RHYTHM PATTERN OF ENGLISH IN ADULT NATIVE KANNADA SPEAKERS

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CERTIFICATE

This is to certify that this dissertation entitled "**Rhythm Pattern of English in Adult Native Kannada Speakers"** is a bonafide work submitted in part fulfilment for degree of Master of Science (Speech and Language Pathology) of the student Registration Number: 16SLP017. This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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This is to certify that this dissertation entitled **"Rhythm Pattern of English in Adult Native Kannada Speakers"** has been prepared under my supervision and guidance. It is also been certified that this dissertation has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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DECLARATION

This is to certify that this Master's dissertation entitled "**Rhythm Pattern of English in Adult Native Kannada Speakers**" is the result of my own study under the guidance of Dr. N. Sreedevi, Professor and Head, Department of Clinical Services, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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Chapter I

Introduction

"Rhythm research is not withering in the phonological laboratory, on the contrary, it is blooming in the field of communication research." - Manfred Schroeder

English is a lingua franca of India and is used as in addition to the other official national language, Hindi. There are few peculiar features for the English expressed in India, which differentiates it from the other English varieties such as American English (AE) and British English (BE). This might be due to the influence of regional native languages of India on the second language English. Thus this heterogeneous mix of English spoken in India is generally called as Indian English and these speakers tend to carry over the intonation and phonetics of their native language in English speech. Kannada is one of the major Dravidian language belonging to Southern Dravidian languages along with Tamil, Telugu, and Malayalam (Krishnamurti, 2003). It is used as the mode of communication in Karnataka state in southern India. Generally, listeners recognize the regional identity of the speakers using both segmental and suprasegmental information in speech. The variations in rhythm, pitch, loudness, and tempo make up prosody or suprasegmentals. The movement of pitch in a phrase or a sentence is referred to as intonation, the extra effort is referred to as stress and the pattern of movement is referred to as rhythm. Tempo and rhythm are two important prosodic characteristics of any enunciations and marks the deviations based on temporal features. The word rhythm is derived from the Greek word "Rhuthmos" where "rhu" means flow.

Cumming (2011) defined rhythm of an expression as the regularity which is comprehensible and has been originated by the grouped prominences (including different speech acoustic signal characteristics), and also affected by the vernacular language of the perceiver. The above definition and each component of it make a significant note. Firstly the description of speech rhythm as a perceptual event in speech production, which might not have a simple capturable correlate or collection of correlates. Secondly presence of numerous dimensions of acoustic features in signal lead to the speech rhythm perception such as the duration, amplitude, tonal and spectral properties (e.g. formants) of different components such as syllables, segments and lengthier prosodic units. Generally the acoustic features are possible prompts for prominence across languages, as well as for noting the sections of prominence and non-prominence in different parts of the speech that is the way in which different sections are categorized and forms the key for the rhythm perception. Thirdly there are affirmations that the phonological characteristics of the perceivers native language has an effect on his/her rhythm perception by affecting the features/cues which are more evident than the remaining and influencing the perception of rhythm (Cumming, 2011).

Encyclopedia Britannica refers Rhythm as a fluctuation pattern which occurs due to temporal variations at different levels (Encyclopedia Britannica, 1965). Pike (1945) and Abercrombie (1967) have classified rhythm in world languages as stress-timed and syllable-timed and explained rhythm in terms of isochronous repetition of speech units expressed across languages. Stress-timed languages have recurrence at equal intervals of time as seen in BE (Ladefoged, 1975; Smith, 1976), and in languages which are syllable-timed, duration are equal for syllables. Speakers appear to have almost equal time gaps

between the syllables which are stressed in stress-timed languages and thereby put forth a further rhythm unit called as feet which includes a syllable which is stressed and shadowed by syllables which are unstressed and of almost equal time intervals, but it shows poor variation of duration between syllables which might be stressed or unstressed. But based on these classifications, it's difficult to differentiate languages into two rhythm types. Hence modifications have been made (Dauer, 1983) to expand the dichotomy by adding mora-timed rhythm. The traditional rhythmic classification of languages into three (syllable, mora and stress-timed) rhythmic classes was based on the Isochrones theory where each interval has a constant duration. In languages which are stress-timed, postulations are made that durations are less similar to each other and in syllable-timed languages, durations of syllables and vowels are more similar to each other.

Among the several metrics of speech rhythm, Pairwise Variability Index (PVI) is one of the most common metrics being used for rhythm classification, generally placing the languages between either syllable or stressed (Nolan & Asu, 2009). PVI measures the sequencing of vowel (vocalic) and consonantal (intervocalic) durations in an acoustic speech signal and quantitatively weighing the speech rhythm, displaying how each linguistic component differ from each other (Low, 1998). Pairwise Variability Index could classify rhythm of languages which were traditionally classified as stress-timed, mora-timed and syllable-timed (Low, Grabe, & Nolan, 2000). High vocalic and intervocalic PVIs implied stress-timed rhythm, low vocalic and intervocalic PVIs implied mora timed and low vocalic and high intervocalic PVIs implied syllable-timed rhythm. Apart from PVI, there are various other measures that have been used to classify speech

rhythm in languages. These include standard deviation and syllable duration (Abercrombie, 1967), inter-stress interval (Roach, 1982), vocalic intervals or vocalic durations, % V, vocalic intervals SD- Δ V, consonant intervals SD- Δ *C (*Ramus, Nesper, & Mechler, 1999). Grabe and Low (2002) calculated PVIs in languages which were categorizes using traditional classification (syllable-timed, stress-timed, mora-timed and unclassified) using passages spoken in 18 languages. Based on PVIs, Japanese fell under mora timed rhythm; stress-timed category included English, German, and Dutch; whereas Spanish and French were stratified under syllable-timed rhythm class. Remaining languages were unclassified. White and Mattys (2007), reported that first language speech production is affected by speech rhythm of the second language. Native varieties of English (British, American, Canadian, Australian, New Zealand English) were mentioned as having a stress-timed rhythm. Nativised varieties (Indian, Nigerian, Jamaican, Singapore English and others) are categorized as belonging to a more syllable-timed class than the native varieties of English (Wells, 1982).

In the Indian context, such studies on the influence of rhythm of regional languages (L1) on English (L2) have been less explored. However, there are ample studies on the development of speech rhythm in children and in communication disorders. Savithri, Maharani, Sanjay, and Deepa (2007), determined rhythm in twelve major languages of India including Marathi, Punjabi, Rajasthani, Assamese, Oriya, Gujarathi, Bengali, Malayalam, Kashmiri, Tamil, Telugu, and Kodava. For reading task, passages with hundred words were constructed in each language with the exception of Kodava and Kashmiri Language which have no script. Measurement of both vocalic and intervocalic durations was carried out in these languages and the study revealed

Assamese, Punjabi, and Telugu to be mora-timed languages and Bengali, Malayalam, Tamil and Kashmiri to be syllable-timed languages. In another study by Savithri, Jayaram, Kedarnath, and Goswami (2006), they measured PVI in adults and described Kannada under mora timed rhythmic class.

Need for the study

The unique variety of English evolved in the Indian subcontinent was termed as Indian English (IE). Currently, in India, IE along with Hindi is the co-official language and around 23 % of the population of India have at least basic knowledge of English. According to the recent 2011 census, over 50 million population of the country speaks English. But only a small percent of the population uses IE as the nativized one. Majority speakers of IE are introduced to English as their second language in schools, where English is used as the medium of instruction and majority of them have their first language as the regional languages such as Tamil, Punjabi, Hindi etc. Indian English is the de facto standard taught in schools and universities although it lacks full official recognition. Indian English is considered as a yardstick for educated speakers by the speech community in the country. The phonology of IE differs in several respects from that of British English, due to the transfer of features from Indian languages. These languages have converged over time in several respects and have formed a sprachbund though they belong to several different language families.

There is a possibility that second language speakers of English bring about many nativized changes in prosodic as well as segmental aspects of the language. But there is also a chance of native-like prosodic aspects and having native like rhythmic scores in L2

(second language) speakers. As well as accommodation of L1 (first language) features on L2 rhythm thereby failing to fall into a proper L2 rhythm. Many previous studies suggest that IE, unlike AE or BE, is more syllable-timed rather than stress-timed, where "syllables are uttered with almost equal prominence" (Gargesh, 2004). The schwa is not realized in weak positions and the vowels retain their quality and, often, duration, thus presenting different timing patterns from BE or AE.

Kachru and Nelson (2006) noted that this feature could be shared across Southern Asian English varieties. The fact that the phonologies of a large number of languages spoken in the subcontinent, including their rhythmic properties, are under-researched, adds to the complexity of investigating rhythm in IE. Moreover, with an interest in quantifying the rhythmic variations across different languages, development of various new rhythm metrics were started up and the division between stress-timed and syllable-timed, which was taken for granted for a long time, has been questioned, resulting in various new approaches to investigating rhythm (Roach, 1982; Nespor, Shukla & Mehler, 2011; Fletcher, 2010; Fuchs, 2013). Acoustic-phonetic studies mostly focused on aspects as lexical prominence or reported preliminary results on the use of phrasal prominence and pitch movements on accented words (Wiltshire & Harnsberger, 2006). The Wiltshire and Harnsberger (2006) study, investigating the differences and similarities in intonation patterns across IE speakers of Gujarati and Tamil L1 backgrounds, confirmed a substantial degree of L1 influence but also showed that some of the features could be shared by speakers from two different L1 backgrounds. The source of the similar features could not be determined. It could have been due to the result of similarities in the intonational phonologies within one language family, the nature, and use of English in

the subcontinent, or even the effect of the transfer from the substratum language, Hindi. These findings indicate the need for more detailed and systematic research in this field in order to describe IE prosodic features and, most importantly, the degree of variation within this variety of English. In this regard, many Indian languages have been studied but there are no published reports on proficient English speaking native Kannada speakers. This serves as the motivation for the present study. Knowledge about IE rhythm helps in the better cross-linguistic understanding of the language and will help Speech Language Pathologists to appreciate normal and abnormal prosodic aspects in the English speaking communities of India.

Aim of the study

The study aims to determine speech rhythm pattern in native Kannada speaking individuals proficient in English.

Objectives of the study

- To determine speech rhythm pattern in English reading task in native Kannada speaking individuals.
- To investigate the variation in speech rhythm in English across gender.

Chapter II

Review of Literature

The isochronous repetition of units of speech is referred to as rhythm by Pike (1946) and Abercrombie (1965). When any event or unit occurs at a regular interval, they are said to be in rhythm. As in the poem, even prose has a rhythm which is called the speech rhythm. According to Crystal (1986), rhythm is the regularity of prominent speech units and it could be based on length of the syllables (long or short), the pattern of stressing in syllables or based on the pitch variations (high or low) or based on the combination of those factors. According to Pike and Abercrombie, languages should belong to a stress-timed rhythmic class or syllable-timed rhythmic class. The gap between the stresses are observed to be almost same in languages which are identified as stress-timed but the successive syllables are of almost equal length in the syllable-timed ones. The viewpoint of Pike and Abercrombie suggests that the languages are to be either one of the rhythmic class but not less or more of one type of rhythm class. The categorical observation by Abercrombie (1965) was put forth based on the speech production physiology. Chest-pulses and stress-pulses are the two variants of pulses which are present in spoken languages. The alternate movement of respiratory muscles results in pulse-like puffs of air and is termed as Chest pulses. Whereas the more strong contractile movements of the respiratory muscles were termed as Stress-pulses. Thus rhythm is a product of combination of two pulse systems as suggested by Abercrombie. Isochronous sequencing of chest pulses occurred in syllable-timing. And the stress pulses were re-enforced in isochronous sequence in stress timing. Bloch (1950), Han (1962),

and Ladefoged (1975) put forth an additional type of rhythm class and termed it as mora timing. Japanese symbolized mora timing. Syllable sub units subsisting of a short vowel and preceding consonants make up morae. The duration of consecutive morae is found to be almost same in mora timing. Thereby showing that syllable-timed languages resemble more with mora timed languages than with those of stress-timed languages. Nakatani, O'Connor, and Aston (1981) found that the syllable duration, word size, word stress, syllable stress and position within the word, syntactic content, syllable position within a phrase and metrical feet influence rhythm. Dasher and Bolinger (1982) suggested that certain phonological features like reduction of vowels, syllable type variations, variations in the vowel length can also contribute to changes in speech rhythm, which indicates that the rhythm could be influenced by the first language (L1).

2.1 English in India

English is a widely spoken language and globalization has lead to a dramatic rise in the number of English speakers across the globe. It is well known that L1 has a prominent impact on English, most often learned as L2. Hence English spoken in worlds certain countries have been explored for their differences with respect to native speakers. The relationship of English with India starts from the colonial history of the country and as a result, there is a wide range of emotions towards IE in the country (Phillipson, 2001). But many people accept English as a functional necessity amidst the chaos prevailing even now. Indian English belongs to the group of 'world Englishes' varieties under the subsection of Englishes of the South Asian continent (Kachru & Nelson, 2006). The 'world Englishes' framework not only includes such well-known varieties like BE or AE

where English is used as the L1 predominantly but even the ones where English is considered as L2 and where the use had started after the colonial control of the countries like India, Sri Lanka, Singapore, Philippines, Nigeria etc and other countries around the world where English has been institutionalised and now plays an important part in education, administration, the media and the economy. IE is used as the lingua franca by the majority of the youth as well as the working population of the country especially when there is a need to communicate to different people from different parts of the country with diverse regional languages. Few studies in the late 20th century have revealed that there is an influence of regional languages over the variety of IE in different states of the country (Thundy, 1976). The investigation by Sirsa and Redford (2013) studied the IE sound structure and explored whether it varies with the native language influence or not. The study explained that the IE phonology produced by native Hindi and Telugu speakers varied from the native language phonology. Since India is a multicultural and multilingual society, there are umpteen numbers of regional languages and dialects to be explored and studied.

2.2 Measures of speech rhythm

Rhythm metrics have evolved over time and different measures have been used to classify speech rhythm in different languages. The measurement of rhythm started with the concept of isosynchrony. The principle of isosynchrony states that the speech unit or event will occur at approximately equal intervals of time. Abercrombie (1967) first made an attempt to measure the speech rhythm in different languages and classify them using standard duration and syllable duration. The rhythm class hypothesis given by

Abercrombie put forth that each language belongs to one of the stress-timed, syllable-timed or mora timed rhythmic class. Languages which are said to be stress-timed have stress at equal intervals or near equal intervals (e.g., English). On the other hand, languages which are said to be syllable-timed have syllables occurring at equal intervals or near equal gaps (e.g., French), but in languages which are mora-timed, consecutive mora is said to occur at almost equal intervals (e.g., Japanese). However, Abercrombie found them to be ineffective in classifying the speech rhythm of different languages. Later, Roach (1982) used the inter-stress interval to measure the speech rhythm. But even this was not able to differentiate various languages in terms of rhythm. Dauer (1983) believed that the rhythm of different languages falls on to a continuum between the stress and the syllable-timed levels. Some authors claimed that the speech rhythm is isochronic only on a perceptual basis.

Low (1998) introduced Pairwise Variability Index (PVI) to quantify the speech rhythm which measures the durational difference between successive vocalic intervals and successive intervocalic intervals. PVI measures have shown to be good indicators of what rhythm is really. In recent years, the rhythm was measured using a combination of duration of vowels (%V), vocalic intervals SD (ΔV) and consonantal intervals SD (ΔC) and Ramus, Nespor, and Mehler (1999) explained that these measurement systems could place the languages on a continuum based on the type of speech rhythm and not as different classes. However, they reported that these metrics were found to be effective in measuring the type of rhythm. Low, Grabe, and Nolan (2000) developed normalized Pairwise Variability Index (nPVI) as well as raw Pairwise Variability Index (rPVI) which were able to successfully classify different languages into different rhythm categories in

terms of their values either as low or high. nPVI measured the rhythm of vocalic segments and rPVI measured the rhythm of intervocalic segments. The vowels are usually either stretched or compressed and the intervocalic segments include different segmental units which affect the speech rate. Thus to adjust or neutralize the rate variations within the segments across speakers of different languages, normalization process was carried out. However this was done only for vocalic and not for intervocalic segments as the intervocalic segments provided information about the complexity of the syllabic structure of the language which accounted for the difference in speech rate in different languages and assisted in classifying different languages into one of the three types of the speech rhythm. Based on the PVI values for vocalic and intervocalic segments, rhythm patterns were classified as shown in Table 2.1.

Table 2.1

Rhythm Pattern Classification Based on Vocalic and Intervocalic Segments

	Stress timed	**Syllable timed**	**Mora timed**
rPVI	High	High	Low
nPVI	High	Low	Low

The assumption on which the speech rhythm metrics work is that the phonological pattern of the language influences the rhythm (Grabe & Low, 2002). The syllable-timed languages will have simple syllabic structure, for example, VC or CCV where there is not much wide variation in duration across the syllables which are very complex (<330ms)

and the most simple. Hence, also called fast syllable-timed languages. But in cases of mora timed languages the structure of syllables are very simple such as CV or VC and the durational variation is very subtle. However, in languages having a complex syllabic structure like CCCVC, the durational variation across the syllables are wide and hence are called slow stress-timed languages. Thus, increase in the convolutedness of the syllables that is, the clustering of the phonemes leads to increase in PVI values.

2.3 Rhythm across languages

Several studies have been carried out in the western context (Nakatani et al., 1981; Hoequist, 1983; Nolan & Asu, 2003) as well as Indian context to determine rhythm across languages. Abercrombie (1967) found out that stressed timed languages comprised of Arabic, English, and Russian; languages in the syllable-timed category included French, Telugu, Yoruba, and Japanese came under the mora timed class. Few other syllable-timed languages were found to be Tagalog (Gonazalez, 1970), American English (Nakatani et al., 1981) and Spanish (Hoequist, 1983). Ramus, Nespor, and Mehler (1999) analyzed 5 sentences spoken by 4 speakers of different languages including Dutch, Polish, English, Spanish, Italian, French, Catalan, and Japanese and measured the rhythm classes. % V in English (which have vowel reduction) was lesser than in French. Consonant interval SD was greater in English compared to other languages. Thus English had more complex syllable options. Based on % V and Δ C, stress-timed languages included English, Dutch, and Polish; syllable-timed category included French, Spanish, Italian, Catalan as syllable-timed languages, and the Japanese language had mora-timing.

Low, Grabe, and Nolan (2000) used a similar metric as by Ramus et al. (1999) and familiarised Pair-wise Variability Index (PVI**)**. Using the PVI, Low et al. (2000), mentioned Singapore English to belong to the more syllable-timed category than British English. They collated nPVI with the standard deviation measures ΔV and ΔC and mentioned that PVI might be a better indicator of rhythmicity than ΔV or ΔC. Whereas in a less tightly controlled data, they described that standard deviation might reflect spurious variability due to variation in speaking rate. Grabe and Low (2002) calculated PVIs in languages which were classified into different rhythmic classes or as unclassified based on stress timing, syllable timing and mora timing. The participants were made to read passages in 18 separate languages (one speaker per language). Based on PVIs, English, Dutch, and German had stress timing; French and Spanish had syllable timing, and Japanese had mora timing. Remaining languages were unclassified. The study suggested that the categorical distinction between languages which are stress timed and syllable timed is weak and that all languages won't fit into these two categories. They also revealed that rPVI gives a better understanding regarding why few languages (such as Polish and Estonian) does not fall into the proto typical rhythm classes. They supported the view point that there could be a considerable interaction between the stress timed, unclassified and syllable timed groups.

Rhythm in the first and second language studied by White and Mattys (2007), presented a relative evaluation and quantification of the rhythm of speech using different rhythm metrics. They carried out first language analysis on native English, Dutch, Spanish and French speakers. And for the L1 versus L2 analysis, six speakers (males and females) of each language condition such as native English speakers, native Dutch

speakers, native Spanish speakers, English speakers proficient in Spanish, English speakers proficient in Dutch, Spanish speakers proficient in English and Dutch speakers proficient in English was taken up. The participants were instructed to read 5 sentences in each language condition (L1 and L2) and rhythm metrics were determined, such as SD of vocalic interval duration, SD of duration in consonantal intervals, %V, VarcoV, VarcoC, nPVI-V and rPVI-C. The investigation revealed that the rhythm in L1 matched with the literature. The non normalised measures were found to be indicative of accommodation within L1 and L2 rhythm. Δ C , %V and rPVI-C showed an effect by native language. The study concluded that for vocalic intervals nPVI-V and VarcoV to be more apt and for rhythmic typology %V and VarcoV together provided a better understanding. Thus this study also provided evidence with respect to effect on second language rhythm due to first language influence.

In the Indian context (Savithri, Jayaram, Kedarnath, & Goswami, 2006; Savithri, Maharani, Goswami, & Deepa, 2007) investigated cross-linguistic speech rhythm. Savithri et al. (2006) revealed that Kannada is a mora-timed, they reported that intervocalic PVI had a mean of 46.18 and vocalic PVI had a mean of 46.95. Similarly, Savithri et al. (2007) conducted a cross-language study and found that Assamese, Bengali, Kashmiri, Marathi, Punjabi, Malayalam, Oriya, Telugu Tamil, are mora timed whereas Hindi is a syllable-timed language. Developmental studies on rhythm in Kannada language was carried out across typically developing children of various age ranges such as 3-4 years, 4-5 years, 8-9 years and 11-12 years and was characterized as syllable-timed, mora-timed and unclassified respectively using pair-wise variability index of durations. Maruthy, Venugopal, and Parakh (2016) used reading task in 15 adults who

do and do not stutter to determine speech rhythm in Kannada speaking adults. They calculated pairwise variability index (raw PVI for consonantal intervals and normalised PVI for vocalic intervals) and interval-based rhythm metrics (PercV, DeltaC, DeltaV, VarcoC and VarcoV) for all the participants and suggested that there are higher mean values in adults who stutter when compared to adults who do not stutter for all the rhythm metrics except for VarcoV. The study provided strong empirical support for the hypothesis that stuttering is a rhythmic deficit.

Similarly there have been studies on rhythm in different communication disorders such as hearing impairment, dysarthria and stuttering and their rhythm pattern was found to be varied from their native rhythm (Savithri, Johnsirani, & Ruchi, 2008; Santosh & Sahana, 2012; Amulya & Swapna, 2013; Swathy & Santosh, 2014; Merin & Savithri, 2016; Deepthi & Santosh, 2016; Maruthy,Venugopal, and Parakh, 2016). In general, the findings of these studies indicate that speech rhythm varies across different languages and rhythm of one language cannot be generalized to other languages.

2.4 Rhythm in Non-Native Speakers of English

Using the PVI, Singapore English was categorized as more syllable-timed than British English by Low et al. (2000). Deterding (2001) compared the speech rhythm of six British English speakers and six Singapore English speakers and the results supported the previous studies and indicated that the Singapore English is more syllable-timed and also mentioned that greater incidence of reduction of syllables with schwa in the British English speaking participants might be the cause of differentiation of rhythmic properties of two languages. Gut (2005) studied the influence of three varieties of Nigerian

languages (L1) on the second language English. The results showed that the L2 prosody consisted of both tone language features and stress languages features. The speech rhythm of Nigerian English fell between Nigerian languages as well as the British English. The speech rhythm in the L2 English expressed by Hong Kong Cantonese speakers was studied by Setter (2006) in terms of duration of syllables and revealed that the differences were very less in comparison with the speech rhythm of British English. Coetzee and Wissing (2007) examined the global and local durational properties of three types of South African English. The results revealed that L1 South African English and Afrikaans English have stress timing and phrase lengthening was noticed in both but the Tswana English had more syllable-timing and didn't use phrase-final lengthening.

2.5 Rhythm in Indian English

The literature generally supposes that IE unlike BE or AE is more syllable-timed and not stress-timed (Hannah & Trudgill, 2008) and syllables are expressed with almost equal prominence. Wiltshire (2005) examined Tibeto-Burman language family (Angami, Ao, and Mizo) and studied the phonological and phonetic features of Indian English produced by them. The type of IE varied from the typical variety and was characterized by the absence of coronal consonant retroflection, consonant cluster simplification, the absence of voicing in word-final obstruents, the occurrence of post-vocalic [p] as well as decreased vowel contrasts. These phonological features were found to be derived from the phonology of first language (L1).

Krivokapić (2013) compared the rhythmic properties of AE and IE and examined rhythmic convergence between the speakers of these varieties. She indicated that IE had a

more syllable-timed rhythm, where an increase of foot duration with the number of syllables was larger compared to AE. A study by Fuchs (2014) also claimed that IE is syllable-timed. Fuchs examined Hindi, Malayalam, Bengali and Telugu speakers of English and compared their IE speech rhythm with the Southern England speakers of BE. In order to test potential differences in rhythm between BE and educated IE, the researcher followed a multi-dimensional model of rhythm and applied a range of metrics to investigate variability in loudness, intensity, *f0*, syllable durations, vocalic intervals and the variability of voiced and sonorant durations. The study explained that educated IE has more syllable timing in comparison with BE. However, rhythmic properties showed differences across metrics and between reading and spontaneous speech styles. IE exhibited less variability in syllable durations. The author also suggested that for marking prominence, duration has a less significant role in IE with respect to BE. Combined variability was also found to be smaller in IE in terms of intensity and duration. In spontaneous speech sample of IE, the variation in intensity averaged raised with increase in the minimum number of intervals, showing that IE speakers did not vary average intensity in longer utterances to the same extent BE speakers did. Fuchs suggested that this could potentially be the feature that contributes to the perception of IE being more monotonous; however, the conclusion was based on single utterances only, thus excluding the patterns of variability in intensity between the utterances. Fuchs (2013) also reported that educated IE was spoken more slowly than BE, contrary to previous claims about IE.

Maxwell (2014) studied the intonational and prosodic features of the speech of eight educated IE speakers from Bengali (Indo-Aryan) and Kannada (Dravidian) L1

background and stated that her findings support the more recent experimental research suggesting that there is no uniformity of IE across the country (Sirsa & Redford, 2013) and also described that greater accentual density, a smaller pitch accent inventory, frequent use of nuclear falls and narrower pitch range are characteristic of Kannada English (KE).

In sum, the literature reveals that speech rhythm varies across languages and could be influenced by numerous factors including the proficiency, working environment and the influence of native language. The studies to investigate the speech rhythm in second language speakers of English have revealed that the rhythm was different due to various influences over the language. The studies investigating speech rhythm of English in different regional languages and dialects of India are limited. Further, there have been no studies that have documented the variations in speech rhythm in English, especially in Kannada speaking adults. Hence, the study was planned to investigate the speech rhythm of English in Kannada speaking adults using a reading task.

Chapter III

Method

The present study was carried out to determine the speech rhythm pattern in native Kannada speaking individuals proficient in English. The methodologies adopted were as follows:

3.1 Participants

Twenty literate adult native Kannada speakers proficient in English, including an equal number of males and females, were considered for the study. All participants were in the age range of 20- 30 years and the mean age was 23.8 in males and 24.2 in females. The inclusion criteria for the participants were as follows:

- Graduate native speakers of Kannada (Mysore dialect).
- Had schooling in English Medium from grade 1.
- Passed English proficiency scale (Ramya & Goswami, 2009).
- Had no visual or auditory deficits which were ruled out by informal assessment.
- Had no cognitive or language impairment, ensured using MMSE (Folstein, Folstein, & McHugh, 1975).

And the exclusionary criteria for the participants were as follows:

- Had upper respiratory tract infections, asthma, or allergic diseases at the time of recording.
- Had a history of neurological, speech, language or hearing disorders.

3.2 Stimuli

A reading task including five standardized sentences (Appendix) in English language, adapted from White and Mattys (2007) study was used. The sentences excluded approximants /l/, /r/, /w/ and /j/, as the boundary between an approximant and a preceding or following vowel is difficult to determine reliably. Reading task was selected as there will be a smooth flow of speech and there will be no pauses and prolongations of phonemes in different length which can further increase the rhythm metric measures.

3.3 Procedure

Participants were explained about the procedure and an informed consent was taken before the recording. The English proficiency of all the participants was ensured by administering Language Experience and Proficiency Questionnaire – LEAP Q (adapted to Indian context by Ramya & Goswami, 2009). Proficient speakers of English participated in the study. They were asked to sit in a relaxed manner and audio recordings were obtained in a quiet room using Olympus LS 100 digital voice recorder with a sampling frequency of 44.1 KHz and 16-bit resolution in .wav format. The microphone of the recorder was placed at 6 cm away from the mouth of the participant to avoid breathing noise. The participants were given sentences to read silently before reading them aloud. All the five sentences were presented one after the other on a 15.5-inch VAIO E series laptop screen with an interstimulus interval of 3 seconds. They were instructed to speak in their normal conversational voice at a rate that felt natural and comfortable. They were asked not to pause during sentences but were instructed to pause between successive sentences and to repeat a sentence if they made any mistake. The

experimenter also occasionally requested repetition of sentences, in the interest of fluency, but speakers were not guided further about how to read the sentences.

3.4 Acoustic Analyses

Speech samples were transferred to the computer memory and PRAAT 5.1.14 (Boersma & Weenink, 2009) was used to measure Vocalic (V) and Intervocalic (IV) durations. The Vocalic (V) and Intervocalic (IV) segments were highlighted using a cursor and intervals were measured. The vocalic measure referred to the duration of a vowel/semivowel/diphthong which was measured as the time difference between the onset of voicing to the offset of vowel/semivowel/diphthong voicing. The intervocalic measure referred to the time difference between two vocalic segments (Ramus, Nespor, & Mehler, 1999; Grabe & Low, 2002) and was measured as the time difference between the offset of the initial vocalic unit to the onset of the next vocalic unit. Pauses were eliminated in order to get an appropriate measure of the vocalic and intervocalic intervals. Inter-rater reliability was established for vocalic and intervocalic segments by involving another Speech Language Pathologist experienced in analyzing the speech rhythm acoustically.

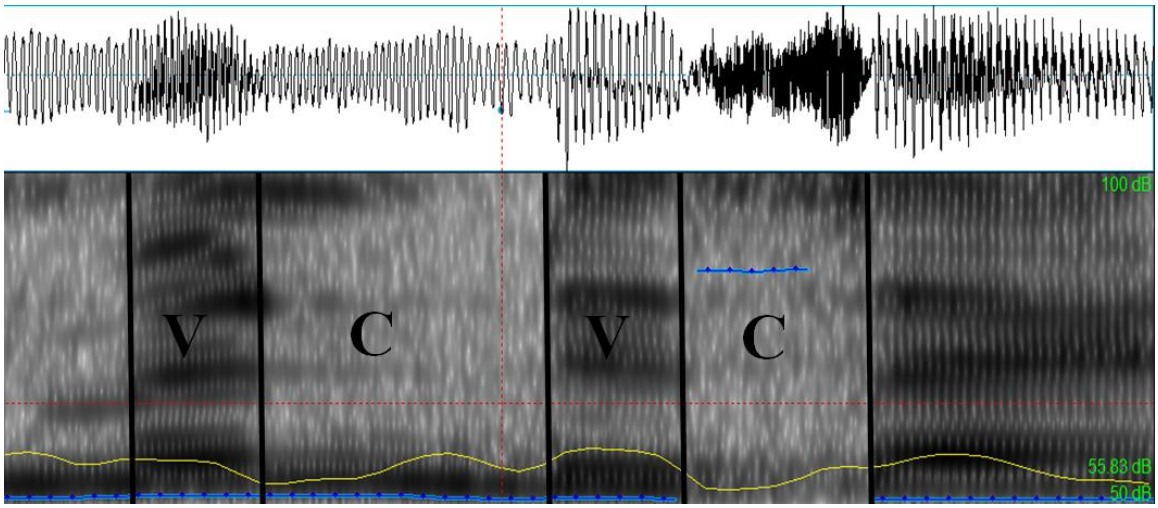

Figure 3.1. Spectrogram labeling vocalic and consonantal intervals. V = vocalic intervals; C = consonantal intervals.

Normalised vocalic (nPVI-V) and raw consonantal (rPVI-C) scores for duration were calculated using the below-mentioned formulae given by Low, Grabe, and Nolan (2000):

$$\text{nPVI} = 100 \times \left(\sum_{k=1}^{m-1} |(d_k - d_{k+1})/((d_k + d_{k+1})/2)| \right) \Big/ (m-1)$$

$$\text{rPVI} = \left(\sum_{k=1}^{m-1} |d_k - d_{k+1}| \right) \Big/ (m-1)$$

The duration difference between successive intervals was calculated and averaged to get the normalized Pairwise Variability Index (nPVI) and the mean of the differences between successive intervals was calculated to obtain raw Pairwise Variability Index

(rPVI). In the formulae, m is the number of intervals and d_k is the duration of the k^{th} interval. Microsoft office excel program was used to calculate PVIs. After data was tabulated appropriate statistical analysis was carried out.

3.5 Statistical Analyses

Statistical analysis of the data was carried out in the commercially available SPSS (version 20) software. Shapiro Wilk's test for normality was administered for both the groups for vocalic nPVI and intervocalic rPVI. Both descriptive and inferential statistics were carried out using the statistical package SPSS version 20. Under descriptive statistics mean, median and standard deviation were measured and under inferential statistics one-way MANOVA (between subject group comparison) was carried out.

Chapter IV

Results and Discussion

The present study aimed at determining speech rhythm pattern in native Kannada speaking adults for English reading task and to investigate if there is any variation across gender. The reading material consisted of five sentences adapted from White and Mattys study (2007) and 10 participants were considered in each group (males and females). The responses were recorded using Olympus LS 100 digital voice recorder and the audio recorded samples were subjected to acoustic analysis in PRAAT software where the vocalic and intervocalic segments were measured. Pairwise Variability Index (PVI) was calculated for each participant using Microsoft Excel for the vocalic (nPVI-V) and intervocalic (rPVI-C) segment duration. These PVI values were tabulated and subjected to statistical analyses using SPSS software version 20.0. The following statistical procedures were carried out:

- Descriptive statistics to obtain mean, median, and standard deviation for both the groups.
- One way MANOVA to check for the significant difference, if any, across the groups i.e., between males and females.
- Cronbach's alpha to determine the inter and intrajudge reliability.

The results obtained from all the above statistical measures have been presented and discussed below under the following sections:

I. PVI values in English speaking native Kannada speakers

II. Comparison of PVI values across gender

III. Comparison of PVI values across various languages (retrospective)

IV. Inter and intrajudge reliability of nPVI and rPVI values

I. PVI values in English speaking native Kannada speakers

To determine the PVI values in English speaking native Kannada speakers, descriptive statistics were carried out. Initially, the mean, median, and standard deviation (SD) were computed for both the groups together and later separately. Table 4.1 shows the mean, median and SD values of nPVI-V and rPVI-C for the groups.

Table 4.1

Mean, Median, and Standard Deviation (SD) Values of nPVI-V and rPVI-C

	Combined			**Males**			**Females**		
	Mean	**Median**	**SD**	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**
nPVI-V	50.83	51.86	4.50	49.21	48.23	5.73	52.44	52.44	2.00
rPVI-C	45.77	46.59	4.46	43.58	43.96	3.90	47.96	48.54	4.01

The overall mean for nPVI-V and rPVI-C for Kannada speaking individuals in English were 50.83 and 45.77 respectively. The mean values of PVI for both the segment durations across the groups have been depicted in Figure 4.1. A PVI above 50 was considered as high and a PVI below 50 was considered as low (Merin, 2016). Hence based on the present study, the speech rhythm of English was categorized as unclassified in native Kannada speaking adults.

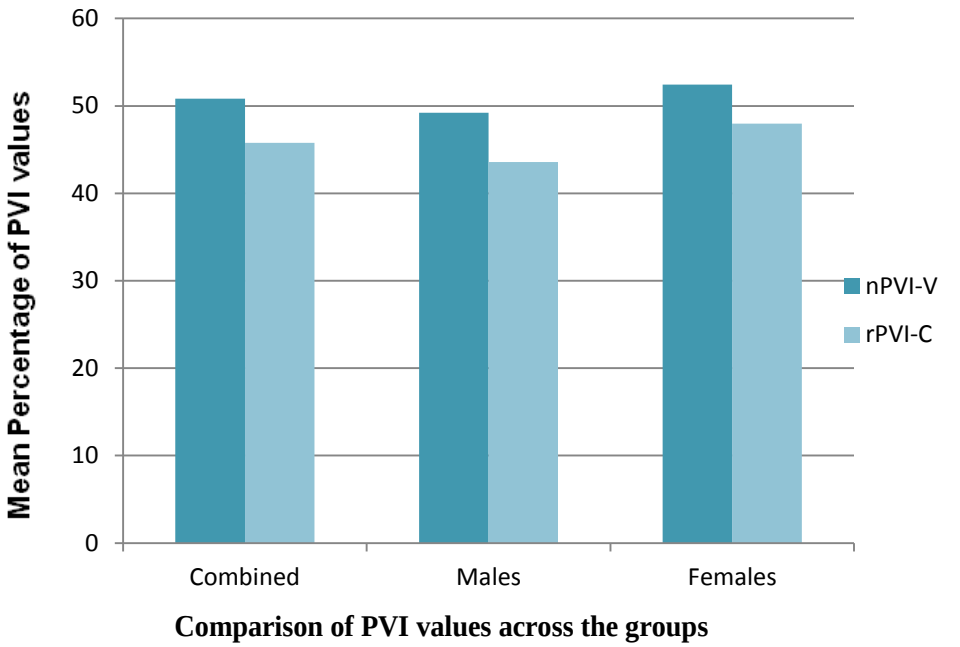

Figure 4.1. Mean nPVI-V and rPVI-C values for vocalic and intervocalic segment duration. nPVI-V = normalized Pairwise Variability Index for vowels; rPVI-C = raw Pairwise Variability Index for consonants.

The results are in concordance with Savithri et al. (2006) were the mean nPVI and rPVI values of native Kannada speakers were elicited as 46.18 and 46.95. The results also revealed that nPVI-V and rPVI-C were high and low respectively in Kannada English which parallels with adults speaking Kannada where they obtained higher vocalic PVI compared to intervocalic PVI. The findings of this study also draw a significant correlation with reports of Wiltshire (2005) who investigated phonetic and phonological characteristics of the English elicited from three Indian L1s from the Tibeto-Burman language speakers and stated that the L2 phonological characteristics

might be influenced by L1 phonology. This adds on to the evidence of variation of rhythm and other prosodic aspects with respect to language. Grabe and Low (2002) stated that in unclassified languages such as Welsh, Greek, Malay, Tamil, and Rumanian there is an overlapping with the edges of the stress-timed and the syllable-timed group. The present study also classified the speech rhythm of English as unclassified in native Kannada speaking adults which could be due to an overlap between stress-timed and mora timed rhythm.

II. Comparison of PVI values across gender

To check whether the PVI values obtained from males and females were varying, descriptive statistics were carried out. The mean of nPVI-V for males and females were 49.21 and 52.44 respectively and the mean of rPVI-C for the males and females were 43.58 and 47.96 respectively. Thus across gender, the results revealed that nPVI-V was high and rPVI-C was low in females and both were low in males. Therefore the study revealed that in males the Kannada rhythm was mora timed and unclassified in females.

In order to determine the normality of the sample selected for the study Shapiro Wilk's test was carried out. It was revealed that all the parameters followed a normal distribution with $p>0.05$. Hence one way multivariate Analysis of Variance (one way MANOVA) was carried out to see the significant differences across both the groups for nPVI-V and rPVI-C values. The results indicated a significant difference in rPVI-C values between both the groups ($p<0.05$) but the significance is

comparatively less because of the lower effect size (0.253). The values obtained from 1 way MANOVA have been depicted in Table 4.2.

Table 4.2

'p' Values and Effect Size for nPVI-V and rPVI-C Values

	p-value	**Effect size**
nPVI-V	.110	.136
rPVI-C	.024*	.253

*$p < 0.05$

The PVIs were widely scattered in males compared to those in females. Figure 4.2 represents the scatter-plot of vocalic PVI (nPVI-V) and intervocalic PVI (rPVI-C) for duration in males and females respectively.

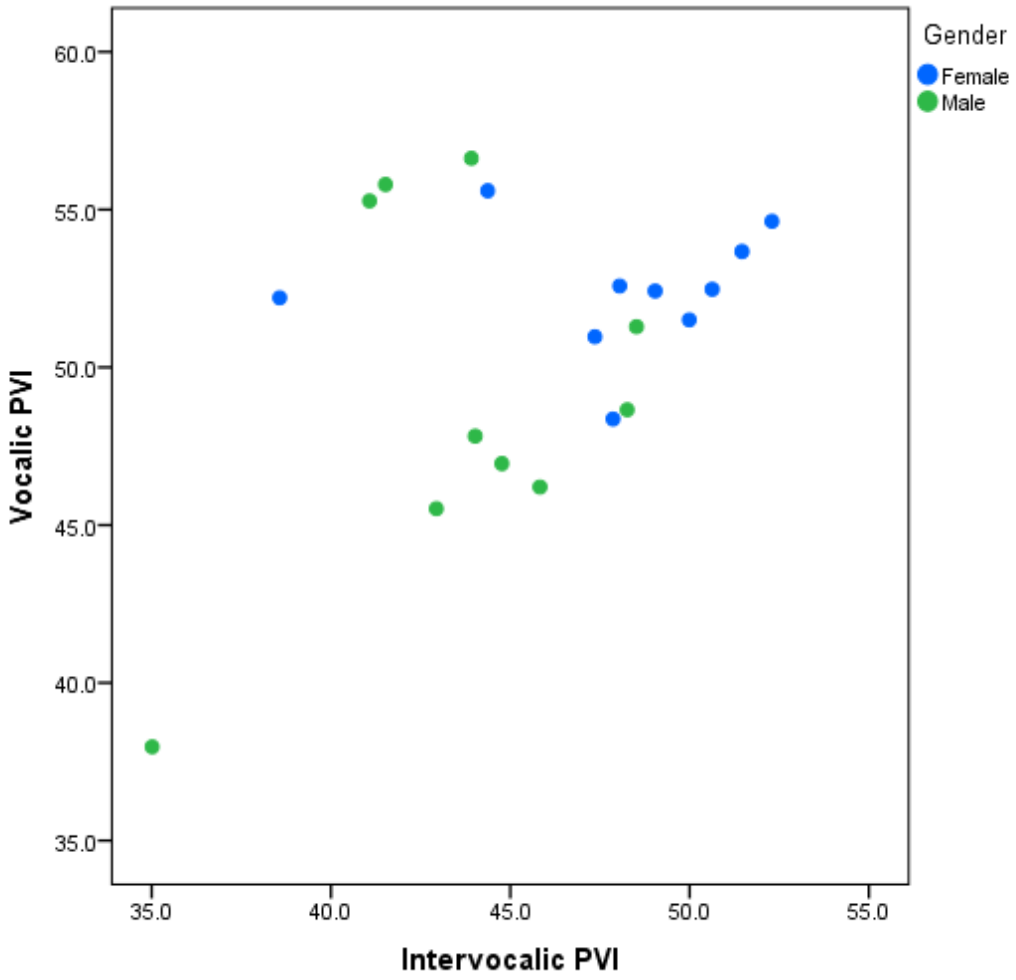

Figure 4.2. Scatter plot for intervocalic PVI (rPVI-C) and vocalic PVI (nPVI-V) values for duration in males and females.

There was significant difference ($p<0.05$) observed on rPVI values across gender groups considered in this study. These results are in consensus with Savithri, Sreedevi, Deepa, and Aparna (2011) study which investigated the effect of gender on speech rhythm in 3-4 year old typically developing Kannada speaking children and reported a significant difference between gender for intervocalic rPVI and no significant difference across gender for vocalic nPVI. The intervocalic rPVI was

significantly lower in boys compared to girls which was supported with the observation that girls articulated all consonants whereas boys deleted or omitted few consonants. This accord to a similar probability of an increase in intervocalic rPVI in adult females in comparison with males in this study.

III. Comparison of PVI values across various languages (retrospective)

The results of the present study were compared with those of the study by White and Mattys (2007) on PVIs for duration, where they compared the rhythm metrics across English, Dutch and Spanish; quantified the influence of the first language on second language rhythm. Figure 4.3 represents the scatter-plot of vocalic PVI (nPVI-V) and intervocalic PVI (rPVI-C) for L1 and L2 speakers of English for reading task. The sentence material used in this study was taken from White and Mattys (2007) which makes the comparison relevant. The mean number of syllables per sentence was 16.2.

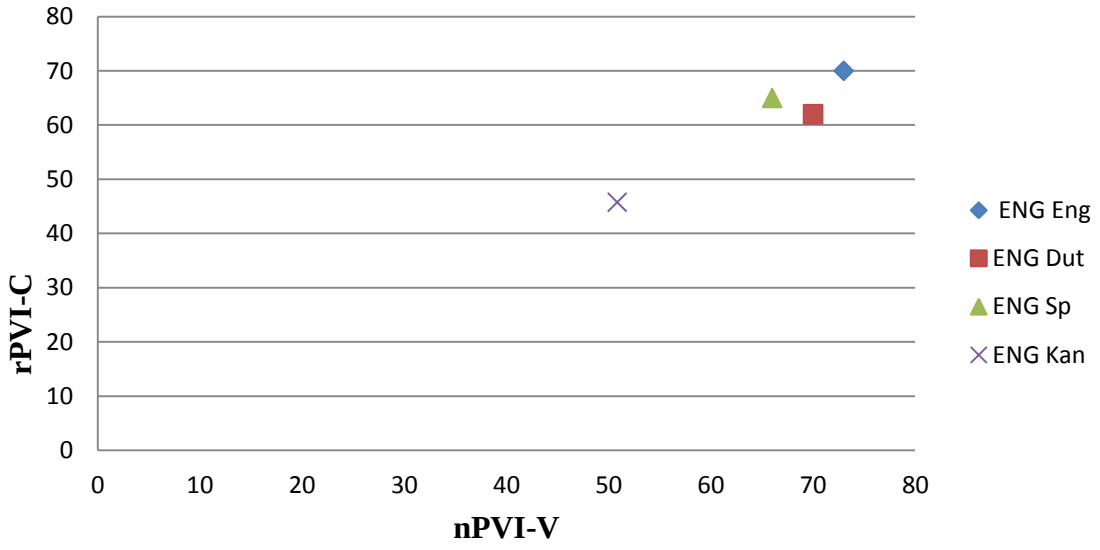

Figure 4.3. Scatter plot for nPVI-V and rPVI-C values across Kannada, English,

Dutch and Spanish speakers. ENG Sp = native Spanish speakers of English; ENG Dut = native Dutch speakers of English; ENG Kan = native Kannada speakers of English; ENG Eng = native English speakers.

The comparison of present results with White and Mattys (2007) first and second language study revealed that the nPVI and rPVI values of English read by native English speakers, native Spanish speakers of English and native Dutch speakers of English were quite high compared to the values obtained by native Kannada speakers in the present study. The speech rhythm in reading for Kannada speakers was unclassified whereas for the British English speakers rhythm fell under stressed time rhythm category which explaining the effect of L1 on L2 rhythm. Grabe and Low (2002) studied nPVI and rPVI values of languages across the world and the findings of their study were compared with the PVI values of native Kannada speakers of English. The present study also compared the results of Savithri, Jayaram, Kedarnath, and Goswami (2006), which found Kannada to be a mora-timed language (low intervocalic PVI and vocalic PVI) in adults. Figure 4.4 was elicited from Grabe and Low (2002), Savithri et al. (2006) and the data of the present study for a better comparison.

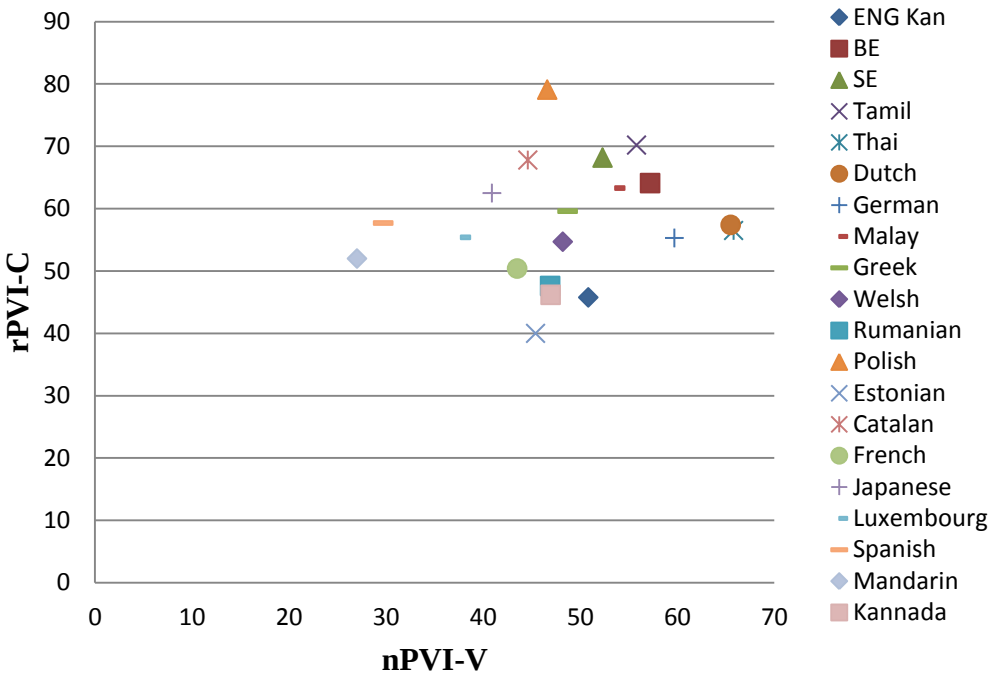

Figure 4.4. Scatter plot for nPVI-V and rPVI-C values across different languages. ENG Kan = native Kannada speakers of English; BE = British English; SE= Singapore English.

Figure 4.4, depicts the 18 languages of the world which were classified as stress timed (British English, German, Dutch, Thai), syllable timed (Tamil, Spanish, French, Singapore English), mora timed (Japanese), mixed (Polish, Catalan) and unclassified (Estonian, Greek, Luxembourg, Malay, Mandarin, Rumanian, Welsh) rhythmic groups according to Grabe and Low (2002) and the comparison of the same with the mora timed Kannada language, Savithri et al. (2006) and unclassified English rhythm of native Kannada speakers. The figure also shows that the intervocalic rPVI values for English speaking Kannada participants were lower compared to almost all other languages except the Estonian language. Whereas the

vocalic nPVI value was relatively high compared to many other languages. Thus the present study found that the rhythm of English in native Kannada speakers is unclassified.

Collating the results of the present study with Grabe and Low (2002) study of world's languages and Savithri et al. (2006) study indicated that the rhythm of English in native Kannada speakers were closer to Kannada language which has been classified to have mora-timed rhythm as well as to Rumanian language which falls under unclassified rhythm category. Thus, the findings of this study put forth that the speech rhythm pattern in English reading task in native Kannada speaking individuals is unclassified as it intermediates between stress-timed and mora timed rhythm categories with mean nPVI and rPVI values as 50.83(±4.50) and 45.77 (±4.46) respectively. The study also reports that in Kannada English there is a significant difference between gender for intervocalic rPVI and the rhythm class in male population is mora timed whereas in females it is unclassified.

IV. Inter and intrajudge reliability of nPVI and rPVI values

The inter-rater reliability was determined for 33% of the samples from both the groups using Cronbach's alpha. The alpha value was found to be 0.80 for nPVI-V and 0.80 for rPVI-C which indicated significantly high inter-rater reliability for both vocalic and intervocalic segment durations. Similarly, intrajudge reliability was determined by rating 33% of the samples twice. The alpha value was found to be 0.80 for both nPVI-V and rPVI-C leading to good intrajudge reliability for both nPVI and rPVI values.

In sum, the results of the present study indicated that the speech rhythm is varied with respect to the native language (L1), as there was a difference in the PVI mean values of native Kannada speakers of English with respect to the native English speakers, native Spanish speakers of English and native Dutch speakers of English. The speech rhythm in Kannada English was revealed as unclassified. Gender comparison showed that the speech rhythm of English in native male Kannada speakers was similar to that of their L1, i.e. Kannada speech rhythm (mora timed) and in females, unclassified.

Chapter 5

Summary and Conclusions

English has become one of the most colloquial forms of communication in developing India since few decades. It is being used as the first language (L1) by a minority population in the country but as a second language (L2) by the majority population of the country. Nearly 23 % of Indians have basic knowledge of English and almost 50 million Indians are fluent speakers of English according to 2011 census. The influence of regional first languages on the second language is immense and the influence of regional languages on prosodic aspects of L2 is less studied in India. According to Encyclopedia Britannica (1965), rhythm is a pattern of movement, which occurs with more or less temporal regularity or is a swing or balance in bodily movement, music, verb or phrase. Although a number of acoustic parameters appear to contribute to the perception of differences in contrastive rhythm, most of the work has concentrated on the explicit role of timing. Many studies have investigated the deviation of rhythm in disordered populations such as hearing impairment, stuttering, Parkinson's disease, dysarthria etc especially with respect to their L1. But very few studies have considered L2 rhythm patterns in the normal as well as the disordered populations. Hence this study was taken up to investigate speech rhythm pattern in English reading task in native Kannada speaking individuals and to determine if there is any gender effect.

Twenty Kannada speaking individuals with good English proficiency (10 males and 10 females) with Mysore dialect were considered for the study. Speech

rhythm was assessed using a reading task. Stimuli included five unrelated sentences in English taken from White and Mattys (2007) study, where they investigated the influence of the first language on second language rhythm in native English, Dutch and Spanish speakers. The reading samples were recorded using Olympus recorder and were edited and acoustically analyzed using PRAAT software (Boersman & Weenick, 2009). The pauses, hesitations and unintelligible utterances in the speech sample were eliminated. Then the duration of the vocalic (V) and intervocalic (IV) (consonantal) units were calculated. Normalized pairwise variability index (nPVI) was calculated by averaging the duration measured of the vocalic units and raw pairwise variability index (rPVI) was used for rhythmic analysis of consonantal units. PVIs were computed using the Microsoft Office Excel Program. Inter-rater reliability was assessed for 33% of the participants from both the groups for the vocalic and the intervocalic segments. The nPVI values obtained for vocalic and intervocalic units were subjected to appropriate statistical analysis using the SPSS Statistics 20 software. Both descriptive and inferential statistics were carried out. Mean and standard deviation were computed and 1-way MANOVA was used to compare between the two gender groups.

The results revealed a significant difference between the rPVI values of males and females for the intervocalic units. But it was also found that there was no significant difference between nPVI values of vocalic units between males and females. The PVI values for vocalic and intervocalic units were higher for females than males indicating that there were more consonantal productions and prolonged phonemes in females than in the males. The mean nPVI and rPVI values in English

speaking native Kannada adults were found to be 50.83 and 45.77 indicating an unclassified rhythm class. The rhythm class in male population was revealed as mora timed whereas in females it was unclassified. Hence, it can be concluded the speech rhythm was found to deviate in Kannada English with respect to Kannada rhythm as well as native English Rhythm.

Clinical Implications

The result of the present study adds on to the available evidence in the literature that the second language (L2) speech rhythm varies from first language (L1) and that L2 rhythm could be influenced by the L1 rhythm. The result of the present study also provides information regarding the variation of speech rhythm across the gender groups in L2. The results also provide the mean nPVI and rPVI values in Kannada English as 50.83 and 45.77, which could be used while evaluating individuals with communication disorders in their L2. These results also contribute to our understanding of changes in speech rhythm due to the influence of first language and other cultural variations.

The results of the present study have some clinical implications also especially for speech-language pathologists for a deeper understanding of prosodic aspects in L2 speakers of Kannada while assessing and rehabilitating individuals with various communication disorders in L2. The results of the present study could be used for the objective assessment of rhythm in different disordered conditions. It also emphasizes the integration of rhythm in the speech intervention and use of the same to track the progress during recovery or treatment in such individuals.

However, there are a few limitations to this study. The sample size considered was less and hence the results cannot be generalized to all the population. Different rhythm metrics could have been used in addition to PVI values to check the most sensitive metric for categorization. The age range considered for the study was limited. Comparison across ages would have provided a better age-related understanding of the same. Further, a reading task was considered which does not mimic natural speech. The rhythm measurement was carried out only in English reading task, a comparison of English and Kannada reading task in the same participants would have provided more accurate values for differentiation.

Future directions

The current study was attempted to understand English speech rhythm in native Kannada speaking individuals with a particular dialect. Future studies could focus on the variation of L2 rhythm with respect to various dialects. In-depth studies should be carried out to investigate the L2 speech rhythm in multilingual individuals with communication disorders such as dysarthria, stuttering, hearing impairment etc.

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Appendix

Rhythm Measurement Stimuli used in the present study:

Sentences in English (White and Mattys, 2007)

1. The supermarket chain shut down because of poor management.
2. Much more money must be donated to make this department succeed.
3. In this famous coffee shop they serve the best doughnuts in town.
4. The chairman decided to pave over the shopping centre garden.
5. The standards committee met this afternoon in an open meeting.