Sonority and Syllable Weight determine Tonal Association in Tashlhiyt Berber

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Abstract

We investigated the alignment of F0 peaks in disyllabic target words in polar questions and contrastive statements in Tashlhiyt Berber, concentrating on cases where both syllables contained a sonorant nucleus. Peak location, interpreted as H tone association, is not only determined by the communicative function of the utterance, but also by sonority and syllable weight, with a preference for more sonorous segments and heavy syllables. This work confirms earlier findings on Intonation Phrase medial tones in this language, and sheds further light on the interaction of sonority and weight as determining factors in tonal association.

Index terms: Tashlhiyt Berber, intonation, polar questions, sonority, syllable weight

1. Introduction

Berber is an Afro-Asiatic language spoken mainly in Morocco and Algeria. Tashlhiyt Berber (henceforth TB), the variety investigated here, is one of three major Berber dialects in Morocco spoken by an estimated 8 to 9 million people [12].

Research into the phonology of the language has mainly concentrated on the phoneme inventory, and the relation between syllable structure and sonority. Dell and Elmedlaoui's preliminary observations suggest that "the main pitch event" in an intonational phrase is generally on the final or penultimate syllable, as long as it has a sonorant nucleus [5: 14]. This caveat is particularly relevant, since the language is notorious for its syllables without vowels. In fact, TB can have whole words without a vowel. In their absence, any consonant, even a stop, can be the syllable nucleus; see (1), where /b/ and /g/ are syllable nuclei:

tbdgt = t**b**.d**g**t 'you are wet' (1)

However, the syllabification of words like *tbdgt* has been subject to debate. They may surface phonetically with one or more schwa-like elements (henceforth @) between the stops. These @s have been interpreted by [2] as syllable nuclei. However, phonetic and phonological arguments [5, 10, 11] lead to the conclusion that these @s are transitional vocoids, and thus a matter of phonetic detail rather than phonological segments in their own right.

Based on preliminary observations and native intuitions, Dell and Elmedlaoui provide an analysis of optional syllabification in Intonation Phrase final position which goes hand in hand with the association to intonational tones [4: 119]. For example, when the word *igidr* 'eagle' is at the end of a phrase with interrogative intonation, a rising tone can occur on the final /r/, in which case it is analysed as a syllable nucleus and thus a TBU. Alternatively, within this analysis, the final consonant can "lose" its syllabic status and be annexed to the previous syllable as a second coda consonant. In this case the peak is on the second vowel /i/. In their view, this optional tonal association is only observable when the word has a final sonorant consonant which would either form the nucleus of a light syllable or be part of a coda. They state that "similar observations can be made with other intonations" [ibid.: 119f.].

It appears from the account of this particular intonation contour that there are three competing tendencies for tonal association. On the one hand, the tone associates preferentially close to the end of the phrase, on the other hand it prefers to associate with a syllable in which the sonority of the nucleus is high. Finally, tones are preferentially associated to heavy syllables. It should also be pointed out that, independently of intonation, syllable weight is relevant for the analysis of versification, as is sonority for syllabification.

Grice et al. [7] investigated the nature and distribution of an Intonation Phrase medial H tone in declarative sentences in which the target word was embedded in a constant carrier phrase and was implicitly contrasted with other target words in the same experiment. The H peak was consistently located on a sonorant nucleus in the target word, unless the target word contained no sonorants. In this case, the alignment of H was highly variable: it was either on a transitional vocoid within the word or on a sonorant to the left of the target word. The function of the H tone, however, could not be clearly identified, since TB has been reported to employ primarily morphosyntactic devices to focus constituents [8].

In this paper we present new data to further probe which factors determine peak placement and how these factors interact. To this aim we investigated peak alignment in both polar questions (henceforth PQ) and contrastive statements (henceforth CS) where the focus of the sentence is on the final word in the Intonation Phrase. Whereas in [7] the contrast was implicit, here it is explicit and corrective (not X, but Y). Apart from sentence modality, we control the target word, so as to investigate the interaction of sonority and weight as determining factors in tonal association.

2. Methodology

2.1. Speakers, stimuli, procedure

Three native speakers of Tashlhiyt Berber (1 male, 2 females) were recorded. All speakers live in Paris, but have spent at least their first 24 years in Morocco, and report using the language frequently. The age of the subjects ranged from 31 to 40 (mean = 35).

Stimuli contained 28 pairs of disyllabic target words varying the sonority of the nucleus of both syllables. Corresponding members of a pair differ only in syllable weight of the final syllable (CV vs. CVC). They were selected to cover a wide range of segment type. For each combination two different words were used. Table 1 shows the make up of the syllabic nucleus on the penult (PU) and the final syllable (U)

Table 1: *Stimuli and conditions, each condition consisting of two item pairs differing in syllable weight; Sx=less sonorous sonorant; Sy=more sonorous sonorant, +/-=voiced/voiceless*

PU	V	S	V	Sx	Sy	S
U	V	V	S	Sy	Sx	S
example	tiri tirit	tnza tnzam	tugl tuglt	tmdl tmdlt	trkm trkmt	tndm tndmt

PU	S	O+	S	O+	O+	O+	O-	O-
U	O+	S	O-	S	O+	O-	O+	O-
example	trkz trkzt	tbdr tbdrt	trks trkst	tskr tskrt	tbdg tbdgt	t3cq t3cqt	3tqR 3tqRt	tkcf tkcft

Participants were seated in front of a computer screen and read out orthographically presented sentences. The target words were embedded in the following carrier phrases:

Is inna tiri? 'Did he say *tiri*?' (2)

Ur inna tiri. 'He did not say *tiri*.' (3a)

Inna tnza. 'He said *tnza*.' (3b)

In (2) the target word is in a polar question. In (3) a different target word is in a contrastive statement. Because of the negation in (3a), the target word in (3b) is explicitly contrasted (corrective focus). In both cases the target word is located at the right edge of the Intonational Phrase. Each target word appeared in both positions three times resulting in 336 tokens per speaker (14 conditions * 2 pairs * 2 weights * 2 carrier phrases * 3 repetitions).

2.2. Recordings and analyses

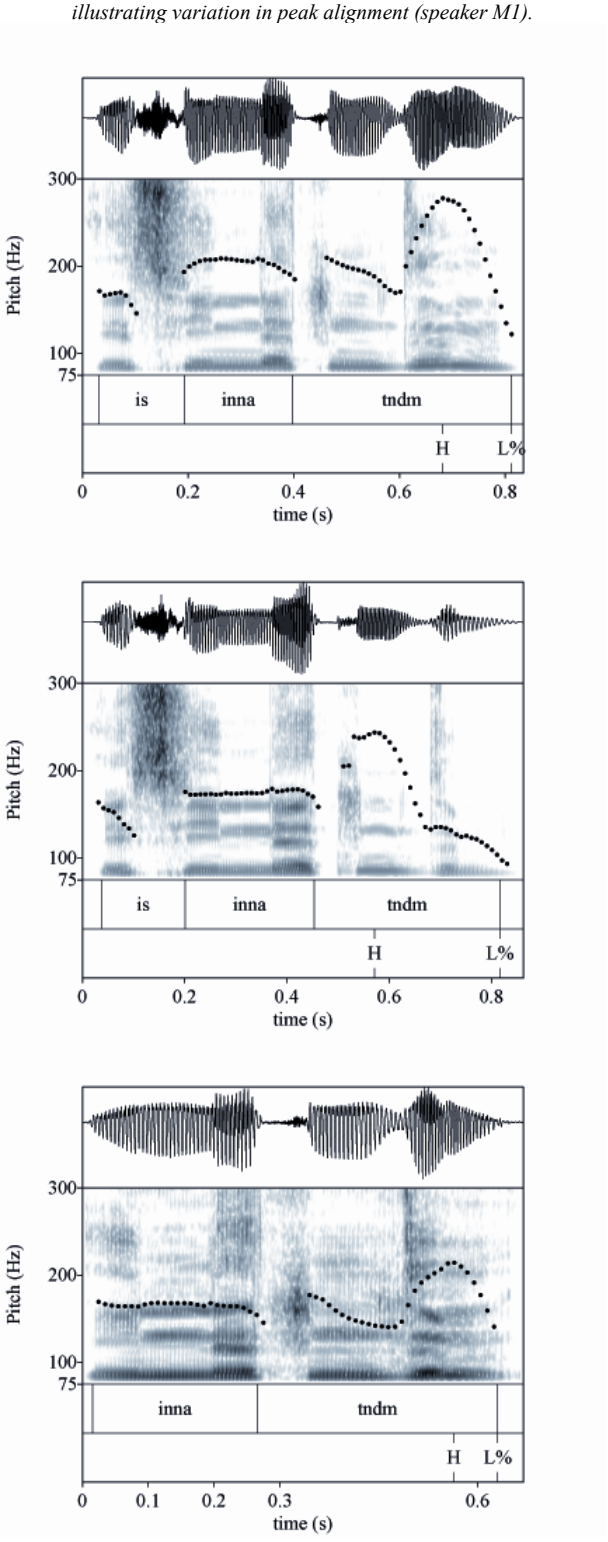
Recordings were made in a soundproof booth at the Laboratoire de Phonétique et Phonologie in Paris for two subjects F1 and M1, and in a quiet room for F2. Before recording began, participants were asked to read the list to the experimenter (the second author) to ensure that they were familiar with all the items. All acoustic material was manually annotated by the first author. The location of the tones under investigation were judged by ear and subsequently confirmed by visual inspection of the F0 contour and spectrogram provided by Praat 5.2 [1]. If the tonal prominence was ambiguous or not detectable at all, the datum was excluded (total 36 tokens).

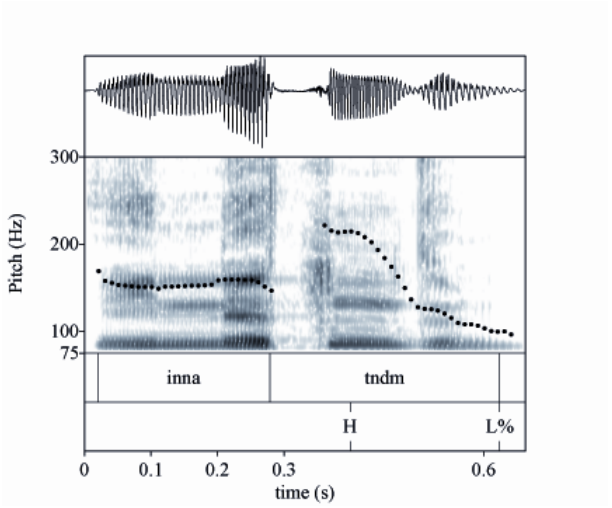
3. Results

3.1. General properties

In both sentence types there is a rise to a F0 peak (represented as a H tone) followed by a fall in pitch (represented as L%). This L% tone may sometimes appear to be undershot, or truncated, if there is tonal crowding (H and L% both on the final syllable). In general, polar questions reveal an overall greater pitch range and a concomitant steeper rise to the H peak than contrastive statements (cf. fig. 1-4).

Figure 1-4: *Spectrogram and f0 contours of PQ is inna tndm? 'did he say 'she regretted'?' and CS inna tndm! 'he said 'she regretted''. Two realisations for each sentence, illustrating variation in peak alignment (speaker M1).*



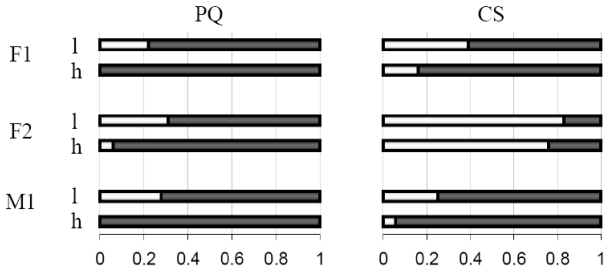


If the target word contained neither a vowel nor a sonorant consonant, it sometimes had no tonal prominence at all. Alternatively, the peak was either on a vocalic nucleus of the previous word or on a transitional vocoid (@) within the consonant string of the target word. This pattern is consistent with the above mentioned study in which the target word was phrase medial [7]. In all productions of target words with only one sonorant nucleus (vowel or sonorant consonant), the H peak is almost consistently located on it (also consistent with [7]). These cases will not be discussed further here. Instead, in the rest of this paper we shall focus on cases where both syllable nuclei are sonorant (V or S), looking first at speaker specific tendencies and then taking polar questions and contrastive statements separately.

3.2. Speaker specific tendencies

Figure 5a shows the results for each speaker separately. In heavy syllables, all speakers tend to place the H peak on the final syllable (U), with the exception of speaker F2. Although this speaker places the peak on final heavy syllables in PQ, she rarely does so in CS, where she mainly places it on the penult (PU). We now examine each communicative function separately, looking at the role played in determining peak location within each functional category.

Figure 5a: *Mean proportion of peak location on PU (white bars) and U (black bars) for both communicative functions; final syllable specified as l=light or h=heavy.*

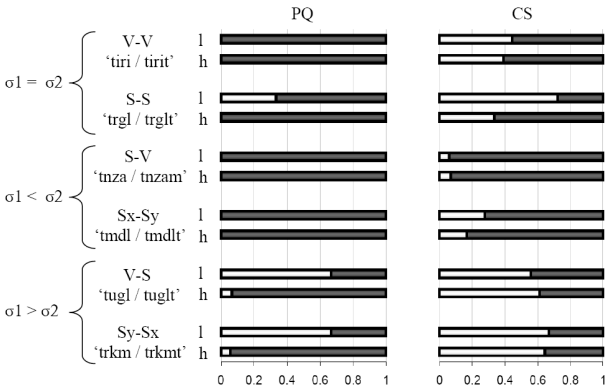


3.3. Peak location

Polar questions

As long as the nucleus of the final syllable is either a vowel (VV, SV) or higher in sonority than the penult (SxSy), the H peak is on the final syllable (e.g. *ti.ri*, *tn.za*, *tm.dl*). If the final sonorant is equal (SS) or lower in sonority (VS, SySx) (e.g. *tn.dm*, *tu.gl*, *tr.km*), speakers appear to have various options. Note that for an accurate description of these patterns a categorical distinction between vowels and sonorants is necessary, since this effect is not obtained in words with two vowels. Most of the remaining variability can be attributed to syllable weight: Whereas light syllables do not necessarily attract H, heavy ones do; this is the case as long as the final sonorant is equal to or less sonorous than the penult (e.g. *tn.dmt*, *tr.kmt*).

Figure 5b: *Mean proportion of peak location on PU (white bars) and U (black bars) for both communicative functions pooled over speakers; final syllable specified as l=light or h=heavy.*



Contrastive statements

As mentioned above, speaker F2 strongly prefers to place the peak in contrastive statements on the penult, whereas F1 and M1 prefer the final syllable. Looking at the segmental properties of the words across all speakers, vowels are stronger attractors for the H than other sonorants, more sonorous segments are preferred over less sonorous ones (i.e. the peak is more frequently on the penult in σ1 > σ2 and on the final in σ1< σ2), and there is a slight tendency for heavy syllables to be preferred over light syllables.

4. Discussion

Our results point to four competing factors affecting the location of the H peak:

SONORITY: The most sonorous syllable attracts the peak.

WEIGHT: Heavy syllables attract the peak.

PROXIMITY TO RIGHT EDGE: The rightmost syllable attracts the peak.

COMMUNICATIVE FUNCTION: If the peak is on the final syllable, there is a RISE in pitch over the target word (with a following fall which may or may not be truncated). Such a rise is cross-linguistically common in questions. If the peak is on the penult, there is a FALL in pitch over the target word, a pattern common in statements.

It appears that although communicative function has an effect on peak location, there being a strong preference for H to be located on the final syllable in polar questions, tone location in contrastive statements is more strongly affected by segmental properties as well as by the speaker. However, there are some common trends. In both sentence modalities H peaks tend to be aligned with more sonorous segments and to heavy syllables.

It is possible to account for some of these tendencies in terms of phonetic grounding, a pitch event near the end of the

phrase being a salient position due to recency, and a tone on a more sonorous segment being more salient than one on a segment with less energy.

The different preferences in interrogatives and statements have to be considered as functionally motivated to distinguish sentence modality. A final RISE in pitch is common across languages, especially for polar questions [13]. The remaining variability, however, reflects the redundant nature of peak location. Both morphosyntactic devices (question particle) and global pitch cues could already be sufficient for marking sentence modality. The actual peak location phrase finally is thus one of a number of cues.

The variation in H placement found in this study supports the observation by [4] that there is free alternation that is constrained by the identity of the segment in final nucleus position as well as by syllable weight. However, the details of our findings differ. Where for [4] the peak in interrogatives may occur on the prefinal syllable only if the final syllable is light and contains a consonantal nucleus, our data contain a considerable amount of counterexamples to this categorical claim (e.g. peak on PU of *ti.lit*).

Furthermore, [4] equate the H peak association to the /u/ in *tugl* with a syllabification which makes the word monosyllabic, thus making /l/ part of a complex coda. However, if we consider tonal association in TB to be an optional alternation at the level of intonation, there is no need to analyze *tugl* as monosyllabic just because the peak is on /u/.

5. Interpretation and concluding remarks

The observed patterns of tonal association need to be considered in the light of language typology. Cross-linguistically, it is a well known phenomenon that syllable weight determines certain word-prosodic regularities. Many languages have weight-sensitive word stress or tone systems (cf. [6] for an overview). The concept of sonority is a well known determinant of phonotactic patterns and syllable structure. Languages in which sonority determines structures at higher levels of the prosodic hierarchy, however, are typologically more rare. While sonority certainly plays a role in many lexical tone system, there are just a few languages in which the sonority of segments determines word stress patterns (cf. [3] for an overview). So both syllable weight and sonority are known to have an impact on prosodic regularities within word prosodic domains. An impact of these factors on prosodic constituents higher in the prosodic hierarchy has rarely been reported in the literature. Japanese, for example, allows secondary association of edge tones only to moras which are sonorant [9].

The observed tonal events in TB have to be considered as tones associated to prosodic constituents above the prosodic word which may correspond to what [4] referred to as a "stress accent" as "a property of units larger than words" [5: 14]. The fact that there are different preferences for peak placement dependent on sentence modality speaks in favour of such an analysis. In line with the proposed analysis of Intonation Phrase medial tones in [7], one could account for this association as a secondary association of IP right edge tones to a TBU. In this analysis, both the H peaks in contrastive statements and in polar questions are edge tones seeking secondary association on a preceding syllable, preferentially heavy and/or with the most sonorous nucleus. If the H tone is primarily an edge tone, the distance from the right edge should be kept to a minimum, as this peak also marks the end of a prosodic constituent, as suggested in [7].

We have observed a great deal of variability in the placement of the H peak, both within and across speakers. We have also shown that H peaks are preferentially obtained on syllables which can be regarded as prosodically priveleged, due to their weight or the sonority of their nucleus. At the same time, this language allows for and sometimes prefers the peak to be on transitional schwa-like vocoids [7], elements which are not even incorporated into the phonological structure of the word. All this suggests that the association of tones in this language is highly complex and clearly subject to the influence of a number of interacting factors. We have identified four of these: sonority, weight, proximity to the right edge and communicative function. The weighting of these different factors and how exactly they interact will be left for further study.

6. References

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