STRESS IN KANNADA WORDS IN NARRATIVE DISCOURSE

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MAY 2002

TO

MANJULA MA' M

AMMA, APPA, MEERA……

WITH ALL RESPECT

Certificate

This is to certify that the dissertation entitled "**Stress In Kannada Words In Narrative Discourse** " is the bonafide work done in part fulfillment of the degree of Master of Science (Speech and Hearing) of the student (Register No. M 2K06).

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Certificate

This is to certify that the dissertation entitled **"Stress In Kannada Words In Narrative Discourse"** has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier in any other University for the award of any Diploma or Degree.

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Declaration

I hereby declare that this dissertation entitled **"Stress In Kannada Words In Narrative Discourse"** is the result of my own study under the guidance of Dr. R. Manjula, Reader, Depaitment of Speech Pathology, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier in any other University for the award of any Diploma or Degree.

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TABLE OF CONTENTS

	Chapters	Page No.
1	Introduction	1-3
2	Review of Literature	4-18
3	Methodology	19-24
4	Results and Discussion	25-45
5	Summary and Conclusion	46-49
6	Bibliography	50-56
7	Appendix	57-63

LIST OF TABLES

Table No.	Title	Page No.
Table 1	*Target words selected in the narrative discourse sample*	21
Table 2	*Syllables in the target words (nouns) which carried primary and secondary stress*	26
Table 3	*Syllables in the target words (pronouns) which carried primary and secondary stress*	30
Table 4	*Syllables in the target words (verbs) which carried primary and secondary stress*	33
Table 5	*Mean and Standard deviation of Peak FO and duration of the target syllables and the syllables preceding and following the target words*	39

LIST OF GRAPHS

Graph No.	Title	Page No.
Graph 1	*Percentage of occurrence of primary stress on the stressed syllable (nouns) as identified in perceptual analysis*	27
Graph 2	*Percentage of occurrence of primary stress on the stressed syllable (pronouns) as identified in perceptual analysis*	31
Graph 3	*Percentage of occurrence of primary stress on the stressed syllable (verbs) as identified in perceptual analysis*	34

INTRODUCTION

Following the studies of human communication behavior conducted over the past fifteen years, substantial agreement as to the general nature of the components of any act of human communication has now been reached. The total meaning of an act of communication to the receiver is the result of a process of recognition, collation and interpretation of a number of signals, selected from potentially significant and nonsignificant events being continuously transmitted by the sender (Crystal, 1969). Considering the communication system as a whole, it is necessary to distinguish features of an individual's behavior which are being used as a systematic element in the linguistic conventions of a speech community and which are not. This is particularly important for the study of prosodic systems of any language.

Discourse analysis is one of the techniques to study the communication behavior. This type of analysis is acknowledged as an important tool for Speech and Language pathologists. The basic premise of discourse analysis is that the meanings are conveyed through extended units of language where the participants attempt to share perspectives and exchange knowledge about the world, not only by words and sentences alone (Atkinson & Heritage, 1984; Glosser & Doser, 1990).

Need for the study

The analysis of language in discourse has helped the clinicians to understand the relationship between language, the meaning it expresses, the context in which these meanings occur and the effects of factors such as social distance, power and authority (Penn & Cleares, 1988). In discourse analysis, segmental aspects of speech and linguistic abilities have received due attention, but prosodic aspects remain largely unspecified.

Prosodic features may be defined as vocal effects constituted by variations along the parameters of pitch, loudness, duration and silence (Crystal, 1969). The rules of prosody are systematic, bound by conventions and convey important information to listeners. Stress is one of the prosodic features. Stress is assigned to that syllable of a word, which stands our more conspicuously. Stress is conveyed by variation of frequency, intensity, duration and /or pause (Hargrove and Mcgarr, 1994). Different stress levels and categories of stress have been identified (Hargrove and Mcgarr, 1994; Lieberman, 1965; Jesperson,1970; Block and Trager, 1942). There are very few studies in Indian languages (specifically, Kannada) addressing the feature of stress. Further, the behavior and occurrence of stress in discourse mode is not studied in any Indian languages. A study of stress in discourse mode in Kannada is planned in order to collate database on Kannada stress. The benefit derived out of the study will be multifold and will serve as an useful input in the field of prosodic analysis.

The study aims to analyze the segmental and acoustic factors related to the perceived stress on selected target words in a narrative discourse mode in Kannada language. Stress placement in isolated words may differ from that in narration/ connected speech. Stress placement may be influenced by co-occurrence of different vowels and consonants, pauses, emotional value that the context carries etc. An attempt is made in the study to establish the features of stress in a limited context of narrative discourse and by controlling the variables, which are known to affect stress.

Aims of the study

1. To determine the occurrence of stress on the syllables of target words in discourse mode, specifically narration in Kannada.
2. To correlate the acoustic features (frequency and duration) with syllables perceived as stressed in the target words in narrative discourse in Kannada.

Method

In the study, 30 native Kannada speakers narrated a sequential Kannada story, which was recorded and transcribed. Twenty target words were selected (nouns, pronouns and verbs). The recorded sample and the transcribed written material with target words highlighted were given to two judges who were asked to identify and mark the stress on syllables of target words which occurred in the narration. Acoustic analysis was done to identify the frequency and durational factors of the stressed syllable with reference to other syllables in the word. This was done using Computerised Speech Lab (CSL 4400). The data obtained from the perceptual and acoustic analysis was computed to determine the stress pattern on the syllables of the target words in narrative discourse mode.

Implications of the study

- The study provides database on the behavior of stress in narrative discourse in Kannada language.
- The data obtained will foster our understanding of the behavior of stress in a controlled discourse mode.
- It will provide a thrust to the long felt need for research in the field of prosody in various Indian languages.
- The data will serve as a useful input in text to speech synthesis.

Limitations of the study

- Limited number of judges were involved in the study for perceptual analysis.
- Correlation of perceived stress with the acoustic features is undertaken within a limited context because of the small sample size. However, due to time constraints the study did not give scope for inclusion of more subjects.

REVIEW OF LITERATURE

Features of spoken language which are not easily identified as discrete segments are variously referred to as prosodic features, nonsegmental features or suprasegmentals (Clark and Yallop, 1995). The term 'Suprasegmental refers to those properties of an utterance which do not belong to any single segment. The suprasegmental properties are :

- Stress
- Tone
- Intonation
- Length
- Organization of segments into syllables.

Crystal (1969) has described prosodic systems as sets of mutually defining phonological features which have an essentially variable relationship to the words selected, as opposed to those features which have a direct and identifying relationship to such words. The primary prosodic parameters, along which systems of linguistically contrastive features can be plotted, are the psychological attributes of sound described as pitch, loudness and duration. These have a primary relationship with the physical dimensions of fundamental frequency, amplitude and time respectively. For example, intonation is viewed as the product of a conflation of different prosodic systems of pitch contrasts; stress is referred to as the variations in the loudness parameters. Thus the term 'prosody' has been used in a number of different ways in different contexts, though there is none-the-less a clear common element in each.

Stress is one of the prosodic aspects. Stress is the relative force with which a given sound, syllable or word is pronounced. Force here, is the degree of effect used in pronunciation, which is determined by the amount of breath pressure being used at any given time (www.medline.com). Stress is assigned

to that syllable of a word, which stands out more conspicuously. It is conveyed by variation of frequency, intensity, duration and pause (Hargrove and Mcgarr, 1994).

A good sentence is clear not only because the words are well chosen and it fits clearly into its content, but also because it emphasizes the right ideas by planning them in positions where they receive special 'stress' or by giving them extra grammatical bulk (Glasser, 1999). Stress plays an important role in judging the grammatical categories of the word. Stress is a phonetic element that has definite acoustic correlates in the speech signal that are independent of the acoustic correlates of the segmental phonemes (Lieberman, 1967).

Kinds of Stress

It is observed that two kinds of stress are commonly defined in the literature. They are Word stress and Sentence stress.

Word Stress : Every word containing two or more syllables will have one prominent syllable requiring the main or sometimes secondary stress. Stress is not absent in a word of two or more syllables. Words of one syllable do not require indication of stress because when pronounced in isolation, their only syllable always possesses some degree of inherent stress. (Lieberman, 1960)

Cruttenden (1986) states that in most of the languages the word stress occurs regularly in a certain position of words in a sentence. He reports that the Czech and Finnish languages have stress on the first syllable, Spanish and Welsh languages have stress on the penultimate syllable. French and Turkish have stress on the final syllable. Thus, stress being predictable, it was said to assume delimitative function in such languages. In other languages like English, Russian and Greek, stress did not assume a delimitative function, but assumed a distinctive function, in which case word stress could be predicted only by a set of complex rules.

Summarizing the views on stress plncement in different grammatical classes like noun, verb etc. in English, Ladd (1978) commented ". . . . . the answer to many puzzles about accent placement lies in the principle that nouns are in general, more accentable than other content words. But they may be deaccented, or lowered in relative accentability for a variety of reasons".

Sentence Stress : Certain words and certain syllables have a particular kind of stress according to the function, significance or importance they have in the sentence. This means that certain words of one syllable may have no stress at all and that certain words / two or more syllables may, under the influence of sentence stress have different types of stress. According to Hargrove and Mcgarr (1994), there are three categories of stress.

Lexical Stress : Pattern of stressed / unstressed syllable at word level

Phrasal Stress : Marks the most prominent syllable in a phrase

Emphatic Stress : Distinguishes a sentence from its negation

The words which have full vowels are typically accented. This is the class referred to as 'lexical words'. In every word in English, there is one main emphasized syllable. The vowel in this syllable sounds higher in pitch, longer and louder and this is called stress. This helps create the rhythm of the language and knowing how to recognize the stressed syllable will help in comprehension (Ewens and Hulst 2001)

Spoken or written English moves along in a series of breath units, each one containing a separate bit of information, within each breath unit a distinctly stressed syllable or 'nucleus' highlights a certain word. The nuclear stress is the main stress in a phrase (Glasser, 1999).

Chomsky, Halle and Lukoff(1956) and Chomsky and Halle (1966) have shown that cyclic phonological rules assign a set of stress "level" to the vowels of a word or phrase. These stress levels that arc assigned to a word are a

function of the phonemic structure of the word, its syntactic function and the constituent structure of the derived phrase marker (Lieberman, 1967).

Sentence Stress

Thorsen (1983) viewed 'sentence stress', 'primary accent', 'sentence stress', 'nuclear stress', 'tonic', 'focal accent', 'satzakzent' as more or less synonymous terms which designated that one stressed syllable was more prominent than other stressed syllable in a stretch of speech.

Sentence stress was considered as another "level of stress" by Ladd (1978) in American English. In British English, sentence stress was called the 'nucleus'. Sentence stress is simply the place where the greatest prominence of the rhythmic structure is associated with the nucleus of the intonational configuration. Cutler and Ladd (1978) also stated that the terms 'sentence accent', 'sentence stress', 'nuclear accent', 'nucleus', 'focal accent', and 'tonic' all referred to a phenomenon at the conceptual level between prominence and intonation. They quote Brown (1970) according to whom there was no basis for designation of one syllable in a sentence as more prominent than the rest. Garding (1972) was of the opinion that sentence accents could have separate phonetic basis for the distinction. Cutler and Ladd (1983) however, believed in the existence of one most prominent syllable in a given domain. When the domain was not a sentence, then nuclear stress or nuclear accent was considered to be a more appropriate term than the sentence stress or sentence accent. The function of sentence accent, according to them was to highlight, focus, contrast, comment or indicate new information.

Hirsh (1977) proposed that the feature of emphasis contributed to the intonation of a sentence, specifically, the high falling and falling rising intonation patterns. Cooper, Eady and Muller (1985) reported that the focus of the sentences which was manifested by contrastive stress was generally accompanied by an increase in duration on the focused word and a sharp drop in F0 following the focused item.

The following are listed as features of sentence stress in English according to Cooper et.al.,(1985)

1. Words of one syllable may or may not be stressed according to their grammatical function in the sentence. We can generally say that the content (lexical) words are stressed and the structure (grammatical) words are unstressed.
2. Every sentence, regardless of the number of words it contains, must have at least one word that will take the main stress.
3. Some words of one syllable will normally have a main stress in the sentence and some words will normally have a secondary stress. Others will vary between main and secondary stress, according to the actual position in the sentence and to some extent, according to the relative significance of the word in its particular context.
4. Disyllabic and polysyllabic words must take some kind of stress and that will depend upon the relative significance they have in the context, as well as the function they perform in the sentence. So, if they are content words whose meaning carries vital information in the sentence they will take a main sentence stress which will fall at the same position of the word main stress. If they are grammatical words or words of minor significance, they will take the secondary sentence stress which will fall on the syllable carrying the main word stress.
5. Secondary word stress becomes secondary sentence stress without changing its position or prominence.
6. There is a strong tendency in English to avoid two adjacent main stresses, the rhythmical pattern of a word may be altered by the rhythmical requirements of a sentence as a whole, i.e., one of the main stresses will become a subsidiary main stress or even secondary stress.

Realization of Stress

There have been varied views about the acoustical correlates of stress. The parameters which determine stress are F0, intensity and duration. Various experiments have been done and results have been varied. The acoustic correlates of stress varies depending on the language under study.

Scott and Newman (1916) and Malmberg (1955) studied the acoustic correlates of stress in English and concluded that frequency is an important cue for stress. Jones (1940) defined prominences as the combined effect of timbre, length, stress and intonation of the syllabic sound. While prominence is a perceptual quantity, stress is an articulatory gesture due to force of utterances, it is independent of length and intonation, although it may be combined with these aspects. This study is in consensus with study done by Fry (1955,1958) who said that frequency, intensity and duration are important aspects of stress in English. Another study conducted by Block and Trager (1942) in English suggested that loudness acts as a cue to stress. Trager and Smith (1951) were of the same opinion. They stated that the stress perception is due to relative strength or loudness. Various other studies in English have reported that pitch prominence is the primary cue to stress (Bolinger, 1958; Mortan and Jassem, 1965). Most of the studies conclude that perception of stress in English is a complex of FO, intensity, spectral composition and duration features. (Gimsen, 1956; Lehiste and Peterson, 1959; Gay, 1978).

Experiments have been carried out to see which acoustic cue/ cues are evident in the production of stress. There have been varied results in English. Study conducted by Fry, (1955) and Lieberman, (1960) reveals than in adult English, stressed syllable can be identified by several acoustic cues. Stressed syllables may be louder, longer and higher/ lower in pitch (Fo) or have more steep rising contours than unstressed syllable. Fry (1958) studied stress in English language and reported that duration is the important cue for stress. Duration increases in stress. Morton and Jassem (1965) reported that a raised

fundamental frequency is seen during stress in English. Similar results were found by Lieberman and Pierrehumbert (1984). Lieberman (1960) and Fonogy (1966) found yet another cue as being evident in the production of stress in English. They have said that the peak amplitude will be more in stress. Though there are several studies which indicate that listeners rely on a variety of acoustic and temporal cues to perceive stress, the results indicate that there is no one to one correspondence between stress perception and any single acoustic or temporal parameter (Lehiste,1970).

Another study by Lehiste and Peterson (1959) state that speech power, fundamental frequency, phonetic quality, duration and to some extent laryngeal quality contribute to stress. Every word in English has one main emphasized syllable. The vowel sound in this syllable sounds higher in pitch, longer and louder and this is called stress. English word stress is not always on the same syllable, like in some languages. In English, the stress lies usually on one of the last three syllables in the word (Tutorial on stress http://www.google.com, word stress in English). The general rules of stress placement in English is as follows.

Word Type		**Where is the stress ?**	**Examples**
Two syllables	Nouns	On the first syllable	Center, object flower
	Verbs	On the last syllable	Release, admit arrange.
Compound	Nouns (N+N) (Adj. + N)	On the first part	Desktop, pencil case, book-shelf green-house.

Compound	Adjectives (Adj. + P.P)	On the last part (the verb part)	Well-meant^ Hard-headed, Old-fashioned
	Verbs (prep.+verb)		Understand, overlook, Outperform
Phrasal Verbs		On the particle	Turn off, buckle up, hand out
Word with added ending	-ic	The syllable before the ending	Economic, Geometric, Electrical
	-tion,-cian, -sion		Technician Graduation Cohesion
	-phy,-gy,-try,-cy,-fy,-al	The third from the last syllable	Photography^ Biology^ Geometry
	-meter		Parameter Thermometer} Barometer

Stress occurrence may vary depending on the dialect of the spoken language. Hung (2000) has established that in English spoken in Hong Kong, at the phonetic level, stress is manifested mainly in terms of pitch. The stressed syllable carries a high tone, the difference in pitch being much more pronounced than in other varieties of English. Stress on individual words appears to be learned as a lexical property. Lexical morphemes retain their original stress regardless of all types of sophistication.

Tan (2000) conducted experiments on proficient speakers in English belonging to the Chinese, Malay and Indian communities who stayed in

Singapore. Durnlion, amplitude nnd fundamental frequency were analyzed. The findings showed that the Chinese, Malay and Indian sub varieties of Singapore English have different acoustic cues for lexical stress.

Adults use pitch as an important acoustic cue to mark stress (Edwards and Gregg, 1992). In American English, Pitch is used more frequently to show the prominence where as loudness and duration are important to secondary stress (Edward and Gregg, 1992). The relationship between stress and Fo is often confounded with intonation patterns and position of the stressed syllable within the utterance. Finally, the vowels in stressed syllables may have a more distinct quality than those in unstressed syllables (Lehiste,1970). The actual use of each of these cues varies greatly and research indicates that a complex relationship exists among them (Fry, 1955; Liberman,1960 and Lehiste,1970).

Sereno and Jongman (1995) conducted an experiment to investigate acoustic correlates of grammatical class in English. Results of previous studies examining the acoustic correlates of stress had established that variations in duration, amplitude and fundamental frequency were cues to lexical stress, hi the study, the investigator examined whether systematic acoustic differences would also be observed in words which maintain a constant stress pattern across syntactic function. Five speakers recorded 16 grammatically ambiguous lexical items stimuli which were read either as a noun or a verb. The acoustic parameters measured were duration, amplitude and fundamental frequency. Results showed that duration and amplitude cues were robust cues for signaling the syntactic differences. These results were in accord with recent evidence documenting the paradigmatic stress pattern for grammatical class in English.

Bergem (1993) studied the effect of sentence accent, word stress and word class (function words Vs Content words) on the acoustic properties of nine Dutch vowels in fluent speech. It was concluded that word stress and word class had a significant effect on the steady state formant frequencies (Fl and

F2) and on the duration of the vowels. Word stress and word class had a stronger effect on vowels than sentence accent. Further, listening experiment showed the perceptual significance of these acoustic measurements.

Summarizing the finding on English stress, William (1986), stated that there was a fair degree of consensus as to the acoustic correlates of stress in English. The consensus was that the primary cue to stress was a change in Fo within a syllable and neighboring syllable, the stressed syllable usually having higher Fo. Also important, was the fact that the stressed syllable usually had longer duration and greater amplitude, though the relative importance of these two cues were uncertain.

In French, the final syllable of a word group is said to be accented and non final syllables in a word group are generally un accented (Cruttenden, 1986). Most of the studies in French distinguished one intermediate level of stress / accent which is often called "accent d' insistence" indicated by high pitch and / or extra length and loudness. French, according to Cruttenden, (1986) is a syllable timed language, where there are no reductions in vowels. Syllable timed languages like French, Italian and Hindi are said to operate with fewer distinctions of stress/accent than languages like English, which are stress timed (Cutter and Ladd, 1983).

Studies in French by Rigant, (1962) reveals that frequency is an important correlate of perceived stress. The relative importance of duration and intensity are approximately the same. In contrast, frequency serves as an important cue in Swedish (Westin, Buddenhagen and Obrecht, 1966). They have reported that frequency, specifically the frequency of the first syllable, overriding opposing cues of pitch, quantity and intensity in the final syllable provides the primary cue for identification of stress. In Swedish, stressed syllables are usually lower in pitch reported as one of the most noticeable feature of a Swedish accent (http://www.vmanitoba.in/ faculties /arts /linguistics/ /138/ /stress.htm - suprascgnicnlals). Fundamental frequency is

the decisive parameter in the perception of stress in Serbocroatian and Polish languages (Rehder,1968; Jassem, Morton and Stefen-Batog, 1968). In Italian verbs bear a stress on the stem or on the theme vowel with future and conditional verb forms, however stress is always on the inflectional ending (Vander Leeuw, 1995).

Hymann (1977) studied 444 languages to survey the incidence and distribution of stress as a linguistic phenomenon. If a language makes linguistic use of stress, then it will fall into one of two broad types; locating the word stress predominantly on a given syllabic location in the word called fixed lexical stress or allowing much more freedom for placement of the stress, called variable lexical stress. Out of 444 languages, 306 were found to be fixed lexical stress and 138 had variable lexical stress. . Default stress placement in Turkish is the word final position. Some words have presperified stress placements like, penultimate and other. In compound words, usually the first member is stressed. Any kind of affixes does not interfere with word-final stress pattern. Thus Turkish has a rule based stress placing system.

Some of the languages which have fixed lexical stress are: Tatar, the Altaic language spoken in the Central area of the Common wealth of independent stales, French, Mcsomerican languages, Finnish, Polish, Czech etc.,. Of these, French and Tatar have stress on the last syllable, Mesomerican languages, Polish and Swahili have stress position fixed in antepenultimate syllable, whereas Finnish and Czech both have initial syllable stress (Lehiste,1970)

A relatively small proportion of the languages of the world allow a range of different locations of lexical stress. Examples of such languages using relatively free placement of stress include Assamese (Goswami,1966), Dutch (Von Essen, 1956), Greek (Jones, 1940), Italian (Vincent, 1988), Russian (Brosnaham and Malmberg, 1970), Spanish (Green, 1988), and English (Wenk and Wioland, 1982).

Prosodic features are not as rigidly or discretely definable as segmental features, but the criterion for establishing them is similar. Prosodic features like stress has been described as those non segmental characteristics of speech referable to variations in pitch, loudness, duration and silence. There are many studies which describe the acoustic correlates of stress.

A series of experiments were conducted by Cooper, Eady and Mueller (1985) to examine the influence of contrastive stress on intonational patterns of duration and fundamental frequency (F_o). The analysis revealed that "focus" equated to stress is generally accompanied by an increase in duration on the focused word and by a sharp drop in Fo following the focused item. The results for both duration and Fo indicate that the influence of focus assignment on these attributes varies systematically as a function of the focus location in the sentence.

Most work to date has been done in western languages (Lieberman, 1960). Very few studies have been done on stress in Indian languages. In Indian languages studies have been done in Kannada, Tamil and Telugu. According to Rathna, Nataraja and Subramanya (1982), intensity and duration are important cues for perception of stress. Savithri, (1989) studied stress in Kannada sentences and suggested the probability of Kannada being a stress-timed language. She has indicated that Fo and duration are the acoustic features which contribute to perception of stress. Manjula (1997) studied nuclear stress with reference to intonation contour in 'WH' and 'YES-NO' interrogative sentences in Kannada. The occurrence of stress on some segmental features were discussed and among the acoustic parameters studied, fundamental frequency and duration were found to contribute significantly towards perception of stress. Occurrence of primary stress was reported to be more frequent than the secondary stress in the interrogative utterances. The syllables consisting of full vowels and short vowels were more frequently stressed than

the syllables containing reduced vowels and long vowels respectively. Occurrence of a significant percentage of stress was seen on the words consisting of glides, diphthongs, aspirates, geminates, consonant clusters and morphophonemic syllables. Grammatically stress was reported to be more on nouns and adjectives.

Degrees / Levels of Stress

Different views are expressed by various investigators regarding the levels of stress in English. Few investigators however reject the idea of grading of stress (Vanderslice and Ladefoged, 1972 and Lieberman, 1965).

Jesperson (1970), Black and Trager (1942) have identified 4 levels of stress in English as loud, half loud, strong and weak. Cruttenden (1986) has also described four levels of stress in English they being : primary stress, secondary stress, tertiary stress and unstressed.

Liberman (1965) did not agree with the gradation of stress. He was of the opinion that the syllables were either stressed or unstressed and unstressed syllables could have either a full or reduced vowel.

According to Thorsen (1983), three degrees sufficed to account adequately for the distribution of stress in standard Danish : Main stress, secondary stress and weak stress.

Prosody in Discourse

Discourse analysis includes a host of techniques designed to describe how subjects order information and relate ideas across sentences. Numerous abstract units and linguistic devices have been targeted in order to examine those aspects of discourse that govern cohesion, organization and topic manipulation (Bloom, Obler, Desanti and Ehrlich, 1994). Not many studies have been done to analyse the prosodic aspects in discourse. In a study by Coleman (1999) the nature of narrative discourse has been analysed as to why

it has been so natural and so important. It is concluded that narration, as it is natural helps in understanding the emotions displayed by the speaker.

Systematic examination of discourse provides a rich source of data for describing the complex relationships among language, social context and the cognitive processes that underlie discourse comprehension and production. There are various discourse types or genres, each with its own internal structure. Conversational, narrative, procedural, expository and instructional discourse genres may be distinguished from each other by the roles and expectations speakers and listeners form during communication (Bloom, Obler, DeSanti, Ehrlich, 1994).

Although certain basic laws about English discourse intonation are that the key information carries extra stress and non lexical words generally do not, the speaker speaks with more stresses even on non lexical words. Every word is equally stressed especially 'per' and 'week', although they are function words. The reason may be that the speaker treats each word as key information, therefore the speaker speaks with more stress (Clennell, 1996).

In discourse modality, the tone shapes can provide information about the segmental string and prosodic contexts. The variation in the tone shapes is conditioned by many factors: segmental effects from the segment type, contextual phones and syllable composition, tonal effects from tone identity and contextual tones, positional effects from discourse and sentence positions, stress levels and speaking rate (Crestani, 1994).

Another study examined the relation between the prosodic stress and topic detection in spoken sentence. Monologues were used in the study. The acoustic stress and information content of the words were analyzed. On one side, average acoustic stress is measured for each word through out each utterance. On the other side, information retrieval index, based on the word frequency through out the collection of analyzed spoken sentences was calculated. In the scatter plot, higher values of average acoustic stress with the

increasing information retrieval index of the word in the majority of the analyzed utterances. This confirms that word with high average acoustic stress has also a high value of the information retrieval index. Words that are occasionally stressed are because they happen to be in an emotional contrast and they will be stressed only for a little fraction of the utterances (Silipo and Crestani, 1998). It can be concluded that the speaker regards prosody as crucial feature while communicating. It confirms the remark that 'speech relies in part on prosody for information, prosody is crucial to the interpretation of what is intended in a message.

Narrative discourse is composed of a setting (i.e., the characters and story context) and one or more episodes (i.e., the events, responses, and consequences of the story) that may be interrelated. Narratives carry the expectation that the speaker maintain an oral monologue and that the listener assume a relatively passive role. Monologuing requires a great deal of perspective talking ability on the part of the speaker who must assume the viewpoint of the listener and adjust messages accordingly. Thus, the communicative responsibility in narrative discourse falls squarely on the shoulders of the speakers to generate a clear coherent and complete story (Bloom et, al., 1994)

It is evident from the review that not many studies have been done on the suprasegmental aspects using narration or discourse mode. From the available data, it can be said that in different language, the occurrence of stress is different and they follow a pattern. The acoustical parameters, which determine the stress, also varies according to different languages.

METHODOLOGY

Discourse analysis is one of the techniques employed to study communicative behavior. This provides a rich source of information about the complex relationship among language, social context and the cognitive processes that underlie discourse. The study of prosody in discourse, opens up a new arena to our understanding of any rule bound occurrence of prosody. It further helps in understanding how it is different from the sentence or word level occurrence.

The aims of the study were:

- To determine the occurrence of stress on the syllables of the selected target words in narrative mode in Kannada language.
- To examine for correlation of the acoustic features (frequency and duration) with syllables perceived as stressed in the target words in narrative discourse in Kannada.

Subjects

Thirty native normal Kannada speakers (15 males and 15 females), speaking Mysore-Bangalore dialect between the age range of 20-30 years served as subjects. The subjects were screened for structural and functional deficits in speech musculature, psychological and neurological deficits.

Material

Sequential picture cards depicting a legendary epic of "Bhakta Prahlada" were selected. Picture cards were drawn by a professional artist. The story selected was such that, when narrated, the frequency of occurrence of selected nouns and verbs were increased and occurred several times. A pilot study was conducted using this sequential story to verify if the selected nouns and verbs occurred at least more than five times per narration. Picture cards were given to

five native Kannada speakers in the pilot study and were asked to narrate the story. Their narration was recorded and the frequency of occurrence of nouns and verbs were noted. After the pilot study, few more pictures were added to the sequence to elicit an elaborate response and also to see that there were increased chances of uttering the selected nouns and verbs when story was narrated by the subjects. The sequential picture cards used in the study (total number being 28) is given in Appendix 1.

Task

The subjects were instructed to narrate the events in the pictures in as descriptive manner as possible. They were instructed to use the nouns and verbs frequently and to use only Kannada words during narration. The picture cards were presented sequentially to each subject and recording of sample was done individually. During the recording, subjects were seated comfortably and the microphone was placed at a distance of 8-10cm from the mouth. Narration was recorded individually using professional tape recorder, Philips AQ 4150 with built in microphone, in a noise free environment.

Analysis

Transcription of the recorded sample in Kannada script was done. Most frequently occurring verbs and nouns were identified and marked. In nouns category three proper nouns were selected and the inflected forms of the nouns were also considered. Root words in verbs and also the morphological changes were considered. (See Appendix 2 for definition and structure of nouns and verbs in Kannada language). The selected nouns, pronouns and verbs are as follows:

Table 1 : *Target words selected in the narrative discourse sample*

	Words selected	**Roman Representation**
1	ಹಿರಣ್ಯಕಶ್ಯಪು	/hiraNyakashyapu/
2	ಹಿರಣ್ಯಕಶ್ಯಪುವು	/hiraNyakashyapuvu/
3	ಹಿರಣ್ಯಕಶ್ಯಪುಗೆ	/hiraNyakashyapuge/
4	ಪ್ರಹ್ಲಾದ	/prahlaada/
5	ಪ್ರಹ್ಲಾದನನ್ನು	/prahlaadanannu/
6	ಪ್ರಹ್ಲಾದನಿಗೆ	/prahlaadanige/
7	ವಿಷ್ಣು	/VishNu/
8	ವಿಷ್ಣುವಿನ	/VishNuvina/
9	ಅವನನ್ನು	/avanannu/
10	ಅವ್ನು	/avnu/
11	ಅವನಿಗೆ	/avanige/
12	ತನ್ನ	/tanna/
13	ಮಾಡ್ಬೀಕು	/maaDbeeku/
14	ಮಾಡ್ತಿರ್ತಾನೆ	/maaDtirtaane/
15	ಮಾಡ್ತಾನೆ	/maaDtaane/
16	ಕೇಳ್ತಾನೆ	/keeLtaane/
17	ಹೇಳ್ತಾನೆ	/heeLtaane/
18	ಬಂದು	/bandu/
19	ಇದ್ದಾನೆ	/iddaane/
20	ಹೇಳಿ .	/heeLi/

Table 1 gives an account of the number of target words considered for analysis in the study. Numbers 1-8 represent the nouns, 9-12 represents the pronouns and 13-20 represents the verbs. Although a number of target words were selected during pilot study, only twenty were retained during the actual study. This was done after analyzing the occurrence of most frequently occurring words in the narrated sample of the thirty subjects.

Analysis of the recorded sample was carried out in two stages:

- Perceptual analysis
- Acoustical analysis

Perceptual analysis

Perceptual analysis was carried out by two judges. The judges were Speech Language pathologists with working knowledge in prosody and speech analysis. Two judges were given the recorded cassette and the transcribed material of the recorded samples of the subjects.

The instructions given to the judges were as follows:

"Play the recorded sample as many times you want to and listen to it. You have to identify the stress on the syllable/s of the target word, which is underlined in the written script. Stress can be in the form of increased pitch level, increased loudness level, increased duration, segmental combinations as in consonant geminates, any other factor cueing stress or combination of the above features. If the stress is more on one syllable, then mark T above that syllable and if any otlier syllable in the same word carries a lesser degree of stress than 1, then mark it as '2'. If any two/more syllables of the same word are equally stressed then mark 'I' on all the syllables which bear the stress according to what you perceive". (*)

* Syllable marked " 1 " = syllable with 'primary' item
* Syllable marked "2" = syllable with 'secondary' item

Intrajudgc reliability was calculated by repeating the perceptual analysis of samples of three subjects after a gap of one month from the initial judgments. Interjudge reliability was calculated soon after the completion of the first perceptual judgment. The results are as shown:

Judges	Correlation Coefficient
Judge 1 and judge 2	0.92
Judge 1 (in two judgments)	0.84
Judge 2 (in two judgments)	0.78

After the perceptual analysis, those syllables which were perceptually judged as stressed in the target words were identified and tabulated.

Acoustical analysis

Those words with syllables that were identified as stressed in the perceptual analysis were considered for acoustical analysis. To carry out acoustic analysis, the recorded sample was digitized using Speech Interference Unit (SIU) using the line feed method. The signal from SIU was digitized at a sampling rate of 16kHz using a 16 bit analog to digital converter and digital to analog converter housed in the computer. Computerized Speech Lab-4400 (CSL) was used for the analysis and the FO and duration of the syllables of the target words were extracted, using Waveform display and Pitch contour program. The speech signal was edited and the syllables of the target words identified as being stressed during perceptual evaluation were analyzed. Editing was done by moving the cursor to the word initiation and terminal position. Further, each syllable in the word was selected by moving the cursor to appropriate position. The accuracy of the highlighted window was determined by listening to the audio output. The edited, digitized data was used for the extraction of peak FO and maximum duration of each syllable in the selected word. The extracted values were tabulated. Mean and standard deviation for peak FO and duration of each of the syllables of all the target words were

calculated and tabulated. Comparison of mean and standard deviation of FO and duration between the syllables in each target word was done.

Results are discussed in the following chapter under the headings:

- Perceptual analysis
- Acoustic analysis and correlation with the perceptual analysis.

RESULTS AND DISCUSSION

The objectives of the study were to:

a) Analyze the occurrence of stress on syllables of selected target words (nouns, pronouns and verbs) in narrative discourse mode in Kannada language.
b) Identify the acoustic features, which correlated with the syllables perceived as stressed in the narrative discourse.

Thirty native Kannada speakers narrated a selected sequential story in Kannada, which was recorded and transcribed in Kannada script. The samples were given to two judges to identify the stress on syllables of selected words (nouns, pronouns, and verbs) in narrative discourse mode. Total occurrence of the target words and the placement of primary and secondary stress on the syllables of target words were tabulated. The target words were then subjected to acoustic analysis where the peak FO and duration of each syllable was measured and tabulated.

The data was analyzed under two categories:

1) Perceptual analysis
2) Acoustic analysis and correlation with perceptual analysis.

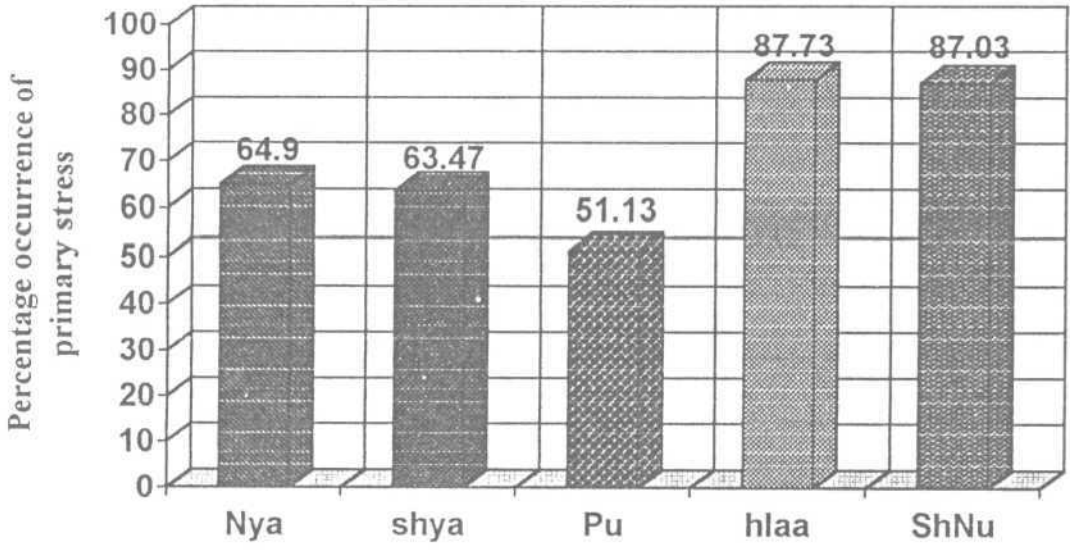
Perceptual analysis:

Perceptual analysis was carried out independently by two judges. They were given the transcribed material and the recorded samples of the subjects. They were instructed to listen to the samples one by one and identify the stress on the syllables of the target words, which were underlined in the respective transcripts. They were asked to listen to the speech sample any number of times before identifying the syllables in the target words as being stressed. Criteria for identification of stress provided to the judges were as follows:

Table 2 : Syllables in the target words (nouns) which carried primary and secondary stress

Sl. No		Nouns	Total target syllables in the corpus	Total occurrence of each syllable in the corpus	Total syllables identified as primary stress	Frequency of occurrence (%)	Total syllables identified as secondary stress	Frquency of occurrence (%)	Total syllables identified as primary and secondary stress	Frequency of occurrence (%)
1	root	hi	3696	616	6	0.9	0	0	0	0
2		ra		616	38	6.16	0	0	0	0
3		Nya		616	400	64.9	31	5.03	14	2.27
4		ka		616	11	1.78	0	0	0	0
5		shya		616	391	63.47	57	9.25	8	1.2
6		pu		616	315	51.13	10	1.62	1	0.16
7	suffix	vu	190	190	53	27.89	18	9.47	4	2.1
8		ge	110	110	77	70	20	18.18	3	2.72
9	root	pra	1614	538	23	4.27	18	3.34	0	0
10		hlaa		538	473	87.73	22	4.08	4	0.74
11		da		538	30	5.57	7	1.3	0	0
12	suffix	na	180	180	46	25.5	0	0	2	1.4
13		nnu	180	180	149	82.7	19	13.9	13	9.5
14		m	136	136	***3***	2.2	2	1.4	0	0
15		ge	136	136	62	45.58	21	15.4	10	7.3
16	root	vi	1080	540		0.5	0	0	0	0
17		shNu		540	470	87.03	0	0	0	0
18	suffix	vi	166	166	12	7.2	18	10.8	14	8.4
19		na	166	166	57	34.33	24	14.45	8	4.8

Graph I *: Percentage of occurrence of primary stress on the stressed syllables (Nouns) as identified in perceptual analysis.*



hiraNyakaShyapu : Nya, shya and pu
Prnhalnnda : hlaa
Vishnu : shNu

1) Increased pitch level
2) Increased loudness level
3) Increased duration
4) Segmental combination as in consonant clusters
5) Combination of any of the above features
6) Any other feature cueing stress

The judges were also asked to identify the degrees of stress as "1" (primary) and/or "2" (secondary) wherever it occurred on the syllables of the target words. Intrajudge and interjudge reliability was calculated.

Table 2 shows the syllables in the target words (nouns), which carried primary and secondary stress. Graph 1 represents the percentage of occurrence of primary stress on the stressed syllable of the target words (nouns). From the Table 2 and Graph 1 the following results can be inferred.

Consonant cluster and stress placement

- Consonant clusters are more often stressed. Cluster syllables in seven out of eight words are stressed.
- In the word /vishNu/ the primary stress has occurred on the final and the only cluster syllable. Secondary stress has not been placed on it in any instance.
- In /prahlaada/, the occurrence of primary stress is maximum on the only consonant cluster which is the middle consonant cluster /hlaa/

Word length and Stress placement

- As the number of syllables in the word increases, (E.g.: from 3 to 5 as in /prahlaada/ to prahlaadanige/) it can be noted that the primary stress is found to occur on more than one of the syllables of the word.
- When /nanna/ and /ge/ which are the case suffix of the noun were added to /prahlaada/, the percentage of occurrence of primary stress on /hlaa/ was reduced.

- When the root word is followed by dative case /ge/, the placement of the primary stress shifted within the root. Eg: when the dative case /ge/is added to the word /hirNayakashyapu/, primary stress shifted from /pu/ to /Nya/.

Primary and secondary stress

- There are few initial syllables of target words on which neither primary nor secondary stress has occurred. (Eg /hi/ in /hiraNyakashyapu/ and /vi/ in /vishNu/)
- It can be noted that the syllables in consonant cluster which have open and rounded vowels seems to carry the primary stress most often. Eg:/a/, /u/ as in/prahlaada/ and /vishNu/.
- Some of the syllables identified as carrying primary stress by one judge has been identified as secondary stress by the other judge and the percentage of such instances are about 12% only in total. That is, there is some inconsistency noticed in terms of degree of stress placement but there is good agreement as to which syllable is stressed.
- Secondary stress has been placed most often on the final syllables of the target words (Eg: /nnu/ m /prahlaadanannu/ and /ge/ in /prahlaadanige/, which happens to be the case markers.
- In the first word, /hiraNyakashyapu/ the final syllable /pu/ was stressed and it has carried primary stress.

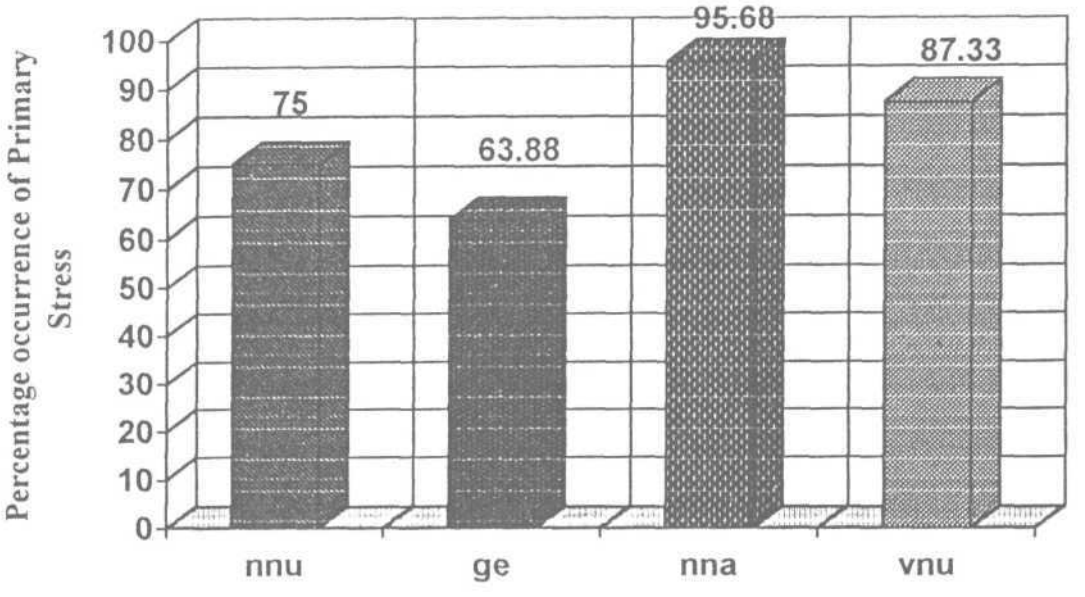
In summary, the salient features of perception of stress on syllables of words which are nouns are:

- The occurrence of primary stress is more on consonant clusters.
- There is a tendency for shift in the occurrence of primary stress, to the preceding, but not immediate syllables as the word length increases, by addition of case markers and suffixes.
- The initial syllables of nouns have not been identified as stressed.

Table 3 : Syllables in the target words (pronouns) which carried primary and secondary stress

Sl. No		Pronouns	Total occurrence of each syllable in the corpus	Total syllables identified as primary stress	Frequency of occurrence (%)	Total syllables identified as secondary stress	Frquency of occurrence (%)	Total syllables identified as primary and secondary stress	Frequency of occurrence (%)
1		a	746	11	1.4	20	0	0	0
2		va	596	8	1.3	32	0	0	0
3	suffix	na	236	168	71.18	20	8.8	2	0.88
4		nnu	236	177	75	24	10.61	13	5.75
5		ni	360	49	13.61	8	2.2	8	2.2
6		ge	360	230	63.88	14	3.8	4	1.1
7		vnu	150	131	87.33	9	6	2	1.3
8	root	ta	348	190	50.86	10	2.8	4	1.14
9		nna	348	333	95.68	12	3.4	18	5.17

Graph 2 *: Percentage of occurrence of primary stress on the stressed syllables (Pronouns) as identified in perceptual analysis.*



avanannu: nnu
avanige: ge
tanna: nna
avnu: vnu

- The terminal syllables of nouns (either the root syllable or case markers or suffixes) have also been identified as carrying primary or secondary stress.

Table 3 shows the syllables in target words (pronouns), which carried primary and secondary stress. Graph 2 indicates the percentage occurrence of primary stress on stressed syllables of the pronouns.

Four pronouns were considered in the study. Most of the characters in the selected sequential story were males. Hence case suffix used were with reference to male subjects only.

From Table 3, the following results can be inferred.

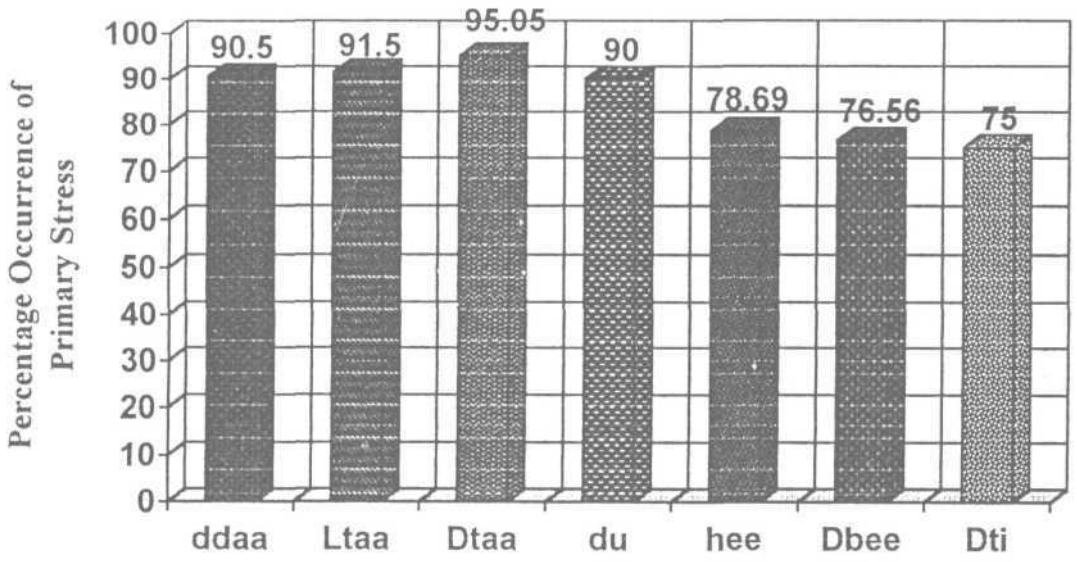
- The placement of primary stress has consistently occurred on the final syllable in all the four pronouns.
- The occurrence pattern of stress is found to be the same irrespective of the number of syllables in the word.
- The percentage of occurrence of the primary stress on the syllables of shorter words is found to be more than that of longer words.
- Secondary stress has also occurred more on the final syllable. Three out of four words in the pronoun category follows this pattern.
- Primary stress is found to be placed on the consonant geminates /nna/and /nnu/ and also on the consonant cluster /vnu/ which have occurred in the final positions of the root words of /tanna/, /avanannu/ and /avnu/ respectively. It seems that the geminates and consonant cluster (like in the noun category) are more likely to be stressed.

In summary, the final syllables of pronoun, which are often in the form of geminates or clusters, are stressed. The shorter the length of the pronouns, the higher the percentage of stress occurrence on the final syllables.

Table 4 : Syllables in the target words (Verbs) which carried primary and secondary stress

SI. No		Verbs	Total occurrence of each syllable in the corpus	Total syllables identified as primary stress	Frequency of occurrence (%)	Total syllables identified as secondary stress	Frequency of occurrence (%)	Total syllables identified as primary and secondary stress	Frequency of occurrence (%)
1	root	maa(Du)	246	22	8.9	4	1.62	0	0
2	suffix	Dbee	64	49	76.56	0	0	7	10.93
3		Dti	80	60	75	18	22.5	23	28.75
4		Dtaa	182	173	95.05	0	0	0	0
5		ku	64	8	12.5	20	31.25	0	0
6		rtaa	80	62	77.5	14	17.5	16	20
7		ne	262	4	1.5	27	10.3	9	3.43
8	root	hee(Lu)	488	381	78.09	1	0.2	1	0.2
9	suffix	Li	142	41	28.8	14	9.8	0	0
10		Ltaa	346	313	90.4	4	1.15	3	0.8
11		ne	346	4	5.4	10	13.5	4	5.4
12	root	kee(Lu)	74	41	55.4	0	0	0	0
13	suffix	Ltna	74	70	94.5	12	16.2	2	2.7
14		ne	74	4	5.4	10	13.5	4	5.4
15		i(ru)	180	4	2.2	0	0	0	0
16		ddaa	180	163	90.5	4	2.2	12	16.2
17		ne	180	19	10.5	22	12.2	1	1.3
18	root	ban	170	40	23.5	4	2.3	14	8.2
19		du	170	153	90	2	1.17	11	6.4

Graph 3 : Percentage of occurrence of primary stress on the stressed syllables (verbs) as identified in perceptual analysis.



iddaane: ddaa
heeltaane, Keeltaane: Ltaa
bandu:du
Heeli: lieeLi

maaDbeeku: Dbee
maaDtirtaane: Dti
maaDtaanc: Dtaa

Table 4 shows the occurrence of primary and secondary stress on syllable in the target words (verbs). **Graph 3** indicates the occurrence percentage of primary stress on stressed syllables of verbs.

The salient features are as follows:

- The syllable length of the verbs ranged from 2-4 syllable. In those verbs with three syllables, where the mid syllable was consonant cluster primary stress has been consistently placed on the middle consonant cluster. In the word /maaDtirtaane/, primary stress has been placed on /Dti/ and /rtaa/, although a higher percentage of primary stress occurrence is seen on /rtaa/.
- In case of /bandu/ primary stress has been on the final syllable /du/. Qualitative analysis indicated that in most instances, /du/ was prolonged by the speaker. It may be inferred that increased duration probably served as a cue in perceptual analysis.
- Primary stress has been placed on the initial syllable /hee/ in the word /heeLi/. This is probably because of the feature 'aspiration' in the sound /h/.
- Maximum percentage of occurrence of secondary stress is nlways on the final syllable in all the words except for /maaDtirtaane/ and /bandu/ where secondary stress has never been placed on the final syllable.

In summary, in verbs the salient features of stress is as follows:-

- Consonant clusters are often stressed.
- Final syllables are stressed and the perceptual cue for identification of stress in such syllables has been the duration.
- The only syllable with aspirate sound /h/ has been stressed. It is probable that aspiration inherent in the syllable has led to the identification of stress.

From the Table 2,3 and 4 and Graphs 1,2 and 3, it is evident that the stress is perceived most of the time on consonant clusters irrespective of its

position in tlie word. This is in congruence with the study done by Manjula (1997) who studied the stress placement and intonation in interrogative sentences in Kannada. She has found significant percentage of occurrence of stress on geminates, consonant clusters and morphophonemic syllables. The present study utilized narrative discourse, where in, different kinds of sentences were narrated in context. Irrespective of the context, stress was found to be placed consistently on consonant clusters in most of the instance.

The initial syllables of any of the target words (nouns, pronouns and verbs) have not been stressed. That is, stress does not seem to occur on the initial syllables of nouns, pronouns and verbs in Kannada. This finding is in contradiction with the results obtained in the study done by Rathna et.al,(1982), where they found that the stress occurred on the initial syllable of the word. It may be noted that the study by Rathna et, al., (1982) was carried out in sentence context.

In the case of /liiraNyakashyapuge/, the placement of stress is on /Nya/ but in the case of /hiraNyakashpu/, stress is on /pu/. This can be explained by the concept of 'Stress shifting'. Stress shifting involves changing the placement of lexical stress in multisyllabic words because of surrounding stress patterns (Hargrove and McGarr, 1994). In tlie present study, with the addition of a syllable /ge/ (suffix) at the end of the word /hiraNyakashyapu/, stress on the final syllable has been shifted to the consonant cluster /Nya/.

It has been reported by Cooper, Eady and Mueller (1985), that in English, disyllabic and polysyllabic words take some kind of stress and that will depend upon the relative significance they have in the context, as well as tlie function that they perform in that context. There is a strong tendency in English to avoid two adjacent main stresses; one of the main stresses will become subsidiary main stress or secondary stress (Cooper et, al. 1985). This pattern is probably seen even in Kannada as in the case of /maaDtirtaane/. Stress placement on /Dti/ and /rtaa/ in any instance has not been identified as

carrying equal primary stress. In all the instances, only one of the either get the primary stress. The total occurrence of primary and secondary stress on these two clusters, as indicated in Table 2 seems to depict this pattern. However, this does not mean that both of them earned primary and secondary stress in the same utterance.

It is also seen that in case of verbs (Table 3) when there is aspiration, primary stress is placed on the syllable with aspiration Eg: /heeLi/ where /hee/ is stressed. This is in agreement with the study done by Manjula (1997) in Kannada language where the occurrence of primary stress on aspirates has been noted. It is also reported that in Kannada language the stressed vowels are generally longer than the unstressed vowels (Savithri, 1984; Manjula, 1997). This rule seems to apply to words in narrative discourse also because the target syllables with long vowels are found to be stressed most often. Eg: /hlaa/ in /prahlaada/, /hee/ in /heeLi/, /Dtaa/ or/ Dbee/ in /maaDtaa/ or /maaDbeeku /respectively. However, this observation is not generalized because the analysis did not include or focus on the vowel types in general.

In summary, the salient features which were observed in the perceptual analysis are as follows:

- Consonant clusters in nouns, verbs and pronouns take up primary stress, irrespective of their position in the utterance.
- Geminates, which have most often occurred as final syllables in pronouns, are stressed.
- Final syllables, which are often, the case markers and suffix tend to take up the secondary stress.
- Word length has an influence on the placement of stress. Phenomena of 'stress shifting' is seen when the length of the word is increased.
- The inherent properties of the speech sound Eg: frequency and duration of the sound seem to contribute to the perception of stress.

Acoustic analysis

Those words that were identified as stressed in the perceptual analysis were considered for acoustic analysis. The syllables identified by the judges as stressed on at least more than fifteen occurrences in the corpus were subjected to acoustic analysis. The recorded sample was analyzed using the instrument Computerized Speech Lab (CSL-4400). The Waveform display and Pitch contour programme were used to extract the peak FO and duration of syllables of the target words in all the utterances.

Most of the studies done in different languages indicate that peak FO is one of the major cues to determine stress. In American English, pitch is used more frequently to show the prominence (Edward and Gregg, 1992). Studies by Lehiste (1970), Fry (1955), Sereno and Jongman(1995) in English have shown that peak FO and duration are important cues for stress identification. In Indian languages, study by Savithri (1995) and Manjula (1997) showed that peak FO and duration are important cues to determine stress in Kannada language. Hence, peak FO and duration was considered.

Mean and standard deviation (SD) of the peak FO and duration of the stressed syllables and the syllables preceding and following the stressed syllables are shown in **Table 5.** It is interesting to note from Table 5, that the peak FO and duration on the syllables following and preceding the stressed syllables are lower than the peak FO of the stressed syllables. Production of stress by males and females seems to be done by effecting a change in frequency and this is perceived by judges. There is no discrepancy between the values obtained in male and female subjects. The subjects who participated in the study had different vocal registers/ fundamental frequency values, which varied from subject to subject. Hence, the variability of peak FO values in both males and females are high, which is indicated in the standard deviation scores.

Results in Table 5, suggest an evident pattern with respect to the relationship between the stress, peak FO and duration of syllables. The results indicate that:

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Table 5: Mean and Standard deviation of Peak FO and duration of the target syllables and the syllables preceding and following the target words (TW: Target Word) (S.D. = values hi bracket)

Sl.no	Target Syllables		Mean of Peak FO occurring on previous syllable (Hz)	Mean of Peak F0 occurring on stressed Syllable (Hz)	Mean of Peak F0 occurring on following syllable (Hz)	Mean duration of the previous syllable (sec)	Mean duration of the Stressed Syllable (sec)	Mean duration of the following syllable (sec)
1.	pu Tw: hiraNyakashyapu	Female (F)	285.37 (31.18)	262.26 (19.39)	-	0.072 (0.013)	0.073 (0.014)	-
		Male(M)	198.31 (20.11)	203.91 (24.08)	-	0.070 (0.018)	0.089 (0.021)	-
2.	Nya Tw: hiraNyakashyapuge	Female (F)	227.73 (16.71)	282.14 (15.99)	249.4 (16.10)	0.043 (0.012)	0.12 (0.024)	0.02 (0.01)
		Male(M)	141 (21.62)	185.55 (23.53)	131.52 (14.33)	0.03 (0.014)	0.09 (0.021)	0.06 (0.11)
3.	Nya Tw:hiraNyakashyapuvina	Female (F)	255.41 (25.16)	290.8 (26.33)	253.9 (29.96)	0.03 (1.01)	0.05 (0.01)	0.02 (0.01)
		Male(M)	146.54 (27.51)	187.36 (25.68)	150.18 (16.96)	0.03 (0.01)	0.063 (0.013)	0.04 (0.014)
4.	hlaa Tw: prahlaada	Female (F)	275.68 (24.03)	294.32 (23.48)	258.41 (29.14)	0.043 (0.013)	0.085 (0.013)	0.037 (0.011)
		Male(M)	173.13 (19.13)	185.39 (16.84)	159.20 (16.95)	0.031 (0.011)	0.072 (0.02)	0.048 (0.01)
5.	hlaa Tw: prahlaadanannu	Female (F)	239.29 (17.84)	283.5 (22.37)	250.14 (16.79)	0.04 (0.03)	0.06 (0.01)	0.03 (0.018)
		Male(M)	170.3 (25.01)	212.6 (26.4)	165.6 (24.61)	0.03 (0.01)	0.07 (0.019)	0.03 (0.013)
6	hlaa Tw: prahlaadanige	Female (F)	235.78 (12.10)	269.68 (15.78)	223.5 (13.36)	0.04 (0.01)	0.06 (0.012)	0.03 (0.014)
		Male (M)	154.3 (30.13)	189.42 (21.03)	139.51 (24.03)	0.03 (0.01)	0.07 (0.013)	0.03 (0.02)

7	shNu Tw: vishNu	Female (F)	250.61 (18.79)	294 (23.8)	-	0.035 (0.013)	0.07 (0.02)	-
		Male(M)	168.34 (17.33)	193.76 (13.81)	-	0.04 (0.02)	0.07 (0.01)	
g	shNu Tw: vishNuvina	Female (F)	239.5 (23.22)	286.78 (27.39)	245 (19.73)	0.04 (0.046)	0.05 (0.013)	0.03 (0.02)
		Male(M)	151.07 (21.59)	195.46 (15.93)	168.3 (31.47)	0.03 (0.01)	0.061 (0.012)	0.04 (0.013)
9	nnu TW: avanannu	Female (F)	231 (23.55)	252.4 (23.21)	-	0.05 (0.02)	0.07 (0.018)	-
		Male(M)	184.48 (19.39)	208.53 (28.11)	-	0.07 (0.02)	0.06 (0.011)	-
10	ge TW: avanige	Female (F)	249.85 (19.3)	266.8 (21.4)	-	0.03 (0.02)	0.07 (0.04)	-
		Male(M)	164.21 (20.44)	174.31 (19.31)	-	0.05 (0.011)	0.07 (0.03)	-
11	vnu TW: avnu	Female (F)	248.52 (25.71)	278.63 (24.03)	-	0.04 (0.015)	0.08 (0.037)	-
		Male(M)	168 (28.41)	190.92 (22.62)	-	0.05 (0.013)	0.11 (0.01)	-
12	nna TW: tanna	Female (F)	228.6 (33.28)	260.3 (27.9)	-	0.04 (0.01)	0.09 (0.014)	-
		Male(M)	159.66 (23.11)	177.14 (23.52)	-	0.03 (0.02)	0.07 (0.021)	-
13	Dbee TW: maaDbeeku	Female (F)	243.91 21.03	279.31 (19.84)	264.18 (31.18)	0.03 (0.12)	0.06 (0.02)	0.02 (0.01)
		Male(M)	143.19 17.31	163.84 (17.11)	149.39 (18.04)	0.04 (0.03)	0.07 (0.021)	0.03 (0.011)

14	rtaa TW: maaDtirtaane	Female (F)	271.86 24.2	271.56 (31.37)	233.39 (15.86)	0.03 (0.017)	0.08 (0.023)	0.03 (0.014)
		Male (M)	173.48 20.18	169.31 (24.17)	153.44 (19.34)	0.039 (0.01)	0.07 (0.021)	0.04 (0.013)
15	Dtaa TW: maaDtaane	Female (F)	227.4 15.43	253.44 (14.01)	235.51 (16.73)	0.03 (0.01)	0.07 (0.011)	0.05 (0.02)
		Male (M)	153.68 18.94	196.82 (20.08)	169.18 (24.08)	0.03 (0.12)	0.04 (0.013)	0.02 (0.024)
16	Ltaa TW: heeLtaane	Female (F)	241.85 30.56	270.7 (26.83)	231.95 (22.84)	0.03 (0.01)	0.05 (0.18)	0.03 (0.011)
		Male (M)	171.41 19.34	184.34 (18.41)	163.33 (20.8)	0.04 (0.013)	0.07 (0.034)	0.03 (0.01)
17	Ltaa TW: keeLtaane	Female (F)	234.65 20.94	261.52 (19.02)	146.73 (23.48)	0.03 (0.018)	0.06 (0.04)	0.04 (0.015)
		Male (M)	147.41 26.58	193.18 (25.18)	156.27 (19.03)	0.04 (0.011)	0.07 (0.018)	0.03 (0.013)
18	ddaa TW: iddaane	Female (F)	227.68 14.91	261.9 (16.26)	239.3 (14.9)	0.04 (0.02)	0.06 (0.014)	0.04 (0.015)
		Male (M)	157.12 25.06	205.03 (26.13)	163.8 (32.54)	0.04 (0.014)	0.07 (0.018)	0.05 (0.017)
19	du TW: bandu	Female (F)	265.93 29.8	273.43 (26.03)	-	0.06 (0.01)	0.07 (0.012)	-
		Male (M)	153.24 19.34)	178.31 (18.11)	-	0.07 (0.013)	0.09 (0.011)	-
20	hee TW: heeLi	Female (F)	-	252.52 (18.6)	236.47 (15.47)	-	0.06 (0.02)	0.04 (0.019)
		Male (M)	-	165.5 (23.07)	144.47 (17.40)	-	0.05 (0.02)	0.02 (0.013)

1. Occurrence of peak FO has often been on the stressed syllable and sometimes on the adjacent syllables preceding and following stressed syllables in the target words.
2. The peak FO of syllables are found to occur more on the longest syllables most of the times.
3. In few cases, the duration of the adjacent syllable is longer than the stressed syllables.

These observations indicate the relationship that exists between the peak FO, duration and the stressed syllables. The peak FO of the stressed syllable *is* consistently higher than the following and preceding syllables. An increase in frequency as well as duration seem to have contributed to perception of stress.

Nouns:

Syllables which were perceptually analyzed as stressed carried higher values of peak FO and duration except in few cases that are discussed.

In the case of the word /hiraNyakashyapu/, though perceptually, stress is placed on /pu/, acoustic analysis revealed a higher value of peak FO on /shya/. This can be attributed to the inherent high frequency of the fricative /sh/ in the cluster /shya/. However, duration of/pa/ is higher than /shya/. Hence it may be inferred that duration and not frequency has served as a cue in the perception of stress.

In the word /hiraNyakashyapuge/, perceptual analysis showed stress on /Nya/, where as in acoustic analysis, increased duration is seen on /shya/. This can be attributed to the longer duration of fricatives when compared to other consonant sounds. The peak FO values obtained from the acoustic analysis are in agreement with the perceptual analysis showing that peak FO of /Nya/ is highest among all the syllables in the word. In this instance, it may be inferred that judges have relied on the frequency cue more than the duration cue to identify the stressed syllable.

In /prahlaadanige/. primary stress was marked on /hlaa/ by the judges and acoustically peak FO was higher on /hlaa/ compared to the rest of the syllables in the word. Duration of the final syllables i.e., /ge/ was more prolonged than /hlaa/ in both males and females. This can be attributed to the lengthening or prolongation of the final syllable. To highlight, it seems like both duration and frequency have been used as cues by the judges in the identification of stress in this target word.

***Verbs**:*

In the selected eight verbs, seven of the words have higher peak FO and duration on the syllables, which were perceived as stressed. In the word /maaDtirtaane/ perceptually stress has been placed on /rtaa/, and higher peak FO is also on /rtaa/. There is a scope for occurrence of primary stress on more than one syllable of the target word in Indian languages unlike in English (Edwards and Gregg, 1992). For example, the perceived primary stress and higher peak FO is on the same syllable. Eg: on /rtaa/ and /Dti/, in the word /maaDtirtaane/. But, perceptually, /rtaa/ has been rated more frequently than /Dti/ for occurrence of primary stress. It may be noted that the long vowel in /rtaa/ has also contributed to increased duration. From Table 5, it is evident that the duration of /rtaa/ is higher than that of /Dti/. So, the perception of /rtaa/ as the stressed syllable has coincided with the occurrence of peak FO and increased duration on this syllable.

Pronouns

Four pronouns were selected in the study. In general, the syllables which were perceived as stressed perceptually, correlated with the higher value of peak FO and duration.

In summary, it can be concluded that there is a definite relationship between the peak FO. duration and the perceived stress. The results obtained in the present study are in agreement with the previous studies, which indicate

that peak FO and duration are major cues for the perception of stress (Edward & Gregg, 1992; Sereno and Jongman, 1995).

The acoustic correlates of stress vary depending on the language under study. In English, as reported by Scott and Newman (1916) and Malmberg (1955), fundamental frequency followed by intensity and durational aspects are important cues for stress. In French, pitch and duration followed by intensity indicate the presence of stress. Study by Rigant (1962) in French language reveals that frequency is an important correlate of perceived stress. The relative importance of duration and intensity are approximately the same. In Kannada, FO and duration are reported to be the major cues for determining the stress (Savithri, 1984; Manjula, 1997). These studies in Kannada were however different in terms of methodology and context in which stress was identified. Savithri (1984) studied the features of stress in the context of words in phrases. Manjula (1997) studied stress with reference to interrogative sentences elicited in a simulated discourse mode. Inspite of these differences based on the results of their studies and the results of the present study, it is evident that FO and duration are important cues for perception of stress in Kannada language.

Stress has delimiting functions in some languages as in Turkish and French. In these languages, the default stress placement is on the word final position. In Turkish, few specific words have prespecified stress placements like penultimate and other placements (Tan, 2000). In French, the final syllable of a word group is said to be accented and non-final syllables in a word group are generally unaccented (Cruttenden, 1986).

However, in Kannadn, a general rule for perception of stress on the syllables in words is not yet derived. Based on the results of this study it may be inferred that significant percentage of stress can be seen on aspirates, geminates and consonant cluster. Based on the previous studies (Savithri, 1984 and Manjula, 1997) and the present study, it may be inferred that the behaviour

of Stress varies depending on the context (isolated words, sentences and narration)

In general, it can be noted that when the suffix is added to the root word, the perceived stress seems to occur on the final syllable (especially in pronouns). In nouns, the final syllable (either of the root word or suffix) have also been identified as carrying primary or secondary stress. Most often, occurrence of primary stress on more than one syllable of a word has not been observed in the study. It is likely that the perception of stress in Kannada is bound by factors such as linguistic complexity, word structure, context and the specific features of the sounds in the words. Verification of these aspects can only be made with a well controlled design in order to establish the features of stress in Kannada.

SUMMARY AND CONCLUSION.

Prosody is a term used to represent the linguistic use of the vocal aspects of speech without consideration of the segmental aspects (Hargrove and Mcgarr, 1994). The syntactic and semantic contents of an utterance are made more transparent to a listener by the feature of 'Prosody'. Prosody can be treated as the most important and highly evasive property of spoken language. Prosody includes intonation, stress, tempo and rhythm (Gaitenby and Mermelstien, 1997)

'Stress' is conveyed by varying the prosodic features of pitch, loudness, duration, and pause.

Kannada is one of the important Dravidian languages that stands third in the antiquity and richness of literature (Hiremath, 1969). The stress behavior on Kannada words in narrative discourse has not been addressed in any of the previous studies. There are very few studies in Indian languages (specifically, Kannada) addressing the feature of stress. Further, the behaviour and occurrence of stress in discourse mode is not studied in any Indian languages. A study of stress in discourse mode in Kannada is planned in order to collate database on Kaimada stress. The benefit derived out of the study will be multifold and will serve as an useful input in the field of prosodic analysis. Hence, the present study was planned with the objective of describing the features of stress in narrative discourse of standard dialect of Kannada.

The specific aims of the study were:

1. To determine the occurrence of stress on the syllables of target words in discourse mode, specifically narration in Kannada.
2. To correlate the acoustic features (frequency and duration) with syllables perceived as stressed in the target words in narrative discourse in Kannada.

Method

A sequential Kannada story narrated by thirty native Kannada speakers (males and females) was recorded in a narrative discourse mode. These samples were transcribed and few nouns, pronouns, and verbs which occurred more frequently in the narrated discourse mode of each sample was selected as target words. The recorded sample and the transcribed material were provided to two experienced judges to perceptually identify the stress on the syllables of the target word. The syllables of the target words which were perceived as stressed, were noted.

Target words were subjected to acoustic analysis using Computerized Speech Lab (CSL-4400). Considering syllables as the basic unit, peak FO and duration of the syllables in the target words were analyzed and tabulated.

Some of the salient features noticed in the study are as follows:

Perceptual Analysis

- Consonant cluster in nouns, verbs, and pronouns take up primary stress, irrespective of their position in the utterance.
- Geminates which have most often occurred on the final syllables in pronouns are stressed.
- Final syllables, which are often the case markers and suffixes tend to take up secondary stress.
- Word length has an influence on the placement of stress. Phenomenon of 'stress shifting' is seen when the length of the word is increased. There is a tendency for perceived stress to be shifted from terminal position of the word to initial position of the word.
- The inherent properties i.e., frequency of the sound vowel duration of speech sounds contribute for the perception of stress

There seems to be a pattern which is followed in the occurrence of stress in narrative mode. Studies using words in isolation, reading context and various

narrative modes needs to be carried out in order to enlist the features of stress in Kannada.

Acoustic Analysis:

Those words which were perceptually analyzed as stressed were subjected to acoustic analysis. Analysis revealed that most of the time the syllables with peak FO correlated with the perceptually identified stressed syllable. However, in few cases, the occurrence of peak FO has been on the adjacent syllables which is preceding or following stressed syllables in the target words. Another feature observed is that the stressed syllables with peak FO also happen to be the longest syllables (increased duration) majority of the times. The results obtained in the study supports a definite relation ship that exist between the peak FO, maximum duration and stressed syllable i.e., peak FO and increased duration serve as the acoustic cues for perception of stress in syllables in target words consisting of noun, pronoun and verbs in a narrative discourse mode.

Information about the occurrence of stress in Kannada is found to be scanty. Although the results indicate that occurrence of stress follows some predictable pattern, at least in nouns, verbs and pronouns in a narrative discourse mode, it is still too early to comment on the delimiting function of stress in Kannada.

The study is a preliminary attempt to describe the occurrence of stress in narrative discourse mode. Research in this area has to be done to study the behavior of stress in Kannada in various contexts.

Recommendations for future research:

- To study the occurrence of stress on different grammatical category in various discourse mode (narration, isolation, reading, etc) in Kannada.
- To study the changes in the occurrence of stress on different grammatical category in discourse modes in different attitudinal context in Kannada.

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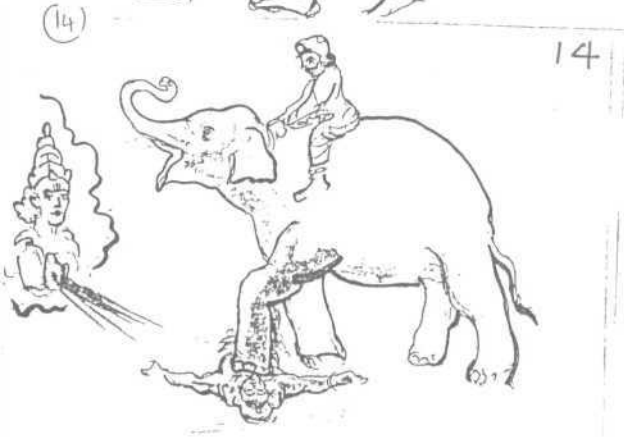
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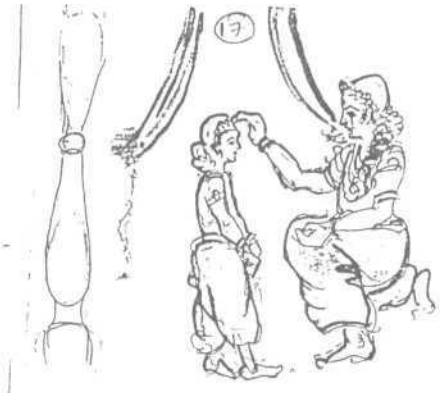
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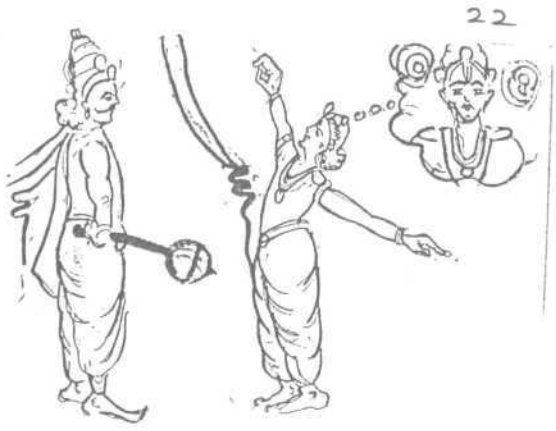
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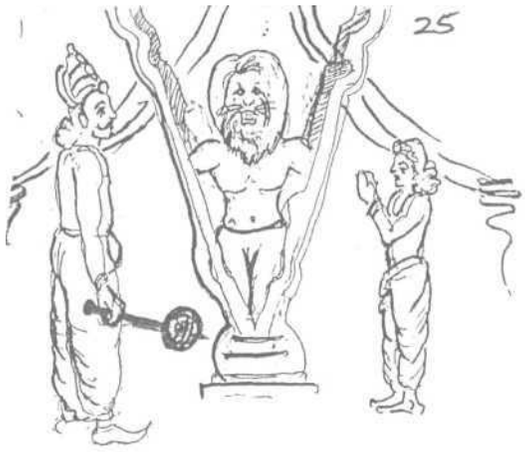
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APPENDIX-2

Structure of words in Kannada

Kannada is one of the major languages of India. Kannada gets the third position in antiquity and richness of literature. Linguistically, Kannada is one of the major languages of the Dravidian family, the other languages being Tamil, Malayalam, Telgu and Tulu (Hiremath, 1969).

The consonants of colloquial Kannada, with their equivalents in Kannada script, are as follows.

Stops and nasals

	Voiceless		**Voiced**		
	Unaspirated	Aspirated	Unaspirated	Aspirated	nasals
Vebr	k	kh	G	gh	n
Palatal	c	ch	j	jh	n
Retro flex	T	Th	D	Dh	N
Dental	t	tli	d	dh	n
labial	P	ph	b	bh	m

Glides, Sibilants, Fricatives, Laterals and Continuants

	Glides	**Sibilants**	**Fricatives**		**Laterals**	**Continuants**
	(voiced)	(voiceless)	(voiced)	(voiceless)	(voiced)	(voiced)
Pharyngeal				h		
Retroflex		S			L	
Apilo-palatal	y	sh				
Alveolar		s	z		**1**	r
labial	v			f		

The vowels of Kannada, along with their equivalent in Kannada script are as follows:

		Front	**Cent ral**	**Back**
High	Short	i		u
	Long	ii		uu
mid	Short	e		**0**
	Long	cc		**0 0**
low	Short		a	
	Long		aa	

The words selected for the study are

Sl.no	**Word category**	**Words selected for the study**
1		hiraNyakashyapu
2		hiraNyakashyapuvige
3		hiraNyakashyapuvina
4	c	prahlaada
5	o	prahlaadanannu
6		prahlaadanige
7		vishNu
8		vishNuvina
9		avanannu
10	p; o	avnu
11	c	avanige
12	o	tanna
13		maaDtaane
14		heeLtaane
15		keeLtaane
16	v) JO	maaDbeeku
17		maaDtirtaane
18		iddaane
19		lieeLi
20		bandu

Noun structure in Kannada takes the fonn of Nominal stem ± plural maker + case suffix.

Verb structure in Kannada, takes the form of Verb stem ±tense suffix + pronominal ending (Hireniath, 1969).

Consonant gemination:

Acconrding to Schiffman(1979), in Kannada, there seems to be a complementary distribution between morphemes with the structures, that is, geminate consonants do not usually follow long vowels, short vowels are often followed by geminate consonant, and geminate consonants following long vowels are phonetically short.

Consonant clusters:

Consonant clusters, both identical and non identical are found in word medial position. This is seen in nouns, verbs, adverbs and interjections in the normal speech. Normally, a cluster of voiced and voiceless stops does not occur. Nasals, laterals, sibilants, trills and semivowels may occur either as first or second member of a cluster with voiced or voiceless stops or af&icates.

According to Krishnamurthy (1972), in spoken Kannada, short vowels are deleted or reduced in order to reduce:

- Clusters consisting of geminate consonants and another consonant.
- Clusters of nasal with homorganic consonant with another consonant.
- Clusters of lateral with preceding retroflex or dental consonant.

Diglossic changes may be noted in the first person singular present verb suffix. The word /maaDuteene/ (I do) in literary Kannada will appear in spoken Kannada as /maadutiini/ (I do) (Schiffman, 1979).

Spoken Kannada deletes many short vowels found in literary kannada words eg. /maaDabeeku / /maaDbeeku/.