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Nature of Sentence Intonation in Kannada, Tulu and Konkani

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Abstract

Intonation is one parameter of prosody that gives information on the production aspects of linguistic prosody. The aim of this study was to understand the terminal intonation patterns of different types of sentences in three languages Kannada, Tulu and Konkani.

Four simple sentences, one for each sentence type namely, declaratives, exclamatory, interrogatives, and imperatives were taken and recorded in Motor Speech Profile software, by native speakers of the three languages. F0 patterns were plotted using the PHH model of intonation. The results showed that declaratives and imperatives had falling contours in all languages. Exclamatory sentences had raising contours in Kannada and Konkani, but falling contour in Tulu. Interrogatives had raising patterns across all languages, except for males in Kannada.

The production of sentences in Kannada, Konkani and Tulu indicated that there are differences in the terminal F0 pattern across the different sentence types.

Key words: Linguistic prosody, intonation, Indian languages, instrumental analysis

Introduction

Speech is the effective way in which we communicate. It has got mainly the segmental and suprasegmental features. Segmental features are the basic inventory of distinctive sounds and the way that they combine to form a spoken language where as suprasegmentals are those

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features that influences the way the sounds are processed for meaning. Suprasegmental features are also called as prosodic features. Segmental features alone do not serve the purpose of communication. Communication becomes meaningful only when the supra segmental features are imposed and is useful in speech production as well as perception.

Prosody serves a variety of functions in language processing. Functionally prosody may convey both linguistic and affective contents based on which prosody can be classified as linguistic prosody and emotional prosody Vivian & Hielscher, 2004. Emotional prosody is defined as the ability to express emotions where as Linguistic prosody is used to disambiguate or to mark the internal organization of sentence constituents or to convey the intonation contour of a sentence (Lieberman, 1968).



Research has indicated that right hemisphere dominates for decoding affective prosody whereas the left is dominant for the linguistic prosody. There are also evidences from the brain damaged individuals that substantiate these views. Right hemisphere damaged individuals have been reported to perform poorly in the perception and production of emotive intonation compared to left hemisphere damaged or non-brain damaged (Ross, 1981). Damage to both the cortical and subcortical structures can give rise to impaired speech prosody (Kent & Rosenbeck, 1982).



Intonation, Rhythm and Stress

Intonation, rhythm and stress are classically understood as prosodic parameters. Rhythm is the variation of the length and accentuation of a series of sounds or other events. Stress is understood as a comparative force with which particular syllable within the group of syllable are pronounced. Intonation is defined as the variation in pitch superimposed on the sentences (Bolinger, 1972). Acoustically, the prosodies of oral language involves variation in syllable length, loudness, pitch, and the formant frequencies of speech sounds.

Speakers use intonation patterns to help them express their ideas or emotions. Intonation conveys meanings that apply to phrase or utterances as a whole, such as sentence type or speech act, or focus and information structure. Intonation patterns are specified as an abstract sequence of high and low tones. These tones have no absolute physical value. Rather, they are implemented relative to each other through the manipulation of pitch and the fundamental frequency (F0) of the voice (Ladd 1996). These are as shown in Table 1.

Table 1: The F0 variation for different intonation types

S No:	INTONATION TYPES	PITCH/AMPLITUDE CONTOUR
1.	FALL /LOW TONE	
2.	FALL-RISE	

3.	RISE	
4.	RISE-FALL	

Some researchers also analyze intonation according to the PHH model proposed by Pierrehumbert and Hirschberg (1990). The model's units are the simplest possible code levels of relative pitch: High pitched peaks, H: low pitched regions, L: and combination of these events with stress (*) and end of utterance (%). Thus, the F0 patterns are described as a series of high and low tones relative to each other.

Linguistic Prosody

Studies on production aspects of linguistic prosody have addressed the patterns or contours of change in fundamental frequency (F0) for different types of sentences. Most of the languages have 4 types of sentences, declaratives, interrogatives, exclamatory and imperatives. A sentence in the form of a statement is called as declarative sentence. An exclamatory sentence is to express strong feelings by making an exclamation. A sentence that gives advice or instructions or that expresses a request or a command is termed as imperative sentence and the form of sentence used for asking questions is interrogative (Richard, 2003).

A study done on Japanese and Russian languages reported that there is an increase in the height or magnitude of a rise for the intonation pattern of a declarative sentence in both languages (Makarova, 2000). Another study concluded that there is a raising terminal contour in the exclamatory sentence in English. (Bolinger,1989). Quirk et al. (1985) claimed that imperative sentence frequently has a tone unit to itself, especially in final position with a rising tone.

According to Bassano and Mendes (1994) in French language declaratives and exclamatives were of falling intonation pattern, interrogatives were of rising and imperatives split between falling and rising contours depending on their specific functions. Falling intonation is reported to indicate a declarative utterance, while a rising intonation contour declares an interrogative utterance in German (Raithel & Hielscher, 2004). Commands are found to have no salient contour.

Studies on Linguistic Prosody in Indian Languages

Few studies on intonation patterns of sentences have also been done in Indian languages. A comparative study on the intonation pattern of declarative sentence in Chattisgarhi and Khariboli speakers done by Manish, Chongtham and Rakesh (2008) reported that Chattisgarhi speakers produce declaratives with a falling pattern, Khariboli speakers show a raising pattern. In Kannada, it has been reported that there is no significant rising or falling contour to mark a statement effectively as a question (Suma & Manjula, 2007).

But, there is a dearth of studies in Indian languages addressing the location and direction of F0 change in a speech segment. And it is evident from the above studies that the intonation patterns do not follow a universal trend, it varies across languages.

Being a multilingual country, in India, there is a wealth of information to be obtained by studying the aspects of intonation patterns in the various languages. This would provide a speech language pathologist an understanding on the normal and abnormal aspects of prosody, which will in turn aid in the assessment and management of prosodic errors in individuals with communication disorders. This would also throw some light on the parameters of prosody that need to be incorporated for the synthesis of speech in the Indian languages.

Need of the Study

Study of prosody in any language yields information on the essential suprasegmental aspects of speech which adds meaning and melody to a speaker's production. Knowledge of the normal patterns of prosody aids in the understanding of abnormal aspects, as in the case of communication disorders. Also, such database can also be incorporated in the corpus for speech synthesis.

Synthetic speech is widely being used in the field of mass media and communication as well as in the field of speech and hearing, especially with respect to the development of speech stimuli as part of test procedures.

Thus, an attempt is being made in this study to understand the terminal intonation pattern, for different sentence types in three languages being spoken in the city of Mangalore; Kannada, Tulu and Konkani. Kannada forms the official language in this city, while Tulu and Konkani are being spoken by culturally different sects of the population.

Objective of the Study

This study aims at understanding the terminal intonation patterns in three languages, Kannada, Tulu and Konkani, for different types of sentences and also to document if there are differences in the patterns produced by male and female speakers of the respective languages.

Method

Participants

Twelve participants were considered for the study. They were divided as native speakers of Kannada, Tulu and Konkani, with two males and two females for each of the languages. All the participants were in the age range of 18-40 years. They were normal healthy individuals, devoid of speech, language problems, neurological problems and hearing problems.

Protocol

a) Preparation of test stimuli: Four sentence types were considered, namely, declaratives, exclamatory, interrogatives, and imperatives. Simple sentences, one under sentence type,

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randomly chosen from text books served as test stimuli in all the three languages.

b) Instrumentation: Motor Speech Profile software (MSP) of Computerized Speech Lab 4150 from Kay Elemetrics, was used.

c) Procedure: The recording was done in a sound treated room, with the participants seated on a comfortable chair and the microphone of the CSL hardware was placed at a constant distance of 10 cm away from the mouth. The participants were visually presented with the sentences written on cards one by one and instructed to say the sentences. They were also provided with a model of each sentence with the appropriate intonation pattern. Each sentence was recorded thrice and the second repetition was considered for the analysis.

d) Analysis: The F0 patterns for all the sentences were plotted from CSL, by an experienced speech language pathologist, using the PHH model of intonation; H for high tone, L for low tone, (*) to mark the stress and (%) to mark the end of utterance. the terminal F0 contours were noted.

For the acoustic analysis, the following parameters from MSP were considered: (1) rfo (running speech average fundamental frequency , /Hz/)- this is the average Fo of during the vocalization; (2) rFhi (running speech highest fundamental frequency, /Hz/)- this is the highest Fo during the vocalization; (3) rFLo (running speech lowest fundamental frequency, /Hz/)- this is the lowest Fo during vocalization; (4) rvFo (running variability , /%/)- this is a parameter which tracks the degree of pitch variability; (5) rvAm (amplitude variability , /%/)- this is a parameter which tracks the degree of amplitude variability. The analysis was carried out separately for Kannada, Tulu and Konkani.

The readings from MSP were subjected to statistical analysis, using Mann Whitney U Test (SPSS Version 16) to explore the possibilities of gender differences in the production intonation. The analysis was carried out separately for Kannada, Tulu and Konkani.

Results and Discussion

The results on the study of intonation patterns for four types of sentences in Kannada, Tulu and Konkani are as discussed below.

Within each language, the F0 patterns did not vary among the subjects of each gender. This was observed throughout for all the sentence types under consideration, thus only one pattern has been plotted for reference. These patterns of the F0 variations plotted for the sentence types in Kannada, Tulu and Konkani are as given in Table 2.

Table 2: Intonation patterns of Kannada, Tulu and Konkani

Sentence Type	Kannada		Tulu		Konakani	
	Females:	Males:	Females:	Males:	Females:	Males:

Declarative						
Exclamatory						
Imperative						
Interrogative						

In Kannada, the pattern of the declarative sentence for females was represented as LH*L% and for males were as HLH*LHL%. The pattern of the exclamatory sentence was HLHLH*LH% for females and LHLH*LH% for males. For imperative sentence the pattern was HLH*LHL% for females and LH*L% for males. The interrogative sentence was marked LH*LHLH% for females and HLHLH*L% for males.

In summary, it can be seen that the terminal pitch contour for declaratives and imperatives was HL, a falling contour. This was common for both male and female participants. Exclamatory sentence was marked by a raising contour, HL, in both males and females. The terminal contour varied between the genders for interrogatives with females having a raising and males having a falling contour.

In Tulu, for declarative sentence the intonation pattern was HLH*L% for females and males. HLH*L% for males were the intonation pattern. The pattern for the exclamatory sentence was LHLH*L% for females and LHLH*LHL% for males. For imperative sentence the pattern was LHL-LH*LHL % for females and LH*L% for males. The interrogative sentence was marked LH*LHLH% for females and LHLH*LH% for males.

In summary, it can be seen that the terminal pitch contour for declarative, exclamatory, and imperatives was HL, a falling contour. This was common for both male and female participants. The interrogatives had a raising terminal contour, marked as LH. This was common for both genders.

In Konkani, LH* LHL% and LH*LHLHL% marked the declarative sentence for females and males respectively. The pattern for the exclamatory sentence was LHLH*LH% for females and HLH*LH% for males. For imperative sentence the pattern was HLH*L% for females and LH*LHL for males. The interrogative sentence was marked LH*LH% for females and HLH*LH% for males.

In summary, it can be understood that the terminal pitch contour for declaratives and imperatives was HL, a falling contour. The exclamatory and the interrogative sentences had a

raising pattern, LH. This was common for both genders.

A Comparison of the Results Obtained for Kannada, Tulu and Konkani

The results of the acoustical analysis for the sentence types across Kannada, Tulu and Konkani are as shown in Table 3.

Table 3: Mean of F0 pattern in Kannada, Konkani and Tulu for the 4 sentence types

Parameters		rfo				rfhi				rflo				rvfo				rvam			
Language	Sentence type	Mean		Z	P value	Mean		Z	P value	Mean		Z	P value	Mean		Z	P value	Mean		Z	P value
		M	F			M	F			M	F			M	F			M	F		
Kannada	Declarative	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	2.00	3.00	-.775	.439	1.50	3.50	-1.54	.121
	Exclamatory	1.50	3.50	-1.63	.102	1.50	3.50	-1.63	.102	1.50	3.50	-1.63	.102	1.50	3.50	-1.63	.102	1.50	3.50	-1.63	.102
	Imperative	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	2.00	3.00	-.775	.439	2.50	2.50	1.00	.000	1.50	3.50	-1.54	.121
	Interrogative	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	1.50	3.50	-.775	.121	1.50	3.50	-1.54	.121	2.50	2.50	1.00	.000
Tulu	Declarative	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	2.50	2.50	1.00	.000	2.50	2.50	1.00	.000
	Exclamatory	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	3.50	1.50	-1.54	.121
	Imperative	2.00	3.00	-.775	.439	1.50	3.50	-1.54	.121	2.00	3.00	-.775	.439	2.50	2.50	1.00	.000	3.50	2.50	-1.54	.121
	Interrogative	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	3.50	1.50	-1.54	.121	3.00	2.00	-.775	.439
Konkani	Declarative	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	3.50	1.50	-1.54	.121	3.00	2.00	-.775	.439
	Exclamatory	1.50	3.50	-1.54	.121	2.50	2.50	1.00	.000	2.00	3.00	-.775	.439	2.00	3.00	1.00	.000	2.00	3.00	-.775	.439
	Imperative	2.00	3.00	-.775	.439	2.50	2.50	1.00	.000	1.50	3.50	-1.54	.121	3.50	1.50	1.54	.121	2.50	2.50	1.00	.000
	Interrogative	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	1.50	3.50	-1.54	.121	3.00	2.00	-1.54	.439	3.50	1.50	-1.54	.121

From the table it can be seen that there were no statistically significant differences between males and females on all the F0 parameters analysed. This was a common finding for all the three languages.

On a comparison across Kannada, Tulu and Konkani, it can be understood that there were certain similarities and differences in the F0 terminal contours for the different sentence types. Declaratives had a falling pattern in all the three languages. This is similar to the findings in the studies done on declaratives in French, German and Chattisgarhi languages Bassano and Mendes (1994) and Raithel and Hielscher (2004), Manish, Chongtham and Rakesh (2008). Imperatives had a falling pattern in all the languages. This finding is similar to the study done in French by Bassano and Mendes (1994).

Exclamatory sentences had a raising pattern in Kannada and Konkani, which is a similar finding reported for English (Bolinger,1972) Whereas, a falling pattern was seen for exclamatory sentences in Tulu. This is in accordance to the study done by Bassano and Mendes (1994) and Vivian and Hielscher, (2004), in this type of sentence in French and German respectively.

The pattern for the interrogative sentences in Tulu and Konkani were the same, a raising pattern. Similar results are reported for French and German languages (Bassano and Mendes, 1994 and Vivian and Hielscher, 2004). While in Kannada this raising pattern was seen for females but not for males. This finding is contrary to that of an earlier study by Suma & Manjula (2007), who reported that there was no significant difference, in the extent of rise (steep/ shallow) to mark a statement effectively as a question. The reason for the differences in the pattern between the genders is interesting to note, since it was seen only for the interrogative sentence. This could indicate that there are gender differences in the production of intonation. Though conflicting, it remains to be seen if this phenomenon is observed on larger samples.

Another interesting finding is that, on the acoustic analysis, there was no statistically significant difference between males and females for the parameters analyzed. But on the spectrographic analysis it was seen that there are differences in the overall pattern of the sentence between the genders. This difference could be assigned to the varied pattern of stress used by males and females. Also, the loci of stress were different for both the genders for all the different sentence types. This phenomenon needs further understanding, including larger sample sizes.

Conclusion

The present study has attempted to provide intonation patterns in the three languages Kannda, Konkani and Tulu. In comparison, Kannada, Konkani and Tulu there is a falling pattern observed in declarative sentence. Exclamatory sentence had a rising pattern in Kannada and Konkani and a falling pattern was observed in Tulu. Imperative sentences had a falling pattern observed. The pattern for the interrogative sentences in Tulu and Konkani were the same, a raising pattern. While in Kannada this raising pattern was seen for females but not for males. Another interesting finding is that, on the acoustic analysis, there was no statistically significant difference between males and females for the parameters analyzed.

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Appendix 1

Sentences in Kannada:

Declarative: /Iðu n^nnɑ: kɑ:ru/ (This is my car)

Imperative: /kitəki mutʃu/ (Close the door)

Exclamatory: /avəlu geðəlu/

Interrogative: /av^ru h3ðəɾɑ:/

Sentences in Tulu:

Declarative: /inð^ ennɑ: kɑ:ru/

Imperative: /k^ndi mutʃɑ:/

Exclamatory: /ɑ:l genðija:l/

Interrogative: /ak^l pojəɾɑ:/

Sentences in Konkani:

Declarative: /œi m^dʒi gɑ:di/

Imperative: /zanel ðɑ:mp^/

Exclamatory: /œé dzinklei/

Interrogative: /œi geleigi:/

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