

THE PHONETICS AND THE PHONOLOGY OF FINAL BOUNDARY TONE IN NORTHERN KURDISH

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In this study we have analyzed the difference in boundary tone in northern Kurdish (Kurmanji) in four different sentence structures: Declarative, Imperative, Exclamatory and Interrogative. The study shows that the mean difference in all sentence structures in Kurmanji language is 59 and the L%, L+H%, H%, L%, and % changes in the ToBI system were observed. In this paper we propose a systematic way to transcribe Kurdish prosody named: KuBI (Kurdish ToBI)

1. Introduction

Northern Kurdish (Kurmanji, Kurmanci) is a group of dialects from the family of Iranian languages and it is spoken in Syria, Turkey, Iran, and Iraq. Kurmanji is the most common dialect group of Kurdish languages. Kurmanji shares many characteristics with Iranian languages especially in terms of phonology. There seems to be limited work on Kurmanji's phonology and in particular prosody in Kurmanji.

ToBI system is set of conventions for transcribing prosodic events in a language. The final boundary as shown with % in the ToBI (abbreviation of "tones and break indices") system (SA Jun, 2005) is the end of the phrase. Each language has its own specific ToBI system. The ToBI system was developed by Pierrehumbert (1980), Ladd (1983), Beckman and Pierrehumbert (1986), Price et al. (1991), and Wightman et al. (1992) for English language and ToBI system for other languages was developed by work of K-ToBI (Korean ToBI) Mary Beckman and Sun-ah Jun (1994), J_ToBI (Japanese ToBI system) by Venditti (1995); Campbell & Venditti (1995), and ToDI (Dutch ToBI) by Gussenhoven (2010).

2. Recordings used in the study

Most of the recordings used in this study were from Balaxan Corpus of Kurmanji (A. Rahimi, 2015) in addition to the original corpus which contained 58 utterances, a total of 32 utterances have been recorded and added to the study.

Table 1. Total number of recorded files

	Balaxan Corpus	Additional files
Declarative	19	14
Imperative	8	8
Exclamatory	13	6
Interrogative	16	4
Total	56	32
	88	

The corpus was recorded in WAV format, mono channel and 3072 kbps bit rate. The noise level on the recordings was approximately -70 dBA. The noise level in dBA (or A-weighted decibel or dB(A)) shows the sound decibel in relative to the maximum sound produced. In this case the noise is -70 decibels below the signal level which shows the low noise level since the human normal voice produces 60-70 dB.

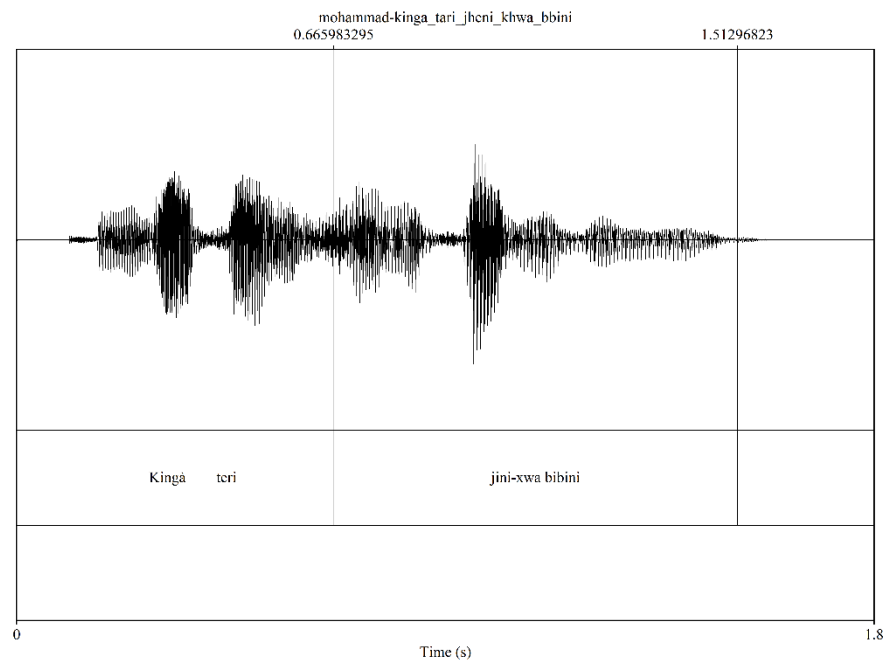


Fig 1 shows the voice level in the interrogative sentence: When are going to visit your wife?

Professional 3.5 mm microphones connected directly to computer were used in the recording sessions of both Balaxan corpus and the additional recordings used in this study.

Since gender does not impact the overall variability in boundary tone our selection of speakers is not homogeneous in terms of speakers' gender. Table 2 shows the description of speakers in recordings.

Table 2. Speakers' profile

	Gender	Utterances	Age
Speaker I	Male	56	25
Speaker II	Female	14	30
Speaker III	Male	18	22

3. Analysis of the recordings

The recordings were analyzed with the computer program Praat (Boersma and Weenink 2007) the maximum and the minimum value of the pitch was measured under Autosegmental-meterical phonology. The Praat pitch settings were set to minimum of 80 Hz and maximum of 300 Hz.

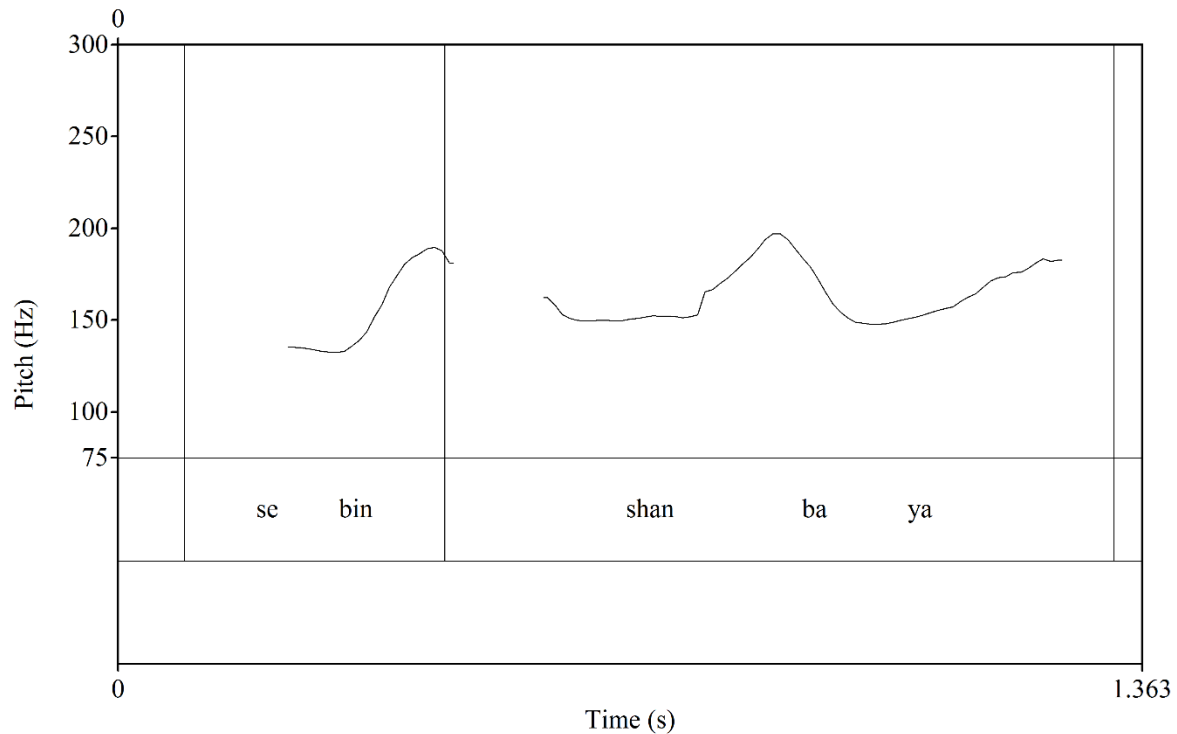


Fig 2. The pitch contour for the Kurdish sentence Sebin shanbaya (tomorrow's Saturday)

Fig 2 extracted from Praat program shows the overall pitch track. A pitch track is a curve that shows the pitch fluctuations of an utterance in the course of time (Sadat-Tehrani 2007). The vertical line is time in seconds and the horizontal line is frequency in Hertz.

These analyses have been done under the Autosegmental-meterical theory of intonation which attributes intonation with significant tonal events such as pitch accents and edge tones. This theory was developed by works such as Liberman (1975), Bruce (1977), and Pierrehumbert (1980). These tonal events consist of High or Low pitch targets (Sadat-Tehrani 2007), which are respectively marked as: H and L. the conventions for transcribing and annotating this tonal events is called ToBI.

4. Measurements of final boundary tone

The sentences in the study were collected from four sentence structures in Northern Kurdish. Declarative, Imperative, Exclamatory, and Interrogative. Kurdish is among Iranian languages therefore it shares many traits with its peer language like Persian.

1 Declarative sentences

In declarative sentences the overall pitch in the final boundary tone is decreasing. The final boundary tone is shown by % in ToBI system. In Kurdish declarative sentences only L% was observed and the mean difference in frequency change for the final boundary tone is 62 Hz

Table 3. The descriptive analysis of the frequency change in declarative sentences

	N	Minimum	Maximum	Mean	Std. Deviation
Frequency change	27	23.52*	93.88*	62.4526*	14.55411

*In Hertz

It was also observed that when there is a downstep in the utterance the frequency change is in the minimum, mainly due to the decrease in the H before the stressed syllables. In this case the

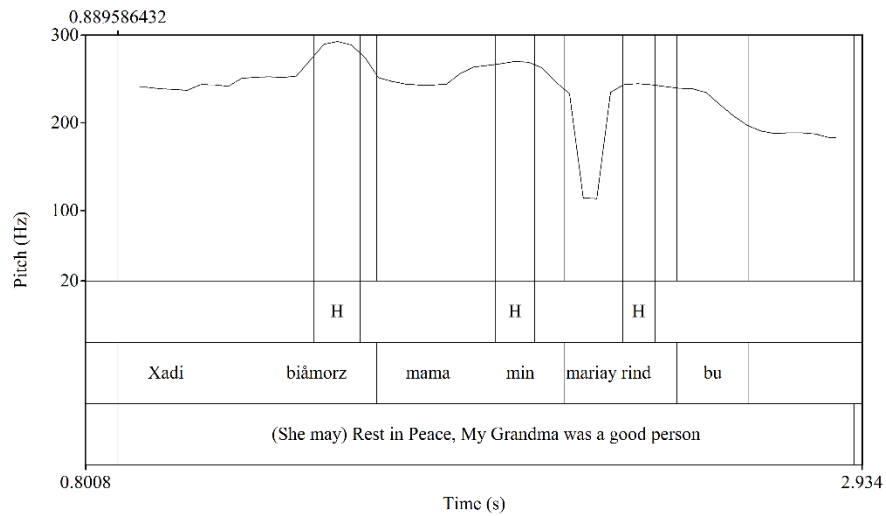


Fig 3. Downstep in the sentence Xàdi biãmorz mama min mariay rind bud

2 Exclamatory sentences

The exclamatory sentences show a decrease in the final boundary tone. The minimum and the maximum i.e. Range, for the frequency change is higher than declarative. This increase in range is mainly due to the tone of the speaker and speaker's voice variability. For the exclamatory sentences the two tonal events of: H% and L% were observed.

Table 4. The descriptive analysis of the frequency change in imperative sentences

	N	Minimum	Maximum	Mean	Std. Deviation
Frequency change	13	17.01*	103.53*	59.4231*	26.36798

*In Hertz

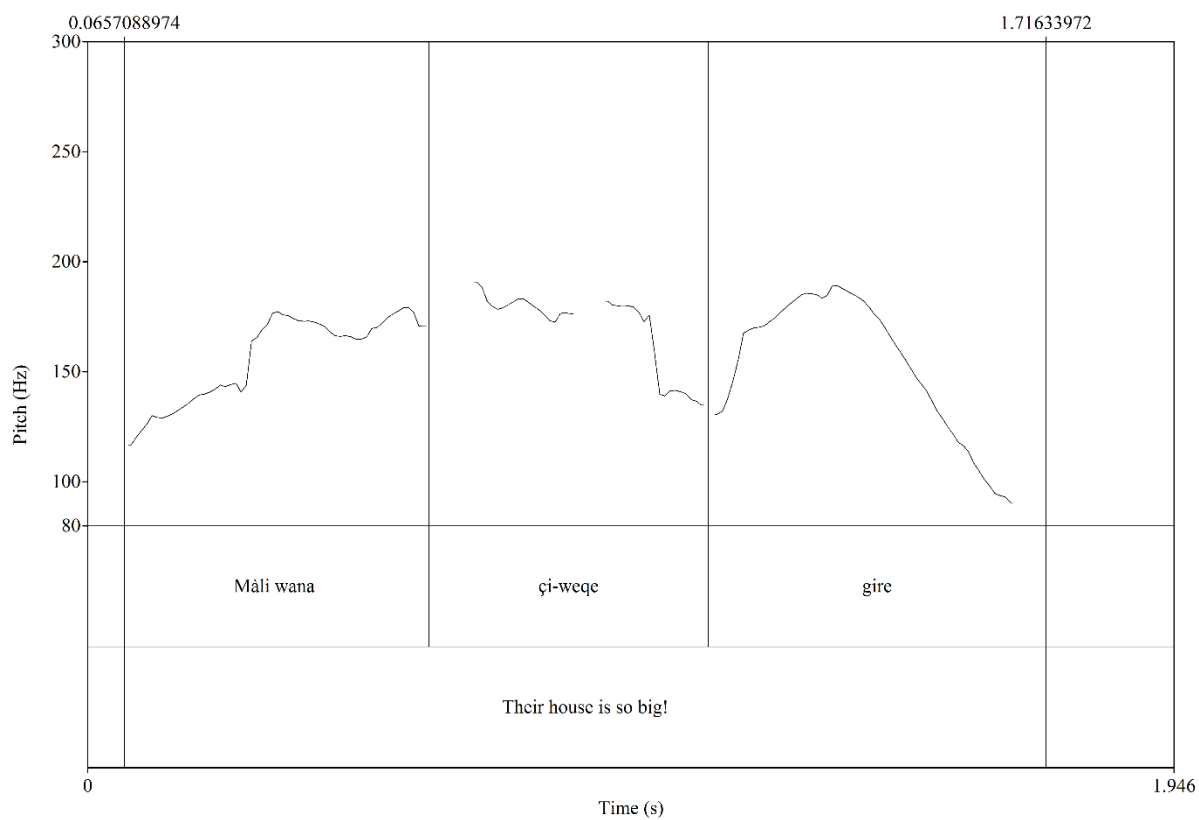


Fig 4. The final boundary tone in exclamatory sentence: Their house is so big!

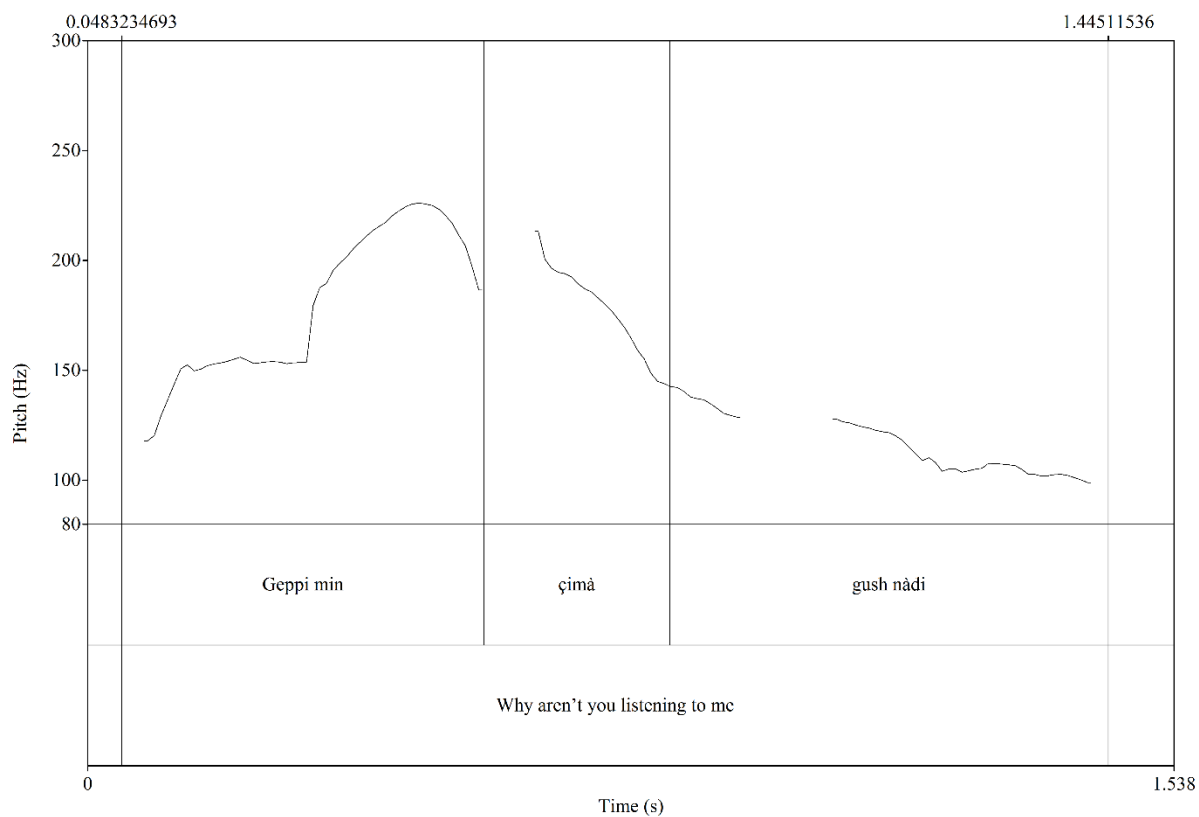


Fig 5.The final boundary tone in exclamatory sentence: Why aren't you listening to me?!!

In the figures 3 and 4 the variability of the voice is shown. In the first utterance the speaker's tone is dramatic. In the second utterance; however the decrease in the pitch is gradual and also the timing for the second utterance is more than the first utterance.

3 Interrogative sentences

Interrogative sentences show a wide range of frequency change. The standard deviation for interrogative sentences is 85. As analyses show, for interrogative sentences two changes of L+H% and L% were observed.

Table 5. The descriptive analysis of the frequency change in interrogative sentences

	N	Minimum	Maximum	Mean	Std. Deviation
Frequency change	16	-160.78*	127.20*	49.3844*	84.67304

*In Hertz

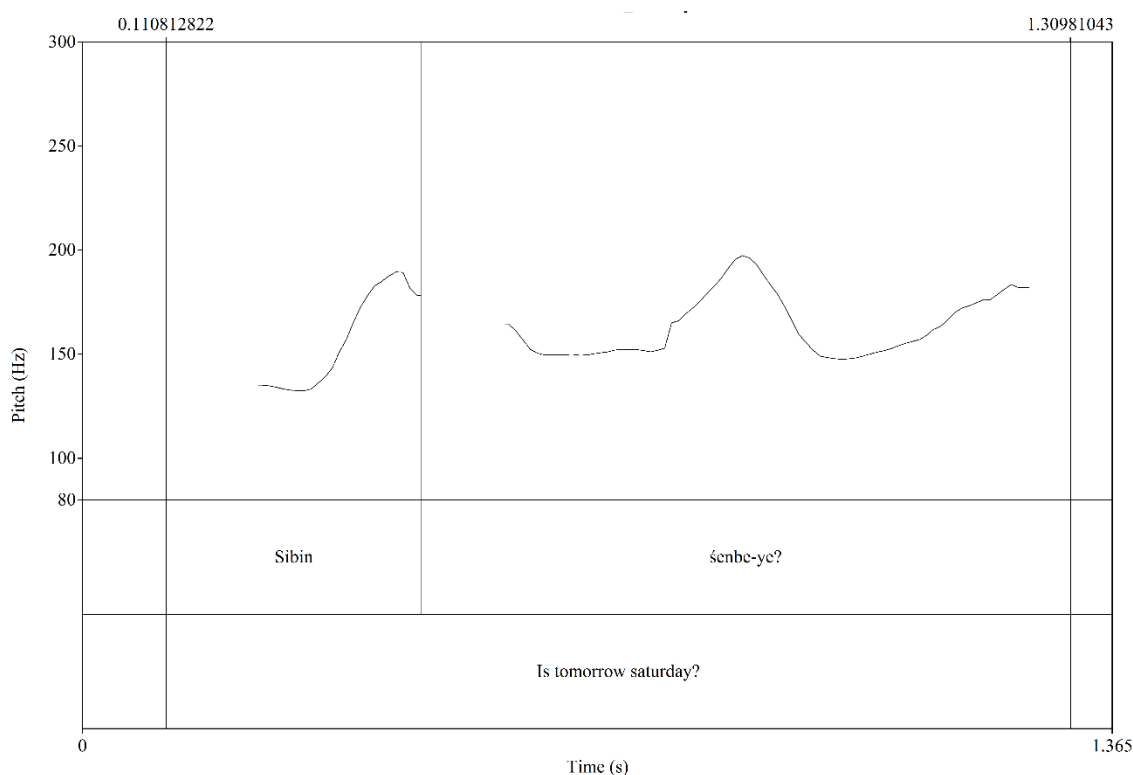


Fig 6. The final boundary tone in interrogative sentence: Is tomorrow Saturday?

4 Imperative sentences

Imperative sentences do show a minimum variance across different sentences. The range of this variability, subtraction of maximum variability from minimum variability, is 30.2. In imperative sentences only the L% tonal event was observed.

Table 6. The descriptive analysis of the frequency change in interrogative sentences

	N	Minimum	Maximum	Mean	Std. Deviation
Frequency change	7	34.55*	64.75*	55.2686*	9.79411

*In Hertz

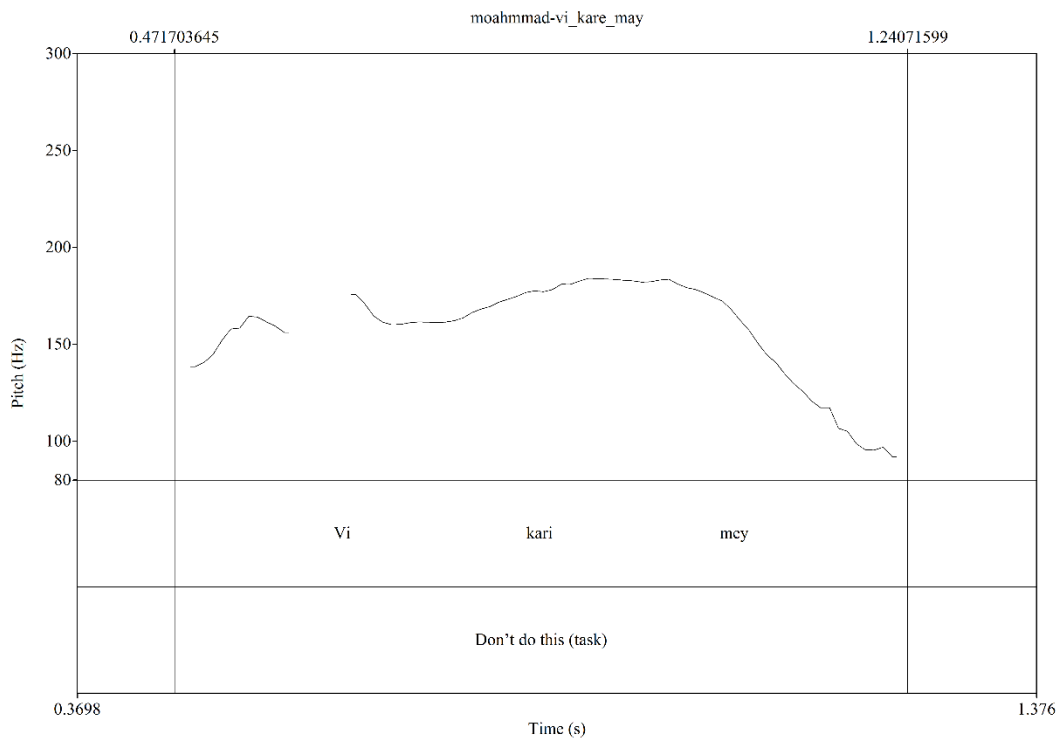


Fig 7. The final boundary tone in interrogative sentence: Don't do this (task)

5 Conclusion

This analysis shows the tonal events of the final boundary tone in Northern Kurdish. The four different tonal events observed were: *L%*, *L+H%*, *H%*, *L%*, and *%*. The mean frequency change for all the sentences is 59 and the most observed tonal event was *L%*. Analyzing final boundary tones is not yet complete but it's a starting point for KuBI (Kurdish ToBI).

6 References

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Appendix I: Samples of the final pitch contour

