e. nátavân	'it is not possible'
f. šâ'yad	'perhaps'

iv. Words Meaning 'Wish'

a. á'min	'amen'
b. kâ'ski	'I wish that'

(25) Ordinal Adverbs¹⁷

a. ávvalan	'firstly'
b. sâ'niyan	'secondly'
c. sâ'lesan	'thirdly'
d. râ'be?an	'fourthly'

¹⁶Most of the data provided on exceptions is from Ferguson (1957).

¹⁷Ordinal adverbs are Arabic loan words, the first two are commonly used in Persian.

e. xâ' mesan	'fifthly'
f. sâ' lesan	'sixthly'
g. sâ' beʔan	'seventhly'
h. sâ' menan	'eightly'
i. tâ' seʔan	'ninethly'
j. ʔâ' šeran	'tenthly'

(26) Miscellaneous

a. â' yâ	'whether'
b. bâ' dâ	'may it be'
c. bâsâ	'many, often'
d. háttâ	'until, even'
e. yâʔni	'that is'

(27) Minimal Pairs

There are some nouns in Persian for which the shift of stress results in a difference in meaning. These words called minimal pairs are illustrated below.

a. ruzí	'daily bread'
b. rúzi	'a day'
c. bandé	'slave, I'
d. bándé	'end of'
e. dasté	'handle'
f. dáste	'hand of'
g. bârí	'truck'
h. bâ' ri	'anyway, anyhow'

(28) Vocative Words

When a word is used in an address, the stress is shifted forward from the final syllable to the first syllable.

a. âqâ'	'sir'
b. â' qâ	'sir!'
c. gârson	'waiter'
d. gâ' rson	'waiter!'
e. sâbér	'Saber'
f. sâ' ber	'Saber!'

(29) Exceptional Suffixes

Personal suffixes, nominal suffixes¹⁸ and the indefinite suffix /-i/ are unstressed. As displayed below, they all systematically violate the regular pattern of stress assignment.

i. Nominal Suffixes		<u>Noun</u>		<u>Preposition</u>
a. -am	'my, me'	ketâ' bam	'my book'	ázam 'from me'

¹⁸Personal and nominal suffixes have various alternate forms in colloquial Persian. For example, /-eš/ and /-oš/ for the form /aš/ is widely used in conversations.

b. -at	'you, you'	ketâ'bat	'your book	âzat	'from you'
c. -aš	'his, him, her'	ketâ'baš	'his/her book'	âzaš	'from him'
d. -emân	'our, us'	ketâ'bemân	'our book'	âzemân	'from us'
e. -etân	'your, you'	ketâ'betân	'your book'	âzetân	'from you'
f. -ešân	'their, them'	ketâ'bešân	'their book'	âzešân	'from them'

ii. Personal Suffixes

a. -am	'I'	'geréftam'	'I took'
b. -i	'you'	'geréfti'	'you took'
c. -im	'we'	'geréftim'	'we took'
d. -id	'you'	'geréftid'	'you took'
e. -and	'they'	'geréftand'	'they took'

iii. Indefinite Suffix '-i'

a. ketâ'b	+ -i	==>	ketâ'bi	'a book'
b. ketâ'b	+ -hâ	==>	ketâbhâ' + i	==> ketâbhâ'yi 'some books'

To account for the unstressed suffixes which trigger exceptional stress, we assume the extrametricality of the final syllable of words containing such affixes.¹⁹ To see the point consider the following typical examples.

- (30)
- | | |
|---------------|-------------|
| a. ke.tâ'b-at | 'your book' |
| b. ke.tâ'b-i | 'a book' |
| b. âz-at | 'from you' |
| c. ge.réf-tam | 'I took.' |

Hayes (1981, mentioned in Hayes 1995:57) proposes the following restrictions on extrametricality.

- Only constituents (segment, syllable, foot, phonological word affix) may be marked as extrametrical.
- A constituent may be extrametrical if it is at a designated edge (left or right) of its domain.
- The unmarked edge for extrametricality is the right edge.
- An extrametricality rule is blocked if it would render the entire domain of the stress rules extrametrical.

Evaluating the typical examples in (30) with the restrictions mentioned above, i.e., constituency, peripherality, edge markedness and nonexhaustivity, it is concluded that the clitics are allowed to be extrametrical. Therefore, the regular pattern of stress assignment for such cases would be as below.

- Make the syllable containing the unstressed suffix extrametrical.
- At the right edge of the word, form syllabic iambs going from right to left.
- Construct End Rule Right.

For example, a word like /ketâbi/ 'a book' has the extrametricality of the final syllable /bi/. Here stress is assigned by End Rule Right, as exhibited in (31).

¹⁹See also the optimality account of extrametricality.

- (31) (X)
 (. X)
 ke.tâ' <bi>

A metrical tree for such words as /ketâbi/ would be as in (32).

- (32) $\begin{array}{c} \diagup \quad \diagdown \\ W \quad S \\ ke \quad tâ' \quad <bi> \end{array}$

Indeed, by making the final syllable extrametrical, we make it invisible to the pattern of stress assignment. Consequently, the rightmost syllable will receive the main stress.

Minimal pairs also arise from exceptional stress. If close attention is paid to these pairs, one would find two sources for their morphological structure. The first source is the (un)stressed /i/. For example, a word like /mahi/ 'fish' has stress on the last syllable (mâ.hi) as all nonderived words have stress on the last syllable. But the word /mâhi/ 'a month' consisting of the free form 'mah' plus the indefinite bound suffix /-i/ has stress on the first syllable (mâ'.hi). The second source for minimal pairs is the (un)stressed /e/. While the nominal suffix /e/ is stressed (e.g., /dasté/ 'handle'), the clitic /-e/ (called Ezafe) is unstressed (e.g., /dâste/ 'hand of'). Thus, the unstressed clitic /-e/ and the indefinite /-i/ making up minimal pairs can be accounted for in terms of extrametricality. Indeed, this is a case of vowel extrametricality, that is, we demote the disyllabic word CVCV (e.g., mâ.hi) to CVC and CVC.CV (e.g., das.te) to CVCC.

The other types of exceptions are words consisting of two or three syllables. They include nouns, adverbs, auxiliaries and conjunctions that are initially stressed. For instance, the noun /â.ri/ meaning 'yes' or the adverb /sâ.ni.yan/ meaning 'second' receive stress on the leftmost syllable. To account for such exceptional cases, there seems to be two options: either to propose a different type of foot of the form '(X .) (X)',²⁰ or to treat them in terms of extrametricality. The first option should be considered as a last resort. This means that we postulate different types of feet in a given language whenever other ways are blocked. Thus, the remaining way would be to make the final syllable of two-syllable words or the final foot of three-syllable words extrametrical. Assuming that extrametrical elements are not accessible to word layer labelling, the correct output is the result of placing the /X/ of the word layer on the leftmost /X/ at the foot layer. For example, in /sâniyan/, the rightmost foot is peripheral within the word. Thus, the extrametricality is not blocked and the End Rule will derive the initial leftmost stress. This can be made clear with the representation below.

- (33) (X)
 (X) <(. X)>
 sâ' <ni.yan>

Having extracted the patterns of stress assignment in detail, we move on the next section to employ the insights of optimality theory to account for the stress assignment in Persian.

²⁰This type of foot is called Syllabic Trochee; however, there is disagreement upon its degenerate foot.

An Optimal Approach to Persian Stress

Optimality theory (see McCarthy and Prince 1993a, 1993b, 1993c, Prince, Smolensky and McCarthy 1993) is a theory of constraints. The constraints are violable and ranked on a language specific basis. The set of constraints involved in the analysis of Persian stress include:

- (34)
- a. Ft-Form: Feet are Syllabic Iambs.
 - b. Parse-Syll: Syllables which are part of the prosodic word are parsed by feet.
 - c. Ft-Bin: Feet are binary at the syllabic level of analysis.
 - d. Non-Finality: Stressed syllables are not final.
 - e. Stress-Well: No stressed syllable may be adjacent to the head²¹ syllable of the prosodic word (see Halle and Vergnaud 1987, Liberman and prince 1977, Pater 1995).
 - f. Align (PWd, R, Head, R): Align the right edge of the prosodic word with the right edge of the head of the prosodic word.
 - g. Align (PWd (=Verb), L, Head, L): Align the left edge of the prosodic word (verb) with the left edge of the head of the prosodic word.

We begin an optimality account of Persian stress by considering the input /qalam/ in Tableau 1. Following the notational conventions, an asterisk exhibits a constraint violation, and an exclamation mark indicates a fatal violation. The optimal candidate, which is the grammatical form, is pointed out (by a hand).

(35) Tableau 1: Ft-Form, Parse-Syll, Align Head, Stress-Well>>Non-Finality

<i>Input: qalam Candidates</i>	<i>Ft-Form (. X) (X)</i>	<i>Parse-Syll</i>	<i>Align Head (PWd,R,H,R)</i>	<i>Stress-Well</i>	<i>Non- Finality</i>
a. [(qa.lám)]					*
b. [(qá.lam)]	*!		*σ		
c. [(qa(lám)]		*!			*
d. [(qá)lam]		*!	*σ		
e. [qalam]		*!*			
f. [(qá)(lám)]			*!	*	*
g. [(qà)(lám)]				*!	*

²¹The most dominant stressed syllable in a prosodic word is called the head.

In Tableau (1), the input has been generated into seven candidates. The constraint Ft-Form is responsible for the fact that dissyllabic words have stress on the rightmost syllable of the foot. Therefore, the candidate (35b) is fatally ruled out. The syllables of the candidates (35c, d, e) are not parsed by feet, so they receive an asterisk for each violation of Parse-Syll. As can be seen, the constraints Ft-Form, Parse-Syll, Align Head and Stress-Well are linearly ordered but they are ranked over Non-Finality.

(36) Tableau 2: Ft-Form, Parse-Syll, Align Head, Stress-Well>>Non-Finality

<i>Input: qalamhâ</i> <i>Candidates</i>	<i>Ft-Form</i> (. X)(X)	<i>Parse-Syll</i>	<i>Align Head</i> (PWd,R,H,R)	<i>Stress-Well</i>	<i>Non-Finality</i>
a. [(qá)(lam.hâ`)]			*!σσ		*
b. [(qà)(lám.hâ)]	*!		*σ	*	
c. [(qá)(lám.hâ)]	*!		*σσ	*	
d. [(qà)(lam.hâ`)]					*
e. [(qa.lám)(hâ`)]			*!σ	*	*
f. [(qá.lam)(hâ`)]	*!		*σσ		*
g. [(qa.lám)(hâ`)]				*!	*
h. [(qà.lam)(hâ`)]	*!				*
i. [(qá.lam)hâ]	*!	*	*σσ		
j. [(qa.lám)hâ]		*!	*σ		
k. [qa(lám.hâ)]	*!	*	*σ		
l. [qa(lam.hâ`)]		*!			*
m. [(qà)lam(hâ`)]		*!			*
n. [(qá)lam(hâ`)]		*!	*σσ		*
o. [(qá)(lám)(hâ`)]			*!σσ	*	*
p. [(qá)(lám)(hâ`)]			*!σ	**	*
q. [(qà)(lám)(hâ`)]				*!	*
r. [qa.lam(hâ`)]		*!*			*
s. [qa.lam.hâ]		*!***			

In Tableau (2), the input /qalamhâ/ 'pens' is a three-syllable complex noun. The Ft-Form constraint is fatal for the candidates (36b, c, f, h, i, k). Similarly, the constraint Parse-Syll fatally disfavors (36j, l, m, n, r, s). Here of special interest is the contrast given by Align Head between the candidates (36a) and (36d). As can be seen, these two candidates respect Ft-Form, Parse-Syll and Stress-Well. They both violate Non-Finality. Align Head requires the main stress (not secondary) be the rightmost syllable of the prosodic word. Thus it selects the candidate (36d) as the best candidate.

At this point, we briefly look at the relationship between Ft-Bin and degenerate feet. As discussed earlier, degenerate feet have been assumed in building up the stress system of Persian. To account for this, Ft-Bin must be ranked lower than Parse-Syll so that syllables are parsed into feet rather than being left unparsed. To see this point we choose a few candidates from Tableau (2) and consider them in Tableau (3).

(37) Tableau 3: FT-Form, Parse-Syll >> FtBin, Align Head, Stress-Well >> Non-Finality

<i>Input: qalamhâ Candidates</i>	<i>Ft-Form (. X)(X)</i>	<i>Parse- Syll</i>	<i>Ft-Bin</i>	<i>Align Head (PWd,R,H,R)</i>	<i>Stress- Well</i>	<i>Non- Finality</i>
a. [(qà)(lam.hấ)]			*			*
b. [qa(lam.hấ)]		*!				*
c. [(qà)(lám.hâ)]	*!		*	*σσ	*	

As Tableau 3 indicates, while ranking of Parse-Syll over Ft-Bin results in the selection of the grammatical candidate, i.e., [(qà)(lam.hấ)], the reversed ranking leads to the selection of an ungrammatical candidate, i.e., [qa(lam.hấ)], as the optimal option. Thus, to circumvent this latter case, it is necessary that Ft-Bin is ranked below Parse-Syll.

In Tableau (4), the input is a four-syllable complex adjective. Again, the constraints do not exhibit domination hierarchy except that Non-Finality is ranked below the others. Similar to other tableaux, each constraint plays a role in disfavoring some candidates, but the decisive role is given to two constraints, i.e., Align Head and Stress-Well which decisively discriminate between the competitive candidates, i.e., (38a, c, d, e, f). Note that these candidates all violate Non-finality. Therefore, from the Non-Finality point of view they are the same. Comparing candidates (38a) and (38c), the former is eliminated by Align head according to which the right edge of the prosodic word must be aligned with the right edge of its head. Between (38c) and (38d), the constraint Stress-Well bans a stress adjacent to any stressed syllable with the dominant stress and, therefore, the former is selected over the latter.

(38) Tableau 4: Ft-Form, Parse-Syll, Align Head, Stress-Well >>Non-Finality

<i>Input: gerântarin Candidates</i>	<i>Ft-Form (. X)(X)</i>	<i>Parse-Syll</i>	<i>Align Head (PWd,R,H,R)</i>	<i>Stress- Well</i>	<i>Non- Finality</i>
a. [(ge.râ ^ˈ n)(ta.rin)]			*!σσ		*
b. [(gé.rân)(tà.rin)]	**!		*σσσ		
c. [(ge.râ ^ˈ n)(ta.rín)]					*
d. [(gè)(râ ^ˈ n)(tà)(rín)]				*!	*
e. [(gè)(râ ^ˈ n)(tà)(rìn)]			*!σ	**	*
f. [(gè)(râ ^ˈ n)(tà)(rín)]			*!σσ	**	*
g. [ge.rân.ta.rin]		*!***			
h. [(ge.râ ^ˈ n)ta.rin]		*!*	*σσ		
i. [(gé.rân)ta.rin]	*!	**	*σσσ		
j. [(ge.râ ^ˈ n)(tà)rín]		*!	*σ	*	
k. [(ge.râ ^ˈ n)(tà)rín]		*!	*σσ	*	
l. [ge(rân.ta)rín]		**!	*σ		
m. [ge(râ ^ˈ n.ta)rín]	*!	**	*σσ		
n. [(ge.rân.ta.rín)]	*!?				*
o. [(gè.rân.ta)(rín)]	*!				*
p. [(ge.rân.ta)(rín)]	*!			*	*
q. [(gè)rân.ta.rín]		***!	*σσσ		
r. [ge.rân.ta(rín)]		***!			*
s. [ge(râ ^ˈ n)tar.in]		***!	*σσ		

So far, we have considered the productive right headedness account of stress assignment concerning nouns and adjectives in terms of optimality theory. In Tableaux (5) and (6), we have a brief look at verbs as well as lexical exceptions.

(39) Tableau 5: Ft-Form, Parse-Syll, Align Head, Stress-Well >>Non-Finality

Input: mixarid Candidates	Ft-Form (. X) (X)	Parse-Syll	Align Head (Verb,L,H,L)	Stress-Well	Non- Finality
a. [mi(xa.ríd)]		*!	*σσ		*
b. [mi(xá.ríd)]	*!	*	*σ		
c. [(mí.xa)rid]	*!	*			
d. [(mi.xá)rid]		*!	*σ		
e. [(mì.xa)(ríd)]	*!				*
f. [(mi.xá)(ríd)]			*!σ	*	*
g. [(mi.xà)(ríd)]			*!σσ	*	*
h. [(mí)(xa.ríd)]					*
i. [(mì)(xa.ríd)]			*!σσ		*
j. [(mí)(xà.ríd)]	*!			*	
k. [(mì)(xá.ríd)]	*!		*σ	*	
l. [(mí)xa(rid)]		*!			*
m. [(mì)xa(rid)]		*!	*σσ		*
n. [mì(xá.ríd)]	*!	*	*σ		
o. [mi.xa(ríd)]		**!	*σσ		*
p. [mi.xa.ríd]		**!*			
q. [(mí)(xà)(ríd)]				*!	*
r. [(mì)(xà)(ríd)]			*!σ	*!*	*
s. [mi(xa.ríd)]		*!	*σσ		*

In Tableau (5), the input is a three-syllable verb. It consists of the prefix /mi-/ and the stem /xa.ríd/ making up the complex unit /mixarid/ 's/he was buying'. In contrast to nouns, Align Head (PWd (=Verb), L, H, L) requires the left edge of the verb be aligned with the left of its head. Also note that since degenerate feet are allowed in feet formations, the Ft-Form constraint is unable to differentiate between close candidates different in just the placement of main and secondary stresses. Again, Align Head compels the selection of the candidate (39h) over (39i).

(40) **Tableau 6: Ft-Form, Parse-Syll, Align Head, Stress-Well >>Non-Finality**

<i>Input: ketâbat Candidates</i>	<i>Ft-Form (. X)(X)</i>	<i>Parse-Syll</i>	<i>Align Head (PWd,R,H,R)</i>	<i>Stress-Well</i>	<i>Non- Finality</i>
a. [(ke.tâ')<bat>]					*
b. [. [(ké.tâ)]<bat>]	*!		*σ		
c. [(ke.tâ')<bat>]		*!	*σ		
d. [(ké.tâ)<bat>]	*!	*	*σσ		
e. [ke (tâ.ba't)]		*!			*
f. [(ke.tâ'.bat)]	*!		*σ		
h. [(kè)(tâ')<bat>]		*!	*σ	*	

In Tableau (6), an optimality account for the lexical exceptions, in general, and the unstressed suffixes, in particular, is provided.²² The input consists of the stem /ketâb/ and the pronominal suffix /-at/ making up the complex /ke.tâ.bat/ 'your book'. The input has been given structure to seven candidates. The constraints Ft-Form, Parse-Syll, Align Head and Stress-Well are linearly ordered. The optimal output violates the constraint Non-finality giving evidence that the other constraints are ranked over it. Three output candidates, i.e., (40b, d, f) violate fatally the constraints Ft-Form. The candidates (40c, e, h) pass down Ft-Form, but they seriously violate Parse-Syll. The first candidate is ultimately favored over the others.

Conclusions

The present paper deals with stress in Persian. Considering Persian stress in terms of metrical theory and optimality theory, we come up with the following conclusions:

- To a very limited extent, stress in Persian is phonemic. There are some minimal pairs that are segmentally identical but distinct in terms of stress placement.
- There are many monosyllabic content words in Persian that violate Foot Binarity. It is due to this condition that degenerate feet are assumed in building up the stress system in Persian.
- Two types of suffixes are distinguished: stressed and unstressed suffixes. The stressed suffixes -- plural markers, ordinal number markers, comparative and superlative markers -- make no difference to the stress pattern since they attract the main stress of the word. However, the unstressed suffixes -- nominal suffixes, personal suffixes, Ezafe /-e/ and the indefinite suffix /-i/ --

²²At this point, it should be mentioned that for unstressed suffixes, it is possible to align 'Stem, R, PWd, R' showing that the suffixes are outside the stem. But this analysis is not applicable to the lexical exceptions that are solely made of a two- or three-syllable stem. Thus, despite the fact that there are serious reservations regarding extrametricality in optimality theory, I, for the sake of general coherence, still rely on it in dealing with exceptional cases.

never bear the stress of the stem to which they are attached.

- c. Two types of prefixes are also distinguished: stressed and unstressed prefixes. In the stressed prefixes, i.e., verb prefixes, the stress is shifted forward from the last syllable to the first syllable. No change is made in the regular pattern of stress assignment whenever the unstressed prefixes including positive and negative adjectival prefixes are added to the word.
- e. The regularities that govern stress assignment in Persian depend entirely on nonphonological information, here on syntactic category information. While nouns and adjectives receive final stress, prefixed verbs receive initial stress. Therefore, any word that does not respect the rule of its category can be named exception. Moreover, since stress regularities do not make reference to syllable weight, they strongly give evidence in favour of a quantity insensitive system.
- f. We provide a unified account of stress assignment in Persian according to which: make extrametrical the syllable containing the unstressed suffix (if there is any), then form Syllabic lambs going from right to left and, ultimately, make use of Right/Left End Rule.
- g. We further illustrate that optimality theory consistently accounts for the patterning of stress in Persian. The constraints standing in the analysis are ranked linearly. However, all are ranked over Non-Finality.
- h. Without doubt a full study of Persian stress is beyond the scope of this paper. Such a study requires not only a full survey into the explored stress patterns, but also a deep insight in word order and its influence specifically on unexplored phrase and sentence patterns.

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