Vowel Lengthening in a Moraic-Trochee System: Stress in Ancient Egyptian

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Abstract:

In generative phonological approaches to the analysis of stress placement, there has been much discussion concerning the status of the uneven trochee: is it allowable? Is it even needed? Hayes (1995) argues that the uneven trochee is not needed, as the moraic trochee can account for stress placement in all analyses previously thought to require the uneven trochee analysis. Likewise, stress placement in Ancient Egyptian can be accounted for in a moraic trochee system. However, stressed light syllables undergo vowel lengthening in this language, a feature that should be incompatible with a moraic trochee. I will show that in Optimality Theory the uneven trochee may arise from constraint interaction in a moraic trochee system.

1. Introduction

The objective of this paper is to examine stress assignment in Ancient Egyptian, and to account for the apparent vowel lengthening in stressed, open syllables. The first part of this account will be to examine whether the vowel-length is underlying or derived by stress placement. Then, I will attempt to account for stress assignment in Ancient Egyptian, and compare a generative account in a Hayesian framework to an Optimality Theoretic account. I will particularly focus on the status of the uneven trochee in these analyses and the status of vowel lengthening in this language.

1.1. Background

Ancient Egyptian was an Afroasiatic language closely related to the languages in the Semitic branch of this family. Of all the Afroasiatic languages, the language family comprising Egyptian and its descendants is the one of the most closely related to the Semitic languages. Egyptian shares many of the characteristics of languages in its sister branch, including "emphatic" consonants, and a vowel inventory of only [i], [a] and [u]. However, like many languages of this early period, the language was written with a consonantal alphabet, with the vowels left untranscribed. The vowels of Ancient Egyptian had been reconstructed from later descendants that did transcribe the vowels, as well as from contemporary borrowings into neighboring languages. Through the course of history, however, unstressed short vowels fell together into schwa, so some of these vowels that did not undergo alternations remain unreconstructable. In my data, they have been indicated by simply [V]. The period which this reconstruction represents is roughly equivalent to the period or the Middle Kingdom or earlier, between 3000 BCE and 1300 BCE. Egyptologists have concentrated mainly on establishing the end of this period, so exactly how far back this stress analysis may apply is open to further study. Sources on Ancient Egyptian are largely philological, and very little synchronic linguistic work has been done on the data. While these sources comment that Egyptian stress may fall on either the ultima or the penult, they little further discussion of its regularity or lack of it. They do note, however, that Egyptian once took stress as far back as the antepenult, but with a historical loss of some final vowels, stress was reanalyzed and reassigned. This synchronic reanalysis is what I will try to address here.

1.2. Vowel Length

Vowel length in Ancient Egyptian is believed to be derived. This was first described in Edgerton (1947). In Ancient Egyptian words of two syllables or more ,all vowels are short, except for all stressed vowels in open syllables. As the data in (1) below shows, short vowels will alternate with long vowels under stress only in open syllables. Even when these same vowels are stressed in closed syllables, the vowels remain short.

(1) Vowel Length and Stress (Loprieno 1995)

a. 'wap.wut 'occupation'

b. wap.'wu:.tij 'messenger'

c. wap.'wut.jVw 'messengers'

d. 'sat.paw 'is chosen'

e. sVt.'pa:.ku 'I chose'

Given that vowel length is predictable in Ancient Egyptian, I will compare analyses of stress placement in both a Hayesian framework and in an Optimality Theoretic account. The two accounts make different predictions about the nature of vowel length in Egyptian. The account of stress placement based on Hayes' (1995) stress theory will predict that there are two different kinds of vowel lengthening in Egyptian: one is moraic and predicted to correct minimality violations, the other purely a phonetic manifestation of stress. The Optimality account will predict only one type of lengthening: a moraic lengthening, but the foot structure predicted for many words will be that of an uneven trochee, which is disallowed in a Hayesian system.

2. Stress Placement

Most words in Ancient Egyptian are stressed on the penultimate syllable. This data is given in (2) below. For these words, it is impossible to tell what kind of foot structure we should expect. In a Hayesian account, we might have a straightforward syllabic trochee, an iambic system with final syllable extrametricality, or if we ignore the vowel-length for the moment, a moraic trochee with final consonant extrametricality. All of these accounts will predict the correct stress placement in these cases of penultimate stress. Of all of these, the iambic account seems the most promising from this data since iambic lengthening is a common occurrence, particularly in languages with no weight distinction.

(2) Penultimate Stress

a. 'ra:.mac / ramac / 'man'

b. 'ha:.tip / hatip / 'pleasing'

c. 'sat.paw / satpaw / 'is chosen'

d. 'jam.nat / jamnat / 'the right side'

e. sVt.'pa:.ku / sVtpaku / 'I chose'

f. Xu.'pir.waw / Xupirwaw / 'transformations'

g. pi.'si:.JVw / pisiJVw / 'nine'

Another class of words, however, takes final stress in Egyptian. The data for these is given below in (3). For the case of monosyllabic words shown in (3a) and (3b), these words undergo vowel lengthening, even though they are in heavy syllables. The syllabic trochee can predict the stress placement if the word has to be stressed, but it cannot account for the vowel length. The iambic account likewise would predict stress, but it, too, would not necessarily predict vowel length. Recall, an iambic system with final syllable extrametricality was predicted above. The final syllable must be stressed in order to have stress at all, but since the final syllable is heavy underlyingly, it should not need to have a long vowel, unless we have two kinds of extrametricality: final syllable and final consonant. Since a light syllable cannot make a well-formed iamb, the vowel should be lengthened only if the final consonant is extrametrical. An iambic account then requires two kinds of extrametricality. However, the moraic trochee account has fewer problems with this type of vowel length. A moraic trochee account already required an extrametrical final consonant to assign stress in the penultimate stress cases. Here, a final extrametrical consonant would leave only a single mora to be footed. As with the iambic case, a single light syllable does not make a well-formed foot, and Hayes' stress theory allows for the final consonant either to be metrified, or for the vowel to be lengthened even though it is already in a closed syllable. While the iambic account is not impossible, it would seem that the moraic trochee account is simpler than the iambic account, but what about other words that received final stress?

(3) Final Stress

a. 'ma:n / man / 'to stay'

b. 'J a:d /J ad / 'to say'

c. ma.'duww /maduww/ 'words' (other plurals may behave similarly)

d. ta.'pij /tapij/ 'first'

e. wa.'baX / wabaX / 'to become white'

f. pu.'rut /purut/ 'seed'

g. jaf.'daw /jafdaw/ 'four'

h. H ac.'cat /H accat / 'armpit'

i. ja'nan /janan/ 'we'

Examine the word in (3c). This type of word, with a final super-heavy syllable, is common to plurals in Ancient Egyptian. This word cannot be accounted for by a syllabic trochee at all, as we would expect stress on the penultimate syllable regardless of the length of the final syllable. As with the monosyllables, the iambic analysis encounters problems by not making the final syllable extrametrical. Hayes would avoid this problem by saying that the final [w] in this word is extrasyllabic, and hence blocks final syllable extrametricality. The moraic trochee account, however, is still consistent in requiring final consonant extrametricality, and stress falls where expected. Rather than being exceptional, final stress is predicted in this case.

The remainder of the words given in (3) are cases of exceptional final stress. The number of words in this class is relatively small. However, if we compare the iambic and the moraic trochee analyses for stress placement, we find that the moraic trochee is exceptional for these words only in allowing the final consonant to be metrified. The iambic account, however, not only requires stressing of a normally extrametrical syllable, but also requires a violation of the extrametrical consonant, which we saw was necessary to account for monosyllabic vowel lengthening. Because a moraic trochee analysis can account for all regular cases of penultimate stress placement, vowel length in monosyllables, and final stress in plurals, as well as producing the least exceptional behaviour in other cases of final stress, the moraic trochee account seems to be the best analysis for stress placement in Ancient Egyptian. However, recall from (2) above that there is still the issue of vowel length in stressed open syllables. This is completely unexpected in a moraic trochee system. Rather, it speaks of a possible analysis as an uneven trochee.

2.1. Hayes & the Uneven Trochee

Hayes (1995) specifically rejects the use of an uneven trochee to account for stress placement. He claims that all accounts of languages that require uneven trochees can be analyzed in terms of a moraic trochee, as I have done above. However, while Hayes acknowledges that some syllabic trochee languages may have vowel length as a feature of their stress system, this lengthening does not rise, in his view, to the level of moraicity, but rather is merely a phonetic manifestation. Ancient Egyptian seems to be a counterexample to his claim. As he predicts, a moraic trochee system can account for stress placement in Egyptian. It cannot, however, explain the vowel lengthening in CV syllables. Hayes' rejection of an uneven trochee analysis would force him into two possible stances: either a) the vowel length is really underlying, or b) the vowel length is merely phonetic. The first option is not likely, since vowel length is completely predictable based on stress placement and syllable shape. The second option is equally inelegant, as this account would then predict two different types of vowel lengthening in Ancient Egyptian: one that is moraic in monosyllables, but merely phonetic elsewhere. However, as the second is preferable to the first, in (4) is given the stress assignment analysis in a Hayesian framework, assuming to absence of an uneven trochee option.

(4) Hayesian stress analysis

x x x x

(mm) (mm) (mm) (mm)

'J a:<d> 'ra:.ma<c> Xu.'pir.wa<w> ma.'duw<w>

2.2. OT Analysis

A constraint-based analysis in Optimality Theory will shed some light on the foot structure needed to best analyze the Ancient Egyptian data. To begin, we will require the foot structure constraints for moraic trochees: Foot Binarity and Foot Form: Trochaic. These are given in (5) below. Also in (5), are the constraints for forming one foot at the right edge of the prosodic word: Align Right (Foot, Prosodic Word), or All Feet Right; and Parse Syllable which commands as many syllables to be parsed into feet as possible. Also needed is a constraint to make final consonants extrametrical. Edgerton (1947) argues that *all* Ancient Egyptian words ended in consonants, so I will simply propose Non-Final Mora to avoid parsing the final mora of a prosodic word into a foot. The final two constraints we will need to begin are Ident Vowel Length to preserve input short vowels, and Stress-to-Weight, as proposed in Fitzgerald (1997), which requires stressed syllables to be heavy.

(5) Constraints

FtBin: feet must be binary at the moraic level

FtForm: feet are trochaic

All-Feet-Rt: form one foot at the rightmost edge of the word

Parse-s: all syllables should be parsed into feet

Non-Final m: the final mora of the word should not be parsed into a foot

Id-V-Length: preserve underlying vowel length

Stress-to-Weight: stressed syllables should be heavy (Fitzgerald 1997)

Based on the data back in (2), we know that Non-Final ¼ must outrank All-Feet-Rt. We also know that Stress-to-Weight must outrank Id-V-Length. From the monosyllabic words, we know that FtBin must outrank Id-V-Length as well, but that Stress-to-Weight appears to outrank FtBin. Also based on the monosyllabic data, we know that Non-Final m must be very highly ranked since it is never violated in words with unexceptional stress. Because uncompounded Egyptian words are only two or three syllables in length, it is not necessary to crucially rank All-Ft-Right above Parse-s, since the addition of a second foot will cause more violations of All-Ft-Right than can be saved by parsing more syllables. In (6) I give my initial constraint ranking.

(6) Initial Constraint Ranking

Non-Final m, Stress-to-Weight >> All-Ft-Rt, Parse-s >> FtBin >> FtForm, Id-V-Length

2.2.1. Penultimate Stress

The tableau in (7) shows how these constraints interact to produce vowel length in stressed open syllables and final consonant extrametricality. The candidates in (d) and (e) are eliminated because they foot the final consonant. The candidate in (a) is eliminated because it violates Stress-to-Weight. Of the remaining four candidates, (b) is eliminated because its rightmost foot is two mora away from the right edge of the prosodic word, while (f) is eliminated for not parsing one syllable in addition to being one mora from the rightmost edge. Candidate (g) is eliminated because it has both a violation of Id-V-Length and of FtForm. This tableau assumes that weight is not phonetic. Notice that the foot shape of the winning candidate in (c), determined by these constraints, is an uneven trochee.

(7) Tableau

/ramac/	Non-	Stress-	All-Ft-	Parse-	FtBin	FtForm	Id-V-

	Final m	to- Weight	Rt	s			Length
a. (rá.ma)c		*!	*				*
b. (rá:.)mac			**!	*			
+ c. (rá:.ma)c			*		*		*
d. ra.(mác)	*!			*			*
e. (rá.mac)	*!				*		
f. ra.(má:)c			*	*!			*
g. (ra.má:)c			*		*	*	*!

In the tableau in (8), the constraints likewise predict stress on the penultimate syllable. As in tableau (7), when the final consonant is footed, a Non-Final ¼ violation eliminates the candidate. Stress-to-Weight cannot be invoked to eliminate candidates that preserve short vowels in the penultimate syllable because the syllable is already heavy. Candidates with stress any further left than penultimate are eliminated by All-Ft-Rt and Parse-s. The ranking of these two constraints is not crucial, and I have found no cases where a crucial ranking would change the outcome. Also eliminated is the candidate in (c) that is predicted from the Hayesian stress account. As with the case in the tableau in (7), an uneven trochee is predicted.

(8) Tableau

/Xupirwaw/	Non-Final m	Stress-to-Weight	All-Ft-Rt	Parse-s	FtBin	FtForm	Id-V-Length
+ a. Xu.('pir.wa)w			*	*	*		
b. Xu.pir.('waw)	*!			**			
c. Xu.(pír.)waw			**	*!*			
d. Xu.('pir.waw)	*!			*	*		
e. ('Xi.pir)waw		*!	**	*	*		

f. Xu.('pi:r.)waw			**	*!*	*		*
g. ('Xi:.)pir.waw			****!	**			*

The tableau in (9), however, reveals a small problem. In a Hayesian account we specified final consonant extrametricality, but under the Optimality Theoretic account described so far, I have posited a Non-Final *Mora* constraint, which in the tableau in (9) shows a vowel-final word should treat the entire final syllable as extra-metrical. We would like for the candidate in either (c) or (f) to win, as either of these give us the desired stress pattern and the required long vowel. Edgerton (1947) suggests a possible reason for this candidate to fail with these constraints. He argues that all Ancient Egyptian content words ended in consonants. If this is true, this particular example from Loprieno (1995) cannot exist, or would at least be extremely rare, and may be treated as an exception. I will return to the analysis of vowel-final words later.

(9) Tableau

/sVtpaku/	Non-Final m	Stress-to-Weight	All-Ft-Rt	Parse-s	FtBin	FtForm	Id-V-Length
a. sVt.(pá.ku)	*!	*		*			
L b. (sV't.pa.)ku			*	*	*!		
+ c. sVt.(pá:.)ku			*	**!			*
d. (sV't.)pa.ku			**	*!*			
e. sVt.pa.(kú:)	*!			**			*
+ f. sVt.(pá:.ku)	*!			*	*		*

2.2.2. Final Stress

In the tableau in (10), we have the case of the monosyllables. Recall from (3), that monosyllables preserve final consonant extrametricality, but have vowel lengthening even though the syllable is closed. Because Non-Final ¼ is ranked so high, footing the final consonant is not a possible repair strategy for obeying foot binarity. Both of the remaining candidates receive an All-Ft-Rt violation, but the long vowel obeys foot binarity. In this case, we see that the canonical moraic trochee emerges.

(10) Tableau

/man/	Non-Final m	Stress-to-Weight	All-Ft-Rt	Parse-s	FtBin	FtForm	Id-V-Length
a. (má)n			*		*!	*	
b. (mán)	*!						
+ c. (má:)n			*				*

The tableau in (11) is likewise a case of final stress. Three candidates are eliminated for violating the high-ranked constraints Non-Final m and Stress-to-Weight. Candidate (d) that stresses the initial syllable has three All-Ft-Rt violations because it is three morae form the right edge of the word. The winning candidate (b) has only one violation of All-Ft-Right.

(11) Tableau

/maduww/	Non-Final m	Stress-to-Weight	All-Ft-Rt	Parse-s	FtBin	FtForm	Id-V-Length
a. ma.(dúww)	*!			*	*		
+ b. ma.(dúw)w			*	*			
c. (má.du)ww		*!	**				
d. (má:.)duww			***!	*			*

e. ma.(dú:)ww			**	*!			*
f. (má.duw)w		*!	*		*		

For other cases of final stress, we see that these constraints will not suffice to explain the stress placement. The tableau in (12) shows that our current constraints predict stress like that as seen in (7), with an uneven trochee footing the word. Since this is not the stress placement given in the data, some other solution is required.

(12) Tableau

/janan/	Non-Final m	Stress-to-Weight	All-Ft-Rt	Parse-s	FtBin	FtForm	Id-V-Length
a. (já.na)n		*!	*				
L b. (já:.na)n			*		*		*
+ c. ja.(nán)	*!			*			
d. ja.(ná:)n			*	*!			*

These cases force us to appeal to some kind of lexical specification of stress to account for the remaining final stress cases, as it is not predictable from these constraints alone. However, simply lexically specifying stress, and adding a high-ranked constraint for underlying stress preservation as given in (13), will only trigger a violation of Id-V-Length. Rather, there must be a way to force the final consonant to remain inside the foot without violating Non-Final m. Reranking Non-Final m below Weight-to-Stress will account for stress placement in (14), and prevent vowel lengthening as needed, however this account predicts an iambic foot. This reranking of Non-Final ¼ does not preserve our previous analyses. This would be the evidence that FtForm is very low-ranked, if only this analysis works as well for the vowel-final cases.

(13) Stressed Vowel Constraint

Ident-Stressed-V: preserve location of lexically specified stress

(14) Tableau

/janán/	Id-Stress-V	Stress-to-Weight	Non-Finalm	All-Ft-Rt	Parse-s	FtBin	FtForm	Id-V-Length
a. (já.na)n	*!	*		*				
b. (já:.na)n	*!			*		*		*
c. ja.(nán)			*		*!			
d. ja.(ná:)n				*	*!			*
+ e. (ja.nán)			*			*	*	

Another mechanism of lexically specifying stress is discussed in Revithiadou's account of stress in Modern Greek. This lexical specification involves specifying either the placement of the weak part of the foot, or the strong part; i.e. a foot-tail or a foot-head. In the case of Egyptian stress, we need only to specify a single foot tail per prosodic word in order to force the final consonant into the foot. In addition to this lexical specification, we need a faithfulness constraint to preserve these foot tails that is undominated in Egyptian.

(15) Foot Tails

Foot-Tail: the weak edge of a foot

Max Ft-Tail: preserve in the output, the location and direction of an underlying foot tail (Revithiadou)

(16) Tableau

/janan)$_T$/	Max Ft-Tail	Non-Finalm	Stress-to-Weight	All-Ft-Rt	Parse-s	FtBin	FtForm	Id-V-Length
a. (já.na)n	*!		*	*				
b. (já:.na)n	*!			*		*		*
+ c. ja.(nán)		*			*			

d. ja.(ná:)n	*!		*	*			*
e. (ja.nán)	*!	*			*	*	

The tableau in (16) shows the result of this type of specification. All the candidates that do not foot the final consonant are eliminated in (a), (b) and (d). Candidate (e) is also eliminated by the undominated Max-Ft-Tail constraint because the word is parsed as an iamb, converting the foot-tail into a foot-head, which is also a violation of Max-Ft-Tail.

Another possible alternative is lexical catalexis, but I am uncertain what this account would predict about vowel-length. The only other realistic alternative is to presume that these must pattern like the case in the tableau in (16). Edgerton (1947) discusses the vagaries of Ancient Egyptian spelling, particularly with respect to final consonants. Idiomatic spelling may be one way out of this problem, but it has not been discussed in the literature, and it is likely that not all cases of final stress can be explained away in this fashion.

Let's return to the question raised in the tableau in (9). As with my initial attempt to explain the cases of final stress, I give the results of the minimal reranking of Non-Final m in (17). Even this reranking does not permit us to predict stress on the correct syllable.

(17) Tableau

/sVtpaku/	Stress-to-Weight	Non-Final m	All-Ft-Rt	Parse-s	FtBin	FtForm	Id-V-Length
a. sVt.(pá.ku)	*!	*		*			
L b. (sV't.pa.)ku			*	*	*		
+ c. sVt.(pá:.)ku			*	**!			*
d. (sV't.)pa.ku			**	*!*			
e. sVt.pa.(kú:)		*		**!			*
f. sVt.(pá:.ku)		*		*	*		*!

The tableau in (18) shows the result of lexically specifying stress with a foot-tail as we used for cases of final stress. This lexical specification, with our other constraints, predicts correctly not only the stress placement, but also the required vowel length. Replacing the Non-Final ¼ constraint with a constraint that does not allow final consonants to be moraic would eliminate this need for lexical specification of vowel-final words. However, as Edgerton (1947) insists that vowel-final words are nearly unheard of in Ancient Egyptian, I do not consider this to be a major flaw in my analysis since the lexical specification is required in any case.

(18) Tableau

10. /sVtpaku)$_T$/	Max Ft-Tail	Stress-to-Weight	Non-Final m	All-Ft-Rt	Parse-s	FtBin	FtForm	ID-V-Length
a. sVt.(pá.ku)		*	*!		*			
b. (sV't.pa.)ku	*!			*	*	*		
c. sVt.(pá:.)ku	*!			*	**			*
d. (sV't.)pa.ku	*!			**	**			
e. sVt.pa.(kú:)			*		**!			*
+ f. sVt.(pá:.ku)			*		*	*		*

In this analysis, words with final stress and words ending in vowels go together because they both have lexically specified foot-tails. The final constraint ranking is given in (19).

(19) Final Constraint Ranking

Max Ft-Tail >> Non-Final m, Stress-to-Weight >> All-Ft-Rt, Parse-s >> FtBin >> FtForm, Id-V-Length

3. Discussion & Conclusion

I have shown that because vowel length in Ancient Egyptian is predictable, we cannot predict stress assignment on this basis. I have discussed an analysis of the Egyptian data in a Hayesian framework and to an Optimality Theoretic framework. These two analyses predict different accounts for the nature of stress in cases of stressed vowel lengthening. The Hayesian analysis requires that vowel length in monosyllables be moraic and based on minimality requirements, but the vowel length in polysyllables is not moraic and merely a phonetic manifestation of stress. The Optimality analysis permits the vowel length to be identically moraic in both cases of lengthening, proving to be the more elegant of the two accounts, but at the cost of having uneven trochees.

More than simply an analysis of stress in Ancient Egyptian, this paper gives the uneven trochee a status in linguistic theory. Like Hayes' analysis of stress in a generative framework, the uneven trochee has no official status in my Optimality Theoretic account. Unlike Hayes' theory, however, the Optimality Theoretic account allows the uneven trochee to arise as a result of constraint interaction. My analysis also shows how lexical specification of stress can account for exceptions to the expected stress placement. What does this do to the functional basis of uneven trochees in the Iambic-Trochaic Law? Re-examining the literature and other examples of uneven trochees in and Optimality Theoretic framework would possibly be interesting, but beyond the scope of this paper.

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