Chapter Three

The Stress System of Casablanca Moroccan Arabic

1. INTRODUCTION

One of the least studied linguistic phenomena in MA phonology is stress. Except for the impressionistic study of Abdelmassih (1973), it was not until the beginning of the 80's that Moroccan scholars started studying stress, especially in the work of Benkirane (1982). This work was subsequently followed by other works such as Benkaddour (1982), Hammoumi (1988), Benhallam (1990b), El Hadri (1993), Fares (1993), and Nejmi (1993, 1995). The objective of this chapter is to enrich the research on MA stress both from an empirical side by doing instrumental work and also from the theoretical side by applying the OT principles to account for stress assignment.

Any analysis of MA stress has to distinguish between the epenthetic schwa [ə] and the underlying full vowels /i, u, a/. Such a distinction is very important in the sense that it helps characterize syllable weight which is a decisive factor in a number of stress systems. Works such as Benkirane (1982), Bennis (1992), Al Ghadi (1994) and Boudlal (to appear a) maintain that, in MA, a light syllable of the type CV (where V is a full vowel) is equivalent to CəC, which should also be considered as light. If this is so, it follows that the weight distinction needed to account for MA stress is one between the heavy CVC syllable and the light CV and CəC syllables. Further support to this claim will be given in this chapter.

In the present chapter we will show that the location of stress depends on whether or not the items considered occur in isolation or in context. The stress patterns obtained from words in isolation show that CMA is a quantity sensitive system which favors trochaic feet. we will also show that the fact that stress falls on one of the last two syllables of a word follows from the constraint requiring the alignment of the right edge of the foot containing the stressed syllable with the right edge of the prosodic word. When the word occurs in context, stress falls consistently on the final syllable, a fact that calls for an iambic type of analysis.

The chapter is organized as follows. In section 2, we present a review of the literature on MA stress. In section 3, we lay down an empirical basis of stress in CMA. The objective of this section is to quantify the native speakers' intuition about the location of stress in CMA. In section 4, we undertake an instrumental test to see whether the results obtained here match up with those obtained from the quantitative test. Finally, in section 5, we offer an OT based analysis.

2. REVIEW OF THE LITERATURE ON MOROCCAN ARABIC STRESS

The last two decades have witnessed a growing body of research on MA stress. A common feature of the literature written on MA is that stress is phonetic and therefore does not interact with word-formation rules.

The body of work on MA stress falls into one of the two categories given below:

(i) Impressionistic [1]: Abdelmassih (1973), Benkaddour (1982), Fares (1993), El Hadri (1993), and Benhallam (1990b). The works of the last three scholars include a quantitative analysis of stress.

(ii) Instrumental: Benkirane (1982), Hammoumi (1988), and Nejmi (1993, 1995).

Abdelmassih (1973) and Benkaddour (1982) try to analyze MA stress on the basis of corpuses that need reconsideration. The former did not include schwas where they should actually be; the latter assumes that MA has long vowels, something which is not true about the language. (For a detailed critical review of Abdelmassih and Benkaddour, the reader is referred to Benhallam, 1990b).

Fares (1993) analyzes stress in nouns and adjectives in Tetuan MA (TMA) which is one of the varieties spoken in the north of Morocco. This variety is characterized by the occurrence of full vowels in places where other varieties of MA have schwas. This means that any conclusion obtained from this study cannot be generalized to varieties such as the one described in the present work.

The subjects, all of whom have a linguistic background, were given a list of more than 400 adjectives and nouns and were asked to locate stress in these words. The results obtained

[1] The appellation is due to Benhallam (1990) who classifies studies on MA stress into two categories: impressionistic and experimental (i.e. instrumental).

show that more than 75 % of the total number of items receive stress on the penultimate syllable. Fares' main findings can be summarized as follows:

(i) Stress assignment is postlexical, that is it applies after all morphological and phonological rules have applied.

(ii) Stress in TMA nouns is not different from stress in adjectives, that is both categories have identical stress patterns.

(iii) Stress is not affected by syllable weight (Cf. [msámaħ] 'forgiven' and [γúlal] 'snails' where the penultimate light syllable is stressed in spite of the fact that the final syllable is heavy).

To account for stress placement in TMA, Fares (1993: 282) proposes the following stress assignment rules:

-1-

Stress the penultimate syllable, except:

a. If the nucleus of the penultimate syllable is a schwa and the item contains more than three syllables, stress the antepenultimate syllable; otherwise stress the penult (e.g. [xnáfərna] 'our nostrils' and [swáyəʕkum] 'your (pl.) watches')

b. If the penultimate syllable is a prefix, stress the final syllable (e.g. [məsrúq] 'stolen' and [məbní] 'built')

Within the theoretical framework she adopted (Metrical Stress Theory), Fares (1993) has shown that stress is represented in terms of left-headed binary branching trees which are constructed from right to left. In order to account for cases with antepenultimate stress, which she considers as exceptional, she assumes ternary branching feet which are assigned by a rule that applies before the binary foot assignment rule. As to items with final stress, Fares has argued that these items are assigned binary branching feet which dominate the final syllable in the head position and a zero syllable node in the weak position.

In the same variety of MA, El Hadri (1993) analyzes stress in verbs within Metrical Theory. Two procedures were followed in the analysis of this phonological phenomenon. First, the subjects, who were all linguistics students at the English department, were given a list of more than 387 verbs and were asked to locate stress in these words. Second, the author proceeded by recording native speakers with no linguistic background. He then listened to these recordings and assigned stress on the basis of his intuition about the repetitions made by the subjects.

Out of a total number of 387 subjects, El Hadri (1993: 236) found out that 208 stress the penultimate syllable (about 54%), 126 stress the final syllable (about 33%), 31 stress the antepenultimate syllable (about 8%) and finally for more than three-syllable words, 22 subjects stress the initial syllable(about 6%). The findings obtained from his experiment do not differ much from those of Fares (1993). He has also found out that stress assignment rules are insensitive to syllable weight; it is the position of the syllable which is the determining factor. Further he has shown that these rules are not sensitive to vowel quality, that is both schwas and full vowels can be stressed. The only exception relates to the schwa and the morphological affiliation of the category within which it occurs. If the schwa is part of the stem, it gets stress as in the case of words such as [nkə́tbu] "we write" and [TaRʒəmli] "translate for me"; if it is part of an affix, it does not get stress as in words such as [nəbRá] "we recover" and [maTarʒmálək∫i] "he did not translate it (fem.) for you".

El Hadri (1993) further assumes that stress may be sensitive to the syntactic information of verbs, namely tense and aspect. Thus trisyllabic verbs in the perfective and imperfective aspect are generally stressed on the penultimate syllable as in [kətbúlum] 'they wrote to them' and [ʒawəbni] 'he answered me' while verbs in the imperative receive initial stress (cf. [kə́tbulum] and [ʒáwəbni]).

Benhallam (1990b) tries to quantify data on the intuitions of the native speaker of MA about the location of stress. His corpus was chosen in such a way that both full vowels [i, u, a] and the schwa [ə] would be tested in all possible environments. The items selected were disyllabic, trisyllabic and quadrisyllabic. His subjects, who were all linguistics students, were given a list of items and were asked to mark stress on the appropriate spot, relying on their intuition and on their prior knowledge of English word stress.

Benhallam's (1990b) findings are reproduced in 2 below:

-2-

Stress the penultimate except,

A. if the word starts by a sequence of CV syllables, stress the one in initial position: krínahum "we rented them."

B. In disyllabics

a. in a structure such as CəCCəC, stress falls on the stem vowel: nəxdə́m "I work."

b. in a structure CəCCVC, stress falls on the final syllable, that is the syllable which contains a full vowel: Trəztíh "you embroidered it (masc.)

C. If the penultimate syllable is an object clitic, stress the preceding syllable: kərkbíhalhum "roll (2 fem.sg.) it for them."

The advantage of Benhallam's experiment is that it is one of the fewest empirical studies of MA stress that tries to quantify the results. The generalizations obtained from this study seem to partially reflect the stress system of the language and therefore the tendency made in previous works, namely that stress falls on the penultimate syllable.

The common point among the works of Benhallam (1990b), El Hadri (1993) and Fares (1993) is that they all try to capture generalizations about stress by relying only on intuitions of native speakers. However, in order for these generalizations to hold for MA, they need to be corroborated by an instrumental study that should refute or confirm the intuition of the MA speaker about the placement of stress. Also, an instrumental analysis would have to examine the effect of clitics on word stress, that is whether or not they are counted in the assignment of stress.

The first instrumental work undertaken on MA stress is that of Benkirane (1982). The author submitted a corpus which consists of monosyllabic, disyllabic and trisyllabic words to 34 subjects who were asked in an auditory test to identify the stressed syllable. The patterns he considered are given in 2 below:

-3-

a. Monosyllabics

CVC	bál	he urinated

b. Disyllabics

CVCV	bála	cunning (sg.)
CV-CVC	mazál	it (masc.)/he is still …

CVCVC	bánan	bananas
CV-CVC-V	mazála	it (fem.)/he is still …
CCVCVC	lħánut	store

c. Trisyllabics

CVCVCV	taráza	turban
CV-CVC-VC	mazálin	they are still …
CCVCVCV	zzitúna	olive
CVCVCVC	tarázat	turbans
CCVCVCVC	lbaláwat	cunning (pl.)

The results of the auditory test were confirmed by the instrumental one where 351 realizations were subjected to a study of fundamental frequency, intensity and duration. The conclusion Benkirane draws from both tests is that stress in MA falls on the ultimate syllable if it is heavy; otherwise it is on the penultimate syllable. The rule responsible for stress is formulated by Benkirane (1982: 78) as follows:

-4-

V ---------> [+accent] / — C (V) # #

In spite of the instrumental nature of Benkirane (1982), the work is questionable from the empirical point of view. First, the rule in 4 does not reflect the stress patterns in 3. For example, the word [banan] receives penultimate stress instead of final stress as Benkirane's rule predicts. Second, the patterns considered do not reflect all the syllable types of the language. For example, schwa syllables were neglected in the analysis in spite of the fact that they are also taken into account in the placement of stress. Third, not all syllable types are considered in different environments. That is, the patterns in 3 do not measure the effect of syllable weight on stress placement, an element which has been proved to be essential to the understanding of stress in MA (Benkaddour 1982, Bohas et al 1989, Bouziri 1991, and Nejmi 1993, 1995) and other languages (Hyman 1985, Prince and Smolensky 1993, McCarthy and Prince 1993a, Hung 1995, Hayes 1995, Pater 1995, Alber 1997, Green 1997, among others). Third, the patterns given above seem to point to the fact that stress in MA takes into consideration morphological boundaries, something which has been found not to be true in later experimental works (Hammoumi 1988 and Nejmi 1993, 1995).

The second instrumental work on MA is that of Hammoumi (1988). Hammoumi's analysis is based on a corpus which contains 61 words ranging from two-syllable to five-syllable cliticized words in verbs and from two-syllable to seven-syllable cliticized words in nouns. The subjects were asked to identify the most prominent syllable and the results of the auditory test were subjected to an instrumental test which confirmed that fundamental frequency and duration are the most important parameters in stress.

The conclusion one can draw from Hammoumi's analysis is that stress falls on one of the last two syllables of the word, a result confirmed by Nejmi (1993, 1995) and the work undertaken in this chapter. Furthermore, the analysis implicitly shows that one has to distinguish between two types of heavy syllables: CəC and CVC, and one type of superheavy syllable CV:C [2]. The stress rules themselves scan the last syllable of word to assign stress first to a final superheavy syllable as in [ʕəgzá:n] "lazy", then to a CVC as in [babkúm] "your (pl.) door", and finally to a CəC heavy syllable as in [Sa:ħə́b] "friend" and [bəddə́l] "he changed". If the last syllable is neither superheavy nor heavy, stress falls on the penultimate syllable as in [DRə́bti] "you (sing.) hit" and [qbí:la] "a tribe".

Hammoumi's analysis could be questioned for two reasons. First, unlike most of the work done on Moroccan Arabic, he assumes that the language has long vowels that shorten in specific environments without presenting evidence for that. Such an assumption about vowel length has serious implications on the analysis since work on stress in natural languages has shown that heavy syllables attract stress and that light syllables receive stress only in the absence of heavy ones. Second, his analysis implicitly equates CVC with CəC, a fact which is not true about MA (see Benkirane 1982, Al Ghadi 1990, 1994, Nejmi 1993 and Boudlal to appear a).

Perhaps the most elaborate instrumental work on MA stress (and more particularly on CMA stress) is that of Nejmi (1993), which analyzes stress in the variety spoken in Casablanca. It is so in the sense that the corpus studied is varied and takes into consideration the schwa and full vowels as well as the different syllables in different environments. The strategy followed was to undertake an auditory test where the subjects were asked to locate the most prominent syllable in a corpus which consists of 104 disyllabic and trisyllabic verbs and nouns. About 20 subjects with a linguistic background, aged between 24 and 30, were selected for this test and asked to provide three repetitions for the target words. Prior to that

[2] In fact Hammoumi (1988) did not distinguish between light/heavy and superheavy but the analysis he presented implicitly makes this distinction. A super heavy syllable is represented here as CV:C where V: stands for a long vowel.

task, the subjects were explained the task they had to do. The results of this test were quantified much in Benhallam's (1990b) sense, and then subjected to a statistical analysis of the mean, the standard deviation and the probability to see their significance for any generalization to be made. The conclusion drawn is that stress is affected by syllable weight, i.e. whether the syllable is light or heavy; and by syllable position, i.e final or penultimate.

The perceptive test was followed by the acoustic test to see to what extent they match up. The recordings of three subjects underwent the instrumental analysis where the prosodic parameters of fundamental frequency, duration and intensity were considered. The analyzed syllabic patterns are: CVCCVC, CVCVC, CVCCV, CVCəC, CəCCV, CVCVCV and finally CVCCVCV.

The results obtained from the instrumental test confirm the perceptive test. The conclusion Nejmi (1993) draws is that the placement of stress in CMA depends on three factors: first, syllable weight, i.e. light versus heavy. Second, the nature of the heavy syllable. In this respect, Nejmi (1993) distinguishes between first degree CVC heavy syllables and second degree CəC heavy syllables [3]. Third, stress placement takes into consideration the position of the syllable, i.e. final or penultimate syllable. According to him, the domain of stress in CMA is restricted to the final two syllables and this in contradistinction with the other Arabic dialects where stress may be on the antepenultimate syllable (Farwaneh 1996). According to Nejmi, the generalization governing stress in CMA could be stated as follows:

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> Stress the final syllable if it is a first degree heavy syllable; otherwise stress the penultimate.

This statement accounts for final stress in words such as [fəkrún] "turtle" and [məktabát] "book stores" and penultimate stress in words such as [xúxa] "a peach", [wáʕdək] "he promised you".

The only criticism that could be leveled at Nejmi (1993) is that it did not consider polysyllabic words. Nor did it consider cliticized words to see whether or not clitics affect

[3] Nejmi (1993) uses the expressions "syllabe lourde du premier niveau" to refer to CVC heavy syllables, and "syllabe lourde du dexième niveau" to refer to CəC syllables, which he qualifies as second degree heavy syllables. (See chapter 2 and also the sections below for an argument against this distinction).

word stress. In the sections to follow in this chapter, we will try to overcome this handicap and consider a varied corpus that ranges from two- to five-syllable words both cliticized and non-cliticized.

3. ESTABLISHING AN EMPIRICAL BASIS FOR STRESS IN CASABLANCA MOROCCAN ARABIC

This section is intended to lay down the background for the analysis of stress presented within the OT framework in section 4 below. It is divided into two major subsections. In the first subsection, a quantitative test is undertaken and a corpus of 39 items is presented to a group of 60 subjects who were asked to place stress on the syllable they perceive as prominent. In the second subsection, the recordings of 5 selected subjects out of the 60 subjects who participated in the quantitative test, were subjected to a laboratory analysis to measure fundamental frequency, intensity and duration.

3.1 The Quantitative Test

The idea of establishing a quantitative analysis of stress is inspired from a similar work undertaken by Benhallam (1990b) whose objective is to quantify the intuitions of native speakers of MA about the placement of stress. The objective of the test undertaken here is to try to set the basis for an instrumental study and see whether or not such a study would match up the intuitions of the native speaker of CMA.

3.1.1 The Hypothesis

Following Benhallam (1990b), we will assume that the working hypothesis in the present work is that stress is placed on the penultimate syllable. Such a hypothesis is to a large extent confirmed by most of the works undertaken on MA stress. Thus our objective in the present research will be to consider why words with final or antepenultimate stress, if there are any, do not receive penultimate stress.

3.1.2 The Questionnaire

The questionnaire consists of two parts: general information about the subjects, and the test items [4]. In the first part, the subjects were asked to respond to the following:

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a. First name:

b. Last name:

c. Sex: ☐ male ☐ female

d. Date of birth:

e. Place of birth:

f. Occupation:

g. Have you taken any linguistics courses?

☐ Yes ☐ No

h. If yes, for how long?

i. Do you speak Berber?

☐. Yes ☐ No

The questionnaire was prepared in such a way that the subjects would first proceed by giving personal information about themselves and then about activities that relate to their field of interest, that is linguistics. While we think that students' names and their gender are not determinant in the activity undertaken, we strongly believe that information about the place of birth and whether or not the subject is a native speaker of Berber play a key role in the research undertaken. Given the fact that the variety of MA dealt with is the one spoken in Casablanca, it follows that choosing the subjects who were born in Casablanca would ensure a high degree of homogeneity. Also homogeneity would be preserved if the subjects speaking Berber were discarded.

The second part of the questionnaire is the list of test items which we give in the following subsection.

[4] I would like to thank Said Bennis for helping out in the designing of the questionnaire.

3.1.3 The Data

The test items were chosen in such a way as to include, whenever possible, only sonorant segments and this to neutralize differences that may be due to the nature of the consonants. It is assumed that a vowel preceding a voiced consonant has a longer duration than one preceding a voiceless consonant (Peterson and Lehiste 1960, Chen 1970, Mack 1982, Kluender et al. 1988, Laefur 1992, and de Lacy 1998, to cite a few). Also in choosing the test items, we tried to include all syllable types (that is CVC, CəC, and CV) in different environments to see whether stress is sensitive to syllable weight as claimed by Hammoumi (1988) and Nejmi (1993) or syllable position as shown by Nejmi (1993). Walker (1996) has shown that languages vary on the way they assign stress. Thus in some languages, stress is sensitive to syllable weight (e.g. Classical Arabic and Hindi); or, it is sensitive to the edge, whether it is the right edge or the left edge (e.g. Tinrin and Uzbek). Finally, in some other languages, stress is prominence-driven, that is to say sensitive to the nature of the vowel that constitutes the nucleus of the syllable (e.g. Koya and Kuuku-Yaʔu).

The test items considered in this work include both simple and affixed forms as well as cliticized forms. Considering this array of forms will allow us to see whether cliticization or affixation, in general, plays any major role in stress assignment. The list of test items includes disyllabic, trisyllabic and polysyllabic words and is listed the way it has been presented to the subjects:

-7-

a. Disyllabic words

law.yin	wilted (pl.)
kal.kum	he ate you (pl.)
məl.yun	a million
DRəb.hum	he hit them
wal.mək	it (mas.) suits you
naw.ya	intending (fem.)
bab.ha	her/its (fem.) door
li.mun	oranges
da.ruh	they did it (mas.)
li.kum	for/to you
məl.məl	he shook (sth.)
wəl.dək	your (sg.) son

ma.yəl	bent (mas.)
ʕu.dək	your (sg.) stick
Rəm.la	sand
Səm.na	we fasted
wa.lu	nothing
Da.ru	his house
li.na	for/to us

b. Trisyllabic words

law.yin.hum	they are twisting them
man.Da.Rin	clementine
wal.mu.kum	they fit you (pl.)
bəZ.Tam.kum	your (pl.) wallet
mər.məd.nak	we trailed you (in dust)
ru.bəl.kum	he disturbed you (pl.)
ʕəR.ga.nin	they are sweaty
mqul.bi.nək	they are deceiving you
wəl.dat.ni	she gave birth to me
min.ʒa.ra	sharpener
ban.ya.ha	she built it (fem.)
rub.lu.ni	they disturbed me
gən.Du.Ra	a Moroccan gown
yəD.Rəb.na	he hits us
məl.mlu.na	they shook us
li.mu.na	an orange
ʕi.ni.na	our eyes

c. Polysyllabic words

ban.ya.ha.lih	she is building it (fem.) for him
di.ri.ha.li.ha	do it (fem.) for her
gəl.bu.ha.li.kum	they reversed it (fem.) for/to you (pl.)

A remark that should be made here concerns the polysyllabic words above. It concerns the dative [-l-] which is always followed by the vowel [i] in CMA, whereas in other varieties of MA such as the one described in Benhallam (1990b), this [i] never appears. Thus [dirihaliha] in CMA is realized as [dirihalha] in other varieties. Also the object clitic [-h] found at the end of words such as [banyahalih] is replaced by [u] in other varieties (cf. [banyahalu]). The difference reflects the variation that exists among the varieties of MA. This justifies our choice of excluding non-native speakers of CMA from the list of the subjects who have completed the questionnaire.

3.1.4 The Subjects

The initial number of subjects was 60. 8 of them were researchers in linguistics [5] ; the rest were all linguistics students in the English department at the Faculté des Lettres, Ain chok, Casablanca[6]. These students had at least two years of linguistics studies. All the subjects were given the list of test items listed in the subsection above and were asked to mark stress on the syllable they judge to be most prominent. Prior to this, we made it clear to the students that the questionnaire was undertaken in the framework of a research project whose objective was to determine some phonological aspects of CMA without ever specifying these aspects. In order not to give the subjects two difficulties at a time, we chose to parse all the test items into syllables. The students were given a brief survey of stress in English, and then explained the task they had to do. They were asked to identify the stressed syllable in the items concerned by pronouncing the word several times and emphasizing at every syllable until they found the alternative pronunciation which best matched their intuition.

Before processing the data, the first task we had do was to select the subjects that meet the criteria advanced above. Out of the 60 subjects, only 35 were retained: 17 males and 18 females. The others were excluded on the ground that their results might threaten the validity of the test either because they were not native to Casablanca or because they had another mother tongue, namely one of the varieties of Berber.

3.1.5 Results And Analysis

Let us first give the numbers that will be used as a base to the interpretation of the results. The total number in 8a corresponds to the maximum possible number of answers which is obtained by multiplying the total number of subjects (35) and the total number of test items (39). The number in 8b corresponds to the total non-respondents (NR), that is the subjects, who for one reason or another, were unable to place stress on one of the syllables. Third, the

[5] Special thanks to Mohamed Sghir Syad, Rachid Hamdi, Samir Diouny, Brahim Taoukkoul, Mourad Mawhoub for accepting to respond to the questionnaire about CMA stress.

[6] Thanks to Professor Mohamed Es-Safi and all his 1998-99 Linguistics students for hosting me at the Faculté des Lettres, Ain Chok, Casablanca and also for accepting to respond to the questionnnaire.

number in 8c corresponds to the total number of responses obtained by substructing the total number of NR from the maximum possible number of answers.

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a Maximum possible number of answers: 35 x 39 = 1365

b. Total NR = 37

c. Total number of responses (a - b = c) = 1328

Since the working hypothesis in this work is that stress falls on the penultimate syllable, we judge it necessary to give the total number of times penultimate syllables in the test items above receive stress.

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a. Disyllabic words: 438

b. Trisyllabic words: 339

c. Polysyllabic words: 12

The total number of penultimate stresses is 789, a number which corresponds to more than half of the number of total responses. The percentage of responses totaled by penultimate stress is given in 10 below:

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$$\frac{789}{1328} = 59\ \%$$

In what follows is a listing of the number of stresses by position. The position includes antepenultimate, penultimate and ultimate stress in all words, whether they are disyllabic, trisyllabic or polysyllabic; and the first and second syllables in polysyllabic words that consist of 4 or 5 syllables:

-11-

	-Disyllabic words	-Trisyllabic words	-Four-syllable words	-Five-syllable words
-First syllable	-	-	-	5
-Second syllable	-	-	4	17
-Antepenultimate syllable	-	133	8	17
-Penultimate syllable	438	339	3	9
-Ultimate syllable	218	112	14	11

In 12 below, we give the number of items totaling the maximum number of stresses on penultimate syllable:

-12-

a. Disyllabic words: 14/19

b. Trisyllabic words: 13/17

c. Polysyllabic words: 0/3

In disyllabic words, 14 out of 19 receive penultimate stress, i.e. about 76%. In trisyllabic words 13 out of 17 receive penultimate stress, i.e. about 74%. Finally none of the three polysyllabic words considered receive final stress, a fact that shows that the more syllables a word has the more difficult it is for the subjects to locate stress.

3.1.5.1 Disyllabic Words

For the sake of clarity of presentation, the results of the questionnaire have been tabulated. The first column contains all the test items; the second contains the total number of no response. The other columns numbered from 1 to 5 correspond to the number of syllables in the word.

Recall from our assumption above that stress falls on the penultimate syllable, an assumption that follows from Benhallam (1990b). If this is so, an explanation of why some disyllabic items do not take penultimate stress is in order. But before we do that, consider the score of the subjects in disyllabic words:

ITEMS	NR	σ1	σ2
a. law.yin	1	15	19
b. kal.kum	0	21	14
c. məl.yun	1	5	29
d. DRəb.kum	0	27	8
e. wal.mək	0	27	8
f. naw.ya	1	28	6
g. bab.ha	0	26	9
h. li.mun	0	23	12
i. da.ruh	1	13	21
j. li.kum	1	16	18
k. məl.məl	1	23	11
l. wəl.dək	1	14	20
m. ma.yəl	1	23	11
n. ʕu.dək	0	26	9
o. Rəm.la	0	34	1
p. Səm.na	0	26	9
q. wa.lu	1	28	6
r. Da.Ru	0	31	4
s. li.na	0	32	3

The first remark that could be made about the results in the tableau above is that the subjects did not hesitate in stressing the penultimate syllable if the word consists of a succession of two open syllables of the type CVCV. Thus words such as [dáru], [wálu] and [lína] take penultimate stress. Such is also the case when the word consists of a succession of a closed syllable of the type CəC and an open syllable of the type CV (cf. [Rəmla] and [Səmna], for example), or a succession of a CV syllable and a CəC syllable (cf. [máyəl], [ʕúdək]). This points out to the fact that CV behaves like CəC, a fact that is phonetically justified (Benkirane 1982, Nejmi 1993). Words on the pattern CəCCəC show a variation between penultimate and ultimate stress. Here again, the instrumental test undertaken in Nejmi (1993) confirms this and shows that words on the pattern CəCCəC may receive peultimate stress or final stress ([mə́lməl]/ [məlmə́l]).

The words which do not conform to penultimate stress are [lawyín], [məlyún] and [darúh] in which stress falls on the final syllable. The final syllable of these words is closed, that is heavy, something that shows that syllable weight might be the reason why stress fails to apply to the penultimate syllable. Does that mean that stress in CMA prefers heavy syllables and that these syllables must be word final? The answer could only be positive at considering the three examples above. However, words such as [kálkum], [líkum] and [límun] seem to contradict this statement. Given that the final syllable in these words is heavy, one should expect it to bear stress. Take for example the words [kalkum] and [likum]. The final syllable in these words is the object clitic
[-kum]. As it has been shown in the literature on stress, clitics tend to show irregularity as far as the stress pattern of the language is concerned (see Benhallam 1990b). Assuming this to be correct and that words such as [kalkum] and [likum] receive penultimate stress because [kum] is a stress neutral clitic, we are left with the word [límun] which does not stress a final heavy syllable. The reason might be that the subjects might have misidentified it with the words that contain clitics in them such as [kalkum] or that are themselves clitics such as [likum]. It is only the instrumental test that will determine the exact location of stress in this word.

The generalization that we could come up with at considering the tableau in 13 and the discussion that follows is that stress falls on the ultimate syllable if it is heavy; otherwise on the penultimate. The exception to this generalization are the words [likum], [kalkum] and [limun] which fail to stress a final heavy syllable.

Now let us consider the results obtained from trisyllabic words to see if they go along the generalization stated about disyllabic words or whether they form a special pattern.

3.1.5.2 Trisyllabic Words

Trisyllabic words seem to confirm, to a large extent, the generalization made in the previous section, namely that stress falls on the penultimate syllable if the final is not heavy. Consider the results listed in the tableau below:

-14-

ITEMS	NR	σ1	σ2	σ3
a. law.yin.hum	2	0	22	11
b. man.Da.Rin	1	7	16	11
c. wal.mu.kum	1	9	17	8
d. bəZ.Tam.kum	0	0	30	5
e. mər.məd.nak	0	2	7	26
f. ru.bəl.kum	0	11	11	13
g. ʕəR.ga.nin	2	5	20	8
h. mqul.bi.nək	2	15	14	4
i. wəl.dat.ni	0	3	31	1
j. min.ʒa.ra	0	9	23	3
k. ban.ya.ha	0	11	20	4
l. rub.lu.ni	1	10	19	5
m. gən.Du.Ra	1	14	20	0
n. yəD.Rəb.na	0	7	24	4
o. məl.mlu.na	0	4	29	2
p. li.mu.na	0	8	24	3
q. ʕi.ni.na	1	18	12	4

Out of 17 items, 12 are stressed on the penultimate syllable by a maximum total of 28 subjects as shown by words such as [wəldátni] in 14i and a minimum total of 6 subjects as in the word [gənDúra] in 14m. The exceptional cases are given below where the letters correspond to the items given in 15:

-15-

b. maDáRin
f. rubəlkúm
g. ʕəgánin
h. mqúlbinək
q. ʕínina

It should be noted that 15h and 15q are the only items that show antepenultimate stress, where penultimate stress is expected. In 15h, it could be argued that the difference in the number of responses between penultimate and antepenultimate positions is not significant (1 response) and that the failure of subjects to score high in penultimate position may be attributed to the fact that the syllable is closed and contains a full vowel as opposed to the penultimate and ultimate syllables which are light. In 15q, there is no way whatsoever to show why stress falls on the antepenultimate syllable instead of the penultimate. Is it because of the existence of 3 light syllables in a row? If this is so, then we should expect stress to shift to antepenultimate syllable in words such as [limuna], [məlmluna] and [gənDura], which show regular penultimate stress (recall that CəC is equivalent to CV). Because it is the only counterexample, it should be discarded and the generalization be made on the basis of words with similar syllabic composition. The same thing could be said about [rubəlkúm] which is the only item where the clitic [-kum] is stressed. We are left with 15b and 15g which have penultimate stress instead of ultimate. These words should be added to [limun] which are the remaining cases that do not stress a final heavy syllable. These are left aside for the moment until the instrumental test is carried out to affirm whether or not they should abide by the general stress pattern of the language.

3.1.5.3 <u>Polysyllabic Words</u>

These include four- and five-syllable cliticized words. The scores obtained from the test are listed in the tableau in 16:

-16-

ITEMS	NR	σ1	σ2	σ3	σ4	σ5
a. ban.ya.ha.lih	6	4	8	3	14	–
b. di.ri.ha.li.ha	6	1	9	8	5	6
c. gəl.bu.ha.li.kum	5	4	8	9	4	5

These items are characterized by the highest number of no responses, a fact that explains why the subjects are hesitant about which syllable should be considered as most prominent. The item in 16a stresses a final heavy syllable and thus conforms to the general tendency. The remaining items are problematic because stress fails to fall on the penultimate syllable. One possible way of explaining this is to say that subjects conceive of these words as phonological phrases that consist of independent words, each of which should be stressed on its own [7]. Thus [banyahalih] consists of [banya] and the clitic [lih], [dirihaliha] consists of [diriha] and [liha] and finally [gəlbuhalikum] consists of [gəlbuha] and [likum]. If this decomposition is correct, the stems in 16a and 16b have stress on the appropriate location while the stem in 16c has stress on the object clitic [ha] instead of the preceding syllable. Here again this example might be neglected on the basis of the total number of responses obtained (9 to the actual stressed syllable as opposed 8 obtained for the syllable which ought to have been stressed).

To sum up, the tendencies that seem to account for stress in the 39 items chosen in this quantitative test could be stated as follows:

-17-

a. In disyllabic and trisyllabic words, stress falls on the penultimate syllable if the final syllable is not heavy or is not one of the object clitics [kum] and [hum].

b. In polysyllabic words, if the word contains independent clitics such as [likum], [lihum] or [liha], then stress the stem according to 17a.

Having quantified the intuition of the native speaker about the location of stress, let us now turn in the next section to see whether or not the instrumental test confirms the results obtained in the quantitative test.

3.2 The Instrumental Test

Prior to this test, we conducted an instrumental analysis whose purpose was to replicate the results of Nejmi (1993)[8]. The results obtained match up to a large extent those of Nejmi. However they cannot be used as a reference since they rely on a single subject (the

[7] Clitics in MA fall into two categories: independent clitics such as [liya] "to me", [lik] "to you" and [lih] "to him" versus dependent clitics such as [-li], [-lək] and [-lu] which occur mostly with verbs (see Harrell (1962) for further details about the distribution of clitics)

[8] I would like to thank Lisa Selkirk for helping me carry out this test and also for initiating me into the domain of instrumental phonetics at the University of Massachusetts laboratory. Thanks also go to John Kingston for helping me out with laboratory work.

author of this dissertation) and as such might threaten the external validity of the test as a whole.

The objective of the present test is to try and validate or invalidate the results obtained in the quantitative test and this by comparing the values for fundamental frequency (F0), intensity (IT) and duration (D) to find out which of these three parameters is the determining factor in stress.

3.2.1 The Corpus

The corpus consists of 28 items taken out of the data presented in section 3.1.3 above. It was organized in such a way to include disyllabic, trisyllabic and polysyllabic items of both simple and affixed forms. Such a distinction aims at considering the effect of affixation and/or clicticization on word stress.

The corpus subjected to the instrumental analysis is given in 7 above and repeated in 18 below:

-18-

A. Disyllabic words

a. CVC.CVC	lawyin
	kalkum
b. (C)CəC.CVC	məlyun
	DRəbhum
c. CVC.CəC	walmək
d. CVC.CV	babha
e. CV.CVC	limun
	daruh
f. CəC.CəC	məlməl
	wəldək
g. CV.CəC	mayəl
h. CəC.CV	Rəmla
i. CV.CV	walu
	lina

B. Trisyllabic words

a. CVC.CVC.CVC	lawyinhum
b. CVC.CV.CVC	manDaRin
c. CəC.CəC.CVC	mərmədnak

d. CəC.CV.CVC	ʕəRganin
e. CCVC.CV.CəC	mqulbinək
f. CəC.CVC.CV	wəldatni
g. CVC.CV.CV	banyaha
h. CəC.CV.CV	gənDuRa
i. CəC.CəC.CV	yəDRəbna
j. CəC.CCV.CV	məlmluna
k. CV.CV.CV	limuna

C. Polysyllabic words

a. CVC.CV.CV.CVC	banyahalih
b. CV.CV.CV.CV.CV	dirihaliha
c. CəC.CV.CV.CV.CVC	gəlbuhalikum

3.2.1 The Subjects

Four among the 35 subjects retained from the quantitative test, were chosen for this test: three males and one female. As it has already been stated in section 3.1.4 above, all the subjects were born in Casablanca and are still living there. The reason behind choosing Casablanca subjects is to ensure a maximum degree of homogeneity. The subjects were given the target words in 18 above and were asked to make three repetitions of the target words first in isolation, and then in a context: (gal [target word] ʒuʒ məRRat) “he said [...] two times/he said [...] twice”. The objective of following this procedure is to see whether or not stress placement varies according to whether the word is in isolation or in context.

3.2.2 Words in Isolation

The items considered in the test have been pitch-tracked using a program called Win-Pitch developed by Philip Martin in (1996). The values for F0, IT and D are given in the charts in Appendix C; the F0 pitch-tracks themselves along and IT curves as well as the sound waves are given in Appendix D.

The stress patterns of CMA obtained from test items in isolation are represented by the following items:

-19-

a. Final stress

lawyín
limún
məlyún
manDaRín
mərmədnák
banyahalíh

b. Penultimate stress

kálkum
bábha
mə́lməl
máyəl
Rə́mla
lawyínhum
mqulbínək
wəldátni
limúna
dirihalíha

The data above show that CMA makes recourse to syllable weight in the assignment of stress. In terms of syllable weight, it has been shown in chapter two that CMA distinguishes between bimoraic heavy syllables (CVC) and monomoraic light syllables, which fall into two types: one where the mora dominates one segment (CV); the other where the mora dominates the schwa and another consonant (CəC). The minor syllable is not included since it does not receive stress by virtue of its being dominated by a mora (see section 4 below) The examples also show that the domain of stress is restricted to one of the last two syllables of the word. Thus a word receives final stress if it ends up in a heavy syllable (e.g. 19a). If the final syllable is light, stress falls on the penultimate syllable, be it light or heavy (e.g. 19b).

The generalization governing stress in words in isolation could be stated as follows:

-20-

When the word occurs in isolation, stress falls on the final syllable of that word if it is heavy; otherwise, on the penultimate.

This statement is generalizable to all the items except those that end up in the object clitics [-kum] and [-hum] which have the shape CVC and yet do not receive stress in spite of their being in final position. As has already been pointed out in the quantitative test, two out of three items that end up in these clitics have their penultimate syllable stressed instead of the final. This shows that the clitics [-kum] and [-hum] could either be stress neutral and therefore lie outside the stress domain or behave as if they were light syllables. The first thesis cannot be defended since, as it will be seen in the next section, it can receive stress when the word occurs in context. We are left with the second, namely that the two clitics should be treated as light syllables. It should be noted here that in other varieties of MA, namely the ones spoken in the north of Morocco (Hammari 2000), the two clitics appear as [kəm] and [həm], i.e. light syllables.

The instrumental test undertaken on words in isolation confirms the native speakers' intuitions about stress and therefore the results obtained from the quantitative test. The doubtful cases, which were found not to correspond to the generalizations in 17, should now be fully integrated on the basis of this instrumental test.

Having shown the stress pattern of isolated words, let now now consider which of the three parameters of F0, IT and D is the determining factor in stress placement. Previous instrumental work on MA stress such as Hammoumi (1988) and Nejmi (1993) ascertain that it is always F0 in combination with either IT or D that determines stress.

In the present work, the analysis of stress offered is based essentially on the distribution of the F0 peaks in spite of the fact that some of the items analyzed in the instrumental test confirm to some extent the results of our predecessors concerning the determining factors of stress. A look at the charts in Appendix D shows that stressed syllables in some words are generally characterized by higher values for F0, IT and D compared with unstressed syllables. Such is the case in most of the words in isolation (see Appendix D for the results). The values of the word [Rəmla] (corresponding to #12 in Appendix D) for the three parameters are given in the chart in 21. The numbers from 1 to 4 correspond to the subjects. The first three are males; the last is a female. F0 is measured in terms of Hertz (Hz), IT is measured in terms of decibel (db) and D is measured in terms of millisecond (ms).

-21-

F0	Rəm	la	*IT*	Rəm	la	*D*	Rəm	la
S 1	144	113	*S 1*	34	32	*S 1*	232	198
S 2	144	85	*S 2*	33	28	*S 2*	190	144
S 3	174	123	*S 3*	27	21	*S 3*	196	154
S 4	265	179	*S 4*	27	21	*S 4*	220	144

The values for F0, IT and D, obtained from the four subjects, show that it is the first syllable in [Rəmla] which is stressed. The minimum difference between the stressed and unstressed syllables for the three parameters is significant: 31 in F0, 2 in IT and 34 in D (the numbers are obtained by substracting the values for the unstressed syllable from those of stressed syllables). The maximum difference between the two syllables, scored by S5, the female subject, is also significant: 77 in F0, 6 in IT and 76 in D.

Further support for the interaction of the three parameters in stress comes from words such as [kalkum]. The chart below gives the values for F0, IT and D:

-22-

F0	kal	kum	*IT*	kal	kum	*D*	kal	kum
S 1	128	93	*S 1*	37	26	*S 1*	304	187
S 2	141	121	*S 2*	33	27	*S 2*	213	236
S 3	167	117	*S 3*	28	24	*S 3*	262	255
S 4	240	242	*S 4*	31	29	*S 4*	289	278

The conclusion we can draw from these results about items in isolation is that the combination of F0 with IT and/or D is important in deciding about stress, an assumption which is hard to defend given the patterns obtained from stress of words in isolation to which we turn in the next section.

3.2.2 Words in Context

In order to determine whether or not stress varies according to context, we carried out an experiment parallel to that undertaken for words in isolation. The items analyzed in this experiment are the ones listed in 18 in the previous subsection. The subjects used for the recordings are also the same, except for S5 who figures in this experiment but not in the previous one [9]. The subjects were asked to go through the target words and read them within a predetermined context which is: [gal [target word] ʒuʒ məRRat] "he said [...] two times/he said [...] twice". The recordings have been submitted first to a process whereby the target words decomposed out of their context and then pitch-tracked, as we did for isolated words in the previous experiment. The values for F0, IT and D are given in Appendix E; the F0 pitch-tracks, the IT curves and the sound waves are given in Appendix F.

The results obtained from the experiment on words in context are different from those obtained from words in isolation in that stress consistently falls on the final syllable of the word as the representative items below show:

-23-

a. Final heavy
lawyín
məlyún
ʕəRganín
banyahalíh

b. Final light
babhá
mqulbinə́k
wəldatní
kalkúm
lawyinhúm

The set in 23a confirms the generalization made in 20, namely that a final heavy syllable receives stress. However, the items in 23b show that even if the final syllable is light, it is stressed instead of the penultimate syllable despite being heavy. Notice that the clitics [kum]

[9] In fact this subject was consistent in as far as stress is concerned. The patterns obtained from this subject are consistently stressed on the final syllable and this explains why her values were not included in the charts for words in isolation.

and [hum] are considered as light, a proposal that emanates from their behavior when the word occurs in isolation.

The stress generalization about words such as those in 23 could be stated as follows:

-24-

When the word occurs in context, stress falls on the final syllable.

Having determined the location of stress in words in context, let us now consider the interaction of the three parameters of F0, IT and D. For words in isolation, it has been found out that a stressed syllable, whether light or heavy, may combine all the three parameters. Such is also the case for a certain number of words in context which end up in a heavy syllable. Consider the values obtained from the word [məlyún] in the chart below:

-25-

F0	li	mun	***IT***	li	mun	***D***	li	mun
S 1	128	154	*S 1*	22	26	*S 1*	187	322
S 2	137	173	*S 2*	25	29	*S 2*	226	315
S 3	131	164	*S 3*	24	27	*S 3*	210	318
S 4	216	262	*S 4*	31	33	*S 4*	176	321
S 5	198	242	*S 5*	23	34	*S 5*	256	319

The stressed syllable in this word is characterized by higher values for F0, IT, and D. The minimum difference in value between stressed and unstressed syllable is 26 in F0 (scored by S1), 2 in IT (scored by S4) and 63 in D (scored by S5). The maximum difference is 46 in F0 (scored by S4), 11 in IT (scored by S5) and 145 in D (scored by S5). These numbers confirm our previous conclusion, namely that stress involves an interaction among all the three parameters.

This conclusion seems to be contradicted by other items where unstressed syllables get higher values for intensity than stressed ones. Consider the values for the item [lawyín] (corresponding to #1 in Appendix E) given in the chart below:

-26-

F0	law	yin	*IT*	law	yin	*D*	law	yin
S 1	120	164	*S 1*	28	24	*S 1*	247	283
S 2	131	176	*S 2*	35	27	*S 2*	317	347
S 3	122	170	*S 3*	30	28	*S 3*	225	312
S 4	201	268	*S 4*	27	25	*S 4*	256	320
S 5	204	260	*S 5*	36	32	*S 5*	286	340

For ll of the five subjects, the values of F0 and D for stressed syllables are higher than those for unstressed syllables. As to IT, it is higher in the unstressed syllables. The reason may be attributed to the quality of the vowel: [a], being open, is more sonorous than the closed vowel [i]. It seems that the distinction between vowel quality works only when the word is in context; when the word is stressed in isolation, vowel quality does not seem to play any major roles as the results in Appendix C show.

Other items in context show that some stressed syllables may get higher values for F0 but not for IT and D. In fact most of the items of words in context show that it is only F0 that is determinant in stress (e.g. [mqulbinək], [wəldatni], [banyaha] and [gənDura]). Compare the following values for IT and D of the stressed syllables in words such as [walmək]:

-27-

F0	wal	mək	*IT*	wal	mək	*D*	wal	mək
S 1	127	170	*S 1*	29	23	*S 1*	258	233
S 2	139	179	*S 2*	32	25	*S 2*	336	250
S 3	132	178	*S 3*	30	24	*S 3*	279	240
S 4	207	264	*S 4*	38	33	*S 4*	285	269
S 5	205	233	*S 5*	35	31	*S 5*	293	270

On the basis of cases such as [walmək], we conclude that it is F0 which is the determining factor in stress assignment. Even when we take into account the intrinsic effect of vowels (/a/ is lower and /i/ and /u/ are higher) there is a clear pattern that it is F0 (and not IT or D or a combination of the two with F0) which is consistently high in all the stressed syllable. In fact, D is much more variable in the data analyzed and as such there are real difficulties in interpreting the results because of the differing intrinsic durations of the consonants and vowels in the syllables being compared. Even in cases where the syllables being compared have the same constituents, we cannot build any real pattern if we have to do it on the basis of D. The word [məlməl] is a clear-cut case for discarding the parameter of D; the second syllable of the word gets a higher value for D whether it is stressed as is the case when the word is in context, or unstressed when the word is in isolation. (Compare # 9 in Appendix F and # 9 in Appendix D).

To sum up, the instrumental test we have carried out has allowed us to find out about the location of stress in CMA. Both words in isolation and words in context have been analyzed. The experiment on words in isolation has generally confirmed the major results obtained from the quantitative test, namely that stress is triggered by two factors: syllable weight and syllable position. It has been shown that a final heavy syllable gets stress. In the absence of a final heavy syllable, stress falls on the penultimate syllable. It has also been shown that the clitics [kum] and [hum] should be considered as light and are therefore not stressed in final position. The subsection has also considered the interaction of F0, IT and D as far as stress is concerned. We have come to the conclusion that it is the distribution of the F0 peak which is decisive in stress. The F0 patterns may not simply be a reflex of stress. In English, for example Pierrehumbert (1980) has shown that it is the main-stressed syllable of the word which is assigned a high pitch accent. Similarly, we think that the F0 peaks in CMA may well indicate the presence of a high pitch accent that associates with the main stressed syllable of the word. This conclusion is further corroborated by a systematic study of intonation in CMA undertaken in Mawhoub (1990).

The experiment on words in context has shown that stress falls consistently on the final syllable of a word regardless of whether or not it is heavy. As to the three parameters associated with stress, it has been shown that some stressed syllables may combine these three prameters or combine F0 with either IT or D; whereas others show only higher values for F0, a fact which has led us to conclude that F0 is the determining factor in stress in context words.

Having established an experimental basis for stress assignment in CMA, let us turn in the following section to see how the variation in stress could be accounted for within the OT framework.

4. WORDS IN ISOLATION AND WORDS IN CONTEXT: A UNIFIED ACCOUNT OF THE STRESS SYSTEM OF CASABLANCA MOROCCAN ARABIC

The results obtained from the instrumental test about words in isolation show that CMA is a quantity sensitive language with trochaic feet. Those obtained about words in context show that the stress pattern of the language is basically iambic. According to Prince and Smolensky (1993) and McCarthy and Prince (1993a), feet are subject to the constraint FT-BIN which demands that they be binary under syllabic analysis if the language in question is quantity-insensitive, or moraic if it is quantity-sensitive. The constraint, given in chapter two, is repeated in 29 below:

-28-

FT-BIN

Feet are binary under syllabic or moraic analysis.

The constraint in 28 is generally in conflict with the constraint PARSE-σ which demands that syllables be parsed into feet:

-29-
PARSE-σ

Syllables must belong to a foot.

The conflict between PARSE-σ and FTBIN arises only when the word concerned contains an odd number of syllables. In CMA this conflict is resolved by ranking FTBIN above PARSE-σ as shown by the foot structure of [limúna] in the tableau below (Feet are enclosed between parentheses):

-30-

	FTBIN	PARSE-σ
☞ a. li.(mu.na)		*
b. (li.)(mu.na)	*!	

The tableau shows that any form violating FTBIN is ruled out. In chapter two, section 3.3, we have presented evidence for the non-foot status of a light syllable of the type CV or CəC. Therein, and with the exception of the two words [ʒa] "he came" and [ma] "water" (which themselves show augmentation to achieve FTBIN, cf. [ʒay] and [lma], "the water" [myah]/[mihan] "waters") and other function words, it has been shown that no lexical word in CMA consists of CV or CəC. Thus the parse in 30b is ruled out exactly because the first syllable of the word, which happens to be light, cannot form a foot on its own.

The results obtained from the instrumental test confirm Nejmi's (1993, 1995) finding, namely that CMA stresses one of the last two syllables of a word. This means that the foot which contains the stressed syllable must be at the right edge of the prosodic word. It also shows that the directionality of footing is from right to left. Within the OT framework, directionality is captured by making recourse to McCarthy and Prince's (1993b) Generalized Alignment Theory. In particular, the constraint we will be using is the one requiring alignment of the right edge of every foot with the right edge of the prosodic word:

-31-

ALIGN-R (Ft, PWd)

The right edge of every foot must be aligned with the right edge of the prosodic word.

Violations of ALIGN-Ft-R are reckoned gradiently in terms of lower constituents, i.e. syllables. Thus a foot structure such as $[(\sigma\ \sigma)\ (\sigma\ \sigma)\ (\sigma\ \sigma)]_{PWd}$ incurs 6 violation marks of ALIGN-R (Ft, PWd). Only the rightmost foot obeys the constraint. In CMA, PARSE-σ should be allowed to dominate ALIGN-R (Ft, PWd) to derive the correct foot structure as shown in 33 by the parsing of the word [gulihaliha] which receives penultimate stress when it occurs in isolation:

-32-

	FTBIN	PARSE-σ	ALIGN-R (Ft, PWd)
☞ a. gu.(li.ha)(lí.ha)		*	**
b. gu.li.ha.(lí.ha)		**!*	
c. (gu)(li.ha)(lí.ha)	*!		******

The parse in 32b, although it observes ALIGN-Ft-R, is not optimal because three of the syllables are not parsed. 32c is also excluded because a monomoraic syllable is parsed into a foot, something that violates FTBIN.

The universal repertoire of feet includes two types: Trochaic feet and Iambic feet. These types are distinguished in terms of headedness. Iambic feet are right headed, that is the stressed syllable is located at the right periphery of the foot (Prince and Smolensky, 1993, McCarthy and Prince, 1993a, Hayes, 1995, among others). Trochaic feet are leftheaded and are further distinguished into moraic trochees which consist of heavy bimoraic syllable or a sequence of two light syllables where the one to the left bears stress, and syllabic trochees in which the foot counts only syllables regardless of their internal structure. According to Hayes (1995) the universal foot types are given in 33 below. Headedness is shown by the accent (′) after the designated element.

-33-

Foot Types

a. Iamb: L H′, LL′ or H′

b. Moraic Trochee: L′ L or H′

c. Syllabic Trochee: σ′ σ

The CMA patterns about isolated words show that feet must be trochaic and therefore the system is quantity sensitive since it is the heavy syllable of the word which receives stress. If there is no heavy syllable, it is the penultimate syllable of the foot which is stressed. This could be captured in terms of a constraint which demands that the foot be trochaic. The constraint, labeled TROCHEE, is stated as follows:

-34-
TROCHEE

Feet are left-headed.

In a disyllabic word such as [sala], where both syllables are light, initial stress is determined by the constraint TROCHEE as shown in the tableau below:

-35-

/sala/	TROCHEE
☞ a. (sá.la)	√
b. (sa.lá)	*!

The same word receives final stress when it is put in context. This shows that the foot must instead be iambic. The relevant constraint is given in 36 below:

-36-

IAMB

Feet are right-headed.

Thus a sequence of a light syllable and a heavy syllable will have to be footed as (LH′) and not as L(H′) where stress falls on the syllable on the right. In the same way, a sequence of two light syllables is footed as (LL′) but not (L′L) as the tableau below shows:

-37-

/sala/	IAMB
a. (sá.la)	*!
b. (sa.lá)	√

The constraint in 37, if satisfied will always stress the rightmost element in LL and LH, thus giving rise to iambic feet rather than trochaic ones. However, and as it has been pointed out, trochaic feet do exist in the language but arise only under certain conditions as will be shown as we proceed down in the analysis. This means that the results obtained from the instrumental test lend themselves to two possible analyses in terms of foot structure: one where the foot is trochaic (i.e. words in isolation); the other where the foot is iambic (i.e. words in context). The challenging question we will try to answer in this section is the following: how could the OT apparatus be made use of to analyze the conflictual stress patterns exhibited in isolated words and words in context? Put differently, is there a way out for a fixed ranking of constraints that would allow us to account for stress in both words in isolation and in context?

The questions raised here relate to the apparent problems a non-OT analysis faces given the stress patterns that the CMA data exhibit: an iambic pattern and a trochaic pattern. This apparent paradox is hard to account for given a parametrized theory which forces a language to choose between iambs and trochees. At this point, it should be made clear that OT differs from earlier treatments within parametrized theories in allowing for both iambs and trochees in the same language, in conditions where higher order constraints end up in determining whether one or the other will appear. McCarthy and Prince (1993a:150), for example, shows that the basic stress pattern of Axininca Campa, an Arawakan language of Peru, is both iambic and trochaic as the examples below show:

-38-

a. *Iambic feet*

(hinó)ki	arriba (por el río)
(iráa)(wanì)ti	su caoba
(apà)(niróí)ni	solo

b. *Trochaic feet*

(círi)	brea de àrbol
(máto)	polilla
(c^hími)	colpa

According to McCarthy and Prince (1993a) Trochaicity is derived from the fact that final syllables, except those containing diphthongs, are always unstressed as is the case with the disyllabic items in 38b. The authors, citing Prince and Smolensky (1992, 1993), show that the basic pattern of iambic stress with final stresslessness can be obtained from the interaction of FT-BIN with three other constraints which are FT-FORM (= IAMB), PARSE-σ and NON-FINALTY. (See McCarthy and Prince 1993a for a more detailed analysis of this seemingly paradoxical stress pattern of Axininca Campa).

In order to account for the stress system of CMA, we assume that the basic stress pattern of the language is iambic and that trochaic feet arise under certain conditions. That iambic feet are basic can be obtained by ranking IAMB above TROCHEE. The effect could be seen in the tableau below for the parses of the input [sala]:

-39-

	IAMB	TROCHEE
☞a. (sa.lá)		*
b. (sá.la)	*!	

However and as it has already been shown in the previous section, trochaic feet of the type in 39b do exist in CMA. In fact, the two parses in 39 should be allowed to be optimal. In order to allow for both parses to be optimal, we have to define the various levels of phrasing at which trochaic or iambic feet are obtained, a fact which calls for a theory of Prosodic Structure. Works which argue for prosodic structure as the basis for a theory of sentence phonology include Selkirk (1978, 1980, 1984, 1986, 1995a); Nespor and Vogel (1982, 1986); Beckman and Pierrehumbert (1986), etc ... According to Prosodic Structure Theory, sentences are organized into a structure whose categories are defined by Selkirk (1978) as follows:

-40-

The Prosodic Hierarchy

Utt	Utterance
IP	Intonational Phrase
PPh	Phonological Phrase
PWd	Prosodic Word
Ft	Foot
σ	Syllable

This hierarchy of prosodic categories forms the essence of the theory of phonological constraints on prosodic structure. Selkirk (1995:5) states the constraints on prosodic domination as follows:

-41-

(i) Layeredness: No C^i dominates C^j, j>i,
e.g. No σ dominates a Ft.

(ii) Headedness: Any C^i must dominate a C^{i-1} (except if $C^i = \sigma$),
e.g. A PWd must dominate a Ft.

(iii) Exhaustivity: No C^i immediately dominates a constituent C^j, j<i-1,
e.g. No PWd immediately dominates a σ.

(iv) Nonrecursivity: No C^i dominates C^j, j = i,
e.g. No Ft dominates a Ft.

It is the constraints on prosodic domination along with the prosodic hierarchy and their interaction with other constraints on the prosodic hierarchy that will allow us to derive both iambic and trochaic feet. In the CMA case, the parse in 39b is possible only when the word is in isolation; or to put it in Selkirk's (1978) terms when the word is at the end of a PPh. On the other hand, the parse in 39a is possible when the word is in context, i.e. when it is non-final in a PPh. Thus a word such as [lina] will have either one of the structures in 42 below:

-42-

a. In isolation: $_{PPh}${[salá]$_{PWd}$}$_{PPh}$

b. In context: $_{PPh}${[gal]$_{PWd}$ [salá]$_{PWd}$ [ʒuʒ]$_{PWd}$ [məRRat]$_{PWd}$}$_{PPh}$

In phrase final position, [lina] will be assigned a trochaic foot; in context, i.e. when the same word is not in phrase final position, it will be assigned an iambic foot. To keep stress off word-final syllables, Prince and Smolensky (1993:40) posit the constraint NON-FINALTY which they formulate as follows:

-43-

NON-FINALTY

The prosodic head of the word does not fall on the word-final syllable.

However, the problem with this version of the constraint NON-FINALTY is that it can derive only trochaic feet in words such as [lina] but never iambic ones, a fact which calls for reconsidering this constraint in such a way that it refers to main-stress at a level of phonological phrasing above the PWd.

The desired version of NON-FINALTY we propose is the one that refers to non-finalty in a PPh. This constraint could be expressed as follows:

-44-

NON-FINALTY (σ′, PPh)

The main-stressed syllable of a word is not in phrase final position.

The constraint NON-FINALTY (σ′, PPh) will have to dominate IAMB to be able to derive phonological phrases with penultimate stress. It will also have to dominate TROCHEE because, as it will be shown below, satisfying NON-FINALTY (σ′, PPh) does not guarantee a trochaic foot. In the tableau in 45 we show how a word such as /lina/ is assigned stress depending on whether it is in isolation or in context. (The straight bars mark PWd boundary).

-45-

	NON-FINALTY (σ′, PPh)	IAMB	TROCHEE
a. {|(li.ná)|$_{PWd}$}$_{PPh}$	*!		*
☞b. {|(lí.na)|$_{PWd}$}$_{PPh}$		*	

The candidate in 45a which appeals to the phrasal organization in 40 has stress on the final syllable and therefore conforms to an iambic rather than a trochaic foot. This leads to a fatal violation of the constraint requiring the main-stressed syllable to be nonfinal within a PPh. In the optimal candidate, stress falls on the penultimate syllable which happens to be nonfinal within the PWd and also within the PPh.

The same word in context would get stress on the final syllable and consequently an iambic foot rather than a trochaic one as the tableau in 46 shows. The dots show that the word is put in context.

-46-

	NON-FINALTY (σ′, PPh)	IAMB	TROCHEE
☞a. {...|(li.ná)|PWd...}PPh			*
b. {...|(lí.na)|PWd...} PPh		*!	

The constraint ranking given in 46 allows for a straightforward account of the contradictory stress system of CMA. It also shows that the prosodic category PPh emanating from the hierarchy in 40 above is very determinant in stress assignment.

Other disyllabic words that are of interest to us here are words that consist of a sequence of the type CVCVC, that is to say a light syllable followed by a heavy syllable. The foot structure of such words may be either (CVCVC) or CV(CVC). In (CVCVC) both syllables are parsed into a single iambic foot; in CV(CVC) only the second syllable is parsed into a foot, a fact which constitutes a violation of PARSE-σ; the remaining syllable is adjoined directly to the PWd. The unparsed syllable cannot form a foot on its own because this would constitute a violation of FT-BIN. Given these two parses, one has to determine which one is the most optimal. Is it (CVCVC) or CV(CVC)?

Ranking PARSE-σ above TROCHEE and below IAMB would ensure that all syllables are parsed and that in the case of conflicts between these two constraints, one has to satisfy the first one. In the tableau below, we show how a disyllabic word such as [limun] would be stressed when it is in phrase final position:

-47-

	NON-FINALTY (σ′, PPh)	IAMB	PARSE-σ	TROCHEE
a. {|(li.mún)|PWd}PPh	*!			*
💣b. {|(lí.mun)| PWd}PPh		*		
c. {|li(mún)| PWd}PPh	*!		*	

This tableau shows that satisfying both PARSE-σ and TROCHEE gives the wrong output with stress on the light syllable rather than the heavy. This means that we need other constraints to be able to get the optimal output. The relevant constraint here is Weight-to-Stress Principle (Prince and Smolensky 1993):

-48-

Weight-to-Stress Principle (henceforth WSP)

A heavy syllable is stressed in foot structure.

WSP applies only at the foot level in order to rule out structures such as (CVC)(CV′.CVC) or (CVC.CV′)(CVC), where the light instead of the heavy syllable of the foot which is stressed. If a foot contains syllables that have equal weight as in (CV.CV), for example, either one could be stressed without there being violation of WSP. By WSP, a bad trochee of the type L′H represented by the candidate *[límun] will be avoided in favor of a parse that gives priority to an iambic foot. To do so, we need to rank WSP above NON-FINALTY (σ′, PPh) to make sure that it is the final heavy syllable that gets main stress. The following tableau shows how the optimal parse is obtained from the input /limun/ when it is a PPh.

-49-

	WSP	NON-FINALTY (σ′, PPh)	IAMB	PARSE-σ
☞a. {|(li.mún)|$_{PWd}$}$_{PPh}$		*		
b. {|(lí.mun)| $_{PWd}$}$_{PPh}$	*!		*	
c. {|li(mún)| $_{PWd}$}$_{PPh}$		*		*!

Candidate 49b is excluded on the ground that it violates a higher-ranked constraint, namely WSP. The remaining candidates both incur a violation mark for the constraint NON-FINALTY (σ′, Ft) but it is 49a which is optimal although it violates TROCHEE, a constraint ranked low in the ranking scale. By parsing the final heavy syllable as a foot, 49c incurs a fatal violation of PARSE-σ.

When the word in 49 occurs in context, we would still get final stress with the difference here that the optimal candidate 49a would spare a violation mark for the constraint

NON-FINALTY (σ′, Ft) since the stressed syllable would no longer be in phrase final position as shown in 50 below:

-50-

	WSP	NON-FINALTY (σ′, PPh)	IAMB	PARSE-σ
☞a. {...|(li.mún)|$_{PWd}$...}$_{PPh}$				
b. {...|(lí.mun)|$_{PWd}$...}$_{PPh}$	*!		*	
c. {...|li(mún)|$_{PWd}$...}$_{PPh}$				*!

Although PARSE-σ is ranked low, it is still relevant in determining the optimal output.

What the tableau in 50 shows is that stress of words in isolation does not always lead to a trochaic foot. Given a sequence CVCVC, an exhaustive parse of this sequence into an iambic LH foot is more highly valued than one where the initial light syllable would be left unparsed. Further support for this claim comes from trisyllabic words such as [manDarín] where it is the final heavy syllable which is stressed whether the word is in isolation or in context. As a PPh, the input /manDarin/ may have the following possible parses:

-51-

	WSP	NON-FINALTY (σ′, PPh)	IAMB	PARSE-σ
☞a. {|(man)(Da.rín)|$_{PWd}$}$_{PPh}$		*		
b. {|(man)Da(rín)|$_{PWd}$}$_{PPh}$		*		*!
c. {|(man)(Dá.rin)|$_{PWd}$}$_{PPh}$	*!			

Candidate 51c is ruled out because it violates WSP by assigning stress to the light rather than the heavy syllable of the foot. Notice here that WSP is invisible to the first heavy syllable in all the candidates since it is the only syllable of the foot. Both candidates 51a and 51b incur a violation mark for the constraint NON-FINALTY
(σ′, PPh) but 51b is suboptimal because it fails to parse the light syllable of the word, thus incurring a fatal violation of PARSE-σ.

Another distinguishing characteristic about CMA stress is that only one of the last two syllables gets stress (Nejmi, 1993, 1995). Translated into OT terms this amounts to saying

that the prominent foot which contains the main-stressed syllable has to be right-aligned with the prosodic word. The constraint responsible for this is formulated within McCarthy and Prince's (1993b) Alignment Theory as in 52.
(Ft′ stands for the prominent foot, i.e. the foot that contains the main-stressed syllable)

-52-
ALIGN-R (Ft′, PWd)

The right edge of the prominent foot must be aligned with the right edge of the PWd.

The constraint ALIGN-R (Ft′, PWd) has to dominate WSP in order to rule out forms such as [(Sán)(Da.la)] where stress falls on the antepenultimate heavy syllable instead of the penultimate syllable when the word is a PPh. Consider two of the possible output candidates from the input /SanDala/:

-53-

	ALIGN-R (Ft′, PWd)	WSP
☞a. (San)(Dá.la)		*
b. (Sán)(Da.la)	*!	

The losing candidate stresses the only heavy syllable of the word which belongs to a foot other than the final, thus fatally violating ALIGN-R (Ft′, PWd).

Since ALIGN-R (Ft′, PWd) dominates WSP which in turn dominates NON-FINALTY (σ′, PPh), it follows that ALIGN-R (Ft′, PWd) must dominate NON-FINALTY (σ′, PPh), by transitivity. To illustrate this domination relation, consider a sequence such as CVCVCV which is footed as CV(CVCV) with stress on either the penultimate if the target word is a PPh, or else on the final syllable if the target word is in the middle of a PPh but never (CVCV′)CV or (CV′CV)CV as shown in the tableau in 54 for the different parses of a word in isolation such as [banana]:

-54-

	ALIGN-R (Ft′, PWd)	NON-FINALTY (σ′, PPh)	IAMB	TROCHEE
☞a. {|ba(ná.na)|$_{PWd}$}$_{PPh}$			*	
b. {|ba(na.ná)|$_{PWd}$}$_{PPh}$		*!		*
c. {|(ba.ná)na|$_{PWd}$}$_{PPh}$	*!			*

Both Candidates 54b and 54c fail to conform to a trochee; however, each is excluded for different reasons. 54b fails because it is assigned final stress at the end of a PPh, a fatal violation of NON-FINALTY (σ′, PPh). 54c is excluded because it fails to parse the rightmost syllable thus incurring a fatal violation of the constraint requiring the alignment of the prominent foot and the PWd.

When in context, the same word would get final stress instead of penultimate. Witness the tableau below for illustration.

-55-

	ALIGN-R (Ft′, PWd)	NON-FINALTY (σ′, PPh)	IAMB	TROCHEE
a. {...|ba(ná.na)|$_{PWd}$...}$_{PPh}$			*!	
☞b. {...|ba(na.ná)|$_{PWd}$...}$_{PPh}$				*
c. {...|(ba.ná)na|$_{PWd}$...}$_{PPh}$	*!			*

The optimal candidate is the one where main stress falls on the final syllable, giving rise to an iambic foot in which the prominent foot is right-aligned with the PWd. Once again, the constraints at our disposal allow us to account adequately for stress cases involving both words in isolation and words in context.

Next, consider another trisyllabic word that consists of a sequence of two light syllables followed by a final heavy syllable. The tableau in 56 lists the different candidate parses for the word [ʕəRganin] in isolation:

-56-

	ALIGN-R (Ft′, PWd)	WSP	NON-FINALTY (σ′, PPh)	IAMB	PARSE-σ
☞a. {|(ʕəR.ga)(nín)|$_{PWd}$ }$_{PPh}$			*		
b. {|ʕəR(ga.nín)|$_{PWd}$ }$_{PPh}$			*		*!
c. {|ʕəR(gá.nin)|$_{PWd}$ }$_{PPh}$		*!		*	*
d. {|(ʕəR.gá)(nin)|$_{PWd}$ }$_{PPh}$	*!	*		*	

Both candidates 56a and 56b assign stress to the final heavy syllable, thus violating NON-FINALTY (σ′, PPh). But because candidate 56a has parsed all of its syllables into feet, it is optimal given the fact that PARSE-σ dominates ALIGN-R (Ft, PWd) in 32 above. 56c is excluded because it stresses the light instead of the heavy syllable of the foot; and finally 56d is also excluded because the right-hand foot does not contain the main-stressed syllable.

In context, the word [ʕəRganín] is assigned final stress. The optimal foot structure corresponds exactly to that in 56a except that here the concerned word spares a violation mark for the constraint NON-FINALTY (σ′, Ft) because it is no longer in phrase final position.

The final cases of words that deserve special attention are words that end up in or have the shape HL, i.e. words that consist of a heavy syllable followed by a light one. Prince and Smolensky (1993: 59) (see also McCarthy and Prince 1993a, Hayes 1995 among others) show that the sequence HL is absent from trochaic systems and as such feet of the type HL are banned on the basis of rhythmic structure which favors heavy syllables at the end of constituents. To rule out HL foot types, Prince and Smolensky (1993) propose a constraint dubbed RHYTHMIC-HARMONY (RH-HARM), also identified as *HL (Prince and Smolensky 1993, Cabré and Kenstowicz 1995).

One could possibly argue against the constraint *HL if FTBIN were stated in such a way that it allows just two moras in a foot. While this solution seems plausible theoretically, it cannot be adopted in the analysis of CMA words that end up in HL for reasons that will become clear down in this chapter. Although the HL foot type does not figure in the inventory in 33, it does not mean that they don't occur at all. Works which have reported HL trochaic foot types to exist include Kenstowicz 1994 for Bani Hassan Arabic, Cabré and Kenstowicz 1995 for Catalan, and Buckley 1994 for Manam. For CMA, we maintain that trochaic feet of the type (HL) do arise for two reasons. First, to secure the undominated constraint ALIGN-R (Ft′, PWd), we need to incorporate the final light syllable into foot structure and at the same time avoid stressing this syllable in order not to violate WSP and NON-FINALTY (σ′,PPh) in case we have a phrase such as [babha]. Second, given the fact that the same word in context would get final stress, there is no way whatsoever to derive the optimal candidate since WSP is ranked above IAMB. More than that, even if WSP were not there, we would get an iambic foot of the type HL′ which is not reported to be part of the foot inventory (cf. 33 above).

Before we see how final stress is obtained in disyllabic words such as [babha], let us consider how the word gets penultimate stress when it is a PPh. In order not to leave the final light syllable unparsed, the constraint *HL has to be ranked below ALIGN-R (Ft′, PWd) and above WSP as the three competing parses for the input /babha/ show:

-57-

	ALIGN-R (Ft′, PWd)	*HL	WSP
☞a. {|(báb.ha)|$_{PWd}$} $_{PPh}$		*	
b. {|(bab.há)|$_{PWd}$} $_{PPh}$		*	*!
c. {|(báb)ha|$_{PWd}$}$_{PPh}$	*!		

Candidate 57c tries to satisfy *HL by unparsing the final light syllable, thus causing fatal violation of right alignment of the prominent foot. Both candidates 57a and 57b violate *HL and tie in everything except the decisive lower-ranked WSP which favors 57a.

This line of analysis seems to be compatible with that offered by Cabré and Kenstowicz (1995) for certain cases of Catalan Hypocoristics Where a LHL in words such “Domingo” is analyzed as a foot of the type (HL) by virtue of an alignment constraint requiring coincidence of the right edge of the PWd with that of the foot. Cases like these are referred to as prosodic trapping and are accounted for by an undominated constraint ranked above *HL, which the authors refer to as ALIGN (PWd, Ft). This constraint has the same effect as ALIGN-R (Ft′, PWd) for CMA cases such as [babha].

The same word in context gets final stress. As it has been pointed out above, given the impossibility of deriving iambic feet of the type (HL′), the only and possible way of getting the optimal output is by regarding the final light syllable as constituting a degenerate foot on its own, thus violating the constraint FT-BIN. FT-BIN in this case needs to be ranked immediately below IAMB as the tableau in 58 shows. Only the relevant constraints are included:

-58-

	ALIGN-R (Ft′, PWd)	*HL	WSP	IAMB	FT-BIN
☞a. {...|(bab)(há)|$_{PWd}$...}$_{PPh}$			*		*
b. {...|(báb.ha)|$_{PWd}$...}$_{PPh}$		*!		*	
c. {...|(bab.há)|$_{PWd}$...}$_{PPh}$		*!	*		
d. {...|(báb)ha|$_{PWd}$...}$_{PPh}$	*!				

The optimal candidate in 58a shows that the best we can get out of a sequence of a heavy syllable followed by a light syllable is a sequence of two iambic feet, the second of which is degenerate. This foot, which we will refer to as the worst iamb, is obtained by ranking FT-BIN below WSP and IAMB. The remaining candidates are excluded for different reasons: 58b and 58c are ruled out because of *HL, whereas 58d is ruled out because the prominent foot is not right-aligned with the PWd. Notice here that FT-BIN is violated only to secure higher-ranked constraints. In cases where these constraints are not at stake, FT-BIN is observed as the different parses of the word [limuna] with final stress when used in context show:

-59-

	ALIGN-R (Ft′, PWd)	WSP	IAMB	FT-BIN	PARSE-σ
☞a. li(mu.ná)					*
b. (li)(mu.ná)				*!	
c. (li.mu)(ná)				*!	

Next, consider trisyllabic words of the type CVCVCCV. The foot structure of such a word when it is in isolation (i.e. a PPh) could be one of the following:

-60-

a. {|CV(CV′C.CV)|$_{PWd}$}$_{PPh}$

b. {|CV(CV′C)CV|$_{PWd}$}$_{PPh}$

c. {|(CV.CV′C)CV|$_{PWd}$}$_{PPh}$

In the parse in 60a the sequence forms an even HL trochaic foot which we have shown to arise in CMA only when ALIGN-R (Ft′, PWd) is at stake. The parse in 60b tries to satisfy *HL by unparsing the final light syllable while at the same time leaving the initial syllable unparsed, thus giving rise to a moraic trochee of the type H. The remaining candidate satisfies *HL by unparsing the final light syllable while grouping the remaining sequence of light and heavy syllables into an iambic foot of the type LH. The result is shown in the constraint tableau for the different parses of the word [wəldatni] in isolation:

-61-

	ALIGN-R (Ft′, PWd)	*HL	WSP	NONFINALTY (σ′, PPh)	IAMB
☞a. {|wəl(dát.ni)|$_{PWd}$}$_{PPh}$		*			*
b. {|wəl(dat.ní)|$_{PWd}$}$_{PPh}$		*	*!	*	
c. {|(wəl.dát)ni|$_{PWd}$}$_{PPh}$	*!				

The tableau in 61 shows that whenever it is possible, priority is given to a parse that would lead to the right alignment of the prominent foot and the PWd even at the expense of the constraint *HL. This is the case with candidates 61a and 61b but 61b is ruled out on the ground that it violates WSP by assigning stress to the light rather than the heavy syllable. In the case of 61c, it is shown that because the final light syllable cannot be integrated in foot structure, the candidate is ruled out.

In context, the word [wəldatni] would receive final stress. Since the final stressed syllable is light and the penultimate is heavy, one would have to expect the foot to be of the type (HL′), where it is the light rather than the heavy syllable which is stressed. Stressing the light instead of the heavy syllable constitutes a flagrant violation of WSP. The only way to get final stress is for the final syllable to form a foot on its own as shown in the tableau below for some candidates of the word [wəldatni]:

-62-

	ALIGN-R (Ft′, PWd)	*HL	WSP	IAMB	FT-BIN
☞a. {...|(wəl.dat)(ní)|$_{PWd}$...}$_{PPh}$			*		*
b. {...|wəl(dat.ní)|$_{PWd}$...}$_{PPh}$		*!	*		
c. {...|wəl(dát.ni)|$_{PWd}$...}$_{PPh}$		*!		*	
d. {...|(wəl.dát)ni|$_{PWd}$...}$_{PPh}$	*!				

The tableau shows that it is more optimal to violate FT-BIN than have a foot that violates both the anti-iambic foot of the type HL and WSP. When the word is stressed in context, *HL is satisfied by unparsing the final light syllable and reanalyzing the HL foot type as (H)(L′) . Such is the case with the optimal candidate 62a. 62b is ruled out because it fatally violates *HL in addition to WSP by virtue of stressing the final light syllable. The same thing could be said about candidate 62c, except that it spares violation of WSP by stressing the heavy instead of the light syllable. Finally candidate 62d is ruled out because it parses the sequence LHL as (LH′)L and assigns penultimate stress to the heavy syllable thus satisfying *HL, WSP and IAMB but falling afoul of the constraint requiring right alignment of the prominent foot and the PWd.

To sum up, the constraint hierarchy needed to account for CMA is given in 63 below:

-63-

Constraint hierarchy for CMA stress cases

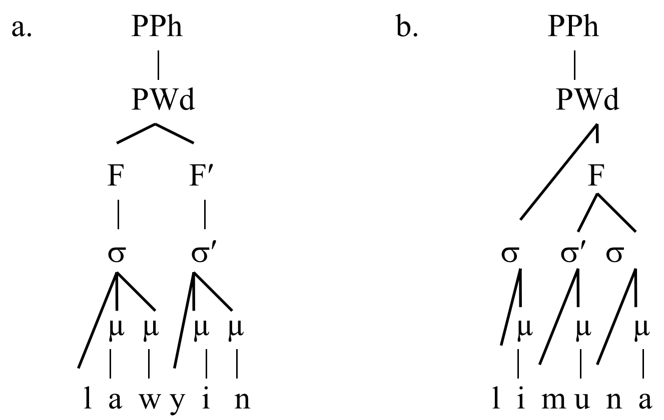
ALIGN-R (Ft′, PWd)
|
*HL (RH-HARM)
|
WSP
|
NON-FINALTY (σ′, PPh)
|
IAMB
|
FT-BIN
|
PARSE-

ALIGN-Ft-R TROCHEE

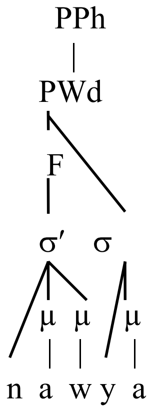
The OT analysis of stress we have offered in this section has allowed us to account for variation in the stress pattern of CMA and determine the possible foot types of the language. When words are assigned stress in isolation, we have shown that the foot types that arise are the universal trochaic L′L and H′ and the anti-iambic foot H′L we were forced to recognize. The three foot types are illustrated by the words [lawyín], [limúna] and [náwya]

-64-

Trochaic feet in CMA



c.

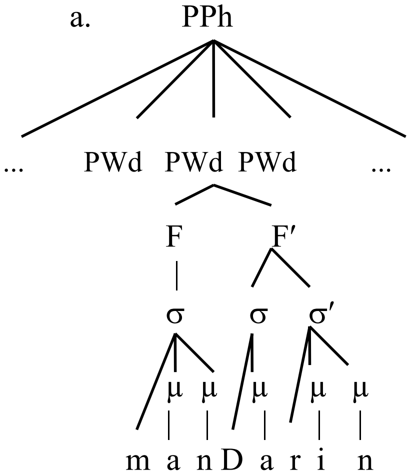


On the other hand, when words are stressed in context, the foot types obtained are iambic LH′, LL′, H′and another degenerate foot of the type L′ that arises when a word end up in HL. In 65 below, we exemplify these types by the structures of words such as [manDarín], [limuná], [lawyín] and [babhá]:

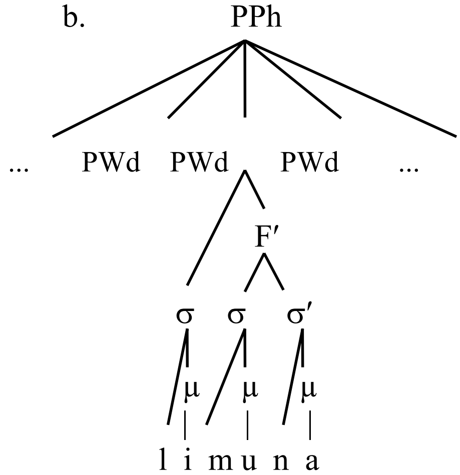
-65-

Iambic feet in CMA

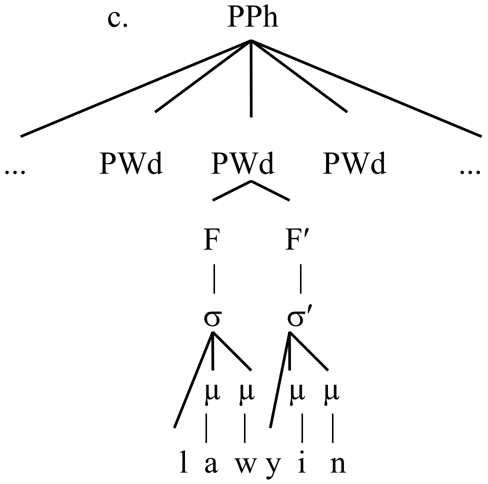
a.



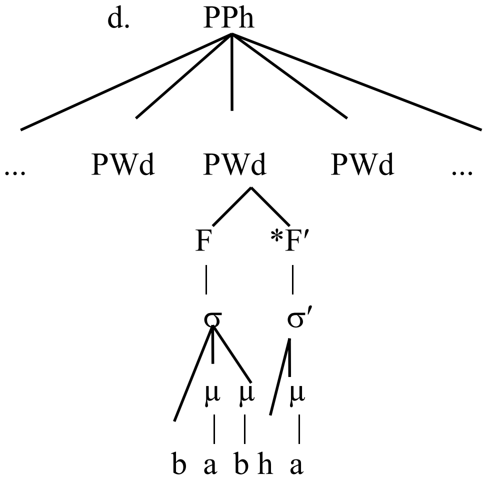
b.



c.



d.



It is noteworthy here that the degenerate foot *Ft′ can never form a lexical word on its own; it occurs only in combination with other iambic feet of the type H as in [(bab)(há)] or LH as in [(wəldat)(ní)]. It should also be noted that these are not the only iambic feet that occur in the language. There is yet another type labeled minor iamb and is called so because it consists of a major syllable preceded by a minor syllable (See chapters five and six below for details).

5. CONCLUSION

We have argued that the stress system of CMA can be accounted for by the ranking of a small set of universal constraints. The analysis we have offered shows that in both isolation and context cases, the location of stress and consequently the foot types depend on the nature of the organization of prosodic words into phrases. The unitary account of stress in CMA proposed in this chapter is based on the idea that both iambic and trochaic feet do occur in the language and this depending on whether or not the word is in isolation or in context, i.e. whether it is a PPh or a PWd within a PPh.

In a phrase with a single word, it has been shown that stress falls on the final syllable if it is heavy; otherwise, on the penultimate. This conclusion has been reached after carrying out both a quantitative and an instrumental test of stress. The instrumental test has provided further support for the quantitative test whose objective was to reflect the native speakers' intuitions about stress. The results obtained show that CMA is a quantity sensitive system which favors trochaic feet. The OT analysis has also shown that restricting stress to the last two syllables of a word is a result of the constraint ALIGN-R (F′, PWd) demanding coincidence of the prosodic word and its head, i.e. the prominent foot. It has also been shown that stressing the final heavy syllable of a word at the end of a PPh is the result of the constraint WSP which is observed in all words except when constraint ALIGN-R (F′, PWd) is at stake. Cases with penultimate stress are obtained by modifying Prince and Smolensky's (1993) NON-FINALTY in such a way as to make it refer to a level of phonological phrasing Selkirk (1978) calls the PPh level. The constraint, dubbed NON-FINALTY (σ′, PPh) and which appeals to the phrasal organization in 40 above, needs to be ranked below WSP in order to derive PPhs with final stress.

In a PPh with more than one member, one word will receive final stress and the others will receive final or no-final stress, depending on whether or not the final syllable is heavy. The arguments presented show that iambic feet take priority over trochaic ones and that this follows from ranking IAMB above TROCHEE. The analysis has also shown that CMA is a language which favors exhaustive parsing of syllables into feet if this parsing does not lead to the violation of higher-ranked constraints. Thus, because the constraint ALIGN-R (Ft′, PWd) is undominated in CMA, we were led to recognize a trochaic foot of the type (H′L) that violates RH-HARM (i.e. the constraint *HL) and an iambic degenerate foot of the type (L′) which is the worst iamb we can get out of the ranking proposed in 63 above.

The analysis about stress and foot structure proposed in this chapter finds support in the prosodic morphology of CMA, namely in the passive participle and the diminutive forms where the foot is basically iambic. Before we show how these morphological classes could be obtained within the OT framework, we turn in the next chapter to consider cases that involve some transderivational relations.