

Word stress in Tashlhiyt - Postlexical prominence in disguise?

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ABSTRACT

This paper reports on a study of lexical and postlexical prominence asymmetries in Tashlhiyt Tamazight (Berber), a language that is renowned for its typologically rare prosodic structures. Carrier phrases were designed to elicit the presence or absence of a postlexical tone on the target word. Contrary to previous reports on the language, measures of acoustic durations and intensity reveal no consistent prominence asymmetries at the level of the word. However, we found evidence for a prominence lending function of tonal events at the postlexical level. We conclude that Tashlhiyt does not show any acoustic evidence for lexical stress and that postlexical events do not appear to be related to lexically determined metrical structures.

Keywords: Tashlhiyt, Berber, word stress, prominence, intonation

1. INTRODUCTION

It is generally agreed that prosodic prominence asymmetries play a role in structuring linguistic utterances. That is, in every utterance one or more elements stand out as more prominent than the others. This prominence is manifested by means of phonetic properties, such as duration, intensity and pitch. In many languages, words have one or more designated syllables that are structurally more prominent, typically referred to as lexically stressed. Stressed syllables might additionally receive postlexical marking in the form of a tonal event, often analysed as a pitch accent.

On the other hand, there are languages that reportedly lack underlying lexical prominence asymmetries, (e.g. Mongolian [16,17], Indonesian [9], and West Greenlandic [15]). Prevalent arguments for a lack of lexical stress in these varieties include the observations that native speakers are not aware of any prominence asymmetries at the word level, and that durational and tonal parameters do not co-vary systematically.

One difficulty in establishing whether a language has lexical stress or not derives from the fact that it is sometimes difficult to tease apart lexical from postlexical prominence. Indeed, surface acoustic

asymmetries may arise as a result of tonal or durational properties at the postlexical level [10].

This paper investigates prominence in Tashlhiyt, one of three main Tamazight (Berber) dialects spoken in Morocco. Its long consonantal sequences and typologically rare syllable structures [6,19,22] have led to a considerable number of studies. Recent work on aspects of higher prosodic structures have revealed even further theoretically challenging phenomena [11,12,13,20,21], one of which is the subject of this paper.

2. PROMINENCE IN TASHLHIYT

Early descriptions of Tashlhiyt have claimed that stress is likely to be a property of constituents larger than words [1,7]. There are few, if any, minimal pairs that are solely distinguished by phonetic prominence. However, Gordon and Nafi [henceforth GN; 11] have argued for word level prominence on the basis of a study investigating three acoustic correlates: F₀, intensity, and duration. Six participants were asked to read out di- and trisyllabic target words in two contexts: In isolation, resulting in the target word forming its own prosodic phrase; and followed by an adverb, resulting in the target word being in non-final position. The authors found that the syllable nuclei of word-final syllables, especially in phrase final position, were longer and had greater intensity than nuclei in penultimate syllables. Interestingly, they also found that phrase-final nuclei were associated with higher F₀ than other nuclei, and interpreted this as a reflex of a high pitch accent associated with a lexically strong final syllable in the target word.

Further research on Tashlhiyt intonation [12,20] has provided data that challenge this interpretation. Grice, Roettger and Ridouane showed that both questions (polar and echo questions) and contrastive statements are characterized by a rise to a F₀ peak followed by a fall on the final/contrasted word. This rise fall was analysed as edge tones secondarily associated with the penultimate or final syllable. Most importantly, the location of the F₀ peak within the word was variable in both sentence modalities, occurring either on the penultimate or final syllable. F₀ peak location was probabilistically determined by competing factors: There was a preference for the F₀ peak to be located on more sonorous elements and on heavy

syllables. Moreover, questions revealed a stronger tendency to have an F0 peak on the final syllable. Despite these probabilistic tendencies, tonal placement was to some degree freely alternating, since the same speaker often produced both penultimate and final F0 peaks in different repetitions of the same target word [12]. This alternation has recently been confirmed perceptually: Tashlhiyt listeners are strikingly indifferent to the position of F0 peaks [20]. Our interpretation of these findings is that the location of postlexical prominence cannot be predicted based on lexical stress. These findings also call for a reconsideration of GN's data: was the prominence they found due to lexical stress or was it merely a reflex of postlexical prominence?

First, durational asymmetries in phrase-final words might be due to postlexical strengthening phenomena such as final lengthening [3 *inter alia*]. Second, due to the segmental make-up of GN's stimuli (syllable weight and sonority asymmetries favouring the final syllable), tonal events were likely to be attracted to the final syllable, which might also be taken to reflect postlexical prominence. Furthermore, even in phrase medial position, speakers produced different target words in constant carrier phrases, resulting in implicitly contrasted target words. Previous findings have demonstrated that implicitly contrasted target words in phrase medial position are realized with an F0 peak on the final syllable of the target word [13]. This could have been the source of the asymmetries. The present paper follows up on this discussion and presents new data: we make an attempt to distinguish between realisational properties of postlexical prominence and those of alleged lexical stress.

3. METHODOLOGY

Disyllabic target words were embedded into short dialogues. The target word appeared in three different sentences in phrase medial position (cf. 1 - 3).

- (1) <Is inna TARGET A ghakudan?>
'Did he say TARGET A then?'
- (2) <Uhu, inna TARGET B ghakudan.>
'No, he said TARGET B then.'
- (3) <Inna TARGET B ghakudan?>
'He said TARGET B then?!'

The first context was a polar question (1), followed by a contrastive statement (2) with the target word in corrective focus. These contrastive statements were realised with a rise in pitch followed by a fall on the target word. The statement in (2) was called into question in (3), in the form of a confirmation-seeking echo question. Echo questions are characterised by a rise or rise-fall in pitch at the right edge of the

utterance-final word, which, in the case of (3) is not the target word, but rather the adverbial. Thus, although the morphosyntactically identical utterances (2) and (3) are distinguished by prosodic factors only, (2) has a phonologically relevant tonal event on the target word that (3) lacks. This enables us to disentangle the effects of postlexical prominence (co-occurring with functionally relevant tonal events) from correlates of lexical prominence only.

3.1. Participants and procedure

Nine native speakers of Tashlhiyt (5 male, 4 female, mean age = 25) were recorded in November 2014. All live in Agadir, Morocco, are fluent in Moroccan Arabic and have a basic command of French. Participants individually read out orthographically presented dialogues (in Latin script) containing the target words as presented in (1) to (3).

3.2. Speech Material

We constructed a corpus of disyllabic words containing a vowel in each syllable nucleus position. One set of words (n=6) contained two identical syllables (e.g. /baba/ 'father'), the other set contained word pairs (n=5) that contained identical syllables, but in different positions (e.g. comparing the syllable /di/ in /sidi/ 'sir' and /dima/ 'always'). Each target word was produced twice in each sentence modality by every speaker.

3.3. Analysis

Target words in echo questions (henceforth EQ) and contrastive statements (henceforth CS) were manually segmented and annotated with Praat 5.4 [4]. To compare our data to GN's study as closely as possible, we extracted duration, intensity, and mean F0 for syllable nuclei. Data were statistically analysed with generalized linear mixed models, using R [18] and the package *lme4* [2].

We analysed EQs and CSs separately. As fixed effects we included SYLLABLE POSITION (PU vs. F). We included random intercepts for SPEAKER and WORD. Finally, random slopes for SPEAKER and WORD were included for the fixed effect of SYLLABLE POSITION to account for WORD- and SPEAKER specific variance with respect to the potential asymmetry between syllables.

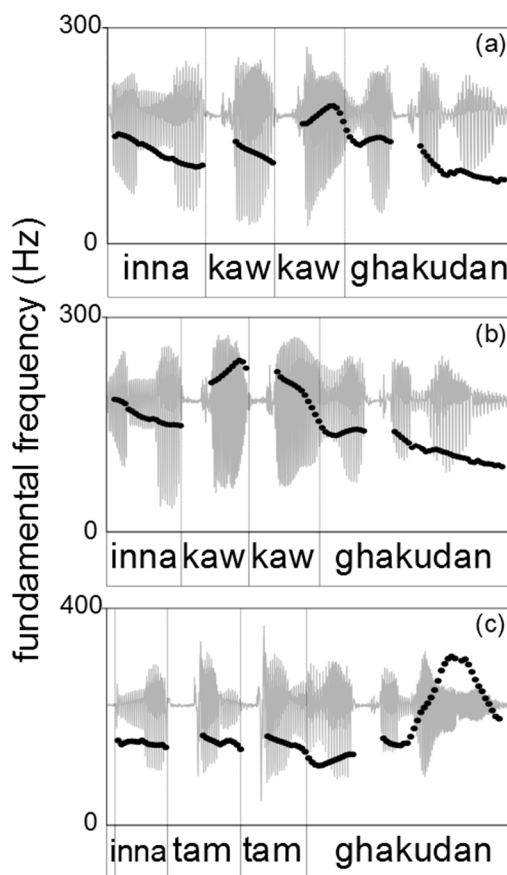
4. RESULTS AND DISCUSSION

4.1. General observations

In line with previous work, contrastive statements are realised with a rise to a high pitch target either on the penult (PU) or final syllable (F) of the target word.

The position of the high target is prone to a great deal of within- and across-speaker variation, also confirming previous findings [12,20]. In 52% of all productions (N=174), speakers placed the high target on the final syllable. Figure 1 illustrates one speaker's production of the same target word in two contrastive statements: The first (a) with a high target on the final syllable, the second (b) with the target on the penultimate syllable. The first syllable of the following adverb optionally bears a downstepped high target (in line with [13]). Echo questions (c) were realised with a F0 rise or rise-fall phrase finally, there being no tonal event on the target word, allowing us to investigate phonetic properties of syllables not subject to postlexical prominence.

Figure 1: Representative waveforms and F0 contours for contrastive statements (<kawkaw> as target word): F0 peak on F (a), and on PU (b), and an echo question (<tamtam> as target word) (c): no peak on target word, all produced by the same speaker.



4.2. Prominence measurements

Following our discussion of postlexical realisations of the utterances, we turn to potential prominence asymmetries between syllables within the words. For EQs, in which the target word bears no postlexical event, there was no effect of syllable position, on

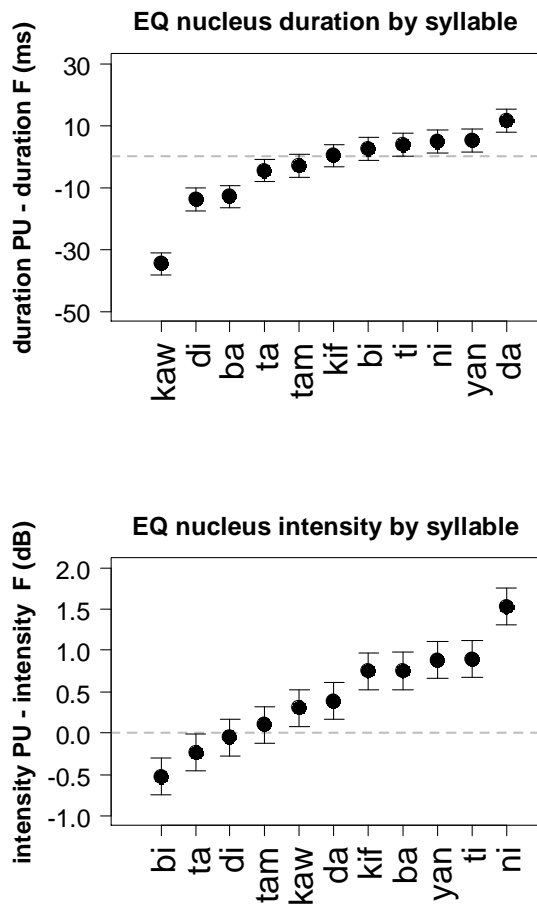
either vowel duration ($\beta=3.8$ ms, $SE=4.5$ ms, $\chi^2(1)=0.7$, $p=0.39$) or on vowel intensity ($\beta=0.36$ dB, $SE=0.27$ dB, $\chi^2(1)=1.9$, $p=0.17$) (cf. Figure 2). There was, however, a significant asymmetry in terms of mean F0 values ($\beta=11.6$ Hz, $SE=3.9$ Hz, $\chi^2(1)=6.8$, $p=0.009$), with the final syllable having 9 Hz lower mean F0 values.

For contrastive statements (CS), there was a significant interaction between syllable position and the position of the F0 peak ($\chi^2(1)=8$, $p=0.005$) such that the vowel bearing the F0 peak was slightly longer, especially when the F0 peak was on the final syllable (PU=0.3 ms, F=8 ms). For vowel intensity, there was neither a significant effect of syllable position ($\beta=0.28$ dB, $SE=0.47$ dB, $\chi^2(1)=0.4$, $p=0.5$) nor a significant interaction between syllable position and the position of the F0 peak ($\chi^2(1)=0.1$, $p=0.8$). Descriptively, there is a modulation of an effect by the position of the F0 peak such that the vowel bearing the F0 peak was slightly louder (PU=0.8 dB, F=0.1 dB). For mean F0, there was a significant interaction of syllable position and F0 peak position ($\chi^2(1)=28.2$, $p<0.0001$): the syllable bearing the F0 peak (unsurprisingly) had higher F0 mean values (PU=7 Hz, F=36 Hz).

To sum up, in a context in which potential prominence asymmetries are disentangled from postlexical phenomena (i.e. in EQs), we did not find evidence for phonetic enhancement of either target syllable via duration or intensity. Since it is rather difficult to prove the null [8], descriptive difference scores for duration and intensity for each individual syllable may be invoked. Figure 2 indicates that there are no consistent duration asymmetries across target syllables. In almost half of the items the PU is longer, while in the remaining words F is longer. Any claim of a *fixed* word level prominence generalising over the language should crucially allow for a generalisation across all words. This generalisation does not apply to our data. For intensity, the majority of syllables showed higher intensity values for the PU (contrary to the findings of GN), although this did not turn out to be a statistically robust pattern. Nonetheless, we do find slightly higher mean F0 values for the penultimate vowel of the target word in EQ, although this may well be an artefact of microprosodic influences of the initial voiced uvular fricative in <ghakudan>.

In a context in which a tonal event co-occurs with the target word (CS), we find significant interactions between syllable position and the position of the F0 peak for vowel duration: the co-occurrence of the F0 peak causes vowels to be slightly longer.

Figure 2: Duration difference score (top panel) and intensity difference score (bottom panel) for the target syllable nucleus in echo questions (EQ). Negative values indicate that F is longer / louder than PU, positive values indicate that F is shorter / quieter than PU. The dashed line indicates no difference. Error bars indicate standard errors as estimated by the applied model.



5. GENERAL DISCUSSION

The present paper sheds light on potential word-level prominence in Tashlhiyt. Despite earlier claims [10], we were unable to replicate evidence for fixed word level prominence. In light of our distribution of variance (Fig 2) even an interpretation assuming different stress patterns for different words appears unlikely: the variance across syllables shows a unimodal distribution, implying that a categorical difference that would characterise different inherent prominence patterns is lacking. Moreover, the order of syllables in the upper panel (duration) does not match the lower panel, (intensity), providing even more evidence against any kind of lexical word stress. In line with previous studies, we further replicated the finding that tonal events, such as focal F0 peaks, show considerable variance with regard to their location,

i.e. the syllable they are associated with [12,20]. Furthermore, we have provided evidence that the presence of an F0 peak comes with additional vowel lengthening. This latter result allows us to interpret GN's [11] findings, where durational asymmetries were found word-finally. Any duration asymmetries might have been artefacts of postlexical prominence: a focal tone (similar to the contrastive tone in the present study) that is frequently located on the final syllable might have led to greater duration on this syllable.

It is also conceivable that GN's results might have been a statistical artefact resulting from the small set of words used, especially since their analysis of vowels was based on two words. Considering Figure 2 again, it should become apparent that unlucky sampling (e.g., a generalization based on /kaw/ and /ba/) might lead to the erroneous conclusion that final syllables are longer than penultimate ones. Since GN analysed their data using classic ANOVAs with speakers as the sample over which they inferred, it would have been impossible to statistically generalise over words. This is related to the "language-as-fixed-effect fallacy" [5].

To sum up, postlexical tonal events analysed as H tones, are realised with slightly longer duration accompanying the F0 movement. Furthermore, H tones show a bimodal alignment pattern, occurring either on the PU or F of the phrase-final word. This can be interpreted as tonal association to a specific syllable. One could account for this association as a secondary association of an edge tone to a TBU [12,20] (In contrastive statements the tone is at the edge of a focal constituent, and in echo questions it is at the edge of an intonation phrase). This association might lead to increased duration [17], explaining GN's and our own observations. Thus we suggest that these tones are at once edge tones ('phrase') and prominence lending tones ('accent') (phrase accents in [14]).

The lack of phonetic evidence for lexical stress is interesting with respect to the placement of these phrase accent tones. With no lexical stress, the location of postlexical tones in Tashlhiyt is not conditioned by lexically determined metrical structures either. This might explain the fact that Tashlhiyt shows a great deal of within word variability in the position of such tonal events.

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