INTONATION IN INDIAN ENGLISH AND HINDI LATE AND SIMULTANEOUS BILINGUALS

BY

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DISSERTATION

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ABSTRACT

Very little has been said about the intonation system of Hindi and Indian English. This study aims to contribute to the field of intonation studies by bridging the gaps in the understanding of intonation patterns of Hindi and Indian English. By analyzing the speech of both late and simultaneous bilinguals, this study aims to give a broader prospective about the speech of Indian English-Hindi bilinguals. The main objectives of this study are to understand the intonation system of Indian English and Hindi spoken in Delhi, India; to explore if simultaneous bilinguals of Indian English and Hindi have two different systems of intonation; and to explore if the intonation system of simultaneous bilinguals is different from late bilinguals. Three experiments were conducted in both Indian English and Hindi investigating pre-boundary lengthening (PBL), pitch accents and focus.

This study shows that simultaneous bilinguals of Hindi and Indian English don't have two different systems of intonation. They have a merged system probably because they acquired a nativized variety of English; however, there are some subtle features that mark their identity as separate from the late bilinguals (e.g. the use of H*/H*L pitch accent). With respect to the question of the difference between late and simultaneous bilinguals, we find that in pitch accents, late and simultaneous bilinguals have the same system in Hindi but different systems in IE; in PBL, both late and simultaneous bilinguals have the same domains of PBL and in the focus experiment, we find that there are statistically significant differences between late and simultaneous bilinguals in RMS amplitude and F0 excursion in Hindi and duration in IE. Here the late bilinguals express focus with higher amplitude, a bigger F0 excursion and longer duration than those of simultaneous bilinguals.

The results of the PBL experiment show that Hindi and Indian English have pre-boundary lengthening and that the PBL effects can be seen both on the final and the penultimate syllable. The highest effects of pre-boundary lengthening can be seen on the final stressed syllable. Stress seems to significantly increase the effects of lengthening on rhyme and syllable but not vowel. Also, unlike Cambier-Langeveld, Nespor and Heuven (1997) where the non-final syllables gets PBL when the final syllable has a non-expandable vowel, in this study in spite all the stressed

final vowels being expandable, PBL effects can be observed on the penultimate syllables. Simultaneous bilinguals and late bilinguals don't have the same kind of lengthening effects in both their L1s, however, there doesn't seem to be any difference in the domain of pre-boundary lengthening between simultaneous and late bilinguals. Also, Simultaneous bilinguals have the same domains of pre-boundary lengthening in both their languages.

The results of the pitch accent experiment show that the main pitch contour used by late bilinguals in Hindi and Indian English is a LH contour on every non-final content word. Like late bilinguals, simultaneous bilinguals use this LH pitch contour in Hindi as well. However, in Indian English the simultaneous bilinguals use two types of pitch contours: the Hindi LH and the American/British English H*/H*L. Thus, simultaneous bilinguals use a *fusion system* of pitch accents in their use of English, but not in Hindi.

The results of the focus experiment show that in Indian English, the main acoustic correlates of focal prominence are a bigger pitch excursion on the focus element and post-focal reduction in duration, RMS amplitude and pitch excursion. Hindi differs in that the main acoustic correlates of focus include increased duration as well as a pitch excursion on the focused element and post-focal reduction in duration, RMS amplitude and pitch excursion. Since in both Indian English and Hindi there is a post-focal reduction in pitch range, duration and RMS amplitude, this indicates that there is post-focal compression. There is a difference between late and simultaneous bilinguals in duration in Indian English and RMS amplitude and pitch excursion in Hindi.

With respect to the question of these bilinguals having one or two systems of intonation, it seems that understanding language interference in the speech of late and simultaneous bilinguals of a New English like Indian English is not straightforward. It cannot be categorized into simply *static* and *dynamic* interference, *substratum interference* or simply *fusion* alone. A combination of all these concepts is needed to explain the language interaction in New Englishes. In the pitch accents experiment simultaneous bilinguals display a *fusion* system of intonation i.e. having both the Hindi and the British English pitch accents in their IE. The speech of late bilinguals in this study shows that there is *static interference* (L1→L2). For instance, they use only the Hindi LH

pitch contour in both Hindi and IE. Similarly, in the focus experiment we see both simultaneous and late bilinguals use a bigger F0 excursion in narrow focus when compared to broad and post-focus and both groups have post focal deaccenting by having lower duration, RMS amplitude and F0 range than narrow focus in both Hindi and IE. We also see that both groups don't have a difference between narrow and broad focus in terms of RMS amplitude. The presence of higher amplitude, duration and F0 in British/American English, but the absence of increase in amplitude from broad focus to narrow focus in IE shows that this has not come from British/American English into IE but rather from Hindi to IE. All these factors show that there are similar strategies used by both groups in terms of expression of focus. Similarly, in PBL, these bilinguals use the same domains of PBL. For simultaneous bilinguals, this could be a facet of the language that they have acquired from the nativized variety of English that they acquired as an L1. In the context of simultaneous bilinguals of New Englishes, I propose the term *inherited influence* to explain this.

To Mom and Dadiji

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Chapter 1
Introduction

1.1 Objectives

This study is motivated from conversations that I had with late speakers of Indian English and Hindi in New Delhi, India about their attitudes towards their English:

> "People whose parents teach them English early and work on them, you know, they sound so different from *behenji* type English, almost like they are international".
>
> – (native speaker of Hindi, late bilingual)

> "These days children learn English before Hindi, like girls from ABC, they are all like that. I don't fit in with them because they talk so fluently…like… when XYZ (college) students talk, they sound like they using English words but talking in Hindi only. But when the ABC types talk, they sound like they have just come from England. It is all because their parents teach them English before Hindi".
>
> – (native speaker of Hindi, late bilingual)

These late bilinguals of Hindi-Indian English voice that there is a difference between early and late bilinguals of Hindi and Indian English. These differences could be at the level of syntax, sound or rhythm and intonation. Since there are studies that have looked at syntax and sound, the present study aims to look at intonation as a possible source of this difference between the two bilingual groups.

There are three main objectives of this study: first, to understand the intonation system of Indian English and Hindi spoken in Delhi, India by late and simultaneous bilinguals of English and Hindi; second, to explore if simultaneous bilinguals of Indian English and Hindi have two different systems of intonation or if they employ one system for both their native languages (L1s) in all aspects of intonation; and third, to explore if the intonation system used by simultaneous bilinguals is different from the one used by late bilinguals. Since very little has been said about the intonation of Indian English and Hindi, this study aims to contribute to the

field of intonation studies by bridging this gap. By analyzing the speech of both late and simultaneous bilinguals, this study not only aims to provide a comprehensive picture about the intonation system of Indian English spoken by Hindi speakers, but also aims to contribute to the field of bilingualism and New Englishes. This section outlines the main objectives of this study.

1.1.1 Indian English Intonation

The British Empire brought English to India. Since then, English has undergone a process of nativization and has developed its own particular features, discourse, and style that have come about due to the influence of many local languages and various social and cultural aspects of India (Kachru, 1986). Indian English is a 'New English', which is a stable, self-replicating variety that has developed a high status in the Indian subcontinent and serves a range of functions. Learners of Indian English are exposed to this nativized variety. Indian English is mostly considered an L2 variety; however, with education, economic growth, and globalization the last few decades have seen a growth in L1 Indian English speakers (Singh, 2007; Mallikarjun, 2004). Thus, speakers of English in India can be broadly categorized as *late bilinguals* (L2) or *simultaneous bilinguals* (L1)[1]. Speakers who acquire one language first and acquire the second language at a later age are called *late bilinguals*. Speakers who acquire two mother tongues before the age of three are called *simultaneous bilinguals* (Hamer & Blanc, 2000).

There is very little research about the intonation of Indian English or on the simultaneous bilinguals on Indian English and other Indian languages. This study aims to fill that gap by examining three different aspects of intonation: pitch accents, focus, and pre-boundary lengthening. By looking at both late and simultaneous Indian English bilinguals this study aims to present a bigger picture about the intonation system of Indian English spoken by Hindi-English bilinguals in Delhi. This study looks only at bilinguals of English and Hindi in Delhi because English spoken in different parts of India by speakers of various Indian languages has its own peculiar features and should not be treated as a single variety (Wiltshire, 2005). For instance, according to Chaudhary (1989), there is a difference between the stress placement rules

[1] This categorization is not straightforward because factors like socio-cultural environment, context of acquisition, status of the languages in the society and patterns of language use can influence the type of interaction of the two languages of a bilingual. These issues addressed in Chapter 2.

in the English spoken by an L1 Dravidian language speaker and an L1 Indo-Aryan language family speaker because the way in which a word is syllabified is different in both language groups.

Intonation studies of early bilinguals of New Englishes report that the intonation patterns found can be attributed to both the languages involved. For instance, Gut's (2005) study on the prosody and intonation of Nigerian English (NE), in comparison with the intonation patterns of British English (BE) on the one hand and the indigenous languages (i.e. Hausa, Igbo, and Yoruba) on the other, shows that like BE, pitch has a grammatical function in the speech of early NE speakers. Although the pitch inventory in NE is reduced when compared with the BE pitch accent inventory, like BE it is associated mainly with the accented syllables. However, NE prosody shows elements of a tonal accent language as well. Thus, Gut concludes that NE prosody and intonation have elements of both BE and the Nigerian languages' intonational systems. Similarly, Goh (2001) compares the intonation patterns of early learners of New Englishes like Malaysian English (ME) and Singapore English (SE) with Standard British English (SBE). Goh concludes that early learners of SE and ME have features of the indigenous languages and of Standard British English in their speech. Thus, in order to understand if, like other New Englishes, Indian English also has Intonational features of both native languages and Standard British English, in this study, I compare the Indian English intonation patterns with that of Hindi and Standard British English (as described in the literature).

1.1.2 One system of intonation?

Recent research on the interaction of the two languages of simultaneous bilinguals reports that the two L1s of these speakers interact with each other (Khattab, 2000; Watson, 1996; Mishina-Mori, 2005) and that the speech patterns of simultaneous bilinguals are different from those of monolinguals (Sundara et al., 2006). Other studies on simultaneous bilinguals show that the performance of simultaneous bilinguals is intermediate between native speakers and second language learners (Dupoux, Peperkamp and Sebastián-Gallés, 2009). Queen (1996) reports that Turkish-German bilinguals in Germany employ a 'fusion' of Turkish and German intonational patterns into a single intonational grammar. These bilinguals use two distinct rises in both Turkish and German. One rise (L*HH%) resembles a characteristic German rise, while the other

(L%H%) resembles a characteristic Turkish rise. The rises pattern pragmatically in ways those are non-normative for both Turkish and German. Fusion is proposed to account for the two-way influence between the two languages. O'Rourke (2005) provides evidence that shows that Quechua-Spanish early bilinguals use Quechua prosodic features in Spanish; however, in the context of interrogatives they maintain a 'monolingual like' intonational system. Thus, the second objective of this study is to investigate if simultaneous bilinguals of Hindi-English have one system of intonation for both their languages in all aspects of intonation, or if they maintain two different systems, or a single system that represents a fusion of the two systems in contact.

1.1.3 Difference between late and simultaneous bilinguals

Recent research on late bilinguals reports that L1 intonation can transfer onto L2 intonation patterns (Low, Grabe and Nolan, 2000; Gut, 2005; Coetzee and Wissing, 2007) and in some special cases (such as living in a foreign country) the L2 intonation patterns can transfer onto the L1 as well (Andrews 1993). Moreover, the interference can be bi-directional from L1 to L2 and from L2 to L1 (Flege, 1987; Flege, 1995; Flege et al., 1997). Thus, the intonation patterns of late bilinguals can be different from those of simultaneous bilinguals. Where L2 speakers exhibit L1 to L2, L2 to L1 or bi-directional transfer patterns, simultaneous bilinguals can have a merged system of intonation or can have monolingual like behavior in one aspect but can display evidence of interaction between their two language systems in other aspects of the intontation system. Given the fact that Indian English is a nativized variety (or, New English) that is acquired from other speakers of Indian English, is it possible that simultaneous bilinguals of IE-Hindi also follow the same pattern as simultaneous bilinguals of other languages reported above, or do they follow the L2 transfer pattern? Thus, the third objective of this study is to investigate if the intonation system used by simultaneous bilinguals of Indian English is different from the one used by late bilinguals.

1.2 Organization

This study is organized in the following manner: Chapter 2 consists of background information about the origin and development of English in India; demographic information about the use of English in India; the proposed models and stages of development of *New Englishes* like Indian English and problems in the literature on Indian English; and treating English in India as a

homogeneous and an exclusively L2 variety. I present a brief review of types of bilinguals; linguistic outcome of language contact in bilinguals; factors that influence the linguistic outcome of bilingual speech; and the question of bilinguals having one linguistic system or two different systems for both their L1s. In this section I also discuss recent research on simultaneous and late bilinguals and intonation and bilingualism, background information about Hindi and Indian English vowels, stress and intonation and other assumptions. Chapter 3 consists of the research questions, common methods used for all the experiments and assumptions of this study. Methods that are experiment specific will be addressed with each experiment. Chapter 4 presents the experiment on pre-boundary lengthening, Chapter 5 presents the experiment on pitch accents and Chapter 6 is the experiment on sentential focus. Chapter 7 is the conclusion.

Chapter 2
Background

2.1 English in India

2.1.1 History and Development of English in India

The British Empire brought English to India. The real beginning of bilingualism in India was brought about by a proposal made by T. B. Macaulay to the then Governor General William Bentinck in the year 1835. This proposal was later known as the Macaulay's Minutes. The objective of this proposal was to form a group of Indian people who would act as interpreters between the British and the Indian population. According to Bailey (1991), "the British wanted to produce a class of people who were Indian in blood and color but English in taste, opinion, morals and intellect" (p. 138). The following year the Macaulay's Minute was approved and instructions were given to impart the knowledge of English literature, history and science to the native population using the English medium. The implementation of Macaulay's Minutes became the foundation for a change in educational policies in the Indian subcontinent, and in turn gave rise to a nation of English speaking bilinguals.

In the post-independence era, in 1950 the Constitution of India declared Hindi the national official language of India, and allowed English to be used for official purposes for 15 years, after which it would gradually be replaced by Hindi. However, the official languages (Amendment) Act of 1967 gave English the 'associate' official language status (Jenkins, 2003). Today English is used as an "official" language in the government, higher educational institutions, courts of law, banks, publications, airlines, hospitals and public and private sector offices. It also acts as a *lingua franca* for educated people who do not share a common Indian language (Bansal, 1969). Today, English represents education, upward mobility, modernity and prestige. Bhatt (2001) suggests that in countries like India, English represents what Bourdieu would call 'symbolic capital', which is necessary for the accumulation of both economic and political powers.

Before the 1980s it was important to know English if you wanted to get jobs in the government, science and technology, airlines and education. But today the knowledge of English has become

important for almost any job. This change took place because in 1989-1990 the government of India decided to reform its economy by shifting from centralized economic planning to decentralized decision making and by welcoming foreign investment and trade in order to spur growth in its declining economy. The intended goal was fulfilled by liberalization, globalization, and privatization. Indian exports grew from 3.6% in 1992-93 to 22.2 % in 1993- 94, and the number of proposals approved for overseas investment grew by 115 % to 230 in 1994. Foreign investments in India increased from 68 million US dollars in 1991 to 1981 million USD in 1995-96 (Singh, A & Singh, R., 2006).

Today India has become a major hub for the world market and this makes the knowledge of English even more important in the context of globalization. Many foreign companies have opened shop in India to take advantage of its English-speaking work force, and the local companies are faced with stiff competition from foreign entrepreneurs (Schaeffer, 2005). According to Schaeffer, in the early 2000s firms providing services such as computer software, accounting, customer support, insurance claims, etc. employed about one million workers in India and it was estimated that this outsourcing work force would grow to three to four million in the next decade. Now a career in almost any field including government, business, commerce, teaching, sales and marketing, science and technology, the call center industry etc. requires fluency in English. Even a career in health care requires knowledge of English due to the advent of medical tourism to India in the recent years. This has made English an essential component of everyday lives and a preferred medium of communication among the younger generation.

2.1.2 Demographic Information

It is estimated that there are 37 million proficient speakers of English in India (Melchers and Shaw, 2003). However, according to Kachru (2005), there are approximately 333 million people with varying degrees of bilingual competence in Indian English. Crystal (1997) suggests that if a flexible notion of fluency is permitted, then about one third of the population of India is capable of holding a conversation in English. The remarkable interest in English education in India both in the urban and rural schools is shown in Table 1 below. Table 1 represents the total number of primary, upper primary, secondary and higher secondary schools in India where English is taught (Government of India, 2002a). Such a large number of schools teaching English has been made

possible by the "three language formula" adopted by the Indian government where schools are mandated to teach the regional language, Hindi (or in the Hindi belt another Indian language), and a European language, which in most cases is English.

Name of Language Taught	All	Rural	Urban	Primary	Upper Primary	Secondary	Higher Secondary
English	744,034	623,257	120,777	581,667	139,223	14,717	8,427
Hindi	507,730	420,058	87,672	371,764	116,082	12,216	7,668

Table 2.1: Number of schools according to language taught according to the 7th All India school education survey by (Government of India, 2002).

There has also been an increasing interest in daily English newspapers. The National Readership Council (2006) conducted a survey of 284,373 households using house-to-house interviews to measure the media exposure and the estimated readership of publications in both urban and rural India. The study covers 535 publications, of which 230 are dailies and 305 are magazines. The results of this study show that an estimated 21 million English newspapers are circulated every day (where each paper is read by many people). According to another report (Government of India, 2002b), there are 49,145 periodicals and newspapers published in India in as many as 101 languages and dialects. Out of this Hindi is leading with 19,685, followed by English with 7,175 (Kachru, 2005). Also, India publishes 28,000 English books per year, which makes it the third largest publisher of English books in the world, after the USA and the UK (Shrivastava, 2006). It is also interesting to note that in India many films are being made in English. English is also the main language for many advertisements and talk shows like *We the People*, *The Big Fight*, and *Coffee with Karan*. Like in everyday life, code-mixing between English and the Indian languages in television serials and advertisements is very common.

2.1.3 New Englishes and English in India

Indian English is characterized as a New English. A New English is said to have developed in an area where a native variety of English was not the language spoken by most of the population, and is used for a range of functions. Another characteristic of New English is that it has become 'localized' or 'nativized' by adopting some language features of its own, such as sounds,

intonation patterns, sentence structures, words and expressions (Platt, Webber and Ho, 1984, p.2-3). One of the main characteristics of a New English is that it has developed through an education system. This means that it is taught as a subject, and in many cases is, also used as a medium of instruction.

In the context of New English there are many models that have been proposed (Modiano, 1999; Kachru, 1986; McArthur, 1987; Görlach, 1988; Strevens, 1980). Strevens (1980) created a superimposed upside down tree on the world map. This tree has British English and American English on the top and all the other varieties are shown to be sub varieties with some affiliation with British or American English.

At the center of McArthur's (1987) 'Circle of World English' is the 'World Standard English' (which does not exist in an identifiable form at present). In the next band there are regional varieties including both standard and standardising forms. In the next band, McArthur identifies many sub varieties like BBC English, Black English Vernacular, Singapore English and Caribbean English. McArthur's model categorizes Indian English under South Asian Standard(izing) English. Similar to this model is Görlach's (1988) 'circle model of English' (in McArthur 1998:101). This model has 'International English' in the middle. In the next band are the regional standard Englishes like Caribbean English and South Asian Englishes followed by the sub regional standard Englishes like Indian English and Irish English in the next band. The outer-most band consists of non-standard Englishes like Jamaican English.

The most influential model of world Englishes is Kachru's (1986) 'three circles model'. This model distinguishes between *inner circle*, *outer circle* and *expanding circles* of English. These circles represent the type of spread, the patterns of acquisition and the functional allocation of English. The inner circle includes the 'norm-providing' native varieties of English like in USA, UK, Australia; the outer circle includes norm-developing varieties of English in countries such as India, Ghana and Nigeria. This circle consists of institutionalized varieties of English that are developing their own standards. The expanding circle refers to the use of English as a foreign language, varieties that are 'norm-dependent' on the inner circle. This model categorizes Indian English an institutionalized second-language that belongs to the 'Outer Circle' of the three

concentric circles of Asian Englishes. The most interesting aspect of Kachru's model is that it indicates that the outer circle shares certain features with both the inner circle (potential for developing norms) and with the expanding circle (non-nativeness).

The basic premise of McArthur's (1987) and Kachru's (1986) models in the context of Indian English is that English has gone through a process of nativization and has its own particular features, discourse and style that have come about due to the influence of local languages, culture and society. This nativized variety has developed its own status in the society, and as mentioned above, it serves a range of functions. Kachru (1983) also describes Indian English as a "transplanted variety", which is a stable, self-replicating variety where the learners are exposed to and master the nativized variety of the second language.

Schneider (2003) proposes a dynamic model of the evolution of new varieties of English. Schneider suggests that this model can be invoked whenever a language is transplanted. This model is based on the assumption that there is a shared underlying process which drives the formation of New Englishes and that it accounts for many similarities between them. Schneider's dynamic model is said to have five stages: (1) foundation, (2) exonormative stabilization, (3) nativization, (4) endonormative stabilization, and (5) differentiation. In the foundation stage, English begins to be used in a country where English was not spoken before. At this stage the two communities/ languages in contact are still more or less separate, and cross cultural communication is restricted. In the exonormative stage, an external norm, usually written and spoken British English as used by educated speakers, is accepted as a linguistic standard for reference. This stage is marked by some level of (but not full-fledged) nativization of English due to the use of the language by non-native speakers. In the nativization stage, the New Englishes start to construct their identity independent of the "native" variety, and the characteristic features of the New Englishes start to emerge. In the endonormative stabilization phrase, the indigenous linguistic norms are accepted and are supported by a new local self-confidence. At this stage the nativization process is complete. In the fifth stage, differentiation, the focus of an individual's identity construction narrows down, from the national to the immediate community, and new group identities within the larger community are formed. As Schneider suggests, "Once a solid national basis has stabilized, one's global, external position is

safe and stable, as it were, and this allows for more internal diversification" (Schneider, 2003, p. 253). Mukherjee (2007) applies this model to Indian English and suggests that Indian English is in the endonormative stabilization stage of evolution.

2.1.4 Problems

2.1.4.1 Homogeneous Variety?

Nihalani et al. (2004) identifies 1000 features of Indian English that are widespread in India and can be found virtually anywhere you go in India. There have been many studies that describe the features that are shared by English spoken in different parts of the country (Kachru, 1983; Saghal and Agnihotri, 1988; Agnihotri, 1991; Nair, 1996; Coelho, 1997). According to Wiltshire and Harnsberger (2006), till the 1960s the model variety of English taught in the Indian school system had been a form of British English. During the 1960s a General(ized) Indian English (GIE) model (CIEFL, 1972; Bansal, 1976) was introduced. According to Pandey (1981:11), GIE is ''a socially acceptable pronunciation devoid of regional peculiarities that may impair communication with speakers from within and from outside the country'' (in Wiltshire and Harnsberger, 2006).

However, is Indian English really a homogeneous variety? India is a pluralistic and multicultural nation. There are 22 scheduled languages and many other non-scheduled languages recognized by the Indian Constitution (Census of India 2001). Of the total population of India, 96.56 % have one of the scheduled languages as their mother tongue; the remaining 3.44 % is accounted for by non-scheduled languages. With so many languages spoken in the Indian subcontinent, there is bound to be variation in speech. Yet there are a number of studies (for instance, on the use of articles (Bakshi, 1991) and prepositions (Verma, 1980), phonology (Nihalani, Tongue, and Hosali, 2004), to name just a few) that discuss Indian English "features" as if they were static features used by all the speakers of English in India and that the speakers' native language, geographic location, education, profession, and proficiency had nothing to do with the variation in English spoken in India.

Kachru (1997) explains that the cover term "Indian English" does not mean there is complete homogeneity in the use of English in India, nor does it imply that all the Indian users of English

have uniform proficiency in the understanding of the performance in English. Similarly, since English spoken in different parts of India has its own peculiar features, Wiltshire (2005) suggests that Indian English should not be treated as a single variety. Similarly, Bhatt (2000) suggests that with over 200 years of contact with native Indian languages, Indian English has become an Indian language both in structure and use and that it displays a hierarchy of varieties – from standard to vernacular. Yet, there are very few empirical studies that describe specific linguistic features of these different varieties of English spoken in India (for instance, Das, 2001 on Tripura Bangla English; Vijayakrishnan, 1978 on Tamil English; Nair, 1996 on Malayalee English; Wiltshire and Harnsberger, 2006 on Gujarati and Tamil English).

2.1.4.2 Is Indian English exclusively L2?

Another problem in understanding the status of English in India is its treatment as exclusively an L2. One viewpoint describes English in India as almost an alien or foreign language which is used in certain restricted domains but has not penetrated home domain or the personal lives of people. For instance, Dasgupta (1993) describes IE as 'auntie tongue', i.e. it is not one of us, but it has an important role to play and that must be acknowledged. Similarly, Krishnaswami and Burde (1998) argue that the use of English in India is restricted to certain domains and urban cities. They claim that English has not been permitted to become an integral part of life in India. Another viewpoint describes it primarily as a second language acquired in school functioning as a *lingua franca* with other 'non-native' speakers (Kachru, 1983; Shaw, 1981).

Yet another viewpoint is that Indian English is slowly becoming an L1 (with other L1s) at least for some urban speakers. Singh (2007) defines a native speaker of a language as "a person who has relatively stable and consistent grammaticality judgements, which he shares with some other speakers, regarding structures alleged to be from his language". Furthermore, Singh argues against the treatment of Indian English as a "non-native" variety and suggests that:

> "It is enough to point out here that there are no structural features, at any level of grammatical description, that characterize all 'non-native' varieties of English to the exclusion of all 'native' varieties. Given that most linguists who have made serious efforts to find such features acknowledge/ concede that there aren't any (cf. Trudgill, 1995), we are fully justified in concluding that the dichotomy native variety/non-native variety cannot be structurally or grammatically sustained. And if it indeed cannot be sustained, speakers of at least the varieties that can be shown to have their own norms, such as Indian

> English and Singapore English, must be classified as native speakers of English by virtue of the fact that they are native speakers of their respective varieties—the fact that they are not native speakers of some other variety is irrelevant. And perhaps so is the fact that what is being transmitted today may well have been coloured yesterday by the mother tongues of those who learnt it as a second language before transmitting it to the next generation as its first language." (Singh, 2007)

This viewpoint is supported by Mallikarjun's (2004) observation that many families in the Indian urban areas want their children to acquire English as their "first" language and that this is becoming common in rural India as well. Similarly, Yano (2001) suggests that Kachru's model should be modified in order to take account of the fact that many varieties of English in the Outer Circle have become established varieties spoken by people who regard themselves as native speakers with native speaker intuition. This recent viewpoint of considering the speakers of Indian English as native speakers of this variety is a theoretical suggestion that does not have empirical support.

According to Kachru (1994) there are three factors that cause variation in South Asian English: first, speaker's proficiency (language acquisition and years in institution); second, the influence of those region's dominant language and the user's ethnic background. "The influence of those factors has resulted in a cline of proficiency ranging from 'educated standard South Asian English' at one end and 'broken English' at the other" (Sedlatschek, 2009). So then another question that arises is that is it possible that 'age of acquisition' could also be a factor that contributes to variation in Indian English within the same regional language and ethnic background group of speakers?

Although there is a lot of research on various aspects of Indian English, to my knowledge there are very few (acoustic) empirical studies on specific varieties of English spoken in India as an L1 or L2. The present study is an effort to fill this gap by conducting an empirical study on the speech of "native" speakers of Indian English and Hindi. Since there is so much diversity in India, in this study, I look at only those speakers who were born and brought up in Delhi and learned English (the nativized variety) as an L1 along with Hindi. I compare the speech of these L1 speakers with L2 English speakers (L1 Hindi) to draw a broader picture about the intonation of this variety of Indian English.

2.2 Bilingualism

2.2.1 Language Contact and Bilingualism

Historically, language contact is the result of either migration or conquests/ colonization (Sankoff, 2001). The effects of migration and conquests/colonization lead to different kinds of synchronic and diachronic effects on the languages and linguistic communities in question. Broadly speaking, it can lead to various kinds of bilingualism, code-mixing, convergence and divergence, language shift and language death. In order to understand the types of interaction that take place in a bilingual's languages, in the next section I define bilingualism and give a brief outline of bilingual typology.

2.2.2 Defining Bilingualism

There are two main aspects that contribute to the understanding of bilingualism: degree of bilingualism and function and use of the two languages in question. Degree of bilingualism has been assessed in different ways in the literature. For instance, for Bloomfield (1933:55), a bilingual is someone who has 'native like control' of two languages. According to Haugen (1953:7) bilingualism is achieved at "the point where a speaker can first produce complete meaningful utterances in the other language". On the other hand, for Diebold (1964), someone who has minimal competence in another language and is at the initial stage of acquiring another language is also a bilingual ('incipient bilingual'). The first two definitions involve a requirement of language proficiency and the third definition requires the use of two languages, which may include speakers who only have rudimentary language skills in another language (for a comprehensive list of definitions of bilingualism see Baetens-Beardsmore 1982; Romaine 1995; Hoffmann 1991; Baker 2006). This wide spectrum in the definition of bilinguals arises from the fact that:

a. Speakers can acquire the languages in question at different ages during their lifetime;
b. bilinguals can have different levels of proficiency in the languages they know; and
c. the functions and status that the languages in question in a given speech community define the patterns and amount of language use.

According to Mackey (1968), there are four aspects that must be considered in order to describe bilingualism: degree, function, alternation and interference. Degree refers to the issue of 'how

bilingual' the speaker is by assessing comprehension and expression in terms of phonology, grammar, semantics, stylistics and lexicon in skills such as listening, reading, speaking and writing. Function deals with the patterns of use and the roles these languages play. Alternation deals with amount of alternation that takes place between the languages in question. This determines the function of the language for the speaker as well as the speaker's fluency in the languages. Interference is defined as the use of features belonging to one language while speaking or writing another. The characteristics of degree, function and alternation, determines the degree of interference. All of these factors interact with each other and cannot be seen in isolation (Mackey 1968:555-6).

Based on the different levels of proficiency of different speakers, methods of acquisition, age of acquisition and the different functions and use of languages in a bilingual's everyday interactions, various types of bilinguals have been proposed in the literature. In this section I discuses five main distinctions that are made in the literature about bilingual typology that are relevant for the present study: *balanced* and *dominant* bilinguals, *compound* and *coordinate* bilinguals, *natural* bilinguals and *structure* bilinguals, *simultaneous* and *consecutive* or *successive or late* bilinguals. There are many more types of bilinguals like folk and elite bilinguals, additive and subtractive bilinguals, however these categories are not relevant for the present study.

A. **Balanced and dominant bilinguals**: In order to understand the levels of proficiency, or the degree of bilingualism, the terms *balanced* and *dominant* bilinguals were proposed. Lambert (1978) suggests the term *balanced* bilingual for a speaker who is equally proficient in both languages in all domains of speech and *dominant* bilingual for speakers who are dominant in one language. The less dominant language is called the *subordinate* language.

B. **Compound and coordinate bilinguals:** Based on their patterns of language use and function, Ervin and Osgood (1954) suggest two types of bilinguals: *compound* and

coordinate. Their definitions are inspired by Weinreich's[2] (1968) concept of compound, coordinate and subordinate bilinguals. Weinreich's typology of bilingual description is based on the understanding at that time of how the two languages are mapped in the brain. Ervin and Osgood, however, were concerned with how these different types of bilinguals come into being based on their language use. Ervin and Osgood merged Weinreich's concept of compound and subordinate bilinguals and called it 'compound'. According to them compound bilinguals develop through their experience of using the two languages simultaneously in various domains whereas coordinate bilinguals use one language in one domain and the other language in another domain (for instance Language A at home and Language B at work).

C. **Natural bilinguals and structure bilinguals**: Based on the method of acquisition a distinction is made between *natural bilinguals* and *structure bilinguals*. Skutnabb-Kangas (1981) refer to the term *natural bilingualism* for speakers who acquire both languages in a natural setting and not with structured instructions. On the other hand, *structure bilingualism* is where a language is acquired in a structured environment like a school or from a tutor. It is possible that the natural bilinguals acquire one language in one domain and another language in another domain. This is common with children of migrant populations who speak one language at home and another outside the home.

D. **Simultaneous bilinguals and consecutive or successive bilinguals:** Another distinction is made on the bases of age of acquisition. Children who acquire two languages as 'first languages' or L1s are called *simultaneous bilinguals* (Hamer & Blanc 2000; Lyon 1996). This is also called "bilingual first language acquisition" (Meisel, 1989; de Houwer, 1995). On the other hand children who hear one language at home until age three and come into contact with another language later from their neighborhood, larger community or school after the age of three are called *consecutive* or *successive.* The defining factor of *consecutive* or *successive* bilinguals is that they are speakers who acquire another

[2] According to Weinreich (1968) a *compound* bilingual knows the two different words in the two languages she knows, but has one common meaning for both (e.g. Hindi *kitaab* 'book' and English *book*). A *coordinate* bilingual keeps the words separate and each word has its own specific meaning and a *subordinate* bilingual understands the words of the weaker languages through the words of the stronger language.

language after already knowing a language (Hamer & Blanc 2000; Lyon 1996). This is also called "bilingual second language acquisition" (Meisel 1989; de Houwer 1995). There is no upper age limit for bilingual second language acquisition (Meisel 1989, de Houwer 1995). Such bilinguals are sometimes broadly called *late* bilinguals as well.

Since the different types of bilinguals mentioned above are based on different criteria (i.e. language use, age of acquisition, method of acquisition and proficiency) these categories of various types of bilinguals are not mutually exclusive. For instance, a simultaneous bilingual can be a natural bilingual and a balanced and/or a dominant bilingual. Similarly, a compound bilingual can be a simultaneous bilingual and/or a natural bilingual and/or a dominant bilingual. However, some combinations are less likely. For instance it is not likely that a simultaneous bilingual is a structure bilingual. However, it is possible that a simultaneous bilingual becomes dominant in one language and a late bilingual is balanced in both her languages. Paradis (1996) and Yip and Matthews (2000) propose that dominance in one language may lead to transfer as well. Thus, if in simultaneous bilinguals language use or exposure to their L1s is not balanced, they can become dominant in one language. Dunn and Fox-tree (2009) provide an explanation for this and suggest, "in theory, simultaneous bilingual speakers would learn both languages at the same time with the same relative frequency of use. In practice, simultaneous bilingual speakers may have differences in fluency depending on the fluency of each parent, the language used outside of the home, or the true level of distinct language use between parents and between parent/child interactions" (273).

The subjects of the present study are balanced simultaneous bilinguals. The speech of these simultaneous bilinguals is compared with the speech of bilinguals who acquired English as a second language (consecutive or successive bilinguals). In the present study I use the term 'late bilinguals' for such bilinguals.

Even highly proficient balanced simultaneous bilinguals exhibit language interaction between their two L1s. In the next section I discuss such linguistic outcome of language contact in bilinguals.

2.2.3 Linguistic outcome of language contact in bilinguals

Research on bilinguals suggests that the interactions between a bilingual's two languages result in cross-linguistic influence between the two language systems (e.g., De Groot, 1993; Hazan & Boulakia, 1993; Paradis, 2001; Döpke, 1998; Hulk and Linden, 1996; Müller, 1998; Yip and Matthews, 2000; Kaushanskaya and Marian, 2006). Various studies have found evidence such as the presence of syllabic features (Fabiano & Goldstein, 2005), sounds (Schnitzer & Karsinski, 1996), and prosodic features (Paradis, 2001) of one language in another language spoken by bilinguals.

One linguistic outcome of language contact in bilinguals is what Weinreich (1968) calls *interference*. Weinreich (1968:1) defines interference as the deviations from the norms of either language that are a result of a speaker's familiarity with more than one language. The term interference was replaced by *transfer*[3] in later literature on second language acquisition studies and is defined as the influence resulting from the similarities and differences between the target language and any other language that has been previously acquired (Odlin 1989: 27). According to Meshthrie and Bhatt (2008), interference involves applying cognitive and neurological processing associated with functions in the L1 while performing operations in the L2. They argue that speakers of Northern Chinese who have not acquired /θ/ may substitute /s/ to produce [siŋk] for *think;* however, this is just a transient stage on a cline of acquisition and reflects nothing more than a failure to acquire the cognitive and grammatical processing for the target language and reliance on L1 processes.

The term *interference* is further sub-divided into *static* and *dynamic* interference (Grosjean, 1989; Paradis, 1993, 2004). This distinction is made in terms of interference between the L1 and L2 of a dominant bilingual and between the two L1s of a balanced bilingual. According to Grosjean, static interference is where the speaker's implicit linguistic competence contains elements that are different from those found in a native speaker's competence. Here the

[3] According to Romain (1995) both transfer and interference have negative connotations. Kellerman and Sharwood-Smith (1986:1) suggest that a more neutral term *cross-linguistic influence* should be adopted. This term has been used in the present study to signify the interaction between the two languages of a bilingual.

speaker's grammar of one language contains elements of another language to the extent that the speaker uses the deviant elements systematically. Paradis (2004) expands the definition of static interference and suggests that static interference is when an element of one language is stored in the mental representation of another language at the time of acquisition. But if the linguistic exposure grows, this element can be changed. On the other hand, dynamic interference, according to Grosjean (1999) and Paradis (1993), refers to performance errors where even though the speaker has two native-like internalized grammars, an element of one language occasionally gets activated in the production of another language.

In the context of balanced simultaneous bilinguals, the linguistic outcome cannot always be measured in terms of elements of one language in the other. Queen (1996) explains that it is possible to have a mechanism called *fusion,* where some features come about in the speech of both languages of a bilingual that are a result of mixing two formally distinct language systems, but represent a new structure altogether which is not native to either of the languages of the bilingual.

Thus, we have seen that the linguistic outcome of language contact in bilinguals can range from interference and static and dynamic interference to fusion. This list is not comprehensive; however, it gives us an idea of the types of language interactions that are possible in bilingual speech.

There are various factors that influence the level and types of interaction between the two languages of a bilingual. The main factors that influence the linguistic outcome of language contact are products of the social, political, demographic, and economic situations that the bilingual is in when she acquires and uses her languages. According to Thomason and Kaufman (1988), it is the sociolinguistic history of a speaker that mainly determines the outcome of linguistic contact (p. 35). Thomason and Kaufman argue that it was Turkish that influenced Greek in Asia Minor, because it was the Greeks who were under cultural pressure and therefore the Greeks became bilingual. Thus, it was Greek that was influenced by the structures of Turkish in this context, and not vice versa.

The status of a language in any given bilingual society is also an important factor in understanding the linguistic outcome of language interaction in bilinguals. Romain (1995) illustrates this with an example from Beebe's (1980) study of Thai speakers of English who transfer the trilled /r/ into their English in formal speech but not in informal speech because this trilled /r/ is associated with the Thai royals. Thus due to the prestige value associated with it, the trilled /r/ was used by Thai-English bilinguals in formal speech. Giles (1970) and Hiraga (2005) find that the social value and power of certain accents influence the way an accent is rated by speakers. They find that in the UK, people rate RP as the best accent, followed by standard Scottish, Welsh, and Irish, followed by the rural accents like Yorkshire and Lancashire. Urban accents like Scouse and Cockney are rated lowest of all. This social value and power of certain accents makes them more desirable, and speakers want to approximate their speech to the prestigious variety.

In the context of New Englishes, level of education of the speaker and her family, profession and geographic location can also play a major role in understanding linguistic outcomes in bilinguals. For instance, Pillai, Don, Knowles and Tang (2010) suggest that in Malaysia, the extent of use of and proficiency in English depends on the geographic location and profession of the speaker. As mentioned in section 2.1, the knowledge of English in countries such as India signifies power, status, modernization and upward mobility. Kachru (1986:1) suggests that "competence in English and the use of this language signify a transmutation: an added potential for material and social gain". Kachru further comments that English functions as the 'Aladdin's lamp' that magically opens the doors of knowledge and wealth.

The frequency of language use and the amount of exposure one gets in a language is an important aspect in understanding the interaction of the two languages of a bilingual. The percentage of language use or amount of exposure to a language can make a simultaneous bilingual dominant in one of her L1s. According to Flege (2007), to understand the level of interaction between the two languages of a bilingual, age of acquisition should be correlated with factors such as percentage of language use, years of education in the L2 community and number of years spent in L2 community. Similarly, Paradis & Genesee (1996) and Watson (2007)

suggest that the nature of the interaction between the two languages is influenced by the amount of exposure to each of the languages.

Watson (2007) conducted a study on production and perception of the voicing contrast in simultaneous French-English bilinguals who study in England and France respectively. All bilingual subjects had been exposed to both languages from birth in the home and were receiving some formal instruction in each. Utterances of the words '*cash*' and '*gash*' in English and '*cache*' and '*gâche*' in French were recorded, these being elicited using flash cards with appropriate pictures. The VOT results show that the bilinguals make significant distinctions between the two voicing types and differ between English and French. There is a significant difference between the bilingual groups in England and France ($F[1,33] = 5.37$, $p < .05$); overall the bilingual group in England is somewhat more monolingual-like in their English productions compared to the bilingual group in France, and conversely, the bilingual group in France is more monolingual-like in their French productions compared to the group in England. Thus we see that in this study the subjects show interference in both production and perception, due to cross-linguistic interference. The extent of this interference depended on their relative exposure to their two languages.

Thus, in order to understand the linguistic outcome of contact in terms of language interaction, it is important to keep in mind the social aspects associated with different features of a language, the history of contact, status of a language, domains of use and the function of the languages in question.

2.2.4 One system or two systems?

For many years the dominant view was that bilingual children initially have a single language system. This gradually separates into two systems somewhere between the ages of two and three (Redlinger & Park, 1980; Vihman, 1985; Volterra & Taeschner, 1978). This is known as the *Unitary Language System Hypothesis* (ULSH).[4] Volterra & Taeschner (1978) are proponents of ULSH and their study addresses two main processes: first, the linguistic stages through which the bilingual child passes in the simultaneous acquisition of two languages in early childhood,

[4] The term Unitary Language System Hypothesis was coined by Genesee (1989).

and second, the strategies that a child employs in acquiring these languages. The Volterra & Taeschner study is based on daily notes and audio recordings of the simultaneous acquisition of Italian and German by the authors' two daughters. A syntactic and lexical analysis of the data of this study suggests that there are three stages of the development of language in a bilingual:

1. Stage I: The child only has one lexical system that has words from both languages (but translation equivalents are rare),
2. State II: Two distinct lexical systems develop but only one syntactic system, and
3. State III: Distinct grammatical systems develop, which result in two linguistic systems.

Evidence for stage I is based on the argument that in the first stage, the child appears to have one lexicon with words from both languages that don't overlap. However, other studies have shown that a bilingual child can have two lexicon sets from the start (Quay 1993).

Redlinger and Park's (1980) study on four two-year-old bilingual children also support the ULSH. Similarly, Vihman's (1985) study of her English and Estonian bilingual son's language development also supports this hypothesis. This study provides evidence for Volterra & Taeschner's (1978) first stage but not for the second.

ULSH has faced serious criticism (De Houwer, 1990; Genesee, 1989; Meisel, 1989; Paradis & Genesee, 1996). Studies that support ULSH argue that the initial use of the similar syntactic rules of the two languages by bilingual children is an indication of a hybrid language. Meisel (1989) suggests that children who acquire different languages may have identical development patterns in certain parts of the grammar that are similar in both the languages. However, that does not mean that there is a unitary system of language. In his critique of the ULSH, Genesee (1989) argues that 'issues concerning acquisitional strategies in bilingual development are independent of the issue of language representation' (pp. 169) and that there is little empirical support for the Unitary hypothesis.

The opponents of ULSH proposed the *Dual development hypothesis (DDH)*. This hypothesis suggests that a separate system is maintained for each language from early childhood (Paradis & Genesee, 1996; Keshavarz & Ingram, 2002; Paradis, 2001). Paradis & Genesee (1996) investigate the acquisition interference between the grammars of French and English bilingual

children. The data for this study consists of three filmed play sessions of three children between the ages of 2-3. In all cases the fathers speak French and the mothers speak English. The children's acquisition of the functional categories finiteness, negation, and pronominal subjects, were found to follow the same patterns as those of monolinguals. The results of this study support the hypothesis that the grammars of the two languages in question are acquired independently.

Paradis (1978) proposed the "Three Store Hypothesis", according to which a bilingual possesses two language systems (one for each language) and a non-linguistic cognitive system that interacts with the two grammars. The clearest evidence of a separation between conceptual representations and the linguistic systems comes from cases of paroxysmal aphasia. These patients show normal intelligent behavior during bouts of total aphasia, i.e. in the absence of any comprehension and production. These patients seem to have well-preserved nonverbal intelligence, visuospatial skills and nonverbal learning and memory functions (in Paradis 2004, p. 196).

Similar to Paradis's three store hypothesis, De Bot (1992) postulates a model for language production for bilinguals.[5] Like Paradis (1978), this model proposes a common conceptualizer, which decides the formulation of the message. De Bot proposes one lexicon which consists of two language specific sub-lexica. Two formulators contain language-specific morphosyntactic information about the two languages while there is one lexicon where lexical elements from different languages are stored together. De Bot goes on to propose that the output of the formulators is sent to the articulator, which makes use of a large set of non-language specific speech motor plans. He argues that 'foreign accents' in the L2 of bilinguals can be accounted for by the fact that they possess only one articulator without a systematic division for the two languages.

Other proponents of the dual development hypothesis also suggest that bilinguals acquire and maintain two systems autonomously, but that there are different levels of interactions between them (Fabiano, 2006; Fabiano and Goldstein, 2005; Paradise 2001). Paradis (2001) conducted a

[5] This model is based on Levelt's (1989) 'Speaking' model for monolinguals.

study on eighteen English-speaking monolingual (mean age of 29 months), eighteen French-speaking monolingual (mean age of 32 months) and seventeen French-English bilingual children (mean age = 30 months). All children resided in the greater Montreal area in Quebec, Canada. The objective of this study was to examine whether bilingual two-year-olds have different phonological systems for each language and if so, then are there cross-linguistic influences between them. The data consisted of ten nonsense words in French and twelve nonsense words in English to test the children's sensitivity to word rhythm and syllable weight. The nonsense words were created according to the phonotactics and syllabification constraints in each language. The children were shown stuffed toys and picture books of unfamiliar animals that had a nonsense-word name. When the children were introduced to a creature, they were provided with its name and asked to repeat it. The children's syllable omissions of the four-syllable target words were analyzed for the presence of patterns specific to French and English and for similarities and dissimilarities between the monolinguals and bilinguals in each language. The results of this study suggest that the monolingual children performed in accordance with their language specific rules but the bilingual children's performance provides evidence for separate but non-autonomous phonological systems.

Similarly, Fabiano and Goldstein (2004) conducted a study on Spanish-English bilingual children to examine the frequency and types of phonological cross-linguistic effects that occur over time in bilingual children. To determine the phonemic and syllabic cross-linguistic effects on each participant's speech, single word, conversation, and narrative samples were examined for three female bilingual children (ages 5;0, 6;2, and 7;0). The results of this study show some occurrences of cross-linguistic effects, supporting the view that a bilingual child's two phonological systems are separate, but non-autonomous.

Other studies on simultaneous bilingual children show that simultaneous bilinguals are capable of keeping their two systems apart and are comparable to monolinguals in some aspects, but in other aspects they seem to show aspects of interference (Khattab 2000; Watson 1996; Mishina-Mori 2005). For instance, Khattab (2000) compared the VOT for stop consonants of three Arabic-English simultaneous bilingual children (ages: 5, 7 and 10) to those of monolingual children. The subjects were asked to name pictures in two sessions, one in each language. The

results show that the children with simultaneous exposure to Arabic and English produced voiceless stops in the two languages like their monolingual peers. However, they produced English-like, short-lag VOT for voiced tokens in both languages.

Similarly, Watson's (1990) study on ten British English and French bilingual children (ages 6-10) compares the VOT for stop consonants. The subjects were asked to repeat words presented by different interlocutors in both languages. Like Khattab (2000), the results of this study show that bilingual children produce voiceless stops in English and French with different VOT values, but produce voiced stops in both languages with similar, short-lag VOT. The fact that both Khattab (2000) and Watson (1990) show similar results suggests that at the level of voiceless stops the children are able to maintain patterns like their monolingual peer but at the level of voiced stops they produce short-lag VOTs (like in English) in both languages. This could be a developmental issue or simply the influence of English on their Arabic and French respectively.

We have seen that although ULSH and DDH disagree on the developmental stages of acquisition of the two language systems by simultaneous bilingual children, both the groups agree that ultimately, simultaneous bilinguals develop two different language systems as adults. These studies also suggest that in some aspects bilingual children can maintain autonomy; however, traces of mutual influence of both the L1s can be observed as well. Since these traces of mutual influence could be attributed to developmental issues, comparing the interaction patterns of simultaneous bilingual children to simultaneous bilingual adults does not seem appropriate. That being said, there are only a handful of studies that provide evidence to support the claim that there are two phonological systems in simultaneous bilingual adults or that describe the types of interactions between their two L1s. In what follows, I provide a non-exhaustive account of studies that explore these questions.

2.2.4.1 Adult simultaneous bilinguals

Studies on simultaneous bilingual adults suggest various different kinds of results. On the one hand it has been suggested that simultaneous bilinguals cannot be balanced and that they are dominant in one of their languages (Cutler et al. 1992). Other studies show that simultaneous bilinguals do have two independent systems for their two L1s (Guion, 2003; Sundra and Polka,

2007). Furthermore, other studies suggest that simultaneous bilinguals have an intertwined phonological system, which has phonological categories of both languages (Peltola, Tamminen, Lehtola and Aaltonen 2007; Sundara et al., 2006; Dupoux, Peperkamp and Sebastián-Gallés 2009). It has also been suggested that in their production and perception, simultaneous bilinguals are not completely identical to monolinguals (Sundara et al., 2006) and that they are intermediate between native speakers and second language learners (Dupoux, Peperkamp and Sebastián-Gallés 2009).

Cutler et al.'s (1992) study on English and French simultaneous bilinguals, who spoke their two languages regularly and were considered native speakers of both languages by other native speakers, tested the kinds of segmentation techniques that these subjects employ. To decide language dominance, Cutler et al. asked the subjects to pick one language that they would give up if they had to. The language that they said they would not give up was considered the language in which they are dominant. The speakers were asked to listen to lists of unrelated words and press a response key as soon as they hear a word beginning with a specified word-initial sequence of sounds which is either a CV or a CVC. Cutler et al. (1992) conclude that English-dominant subjects performed like English monolingual subjects in both English and French, and French-dominant subjects also performed like French monolingual subjects in both their languages. They conclude that simultaneous bilinguals can never be balanced and are always dominant in one of their languages.

However, other studies show that simultaneous bilinguals can have two independent linguistic systems for both their languages. Guion (2003) conducted a study on Quichua-Spanish simultaneous bilinguals, Spanish monolinguals, and early, mid and late L2 learners of Spanish. Guion compared the F1 and F2 of vowels produced by all these speakers. The study shows that early and some mid bilinguals acquired Spanish vowels, whereas late bilinguals did not. The late bilinguals were found to have merged Spanish and Quichua vowels and seemed to be using their Quichua vowels while speaking Spanish. The results of this study suggests that the simultaneous bilinguals differed from early bilinguals in that they were able to produce vowels in Quichua like the monolingual Quichua speakers and produce vowels in Spanish like the Spanish

monolinguals. Thus this study provides evidence that simultaneous bilinguals were more likely to have two independent vowel systems than early and late bilinguals.

Sundra and Polka (2007) find similar results from perception. Sundra and Polka compared discrimination of Canadian French (CF) and Canadian English (CE) coronal stops by 10 monolingual English listeners (5 M, 5 F), 10 monolingual French listeners (5 M, 5 F) 10 simultaneous bilingual CE–CF listeners (6 M, 4 F), 10 advanced early L2 learners of French (4 M, 6 F) and 10 native Hindi listeners (5 M, 5 F). The objective of this study was to test whether simultaneous bilinguals, like advanced early L2 learners, develop merged categories for similar phones resulting from interactions between their two languages. French /d/ is phonetically described as dental whereas English /d/ is described as alveolar. Using a categorical discrimination task (AXB), the performance of all four groups was compared to chance and to the performance of native Hindi listeners who were expected to show discrimination levels consistent with the two categories of coronal stops in their native language. Hindi listeners performed well above chance in discriminating French and English /d/-initial syllables. The results of this study provide evidence for interaction in L2 learners as well as simultaneous bilinguals; however, the nature of the interaction is different in the two groups. The discrimination performance of advanced early L2 learners, but not simultaneous bilinguals, was consistent with one merged category for coronal stops in the two languages. The discrimination performance of the simultaneous bilinguals suggests that they do not have shared categories for similar phones in their two L1s.

Other studies have also found that the production of phonological categories by simultaneous bilinguals is not completely identical to monolinguals (Sundara et al., 2006). Sundara et al. (2006) investigate the production of coronal stops /t/ and /d/ in Canadian English and Canadian French by simultaneous English-French bilinguals and monolinguals. The speakers consisted of six monolingual speakers of Canadian English; six monolingual speakers of Canadian French; and five simultaneous bilinguals of Canadian English and French. The subjects were asked to produce target bi-syllabic real words with coronal stops in word initial position in carrier sentences. The vowel formants, VOT, burst intensity and burst spectral properties of /d/ and /t/ were analyzed using Praat. The results of this study suggest that the simultaneous bilinguals

produced the target stops with language-specific differences in voicing and place of articulation between Canadian English and Canadian French but that the production of simultaneous bilinguals was not completely identical to monolinguals.

Peltola, Tamminen, Lehtola and Aaltonen (2007) conducted a study to investigate if balanced bilinguals have two separate phonological systems, which can be activated in accordance with the linguistic context. Discrimination tasks (button press) were performed and the response (two Finnish vowels and three Swedish vowels) from 12 Finnish-Swedish bilinguals was recorded. The results of this study suggest that speech sound perception is based on the functioning of automatically responding long term memory traces, which are language specific, and early exposure to a nonnative language or extensive input during adulthood results in the formation of new language specific representations. The results of this study suggest the simultaneous bilinguals have an intertwined phonological system, which has phonological categories of both languages.

Similarly, Dupoux, Peperkamp and Sebastián-Gallés's (2009) study on simultaneous bilinguals of French and Spanish, native speakers of Spanish and French late learners of Spanish show that the performance of simultaneous bilinguals is intermediate between native speakers and second language learners. Dupoux, Peperkamp and Sebastián-Gallés conducted a perception experiment of Spanish lexical stress using three tasks, two short-term memory encoding tasks and a speeded lexical decision. A composite performance measure computed over the results of the three tasks revealed that the overall performance of the simultaneous bilinguals is best fitted by a bimodal distribution that corresponds to a mixture of the performance distributions of the two control groups. This study disproves the claim by Cutler et al. (1992) that simultaneous bilinguals can have only one language that is processed in a native-like or near-native-like fashion, at least as far as phonological perception is concerned.

Thus, the limited literature on simultaneous bilingual adults suggests the possibility of variation among simultaneous bilinguals. Some suggest that simultaneous bilinguals are always dominant in one of their languages. Others suggest that these bilinguals do have two independent systems for their two L1s. Still other studies suggest that they have an intertwined phonological system,

which has phonological categories of both languages. These studies also show that simultaneous bilinguals are not completely identical to monolinguals and that they are intermediate between native speakers and second language learners. The main objective of the present study is to investigate if Hindi-English simultaneous bilinguals have two independent systems at the level of intonation or if their two systems are intertwined. In the next section I discuss the linguistic outcome of contact in late bilinguals.

2.2.4.2 Late Bilinguals

Penfield and Roberts (1959) and Lenneberg (1967) proposed the 'Critical Period Hypothesis' (CPH), according to which there is a period that is critical for acquiring language. If by this age the appropriate stimuli are not provided to the brain, it leads to a sudden decrease in the neural plasticity, leading to inability to acquire language effectively, easily and quickly. Although the evidence for CPH in Penfield and Roberts's (1959) and Lenneberg's (1967) studies comes from first language acquisition, the CPH has also been refined to accommodate second language acquisition (Johnson and Newport, 1989). Other studies show that although age of learning another language is one of the important factors in assessing language proficiency, there might not be necessarily a critical period. Instead they suggest that there might be a linear decline in language learning abilities throughout a speaker's lifespan (Bialystok and Hakuta, 1994; Birdsong and Molis 2001). For instance, Johnson and Newport (1989) conducted a study on Chinese and Korean second language learners of English. These speakers had come to the United States at different ages. The subjects were divided into four groups based on their age of arrival: 3-7; 8-10; 11-15; 17-39. The participants were given aural grammaticality judgment tests to test twelve morphosyntactic rules. The results of this study show a strong correlation between age of acquisition and test scores. They show that the lower the age of arrival, the higher the proficiency. Similarly, in their study of early and late Italian-English bilinguals, Flege, MacKay and Meador (1999) found that early bilinguals were more accurate in their perception and production of English vowels than late bilinguals.

Flege (1995) rejects the CPH and proposes the *Speech Learning Model* (SLM) to account for how individuals learn or fail to learn to produce and perceive phonetic segments in a second language. According to the SLM, the two phonetic subsystems of the L1 and L2 reside in a

common phonological space in the bilingual's mind. The subsystems then interact with each other via two different mechanisms: 'category assimilation' and 'category dissimilation'. Category assimilation is when a speaker comes across a new L2 sound (which is not there in the L1), and, at first the speaker substitutes this sound with the closest sound in her existing phonological inventory. Later, when the speaker has more exposure to the L2 sound system, a new 'merged' inventory from the L1 and L2 sounds is created. Once this merged category is created, it might be hard to separate the two original categories. On the other hand, phonetic category dissimilation causes a newly established L2 category and the nearest L1 speech category to move away from one another in phonetic space in order to maintain a phonetic contrast in the common phonological space. Thus phonetic interference can be bi-directional from L1 to L2 and from L2 to L1 (Flege, 1987; Flege, 1995; Flege et al., 1997).

Kang and Guion (2006) study on early and late Korean-English bilinguals supports, SLM. Kang and Guion conducted a study on segmental speech production by Korean-English bilinguals who learned English early (*M*=3.8 years old) or late (*M*=21.4 years old). The acoustic properties of voice onset time, amplitude difference between the first two harmonics, and fundamental frequency of Korean and English stops produced by these early and late bilinguals were investigated. The results of this study suggest that the early bilinguals seem to have two independent stop systems, whereas the late bilinguals have a merged Korean-English system.

Similarly, Flege, Schirru, and Mackay (2003) conducted a study on the interaction of Italian L1 and English L2 vowels in early and late bilinguals. Early bilinguals who did not use the L1 very often produced English /eɪ/ with greater formant movement than English native speakers, whereas late bilinguals produced this vowel with less movement. This greater formant movement by early bilinguals was attributed to an effort to dissimilate the English /eɪ/ from the Italian /e/. The less formant movement in late bilinguals is considered an effort to assimilate the English /eɪ/ with the Italian /e/.

Thus, it can be concluded that late bilinguals seem to have a merged system for both their languages when compared to early bilinguals.

2.2.5 Intonation and Bilingualism

Intonation is an extremely important facet of communication. Incorrect use of intonation can convey the wrong message and in turn cause misunderstandings. Native listeners are used to a great deal of variation in the choice of intonation patterns; but some patterns will clearly not be acceptable (Mennen, 2007). For instance, Gumperz (1982) has observed that Pakistani and Indian women who served food in a cafeteria in Britain were misunderstood to be rude by their customers because of the use of incorrect intonation contours. When inquiring if their customers wanted gravy on their meat, they used a falling intonation on the word 'gravy' instead of the rising intonation. When this difference was pointed out to them and they learned the appropriate intonation pattern, the negative reactions of the customers disappeared (in Romaine, 1995). Similarly, Romaine (1995) observed that when Russian speakers said 'thank you' in English they stressed the second word and used a rising intonation, instead of stressing the first word and using a falling intonation. The incorrect stress and intonation made the Russians seem insincere and mechanical. Thus, incorrect intonation can cause misunderstandings amongst speakers of different languages/dialects.

It has been shown that babies use precursors of intonation from the age of 3 months to 9 months which reflect correspondences between contour direction and the context of interaction. In fact, it has been shown that by the end of the single-word period, 1-year-olds use falling intonation to mark utterance boundaries (Snow and Balog, 2002). Yet when it comes to second language learners, intonation seems to be one of the last things that learners master, and in many cases they are not able to acquire all the aspects of L2 intonation. Even though many researchers have voiced the need for studies on bilingual intonation, most studies on intonation are concerned with late bilinguals (for instance, Andrew, 1993; Mennen, 2004; O'Rourke, 2005; Simonet, 2008; Willems, 1982). There are very few studies that look at intonation in balanced bilinguals, early bilinguals or simultaneous bilinguals (Cichocki and Lepetit, 1986; O'Rourke, 2005; Queen, 1996).

In the context of L2 learners, Mennen (2004) reports that interference at the level of intonation can be both at the phonological level and at the phonetic level. At the phonological level the interference can be in the phonological tunes, their form, and in the meanings assigned to the

tunes, and at the phonetic level interference would be in a difference in the phonetic realization of an identical phonological tune. In this context, Mennen (2004) reports Willems's (1982) study which shows the interference both at the phonological level and at the phonetic level. Willems shows that a different direction of pitch movements (rises rather than falls) in the intonation of Dutch learners of English is an example of phonological interference. At the phonetic level, interference can be observed in the different size of pitch excursions.

There are many studies that show that the direction of influence can be from L1 to L2 (Backman, 1979; De Bot, 1986; McGory, 1997; Willems, 1982). Other studies on L2 intonation show that the interference can be from L2 to L1 or bidirectional. For instance Andrew's (1993) study of Russian-English bilinguals shows that the direction of influence can be from L2 to L1, especially in immigrants. In this study, Andrew examines the boundary tones and pitch accents using picture tasks in the speech of twelve young-adult informants. Of these, ten were born in the Soviet Union and left there during childhood or early adolescence, while two were born in the United States to Russian-speaking families. Andrew reports that in all contexts the subjects replace the intonation patterns of Russian with "English like" intonation features. For instance, in Russian the declaratives are associated with a simple falling tone on the accented syllable. This was replaced with the pattern found in English (neutral) declaratives where there is some type of rise before the fall. Thus, this study shows that L2 features can be found in the intonation patterns of L1.

On the other hand, influence can be bi-directional. Simonet's (2008) study on the native dialects of Catalan and Spanish in the island of Majorca is a good example of this. Simonet (2008) examines whether cross-linguistic transfer can be observed in the shape of sentence-final pitch accents in broad focus read-aloud declaratives and the shape of terminal tunes in absolute interrogatives. The subjects of this study differ in language dominance patterns, i.e. Catalan-dominant vs. Spanish-dominant, gender and age. Simonet concludes that the intonation patterns undergo transfer of traits through substratum interference from the L1 to the L2 and borrowing from the L2 to the L1. Thus, it was found that these speakers were using intonational patterns that are intermediate between those used in their L1 and in their L2 by other subjects.

Similarly, Mennen (2004) examines how speakers of Dutch whose L2 is (Modern) Greek but who are fluent in both languages realize cross-linguistic differences in the timing of a phonologically identical rise. Two experiments compared the production of peak alignment by Dutch non-native speakers of Greek with that of a native Dutch and a native Greek control group. Greek and Dutch share the same phonological structure in non-final or pre-nuclear rises. However, the rise is realized in different ways: Firstly, it is timed differently, with an earlier peak in Dutch than in Greek. Secondly, in Dutch the peak timing is influenced by the phonological length of the vowel of accented syllables (i.e., it is earlier when the vowel is long, and later when it is short), whereas no such influence exists in Greek. Evidence was found for bi-directional interference in four out of the five speakers who produced peak alignment which differed from the native control groups in both languages. The fifth speaker managed to produce peak alignment with native-like values in both the L1 and L2. Thus, this study shows that the direction of interference could be both from L1 to L2 and L2 to L1 and that it is not impossible for L2 learners to realize the full set of tonal phones necessary to maintain contrast across languages.

It is not necessary to find influence of one language over another in all contexts. O'Rourke (2005) analyzed the intonation patterns in declarative and interrogative sentences in the Spanish and Quechua production of Quechua second language learners of Spanish from Cuzco, Spanish monolinguals from Lima, Spanish monolinguals from Cuzco and Quechua-Spanish bilinguals from Cuzco. This study shows that Quechua-Spanish bilinguals transfer Quechua prosodic features into Spanish in contrastive focus declaratives. However, in her analysis of interrogatives, it was found that bilinguals maintain a 'monolingual like' intonational system.

Studies on balanced bilinguals show that the linguistic outcome of the interaction between the two languages of a bilingual could be dependent on social factors. Cichocki and Lepetit, (1986) examine the intonation of French-English bilingual speakers in Ontario, Canada. This study examines the rate of declination (the gradual lowering of a pitch contour from the beginning to the end of an utterance) over a series of sentences read aloud by 14 speakers in French. Where French has little declination, English has a more pronounced lowering of pitch throughout the length of the utterance. Cichocki and Lepetit found F0 declination to be variably present in French. Thus, the results of this study suggest that balanced bilinguals used a more English-like

pattern in the production of French. Cichocki and Lepetit suggest that although these speakers are balanced bilinguals, they may want to identify with the majority language English and thus use English like patterns in their French.

Where Cichocki and Lepetit's (1986) study shows the use of one L1 in the production of another L1, Queen's (1996) study of 6 Turkish-German simultaneous bilingual children's intonation patterns shows that these speakers are involved in a process of contact-induced language change. The results of this study show that these bilinguals use two distinct rises in both Turkish and German. One rise (L*HH%) resembles a characteristic German rise, while the other (L%H%) resembles a characteristic Turkish rise. The rises pattern pragmatically in ways that are non-normative for both Turkish and German. Queen suggests "bilinguals produce an intonation pattern that it is clearly the result of mixing formally distinct patterns found in Turkish and German" (p. 56). Queen explains that this pattern is not clearly attributable to language interference (either borrowing or shift-induced language change), but is the result of language contact. It has been proposed that this pattern can be called 'Fusion'.

Similar patterns have been observed in the intonation studies of New Englishes with the difference that unlike Queen's (1996) study the patterns found in the studies on New Englishes can be attributed to both the languages involved. For instance, Gut (2005) conducted a study on the prosody and intonation of Nigerian English and compared it to the intonation patterns of British English on the one hand and the indigenous languages i.e. Hausa, Igbo and Yoruba on the other. The objective was to provide a phonological sketch of Nigerian English prosody and to see if Nigerian English has been influenced by British English or the indigenous tone languages of Nigeria. The speech of five speakers of Nigerian English, three speakers of British English, three speakers of Hausa and Igbo and two speakers of Yoruba was analyzed. Reading passage style and semi-spontaneous speech was analyzed acoustically in terms of speech rhythm, syllable structure and tonal structure. The results of this study show that in terms of speech rhythm Nigerian English is different from both the speech rhythm of the Nigerian tone languages and that of British English. Nigerian English prosody is structurally different from British English and stands "between" an intonation / stress language and a tone language. Pitch has a grammatical function and is closely interrelated with accents. The pitch inventory is reduced in

Nigerian English compared to British English, and it is associated mainly with accented syllables. The domain of pitch appears to be the word, and high pitch seems to be triggered by stress so that Nigerian English prosody shows elements of a tonal accent language as well. Gut concludes that Nigerian English prosody and intonation has elements of both British English and the Nigerian languages' prosodic systems.

Similarly, Goh (2001) describes Malaysian English (ME) and Singapore English (SE) intonation and compares it to Standard British English (SBE). SBE is the target language in the classrooms. Goh (2001) shows that unlike Standard British English (SBE), where prominence is assigned to words that indicate meaning choice, ME and SE assigns prominence to words at the end of a tone unit or phrase, especially in sentence-final position. Similarly, unlike SBE, in ME and SE function words are often assigned prominence. Goh also shows that the three most frequent tones in ME and SE are falling, rising and level, but they do not always have the same discourse functions as in SBE and their occurrence is not always consistent. Both SE and ME are shown to have features of the native languages spoken in the area and of SBE.

Thus, we have seen that in late bilinguals the direction of interaction can be from L1 to L2, L2 to L1 or bidirectional. However, with respect to simultaneous bilinguals interaction between the two L1s has been observed. It has also been observed that the speech patterns of simultaneous bilinguals are different from that of monolinguals and that the performance of simultaneous bilinguals is intermediate between native speakers and second language learners. It has also been suggested that bilinguals employ a 'fusion' of intonational patterns of their two L1s into a single intonational grammar.

2.2.6 Discussion

In this section, we have seen that although ULSH and DDH disagree on the developmental stages of acquisition of the two language systems by simultaneous bilingual children, both the groups agree that ultimately simultaneous bilinguals develop two different language systems as adults. These studies also suggest that in some aspects bilingual children can maintain autonomy; however, traces of mutual influence of both the L1s can be observed as well. Since these traces of mutual influence could be attributed to developmental issues, comparing the interaction

patterns of simultaneous bilingual children to simultaneous bilingual adults does not seem appropriate.

While looking at adult bilingual patterns, it has been observed that where simultaneous bilinguals have two independent systems for their two L1s which might be intertwined, late bilinguals seem to have a merged system for both their languages.

Furthermore, we have seen that in late bilinguals the direction of interaction can be from L1 to L2, L2 to L1 or bi-directional. On the other hand, literature on simultaneous bilinguals reports that the two L1s of these speakers interact with each other (Khattab, 2000; Watson, 1996; Mishina-Mori, 2005) and that the speech patterns of simultaneous bilinguals are different from that of monolinguals (Sundara et al., 2006). Other studies on simultaneous bilinguals show that the performance of simultaneous bilinguals is intermediate between native speakers and second language learners (Dupoux, Peperkamp and Sebastián-Gallés, 2009). Queen (1996) reports that Turkish-German bilinguals employ a 'fusion' of Turkish and German intonational patterns into a single intonational grammar. O'Rourke (2005) provides evidence which shows that Quechua-Spanish early bilinguals use Quechua prosodic features in Spanish; however, in the context of interrogatives, they maintain a 'monolingual like' intonational system. In the context of New Englishes as well, one can observe elements of native languages and that of standard (native) English. Thus, this study aims to explore if simultaneous bilinguals of Indian English and Hindi have two different systems of intonation or if they employ one system for both their L1s in all aspects of intonation. This study also aims to explore if the intonation system used by simultaneous bilinguals is different from the one used by late bilinguals. In the next section I discuss Hindi prosody and intonation.

2.3 Hindi Prosody and Intonation

Hindi belongs to the Indo-European language family. It is spoken by approximately 422 million speakers or by 41% of Indian speakers (Census of India, 2001). Hindi has more than ten dialects (Khariboli, Brajbhasa, Kanauji, Bundeli, Bagheli, Chhattisgarhi (Lahariya or Khalwahi), Hariyanvi (Bangaru or Jatu), Bhaya, Chamari and Ghera Gowli) that have different origins: western Hindi dialects originated from the *Sauraseni* dialect of Middle Indo-Aryan and the

eastern dialects originated from *Ardhamagadhi Prakrit* (Chatterji 1969, Masica 1991). Standard Hindi is a standardized variety and is also called 'Nagari Hindi' or 'Literary Hindi'. Hindi is spoken in mostly the northern states of India like Uttaranchal, Bihar, Rajasthan, Haryana, Madhya Pradesh, Jharkhand, Chattisgarh, Himachal Pradesh and Uttar Pradesh (see Map 1 below).

Map 1: Hindi Belt

Hindi is a head-final (SOV) language and has a relatively free word order. Unlike English, Hindi has postpositions. The verb agrees in number, gender and person with an NP that is not followed by an overt postposition. Unless the subject of a sentence occurs with a postposition, it generally controls the agreement with the verb. In case the subject occurs with a postposition, the verb agrees with the noun following the subject if it is not followed by a postposition. Hindi has grammatical gender and the agreement patterns of the verbs, adjectives, quantifiers and some clitics depend on the gender of the noun they agree with. The verb is an obligatory constituent of a predicate. The form of the noun changes depending on the number (singular/plural) and case (nominative or oblique). Hindi does not use morphological means to express focus. A focused constituent typically occupies the immediately preverbal position (Kidwai 2000). In the following sections, I summarize previous literature on Hindi stress, vowels, and intonation.

2.3.1 Hindi Vowels

According to Ohala and Ohala (1992) Hindi has 11 basic vowels [i, ɪ, e, ɛ, æ, ə, a, u, ʊ o, ɔ] and all of these vowels have nasal counterparts. The vowels [ə], [ɪ], [ʊ] are considered short in all contexts and [a, i, u, e, o, ɛ, ɔ] are considered long. The vowel [æ] occurs only in English loan words. The short vowels do not occur word finally. The sequences [ei] and [eu] are considered vowel clusters and not dipththongs (Ohala, 1999). All the vowels has nasal counterparts. There is inter-speaker variation between [ə] and [ʌ]; [ai] and [æ]; and [au] and [ɔ]. Ohala and Ohala (1992) conducted a study of the duration of short and long vowels in Hindi. Vowel durations before different final consonants in a sentence frame /vo _____aja/ "he _____ came" was obtained. The results of this study show that the short and long vowels average 75.3 ms and 181.9 ms a ratio of 1:2.4. In English the ratio is 1:1.3.

2.3.2 Hindi Stress

Various analyses of stress placement in Hindi have been proposed (Hayes 1995; Kelkar, 1968; Mehrotra, 1965; Pandey, 1989; Prince & Smolensky, 1993), yet there is little agreement in the literature (or among native speakers) about the lexical stress placement rules and the role of syllable weight in determining stress in Hindi. In this section, I discuss the various stress placement rules discussed in previous literature.

Kelkar (1968) suggests a three-way analysis of Hindi syllables: light, medium and heavy. Stress in disyllabic words, is assigned to the heavy syllable if there is only one (e.g. lə.***taa*** 'creeper'). If both syllables are heavy or light, then the penultimate syllable is assigned stress (e.g. ***naa***.*l*aa 'ditch'). If there is more than one heavy syllable, stress is placed on the rightmost non-final heavy syllable (e.g. dər.***vaa***.zaa 'door').

Pandey (1989) suggests a new mode of foot construction for Hindi called the 'Conjugational Mode.' Under this analysis, two factors determine the word level stress: (1) syllable weight (light, heavy and extra-heavy), (2) syllable position. Pandey suggests the following rules for word-level stress:

a. accent the final if it is extra-heavy (e.g. be.***kaar*** 'ruined/ jobless/useless'); if not

b. accent the penultimate if it is heavy or extra-heavy, or if it is light and flanked by light syllables, or if it is the leftmost syllable (e.g. ***jaan***.var ‘animal’); if not
c. accent the antepenult (e.g. ***ʃaan***.*tə*.*nu* ‘proper name’)

Mehrotra (1965) also proposes three types of syllable structures in Hindi: light, heavy and super-heavy. Unlike Kelkar, Mehrotra has a different analysis for words with two syllables and words with more than two syllables:

a. In words with more than two-syllables: If all the syllables are light, then stress is on the word-initial syllable (e.g. ***ʌ***.di.ti ‘proper name). If that is not the case then stress is on the rightmost non-final heavy syllable (e.g. gɪ.rəf.***taa***.rii ‘arrest’). If the final syllable is super heavy and the penult/antepenult or both are heavy, then either the antepenult or the final is stressed.

b. In two-syllable words: If there are no super heavy syllables an initial heavy syllable is stressed (e.g. ***kaa***.laa ‘black’). The stress is on the final, if it is super heavy (e.g. be.***kaar*** ‘ruined/ jobless/useless’). If the penult is also super heavy, then the stress is on the first syllable (e.g. ***vaar***.daat ‘incident’).

Dixit (1963) does not make a distinction between heavy and super-heavy syllables. According to Dixit, if there is one heavy syllable then it is stressed (e.g. kə.vi.***taa*** ‘poem’). If there are many heavy syllables, stress is on the rightmost non-final heavy syllable (e.g. ho.ʃi.***yaa***.rii ‘intelligence’); if all syllables are light, stress falls on the penult (e.g. ʌ.***di***.ti ‘proper name’).

The above analyses differ in their prediction for lexical stress in Hindi for many words. There could be multiple reasons for disagreement among researchers about the placement of stress in Hindi. Firstly, as mentioned above, Hindi has more than ten dialects that have different origins. It is possible that due to different origins there are different stress placement rules in these different varieties. Second, a very large number of people who speak Hindi also speak other languages fluently. This could lead to interference not only at the level of code-mixing, syntax, and phonology but also at the level of stress and intonation. Thirdly, Hindi has a very large number

of borrowed words from Sanskrit, Persian and English. Thus, the stress patterns of these languages could also interfere with the analysis of Hindi lexical stress.

Although there are differences in the stress placement rules in Hindi, there seem to be a few common things that all of these studies predict. Most studies suggest the Hindi stress system is weight-sensitive and that there are 'light' (V), bimoraic or 'heavy' (VV or VC), or trimoraic or 'superheavy' (VVC or VCC) syllables. Also, most studies predict that in two syllable words, if both the syllables are heavy then stress is on penultimate and if the final syllable is super heavy, then it is stressed. In more than two syllable words, if there is more than one heavy syllable, the rightmost non-final heavy syllable is stressed. If the final syllable is extra heavy then it is stressed.

Previous work on Hindi stress is not based on acoustic studies and is primarily based on the author's intuition about stress placement. Ohala (1997, 1986, 1991), Nair (2001), Dyrud (2001) are the main studies that look at the acoustic correlates of stress in Hindi, and they report that he main acoustic correlates of stress are fundamental frequency (F0), duration, and intensity.

Ohala, M. (1977) compared words that have been claimed in previous literature to be minimal pairs distinguished only be stress location in Hindi. These words were recorded and then spliced and played back to the same participant. The participant was asked to judge which meaning of the word they heard. The participant was unable to distinguish between the two words. Ohala found no significant effects of stress on duration but found some correlation of stress with pitch movement. Results showed that the prominent syllable was marked by a rising pitch. Ohala (1986) conducted production and perception experiments. Duration of 36 tokens was analyzed. Kelkar's (1968) algorithm for Hindi stress was assumed. No significant difference was found between the duration of the vowel and the coda of a stressed and unstressed syllable. The study also found that stress could be associated with a rising pitch, but it was not always the case. Ohala (1991) further investigated pitch as a possible correlate of stress. Native speakers were asked to judge synthesized words with two different pitch contours (rise and rise-fall). The results show that the participants did not have a preference for any particular contour. Ohala concludes that Hindi has pragmatic stress and not lexical stress.

Nair (2001) gives the following reasons for Ohala's studies did not yielding consistent acoustic results for Hindi stress:

"One possible explanation for Ohala's (1986) ambiguity of the vowel/coda duration for Hindi may partly involve Pandey's (1989) consonant germination rule. According to that rule, a consonant C followed by a sonorant consonant C2 (especially in /j/ /w/ or /r/) in a C1C2 consonant cluster is subject to gemination. This seems to be precisely the context where Ohala (1986) reports results opposite to what is predicted if stress affected the duration of the segments in a syllable: duration of /t/ in /mʌtlab/ versus /prʌtjek/ is 125 ms versus 177ms. According to Pandey's rule, /t/ is more prone to get geminated when followed by a /j/ rather than by a /l/, and perhaps that is why the /t/ in /prʌtjek/ is longer than in /mʌtlab/. Also, one of the reasons why vowel-duration measurements for the stressed and unstressed vowels might not be yielding a significant result for Ohala, which the author also acknowledges, seems to be because the syllables compared have onsets that do not always match in their complexity as in the in /mʌtlab/ - /prʌtjek/ example."

Dyrud (2001) and Nair (2001) agree that Hindi has lexical stress in the sense that every word has a designated syllable on which prominence is realized. Nair (2001) choose 96 Hindi words (24 trisyllabic, 40 disyllabic and 32 monosyllabic) or 32 triplets matching the first syllable for stressed, unstressed and isolated conditions. All ten non-nasal vowels were included and only CV syllables were investigated except in monosyllabic words. Lexical pairs that have contrastive lexical stress and words matching in their segmental structure were analyzed. These words were embedded in /kʌha_____apne/ 'said _____ you' and /bola_____ apne/ 'spoke ___ you'. Three native speakers spoke these sentences three times each. Length of the onset consonant, length of the vowel and values of the first and second formants of the vowel were extracted. The results of the study show that words with different stress placements but in the same prosodic position differ in terms of duration. The stressed vowels were significantly longer than the unstressed ones. A centralization of vowels was noted as the stress reduces. Nair concludes that Hindi does have lexical stress and that it is expressed by syllable lengthening and less significantly as more extreme vowel formants.

Dyrud (2001) suggest that main acoustic correlates of Hindi stress are pitch and duration. Dyrud suggests that in Hindi-Urdu, stress is marked with relatively low pitch on the stressed syllable followed by a rise (LH). Also, according to Dyrud the acoustic correlates of Hindi stress become more prominent in focus position (see the next section for more details). Hussain's (1997) study

of Urdu also found longer duration and lower F0 on stressed vowels.[6] Hussain further suggests that the position of the lexical stress can be predicted by the weight of the syllable (the heaviest syllable attracts stress).

2.3.3 Hindi Intonation

There are a handful of studies on Hindi intonation (Moore, 1965; Harnsberger, 1994; Rajendran and Yegnanarayana, 1994; Patil et al., 2008; Genzel and Kügler, 2010). In this section I present a review of these studies.

Moore (1965) analyzed the intonation patterns of Hindi in the Delhi variety. His study is mostly based on the function and meaning of intonation in Hindi. Moore calls these functions "expressive prosodemes" that express a speaker's attitudes of emphasis (emphasis and contrast), expression (attitude towards what is being spoken) and segmentation (division of utterances into grammatical units like measure and foot). According to Moore, a foot consists of one or more syllables in which pitch rises continually from beginning to end and can be separated by vowel lengthening, pauses and pitch reset. Each content word and its postposition form a foot. A measure occurs either at pauses or immediately after a foot uttered with strong emphasis. According to Moore, each measure of a sentence ends with an emphasized foot except the last one. Each measure has at least one foot and is associated with a rising pitch. Moore explains that different syllables consists of falling, falling-level, falling-rising, rising, and rising-falling contours but the underlying contour on all content words is a rising contour. These contours convey a speaker's attitude. Furthermore, according to Moore, focus is expressed by the use of an expanded pitch range on the focused element and lengthening.

[6] Hussain's (1997) study on Urdu stress also has similar findings. According to the Linguistic Survey of India (Grierson, 1967) Literary Hindustani was an umbrella term for both Hindi and Urdu (Grierson 1906). The main difference between Hindi and Urdu is that Hindi is written in the Nagari script and Urdu was written in the Persian script. Apart from the script, there are minimal differences in sounds and vocabulary in these two languages (Rai 1984). Vocabulary differences stem from the fact that Urdu has many Arabic/Persian borrowings and Hindi has many Sanskrit borrowings. Moreover, there are some differences in sounds in these languages. Apart from these minimal differences, both languages are essentially the same linguistically. Since these minimal differences in vocabulary and sounds may not affect the prosody of the languages, Hussain's study is as potentially relevant for Hindi as it is for Urdu.

Rajendran and Yegnanarayana (1994) utilized a speech database consisting of about 500 sentences read aloud by two male adult native Hindi speakers in an ordinary office environment. A combination of reading style and conversation style were examined to understand the F0 patterns in Hindi on different kinds of words. The results of this study show that all non-final content words have an L and an H tone assigned to them. This contour is not affected by the weight of the syllable. The monosyllabic content words show a valley followed by a peak within the same syllable. In disyllabic words, the valley occurs on the initial syllable and the peak occurs on the final syllable with a straight transition of F0.

Dyrud (2001) compared the acoustic properties of prominent and non-prominent syllables, by looking at words in both [+focus] and [-focus] contexts. Results showed a significant effect of stress on pitch as well as on duration. It was also found that focus interacts with stress: for two minimal pairs in the data, stress showed a significant effect on both pitch and duration in the [+focus] condition, but on neither pitch nor duration in the [-focus] condition. The results of this study suggests that duration does not function independently from pitch as an acoustic correlate of stress in Hindi-Urdu, and that the language is more accurately classified as having non-stress accent instead of stress accent language like English.

Patil et al. (2008) looked at the effects of focus in relation to word order variation in Hindi. Patil et al. conducted a production study on 20 native speakers of Hindi in Delhi. The data consisted of question and answer pairs where the subjects were asked to read the questions silently and speak the answers aloud. The sentences are in the perfect aspect with transitive verbs. F0 and duration of constituents were measured in SOV and OSV sentences in wide focus, subject focus and object focus. The results of this show that regardless of word order and focus, the constituents are in a strict downstep relationship; with the exception of initial subject focus in SOV structures, focus was not found to affect the pitch excursion and duration of the focused elements, thus, focus is mainly characterized by post-focal pitch range reduction rather than pitch raising of the element in focus; given expressions that occur pre-focally appear to undergo no reduction; and that pitch excursion and duration of the constituents is higher in OSV compared to SOV sentences.

The results of this study show that the primary prosodic cue accompanying focus on a constituent is post-focal compression, rather than the raising of F0 as observed in intonational languages such as German. In sentence-initial focus, canonical (SOV) word order has a greater post-focal compression than in non-canonical (OSV) order. When sentence-medial elements are focused, (i) the sentence-initial object in non-canonical (OSV) order has a higher F0 peak as well as a greater F0 range than the sentence-initial subject in canonical order (SOV) order, (ii) the duration of the medial (focused) element is longer in the non-canonical order compared to canonical order, and (iii) no evidence was found of pre-focal compression for given (previously mentioned) elements.

A similar study on the acoustic correlates of contrastive focus in Hindi by Genzel and Kügler (2010) suggests that the word is lengthened under contrastive focus. In focus position the stressed syllable in di- and tri-syllabic target words contributes most to the word lengthening effect. The same effect was reported for the four syllable target word with initial stress, though not for the other four syllable words. Furthermore, a higher scaling for the H tone in contrastive focus was observed in comparison to the wide focus baseline. And the L tone was also affected showing a significant lowering due to contrastive focus, which together with a change of the H tone results in an increased pitch span.

Harnsberger (1994) attempts to describe the intonational patterns in Hindi on a much wider range sentence types: declaratives, yes/no questions, questions and tag questions. Three native speakers of the Delhi variety of Hindi (two men and one woman) participated in this study. The results of this study confirm Rajendran and Yegnanarayana's (1994) observation that all non-sentence final content words show a characteristic rising contour, which Harnsberger represents as LH.

In sentence final verb phrases, the F0 falls from the H in the penultimate syntactic phrase to the bottom of the speaker's pitch range. There was an exception to this pattern: multiple-item VPs (three or more words) were sometimes assigned an LH to the main verb, followed by a boundary tone, L%. Harnsberger (1994) suggests that the tonal patterns found in Hindi only required the

use of a single boundary tone for the entire intonational phrase. Nothing in the data examined in this study provides evidence for a prosodic phrase immediately below the IP.

According to Harnsberger, exceptions to the LH assignment generalization are pronouns with and without postpositions, two-word postpositions, possessives, and utterance-final complex verb phrases. All pronouns with monomorphemic postpositions have the H of LH assigned to the postposition. Two-word postpositions, unlike the monomorphemic postpositions are assigned LH inconsistently. Longer or more complex verb phrases are assigned an LH. Like Rajendran and Yegnanarayana's (1994) study, Harnsberger also observes that in bi-syllabic words, both tones were assigned to a single syllable, where the L tone was assigned to the first syllable and H to the second. When LH was assigned to words of three syllables or more, the H tone at times appeared over an earlier syllable, extending over the rest of the word. The focused word is marked intonationally by blocking the assignment of LH to the following content word. In addition, the speaker's register expanded over the focused word compared to the same speaker's typical range for LH. Like Rajendran and Yegnanarayana's observation, this study also suggests that in Hindi, all words following the focused constituent have a constrained pitch range.

Harnsberger (1994) suggests that there can be three ways of representing the prominence marking tones in Hindi:

1. bitonal pitch accent: This account assumes that Hindi has stress, since the pitch accent (by definition) is aligning with a stressed syllable to make a word prominent.
2. L* pitch accent, followed by an H boundary tone. Hindi utterances would therefore consist of a series of prosodic words (ala Selkirk), or phonological phrases (ala Hayes and Lahiri's characterization of Bengali).
3. an LH accentual phrase, similar to Korean and Japanese where "the tonal events . . . do not function to mark prominent syllables, but to delimit a prosodic grouping of words" (Jun 1993). This representation does not have to assume that Hindi has stress.

Fery (2010) suggests that Hindi is a 'phrase languages' i.e. it only has phrasal tones (ie., boundary or edge-marking) and does not have pitch accents or lexical tones. Furthermore, there are only two levels of prosodic phrasing: the prosodic phrases (p-phrases) and intonation phrases

(i-phrases). Fery suggests that- the low part of the rising tone is a low phrasal tone (LP) and the high part of the rising tone is neither a trailing tone nor a boundary tone in the traditional sense, but also a phrasal tone. Between the initial LP and the final HP, there is interpolation. It is assumed that both p-phrases and i-phrases are recursive. The term p-phrase is used for prosodic units roughly corresponding to maximal projections or lower domains, and i-phrases roughly correspond to whole sentences or higher domains.

To summarize, for Hindi most studies predict that in two syllable words, if both the syllables are heavy then stress is on penultimate, and if the final syllable is super heavy, then it is stressed. In words of more than two syllables, if there is more than one heavy syllable, the rightmost non-final heavy syllable is stressed. If the final syllable is extra heavy then it is stressed. These commonalities have been assumed in the present study. Moreover there is disagreement in the literature about the presence of lexical stress in Hindi. Dyrud and Nair show that the main acoustic correlates of stress in Hindi are pitch (LH) and duration. Also, although there is disagreement in the literature on Hindi intonation about the status of the Low (L) and High (H) tone associated with content words and the number of phrases that exist between the prosodic word and the intonational phrase (IP), there are other aspects that most studies seem to agree on. Most studies on Hindi intonation suggest that all non-final content words are associated with a Low (L) and High (H) (Harnsberger, 1994, Rajendran and Yegnanarayana, 1994; Patil et al. 2008). Declarative sentences are associated with a low boundary tone. Focus is associated with post-focal compression (Harnsberger, 1994; Patil et al., 2008). However, the results may differ based on word order. In sentence-initial focus, SOV word order has a greater post-focal compression than OSV (Patil et al., 2008). Moreover, when sentence-medial elements are focused, (i) the sentence-initial object in OSV has a higher F0 peak as well as a greater F0 range than the sentence-initial subject in SOV and (ii) the duration of the medial focused element is longer in the non-canonical order compared to canonical order (Patil et al. 2008). Focus is also associated with an expanded register over the focused word (Harnsberger, 1994; Moore, 1965; Genzel and Kügler, 2010), lengthened syllables (Genzel and Kügler, 2010), and blocking the assignment of a LH tone on the following content word (Harnsberger, 1994).

2.3.4 Difference between Hindi and American/British English Prosody and Intonation

Stress makes a syllable more prominent in comparison with others. In AE/BE in low stress conditions, vowels often reduces vowels to schwa. Nair (2001) reports that unstressed Hindi syllables become more central than stressed vowels, but not schwa like. Another difference between Hindi and AE/BE is that in AE/BE there is both primary and secondary stress (in the word ˌ***en***.*ter*.'***tain***.*ment*, the first syllable has secondary stress and the third syllable has primary stress), but in Hindi there is only primary stress. In AE/BE, the main acoustic correlates of stress are increase in duration, intensity and pitch (various kinds of pitch accents). In Hindi the main acoustic correlates of stress are increase in duration and a low-rise (LH) pitch contour. English is considered a stress accent language i.e. a language that uses phonetic attributes other than pitch to indicate a prominent syllable (Beckman, 1986). According to Dyrud (2001), in Hindi since the increase in duration is not independent of pitch, it is more accurately classified as a non-stress accent language. Another factor that distinguishes American/British English from Hindi is that in English, there are minimal pairs that differ in meaning only due to stress, for instance, /ob'**ject**/ and /'**ob**ject/ or /'**per**mit/ and /per'**mit**/. In many cases in English stress rules vary depending on the lexical class of the word. For instance, for nouns, stress on the penultimate syllable if heavy. If the penultimate syllable is light, stress the antepenult; for verbs stress is on the final syllable if heavy. If the final syllable is light, stress is on the penultimate syllable. There are many exceptions to these rules. However, in Hindi the stress does not help in predicting the lexical class of the word. In Hindi, it is claimed that there some minimal pairs (/'**ga**laa/ and /ga'**laa**/) that are distinguished only based on stress, but they are infrequent and native speakers cannot seem to distinguish between the two meanings without their specific sentential intonation pattern (Ohala, 1986). Mehrotra (1965) suggests “stress plays a vital part in Hindi, although not as vital as in English, or Russian, or Greek.”

Another difference between English and Hindi is that in Hindi every non-final content word has a low (L) followed by a high (H) within the same or next syllable. It has been suggested that there is interpolation between these two tones. Here the pitch accents mark prosodic units. A Hindi declarative sentence can consist of a number of LH contours. On the other hand in American/British English pitch accents mark discourse entities as salient in relation to other

entities. Here the pitch accents can be monotonal (H and L) or bitonal which along with phrase and boundary tones complete a sentence.

American and British English are classified as Intonational languages (i.e. each has rich array of pragmatically triggered phrasal tones on top of pitch accent). Here pitch is exclusively relevant at the utterance level. Nolan (2006) suggests:

> "English, then, is a language in which there is a relatively sharp difference between prosodically prominent events and those which lack prosodic prominence. The melodic part of intonation involves tonal events associated with points of prosodic prominence, and additionally with boundaries of intonational phrases." (Nolan, 2006)

It has been suggested that Hindi can be classified as either a Pitch accent language i.e. the tonal events do not function to mark prominent syllables, but delimit a prosodic grouping of words (Harnsberger, 1994), or a phrase-accent language (Frey, 2010).

2.4 Indian English Prosody and Intonation

2.4.1 Indian English Vowels

There have been many attempts at describing a 'generalized vowel system' for educated Indian English (CIEFL, 1972; Bansal, 1969; Nihalani, et al. 2004, Wells, 1982). However, is it really possible to have a 'generalized' system of vowels for English spoken as an L2/L1 by speakers of so many other languages within the Indian subcontinent? Since English spoken in different parts of India has its own peculiar features, Wiltshire (2005) suggests that IE should not be treated as a single variety. Since the present study involves simultaneous bilinguals of Hindi and English, Maxwell and Fletcher's (2009) study on the acoustic analysis of vowels spoken by Hindi and Punjabi speakers is most relevant here.

Maxwell and Fletcher (2009) suggest the following vowel inventory for these speakers:

KIT	ɪ	FLEECE	i:	DRESS	ɛ
TRAP	æ	FACE	e ~ e ɪ	LOT	ɔ
HAPPY	æ, ɪ~i	STRUT	ɐ~ʌ	GOAT	o:
FOOT	ʊ	NORTH	o: (r)	*COMM*A	ə~ɐ
START	ɑ: (r)	GOOSE	u:	NURSE	ə: (r) ~ ʌ: (r)

The results of this study also show that speakers maintain a significant difference in duration for the tense and lax vowels in KIT and FLEECE; GOOSE and FOOT; START and STRUT;

NORTH and LOT. Phonetic variation in terms of duration of NURSE and COMMA vowels was noticed. Four speakers of this study realize the contrast between the DRESS and TRAP vowel using duration alone and not vowel quality. The results of this study show inter-speaker variability in the STRUT, FACE, COMMA and NURSE vowels.

2.4.2 Indian English Stress and Intonation

There are many differences in American English (AE) /British English (BE) prosody and Indian English (IE) prosody. One of the main differences is that many words in IE are stressed differently than AE/BE words, for instance, IE photo'**gra**pher or '**pho**tographer and AE/BE pho'**to**grapher (Nair 1996, Pandey 1981, Wiltshire and Moon 2003). It has also been suggested that syllable weight plays an important role in stress assignment and that there is a lot of inter-speaker variation in terms of stress placement. Some studies (CIEFL 1972; Pandey 1994; Nair 1996; Gargesh, 2004) suggest that the rhythm of Indian English is quantity sensitive and is not stress timed. Timing appears to be mora- or syllable weight based and syllables get almost equal prominence. For instance, Gargesh (2004) gives the following example:

'aːɪ 'æm 'ɵɪŋkiŋg 'ɔf 'juː
I am thinking of you

In this example every word seems to be getting prominence.

In terms of focus, an impressionistic study by Gumperz (1982) suggests that IE speakers do not distinguish between new and given information and allocate an accent to both.

There are many studies that have tried to formulate the rules of Indian English stress. For instance, Gargesh (2004) explains that in IE a syllable of a word is more prominent than in RP. There is a significant correlation between the weight of the syllable and its position in a word with prominence. Gargesh explains that there are three kinds of syllables: Light (C)V; Heavy (C)V:/VC; and Extra heavy (C)V:C/(C)VCC. All monosyllabic words are accented irrespective of the quantity of the syllable. Stress falls on the penultimate syllable of a bi-syllabic word unless the second syllable is extra heavy. In tri-syllabic words the stress is also on the penultimate syllable if it heavy, otherwise it falls on the antepenultimate syllable. However, Sailaja (2009) explains that these rules do not explain the inter-speaker variation. For instance, Gargesh (2004)

proposes that in words like *mistake*, *monsoon*, *taboo* and *concrete* would be stressed on the first syllable; however, there are cases where speakers would stress on the second syllable.

Bhatt (1995) suggests that monosyllabic English words like 'school' and 'store' are sometimes turned into bi-syllabic words in IE. In Jammu and Kashmir, AE/BE [sku:l] turns to IE [sə.ku:I], but in other Hindi-speaking areas an epenthetic vowel [i] is inserted only in the word-initial position to repair illicit onset clusters. Thus, in this variety of IE, the word 'school' is pronounced as [is.ku:l]. The application of the epenthesis rule is necessitated by the wellformedness conditions of the syllable structure. Bhatt suggests that the Jammu and Kashmir variety has a global epenthesis rule that applies in configurations that violate Sonority Principle (A) and (B) (see Goldsmith, 1990).

Chaudhary (1989) explains that there is a difference between the stress placement rules between L1 Dravidian language family speakers and L1 Indo-Aryan language family speakers because the way in which a word is syllabified is different in both language groups (example: Dravidian *mi.ni.stre* and Indo-Aryan *mi.nis.ter*).

Thus, it seems hard to postulate a generalized stress system of English spoken in India. There are other studies like Das (2001) on Tripura Bangla English; Vijayakrishnan (1978) on Tamil English; Pandey (1994) on General Indian English and Nair (1996) on Malayalee English. Some of these studies are impressionistic and do not deal with the acoustic correlates of stress. Moreover these studies are not relevant for the present study because they don't deal with Hindi-English bilinguals or with languages that are closely related to Hindi.

In terms of acoustic correlates of stress in Indian English, Pickering and Wiltshire (2000) conducted a study to investigate the differences between American English and Indian English through the examination of four minutes of discourse from six late bilinguals of IE and various Indian languages like Tamil, Bengali, Hindi-Urdu. They measured the F0 and amplitude on each syllable. F0 was measured at the middle of the syllable and amplitude was measured at its peak value in each syllable. Only the non-final accented syllables were measured to avoid boundary tones. This was compared to the speech of 3 American English speakers. They found that where

in AE there is a reliable increase in both F0 and amplitude in stressed syllables, in IE there is a relative drop in F0 without a reliable increase in amplitude. There was a mean difference of 5.46 db in amplitude on the stressed syllable when compared to the unstressed syllable. Pickering and Wiltshire (2000) conclude that Indian English is a pitch accent language and not a stress accent language like American or British English.

Wiltshire and Moon (2003) argue against Pickering and Wiltshire's (2000) argument that the stressed syllable in Indian English is marked by a relative drop in F0 without a reliable increase in amplitude, by showing that Pickering and Wiltshire misinterpreted the positioning of stress in Indian English and had very few tokens. Wiltshire and Moon (2003) conducted a production and perception study to analyze the phonetic correlates of Indian English stress and the differences between American English and Indian English by collecting data from 10 American English speakers and 20 Indian English bilinguals (with Hindi, Gujarati, Tamil and Telugu as L1s). The speakers were asked to produce 60 words in a carrier sentence "I will say X again". The results of this study show that stressed syllables in Indian English increase in amplitude when compared to the unstressed syllables, but amplitude in Indian English does not increase as much as it does in American English.

There is very little research on IE pitch accent and intonation. Wiltshire and Harnsberger's (2006) study is based on the pitch accents of late bilinguals of English and Gujarati, a language that is closely related to Hindi. They report that most or all the non-final content words are assigned a pitch accent. ToBi labeling of the data revealed that in an utterance there are many more pitch accents assigned to words before a boundary than one would find in AE or BE. More specifically, every non-final content word has a pitch accent. In Gujarati English the pitch accent has a relative drop in F0 followed by a rise (LH). This pitch accent contour is attributed to transfer from Gujarati. This LH is the pitch accent contour which has been observed in Hindi as well (Harnsberger, 1999; Dyrud, 2001).

Thus, the limited literature on IE stress suggests that there is inter-speaker variation in stress placement and that the stress placement is different from that of AE/BE. It is also reported that the acoustic correlates of stress is a relative drop in F0; however, there is disagreement in the

literature about amplitude. Indian English spoken by Gujarati L1 speakers is marked by a relative drop in F0 (L*H).

2.5 Assumptions

The present study assumes Hayes's (1995) metrical stress theory which states that stress/prominence is defined in relation to the other units in the same phrase and that is it a linguistic manifestation of rhythmic structure. The perceived stress of a syllable is a result of its position in the metrical tree and grid in a phrase.

This study also assumes Pierrehumbert (1980), and Beckman and Pierrehumbert's (1986, 1988), model called the Auto-segmental Metrical system (AM) for intonation. The AM system for intonation is based on the Autosegmental approach and the Metrical approach. The AM model of intonation proposes that pitch patterns consist of sequences of categorically distinctive entities, associated with the segmental string (or prominent syllables as proposed by Liberman and Prince, 1977) and with prosodic phrase edges. This model was further developed by Ladd (1983, 1996), Liberman and Pierrehumbert (1984), Gussenhoven (1983). The AM model proposes two types of phonological events: edge tones and pitch accents. *Pitch accents* are local F0 movement on the prominent syllables. Although all stressed syllables can potentially get a pitch accent, it is only the metrically strongest syllable that will get the pitch accent at the phrase level.

In languages like English pitch accents mark discourse entities as important or salient in relation to other entities in the conversational context. The AM model uses two level tones, high (**H**) and low (**L**). The inventory of possible English pitch accents in Pierrehumbert and Hirschberg (1990) also includes combinations of these two tones: **L+H***, **L*+H**, **H*+L**, **H+L***. These bi-tonal pitch accents can be left-headed or right-headed. Their headedness depends on whether the first part or the second part of the accent is associated to the metrically strong syllable. The asterisks [*] that follow individual tones mark the tone which aligns with the stressed syllable of the word, stress here referring to the prominence assigned by lexical-phonological rules. Lack of pitch accent assignment for a syllable means that the syllable is not accented.

Phrase accents are associated with the *intermediate phrase* (ip), and *boundary tones* are associated with the edge of the *intonational phrase* (IP). These edge tones can be either H or L

(phrase tones are H- and L- and boundary tones are H% and L%). The ip boundary tones are phonetically realized as changes in F0 from the last pitch accent of the phrase to the end of the phrase. A complete English utterance consists of at least one pitch accent, ip boundary tone, and an intonational phrase (IP). The boundary tones are marked with a [%] symbol and the phrase accent is marked with a hyphen [-] symbol. According to Pierrehumbert (1980), the *nuclear accent* is the last pitch accent of a series of pitch accents.

Chapter 3
Methods

3.1 Introduction

In this chapter, I describe some assumptions for this study, the methods used in recordings, data transfer, data elicitation and information about the participants in all the three experiments. Experiment specific methods, speech material and other information will be discussed in the respective chapters. Below I summarize the research questions mentioned in Chapter 2:

3.2 Research Questions

1. Do simultaneous bilinguals of Indian English and Hindi have two different systems of intonation or do they employ one system for both their L1s?
2. Is the intonation system used by simultaneous bilinguals different from the one used by late bilinguals?

The first question is addressed qualitatively in this study, and is informed by acoustic findings from three prosody production experiments that address the second question. The three experiments conducted in both Hindi and Indian English are:

1. Pre-boundary lengthening
2. Pitch accents
3. Focus

3.3 Recordings

Three experiments were conducted both in Indian English and Hindi (3*2). In order to avoid transfer effects of one language on the other the English and Hindi experiments were conducted on separate days (a week apart). Two different people conducted the Hindi and English experiments. The author conducted the English experiment and a fluent Hindi speaker helped conduct the Hindi experiments. Verbal instructions for the Hindi experiments were given in Hindi and the instructions for the English experiment were given in English. Before the experiments the participants were also given a written consent form regarding the general

procedures of the experiment. The participants were not given any specific information about the nature or objective of the study.

The speakers were asked to read sentences from that were presented in text format on paper. In order to avoid list-reading each sheet of paper consists of only one sentence for the pitch accent and pre-boundary lengthening experiment. For the focus experiment, the question-answer series for each target word were on the same sheet of paper. Distractor sentences were also used to avoid list-reading. The Hindi experiments used the Devanagri script and the English experiments were written in English. The speakers were asked to say the sentences like they would say them in normal speech. No other information or prompts were given to the speakers. They were asked to repeat the sentence in case there were any hesitations. Participants were permitted to read the set of sentences before they were recorded. This was done because many speakers admitted that they were not fluent in reading Hindi (despite being fluent in speaking) because their method of instruction in school was mainly in English.

The recordings were done in a private sound attenuated room used for music recordings in New Delhi, India. Efforts were made to make sure that the recording room did not contain any electronic equipment that would introduce interference in the audio recordings. The recordings were made using an Olympus digital recorder (VN-5200PC) and a head mounted omnidirectional microphone (10-10,000 Hz). The microphone was two inches away from the speaker's mouth. Speech was digitized at a sampling rate of 44.1kHz (16 bits). Each experiment lasted about 1 hour and participants were given a nominal remuneration after the completion of both English and Hindi recordings.

3.4 Speakers

Before the recordings were made, participants were asked to complete a comprehensive questionnaire about their linguistic background (see Appendix 1). The following questions were asked:

1. At what age did you acquire English?
2. At what age did you acquire Hindi?
3. Which language did you acquire first? Hindi English Both

4. Did you acquire them together at home? Yes/No
5. What is/are your native languages? Hindi English Both
6. Do you think you speak English as well as Hindi? Yes/No
7. Which language did you speak at home as a child? Hindi English Both
8. Which language do you use mostly in your everyday life? Hindi English Both
9. Rate the percentage of use of Hindi and English with your:

a.	Father	Hindi-	English-
b.	Mother	Hindi-	English-
c.	Siblings	Hindi-	English-
d.	Grandparents	Hindi-	English-
e.	Spouse	Hindi-	English-
f.	Children	Hindi-	English-
g.	At work/school	Hindi-	English-
h.	With strangers	Hindi-	English-
i.	With friends	Hindi-	English-

10. Which type of school did you attend? Public/Government/Convent

As seen in Chapter 2 speakers who acquire two languages as 'first languages' or are called simultaneous bilinguals. On the other hand consecutive or successive bilinguals acquire another language after already knowing a language (Hamer & Blanc 2000; Lyon 1996). In the present study I use the term 'late bilinguals' for such bilinguals. Thus, the participants were considered simultaneous bilinguals if:

a. the answer to question 1 and question 2 was 'before the age of 3'; and
b. the answer to question 3 was 'both'; and
c. the answer to question 4 was 'Yes'.

However, if the answer to question 1 was after the age of 3, the speakers were considered late bilinguals.

Questions 7-9 were used to determine if the speakers were balanced bilinguals or dominant in one of the languages. In question 9, if higher percentage of use was shown in Hindi, then the

participant was categorized as Hindi dominant. On the other hand, if the participants showed higher percentage of use in English, they were considered English dominant.

Public schools are tuition-based schools and the medium of education is mostly English. Some schools are English only, in terms of medium of education and use of English in the classroom. There are other Public schools that use English textbooks but the use of English in the classroom might be limited. Government schools are schools run by the government and are free of cost. These schools are mostly associated with the lower or lower middle class and in most cases the medium of education is Hindi (or the regional language). Convent schools are offshoots of Catholic churches in India. These schools are associated with high standards of education and discipline. These schools only use English and pay a lot of attention to pronunciation and diction. Many teachers in such schools are British catholic nuns or priests, or Mother superiors of the Church that the Convent school is associated with. Although language dominance and type of school (question 10) were not controlled variables in this study, they were considered in interpreting the results.

For this study, data were collected from 10 late bilinguals and 20 simultaneous bilinguals of Hindi and Indian English. The speakers were between the age of 19-34 years. There were 18 females and 12 males. All the speakers speak the same dialect of Hindi and were born and raised in Delhi, India. As mentioned above, many Indians are multilinguals. Thus, in order to avoid influence of a third language, only those participants who knew English and Hindi and no other language were included in this study. See Appendix 2 for participant profile.

3.5 Speech Material

Here I discuss the common assumptions for selection of speech material.

As shown in Chapter 2, there are many differences in the stress placement rules in Hindi. However, there are some commonalities in all the studies on Hindi stress. Most studies predict that in two syllable words, if both the syllables are heavy then stress is on penultimate and if the final syllable is super heavy, then it is stressed. Also, in more than two syllable words, if there is more than one heavy syllable, the rightmost non-final heavy syllable is stressed. If the final

syllable is extra heavy then it is stressed. These commonalities have been assumed in the present study.

As we have seen Chapter 2, there is considerable inter-speaker variation in terms of vowels and stress placement in Indian English. Thus, in order to eliminate potential inter-speaker variation in terms of vowels, only the vowels that have no inter-speaker variation in Maxwell and Fletcher's (2009) study on IE were selected. In terms of stress placement, a pilot experiment was conducted where 6 Indian English-Hindi bilinguals (3 late and 3 simultaneous) were asked to identify the primary stress in 100 two-syllable, 100 three-syllable and 60 four-syllable words (n=260). These words were printed on a paper and the speakers were asked to circle the main stressed syllable. The specific instruction given to the speakers was that they should mark the syllable which sounds most stressed out of all the other syllables. All the speakers agreed on 211 words (89 two syllable; 78 three syllable and 44 four syllable). The words that all the speakers agreed on have been used in the present study. More specific details about the actual data can be accessed in the methods section of each experiment.

Chapter 4
Pre-boundary lengthening

4.1 Introduction

A prosodic boundary is known to be associated with lengthening in the word that precedes it. This is known as pre-boundary lengthening (PBL) (Wightman, et al. 1992; Beckman & Edwards 1990). PBL essentially reflects a reduction of the rate of articulation at the end of a prosodic phrase. Thus, words are longer in phrase-final position than when they occur in phrase-medial position (Beckman and Edwards 1990; Turk and Shattuck-Hufnagel 2007). PBL is known to be an acoustic correlate of a prosodic boundary in American English (Beckman and Edwards 1990), British English (Cutler and Butterfield, 1990) and even in New Englishes like Singapore English (Low and Grabe, 1999). PBL has been reported in many other languages including Dutch (Hofhuis, Gussenhoven and Rietveld, 1995; Cambier-Langeveld, 2000), Swedish (Horne, Strangert and Heldner, 1995); Russian (Volskaya and Stepanova, 2004) and Hungarian (Hockey and Fagyal, 1999), to name a few.

PBL is used in many languages to mark phonological phrasing (Hayes, 1995) and is known to cue the phonological hierarchy of prosodic components. Ladd and Campbell (1991) report that PBL can cue different levels of prosodic constituents above the word like the accentual phrase, intermediate phrase (ip) and the intonation phrase (IP) and the lengthening effects of PBL are known to increase with the level of the prosodic domain i.e. prosodic word, ip and IP in English (Wightman et al. 1992). In Dutch the intonational phrase is longer than phonological phrase (Cambier-Langeveld, Nespor and Heuven, 1997). However, in Mandarin there is no significant difference in the duration of the prosodic phrase boundaries and intonational phrase boundaries (Yu-fang and Bei, 2002).

The domains of PBL have been studied in some detail. Volskaya and Stepanova (2004) suggest that the most significant factors influencing PBL are the position of the word in a phrase (beginning or end), stress, type of intonational unit (final or non-final) and the intonational contour. They report, that in Russian, PBL affects the whole word at a sentence/phrase final

position. Here the most lengthening effects can be found on the vowels of the final word. On the other hand, Horne, Strangert and Heldner's (1995) study on PBL in Swedish shows that, here PBL affects the final part of the rime. Horne, Strangert and Heldner (1995) conducted a study on the effect of PBL and pauses in four contexts: 0 boundary, prosodic word, prosodic phrase and utterance boundary. All boundaries occurred after both [+focus] and [-focus]. These sentences were read 10 times by the same speaker and the test word was *procent*. The results of this study show that there is an increase in [t] duration associated with the higher rank end of the boundary scale and that there is a decrease in [ɛ], [n] and [t] duration in the lower end of the boundary scale. Thus, PBL affects the final segment of the rime in Swedish.

Other studies suggest that PBL is known to affect the rhyme of the syllable preceding the boundary in many languages, such as English (Wightman et al. 1992) and Dutch (Camber-Langeveld 1997). Wightman et al. (1992) conducted a study on a corpus containing 35 pairs of phonetically similar but syntactically ambiguous sentences that were read by professional FM radio news announcers who were native speakers of American English. The results of this study show that the segmental lengthening in the vicinity of prosodic boundaries is restricted to the rhyme of the syllable preceding the boundary. Similarly, Cambier-Langeveld, Nespor and Heuven (1997) report that in Dutch PBL affects the final syllable rhyme. Cambier-Langeveld, Nespor and Heuven (1997) conducted a production and perception study to understand pre-boundary lengthening in Dutch. In the production experiment, 2-4 syllable words with different stress patterns and different structure of words were placed at prosodic word, phonological phrase, intonational phrase or utterance boundary. The results of this study show that in most cases final lengthening effect is confined to the final syllable. The rhyme is always lengthened, while the onset is not systematically affected.

It has also been shown that PBL can affect segments before the final syllable. The domain of final lengthening is determined by expandability of the vowel of the final syllable. It has been reported that in final words that have less complex final syllables (lax vowels, high vowels or codas with only one consonant) lengthening effects can be observed earlier than the final syllable of the final word (Byrd and Saltzman 2003). For instance, Cambier-Langeveld, Nespor and Heuven (1997) report that apart from the final syllable rhyme, PBL can also affect earlier parts

of the final word if the final syllable rhyme is not *expandable.* For instance if the rhyme of the final syllable contains only a schwa (ultra-light final syllable), final lengthening begins in the penultimate syllable. Thus, Cambier-Langeveld, Nespor and Heuven suggest that segments preceding a short final segment will have to participate in the final lengthening, resulting in a larger lengthened domain.

Stress seems to play a role in increasing pre-boundary lengthening effects. Rietveld, Kerkhoff, and Gussenhoven (2004) report that in Dutch, the vowels in word-final syllables with main stress, are longer than metrically equivalent vowels elsewhere in the word. It has also been reported that PBL can begin at the non-final stressed syllable and continue to the end of the phrase or skip certain elements between the non-final stressed syllable and the final syllable (Camber-Langeveld 1997). Similarly, it has been reported that in South African English the duration of the stressed vowel increases with its proximity to the prosodic phrase boundary (Coetzee and Wissing, 2007). Turk and Shattuck-Hufnagel (2007), conclude that in American English PBL seems to affect the phrase-final syllable rhyme the most. Statistically significant lengthening of 7–18% also occurs in the main-stress syllable rhyme, when the main stress syllable is not the final syllable. Similarly, in a study on PBL in British English, Cambier-Langeveld (2000) found that in words like Jonny and Joseph PBL affects the main stressed syllable and the final syllable.

Turk and Shattuck-Hufnagel (2007), suggest that there are three main approaches to specifying the domain over which speakers adjust phrase-final duration. They call them structure based, content based and hybrid views. In the structure based view PBL affects a stretch of speech defined by linguistic structure such as final-syllable rhyme or word rhyme. In this view PBL affects a structurally similar region for all phrases even though the number of segments and syllables can differ depending on the word. In the content based view the domain of PBL is structurally variable since it is based on the properties of the last segment or syllable of a phrase. This view suggests that the duration-governing element called the *pi*-gesture (formulated in the Articulatory Phonology, Brownman and Goldstein, 1992) lengthens whatever part of the word that it overlaps with. If it is assumed that the *pi*-gesture has a fixed underlying duration for all boundaries of a given type and aligns at its center with the phrase boundary (Byrd et al., 2005,

2006), then for words with short final gestures, the *pi*-gesture will overlap with earlier portions in the final word and thus to slow them down. Thus, words with less complex final syllables will show lengthening effects on earlier structural portions of the final word. The Hybrid view according to Turk and Shattuck-Hufnagel (2007) suggests that PBL affects a structurally defined fixed domain but the phonological and phonetic properties of the final syllable determine if earlier lengthening can occur.

Thus, it seems that the domain of final lengthening seems to be the final syllable (vowel, coda or rhyme) in most languages. In some cases if the final syllable is not expandable and if the stress is on a non-final syllable, the effects of PBL can be seen much before the final syllable. As noted in chapter 2, Hindi and American/British English stress systems and intonation patterns are rather different. In Hindi the final syllables can be very complex (sometimes heavy or extra-heavy) and in most cases, the non-final rightmost heavy syllable is stressed. So then the question is to explore if the differences in types of stress patterns and syllable structures in Hindi and English lead to differences in the domain of PBL in these languages. In the context of World Englishes, it has been shown that L1 rhythmic properties can transfer onto L2 speech patterns (Low, Grabe and Nolan, 2000; Gut, 2005; Coetzee and Wissing, 2007). Coetzee and Wissing (2007) report that South African English (L1) and Afrikaans English (L2) both have PBL, but Tswana English (L2) does not. The presence of PBL in Afrikaans English and the absence of PBL in Tswana English are attributed to L1 transfer. In some cases the L2 intonation patterns can transfer to the L1 as well (Andrews, 1993). If it is possible for rhythmic properties of L1 and L2 to transfer, is it also possible that the rhythmic properties of two L1s can interact? Can the same be true for Hindi-English bilinguals?

Thus, there are four main objectives of this experiment: first, to find the domain of PBL in Hindi and Indian English; second, to investigate the role of stress in pre-boundary lengthening; third, to explore if simultaneous bilinguals behave similarly or differently in their two L1s in terms of pre-boundary lengthening (qualitatively from overall observations) and four, to explore if there is any difference in the expression of PBL between late and simultaneous bilinguals of Hindi and English. The prediction is that the late bilingual speaker's English should pattern like Hindi. In order to understand these questions, this study looks at two syllable words with expandable final

stressed syllables and with stress on final and penultimate syllables. The reason for looking at expandable final syllables is to see if in spite of final vowels being expandable, is there still PBL before the final syllable? The reason for placing stress on both final and penultimate syllable is to test if stress has an effect on PBL. These answers in turn will help determine which is the best model of PBL in Hindi and Indian English: structure based, content based or hybrid.

4.2 Methods

The present study is divided into two experiments: experiment 1 examines PBL in Hindi and experiment 2 examines PBL in Indian English. In both the experiments, the lengthening effects are measured on the final word of an IP which is also the final word of the utterance. There are two reasons for this: first, in the literature on PBL the maximum level of lengthening effects have been observed at the highest prosodic constituents in the hierarchy i.e. the IP. Second, in the literature on Hindi intonation, prosodic constituents/phrases between the word and IP are not clear. According to Harnsberger (1994) the H of the LH pitch accent in Hindi is either a trailing tone or a (ip) boundary tone. Since the existence of different levels of prosodic constituents between the word and an IP (especially the intermediate phrase) is not clearly established, in this study PBL will be investigated only on the intonational phrase (IP) in both Hindi and IE.

4.2.1 Speech Material

Thirty target words were placed in sentence final and sentence medial positions. All the target words are two-syllable words with fifteen words with stress on the final syllable and fifteen words with stress on the penultimate syllable. In terms of selection of target words, the assumptions and pilot study mentioned in Chapter 3 (section 3.5) have been employed. In both the experiments the sentence length (in the two sentence positions) has been kept constant as far as possible. All the stressed vowels consist of expandable vowels. All the vowels are flanked by voiceless stops, nasal consonants, fricatives /s/ and /z/ or retroflex /ʈ/. Some sample sentences:

English

1a. He likes ruby and **to'paz**.

1b. He likes **to'paz** and Ruby.

2a. The actor likes both John and **'Peter.**

2b. The actor likes both '**Peter** and John.

3a. They lived in China and **Ja'pan.**

3b. They lived in **Ja'pan** and China.

4a. I saw Emily and **Su'zanne**

4b. I saw **Su'zanne** and Emily.

5a. I saw a carpenter, tailor and '**tapster**.

5b. I saw a **'tapster**, carpenter and a tailor.

Hindi

1a. unke na:m haĩ kərən aur prə'**ta:p**
their names be-pr. Karan and Prataap
Their names are Karan and Prataap.

1b. unke na:m haĩ prə'**ta:p** aur kərən
their names be-pr. prataap and Karan
Their names are Pratap and Karan.

2a. ja:ha: haĩ uski: beʈi: aur sə'**pu:t**
Here are his daughter and son
His daughter and son are here

2b. ja:ha: haĩ uske sə'**pu:t** aur beʈi:
Here are his son and daughter
His son and daughter are here.

3a. usne di: dua: aur a:'**si:s**
He Erg. gave prayers and blessing
He gave prayers and blessings.

3b. usne di: a:'**si:s** aur dua:
He Erg. gave blessing and blessing
He gave blessings and prayers.

4a. ra:m ko atʃtʃʰa: ləga: usko ro:kna: aur '**ʈo:k**na:
Ram dat. liked him stop and interject
Ram liked interrupting him.

4b. ra:m ko atʃtʃʰa: ləga: usko '**ʈo:k**na: aur ro:kna:
Ram dat. liked him interject and stop
Ram liked interrupting him.

5a. unke na:m haĩ səndi:p aur **'pu:t**na:
Their names are Karan and Puutna
Their names are Karan and Puutna

5b. unke na:m haĩ **'pu:t**na: aur səndi:p
Their names are Putna and Karan
Their names are Putna and Karan.

4.2.2 Measurements

Duration measures were obtained for the rhyme of the penult syllable (R1), vowel of the penult syllable (V1), penult syllable (S1), rhyme of the final syllable (R2), vowel of the final syllable (V2) and the final syllable (S2) in both sentence medial (M) and final position (F) using Praat (Boersma and Weenink, 2012; version 5.3.35). Twenty eight tokens in the IE experiment and thirty six tokens in Hindi were excluded due to missing vowel or missing final consonant in a CVC. For instance, in Hindi most speakers dropped the final /t/ in the word *aapaat* 'trouble'. The target vowels were identified from the onset and offset of voicing from the spectrograph. Duration measures for pre-final vowels in an open syllable were measured till the location where Praat's formant tracker fails to find a second formant. For vowels flanked by nasal consonants the edge of the vowel was specified as the period whose amplitude was 20% the maximum amplitude of the vowel (Shosted, 2012). All the tokens in the sentences medial position were checked for pauses, hesitations or boundary tones in order to make sure there was no prosodic boundary.

4.3 Results

4.3.1 Indian English

Overall the penultimate and final syllables are longer in sentence final position when compared to sentence medial position (Fig. 4.1). Final syllables get more lengthening than the penultimate syllable.

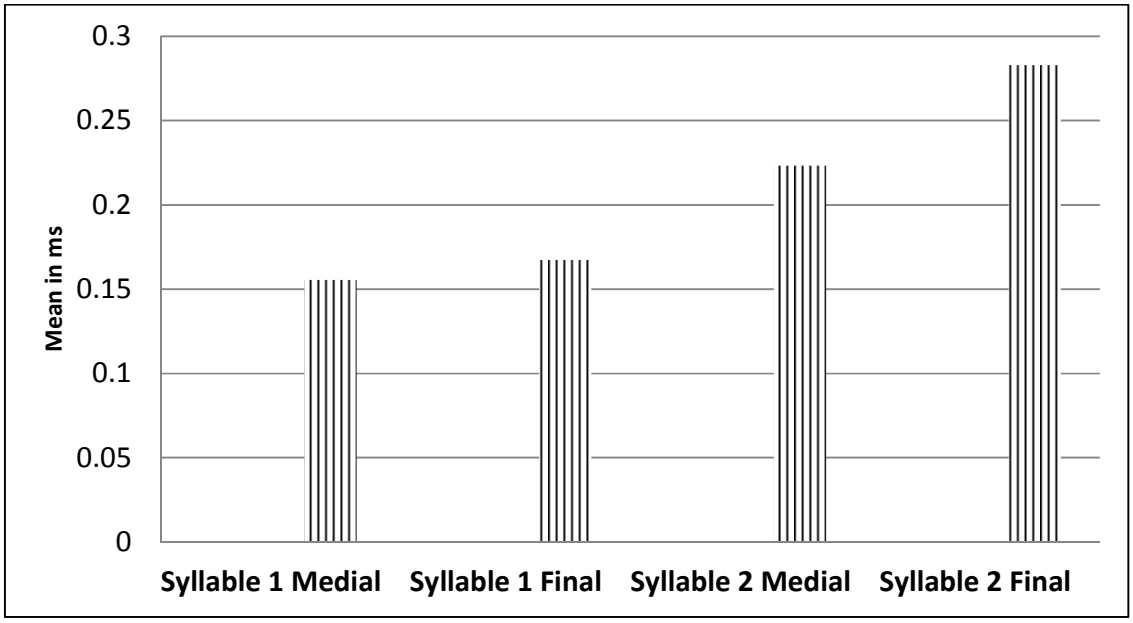

Fig. 4.1: Overall mean length of the penultimate and final syllable in sentence medial and final position in IE.

Paired Sample t-tests were conducted to see if there is a difference between R1, R2, V1, V2, S1 and S2 in sentence medial and final positions. Table 4.1 shows that there are statistically significant differences between phrase-final vs. phrase-medial rhyme, vowel and syllable. Here the larger *t* values for the difference between R2F and R2M; V2F and V2M; and S2F and S2M show that the effects of phrase lengthening are greater on the utterance final rhyme, syllable and vowel. The penultimate rhyme, syllable and vowel of the utterance final word also have statistically significant lengthening. Because the outcome measures were tested in six contexts where PBL was predicted, a Bonferroni-adjusted significance level of 0.0083 was calculated to account for the increased possibility of type-I error.

	Paired Differences mean	***t*-values**	**Significance**
R1F - R1M	.010397466	6.524	$p < 0.0005$
R2F - R2M	.056028784	15.478	$p < 0.0001$
V1F - V1M	.003769196	4.690	$p < 0.0005$
V2F - V2M	.018429949	10.859	$p < 0.0001$
S1F - S1M	.011808553	6.974	$p < 0.0005$
S2F - S2M	.059535753	15.648	$p < 0.0001$

Table 4.1: Paired Sample t-test for R1F with R1M; R2F with R2M; V1F with V1M; S1F with S1M; S2F with S2M for IE.

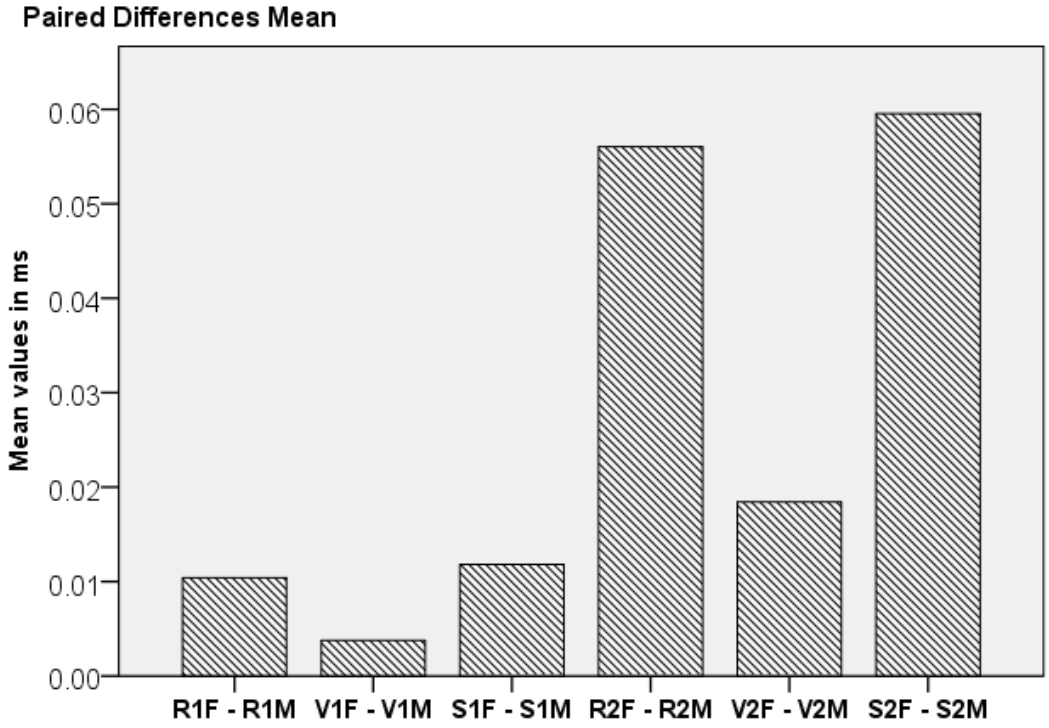

Fig. 4.2: Overall difference in duration between R1F and R1M; R2F and R2M; V1F and V1M; S1F and S1M; S2F and S2M for IE.

Figure 4.2 shows the differences between the mean durations of the rhyme, vowel and syllables in sentence final and medial position. The figure shows that the highest effect of PBL can be seen on the final syllable, followed by final rhyme, followed by final vowel. There are also significant differences between the duration of penultimate rhyme, vowel and syllable in sentence final and medial position.

Position in word and position in sentence

Two way ANOVAs were conducted to see how the duration of rhyme, vowel and syllable are affected by the position in word (syllable 1/syllable2) and how are they affected by position in sentence (medial /final). For rhyme, significant results were found for position in word (F (1,3476)=646.08; p=0.000); position in sentence (F (1,3476)=108.76; p=0.000); and in the interaction between position in word and position in sentence (F (1,3476)=51.32; p=0.000). For vowel, significant results were found for position in word (F (1,3476)=327.52; p=0.000); position in sentence (F (1,3476)=45.99; p=0.000); and the interaction between position in word

and position in sentence (*F* (1,3476)=20.06; *p*=0.000). For syllable significant results were found for position in word (*F (1,3476)= 715.63; p=0.000*); position in sentence (*F* (1,3476)=108.46; *p*=0.000); and the interaction between position in word and position in sentence (*F* (1,3476)=48.54; *p*=0.000).

Stress and position in word

Two way ANOVAs were conducted to see how the duration of rhyme, vowel and syllable are affected by the position in word (syllable 1/syllable2) and how are they affected by stress. For rhyme significant results were found for position in word (*F* (1,3476)= 695.59; *p*=0.000); stress (*F* (1,3476)= 39.17; *p*=0.000); and the interaction between position in word and stress (*F* (1,3476)= 401.01; *p*=0.000). For vowel significant results were found for the position in word (*F* (1,3476)=346.11; *p*=0.000); and the interaction between position in word and stress for vowel (*F* (1,3476)=262.49; *p*=0.000). For syllable, significant results were found for the position in word (*F* (1,3476)= 764.93*; p*=0.000); stress (*F* (1,3476)= 65.95; *p*=0.000); and the interaction between position in word and stress (*F* (1,3476)=342.79; *p*=0.000).

Type of bilingual and position in word

Two way ANOVAs were conducted to see how the durational difference are affected by the type of bilingualism of the speaker and position in word. For rhyme significant results were found for position in word (*F* (1,3476)=535.33; *p*=0.000). For vowel significant results were found for type of bilingual (*F* (1,3476)=7.90; *p*=0.000); position in word (*F* (1,3476)= 378.40; *p*=0.000); and the interaction between type of bilingual and position in word (*F* (1,3476)=15.74; *p*=0.000). For syllable, significant results were found for type of bilingual (*F* (1,3476)= 13.66; *p*=0.000); position in word (*F* (1,3476)=890.27; *p*=0.000); and the interaction between type of bilingual and position in word (*F* (1,3476)=25.44; *p*=0.000).

Stress and type of bilingual

Two way ANOVAs were conducted to see if there is an effect of stress and bilingual on duration and do these effects interact. For rhyme, significant results were found for stress (*F* (1,3476)=27.52; *p*=0.000). For syllable, significant results were found for stress (*F* (1,3476)= 46.53; *p*=0.000); and type of bilingual (*F* (1,3476)=6.29; *p*=0.01).

Figure 4.3 shows the plot for R1, R2, V1, V2, S1 and S2 differences (sentence final position – sentence medial position). This figure shows that stress tends to increase the effects of PBL for both the penultimate and final syllable. Also, simultaneous bilinguals have longer durations overall, i.e., greater PBL effects, than late bilinguals.

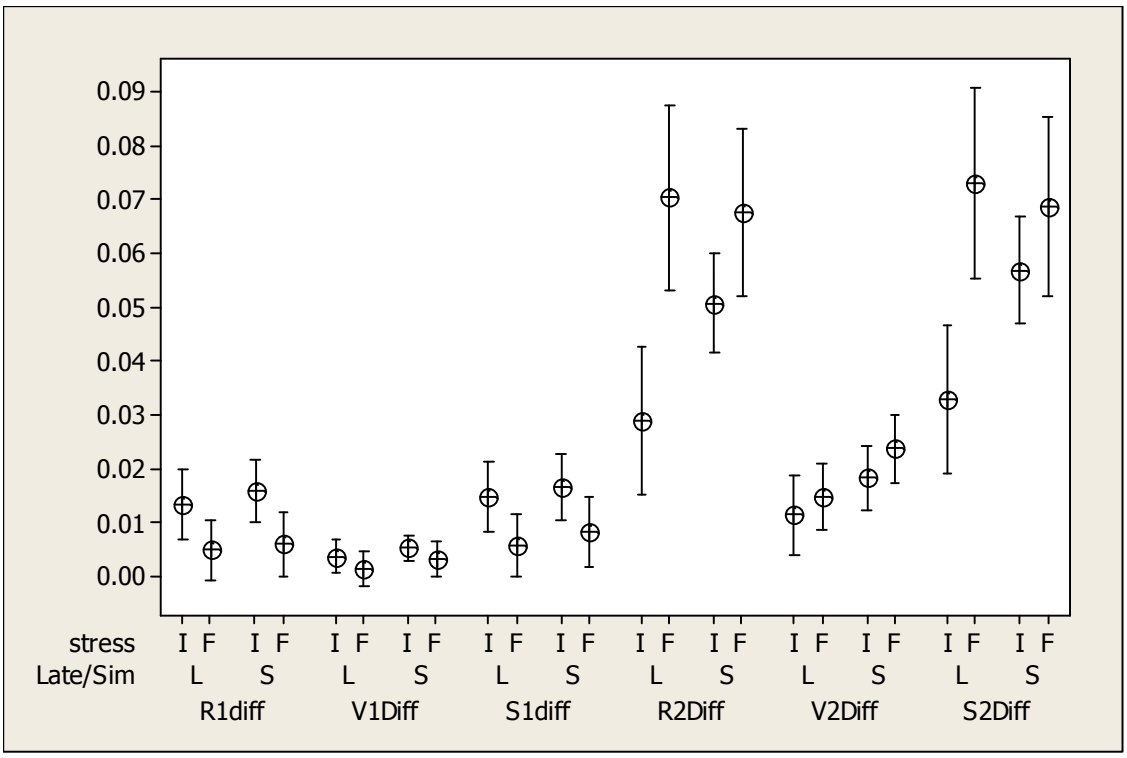

Fig 4.3: The difference between sentence medial and final position for R1, R2, V1, V2, S1 and S2 for both stress (I=initial; F=final) and type of bilingual (L=Late; S=simultaneous) in IE.

To consider effects due to subject and item (word), six mixed effects regressions were conducted with stress as an independent variable, the difference between rhyme, vowel and syllable in both syllables in sentence final and medial position (i.e. R1F - R1M, R2F - R2M, V1F - V2M, V2F - V2M, S1F - S1M, S2F - S2M) as dependent variables and subject and word as random factors. The models with the random effects were better fits than models without the random effects. The results from these mixed models (Table 4.2) also confirm the results of the ANOVAs above. According to Baayen et al. (2008) if there is a large dataset then $t > |2|$ in a mixed effects model can be considered statistically significant. Thus, the results show that for R1, R2, S1, S2 stress has a significant effect on the duration difference measure. However, for V1 and V2, stress has no significant effect on the difference between sentence final and sentence medial duration.

	Estimate	Std. Error	t-value
R1 Difference	-0.009246	0.003176	**-2.911**
R2 Difference	0.006146	0.006146	**4.048**
V1 Difference	-0.002072	0.001607	-1.290
V2 Difference	0.004703	0.003036	1.516
S1 Difference	-0.008539	0.003378	**-2.528**
S2 Difference	0.006499	0.006499	**3.217**

Table 4.2: Summary of the results for six mixed effects regression models for stress as an independent variable, the difference between rhyme, vowel and syllable in both syllables in sentence final and medial position (i.e. R1F - R1M, R2F - R2M, V1F - V2M, V2F -V2M, S1F - S1M, S2F - S2M) as different dependent variables and subject and word as random factors in Indian English. Here values t>|2| can be informally considered significant (Baayen et al. 2008).

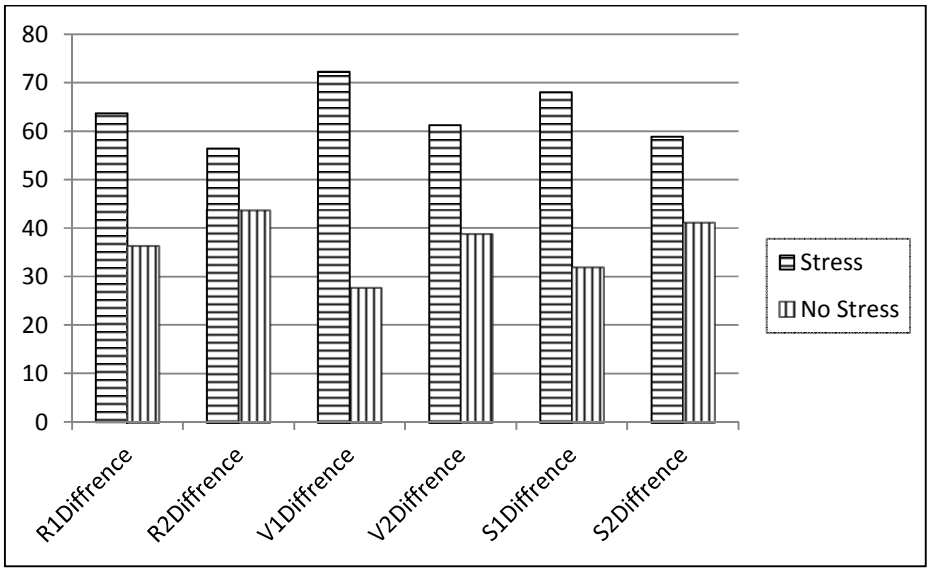

Fig. 4.4 Percentage of mean difference in R1F and R1M, R2F and R2M, V1F and V1M, V2F and V2M, S1F and F1M and S2F and S2M when stress is on the final syllable (stress condition) and when stress is on initial syllable (no stress condition).

In terms of percentage of mean difference in R1F and R1M, R2F and R2M, V1F and V1M, V2F and V2M, S1F and F1M and S2F and S2M, when stress is on the final syllable and when stress is on the initial syllable we find that stress causes an increase in pre-boundary lengthening effects. However, even if there is no stress on the pre-boundary (final) syllable, we can still see pre-boundary lengthening. These effects can not only be found in the final syllable, but also in the initial syllable (Fig. 4.4). Here we see that stress increases the difference between R1F and R1M, V1F and V1M, S1F and F1M is more than R2F and R2M, V2F and V2M, S2F and S2M. This is

probably because the final syllable also gets word final lengthening effects in both the sentence medial and final position. Since the penultimate syllable doesn't get the word final lengthening, the difference between penultimate vowel, rhyme and syllable in sentence medial and final position is more than the final vowel, rhyme and syllable.

Six mixed effects regressions were conducted with type of bilingual as an independent variable, the difference between rhyme, vowel and syllable in both syllables in sentence final and medial position (i.e. R1F - R1M, R2F - R2M, V1F - V2M, V2F -V2M, S1F - S1M, S2F - S2M) as dependent variables and subject and word as random factors. The models with the random effects were better fits than models without the random effects. The results of mixed effects regression shows that type of bilingual has no significant effect on the difference in duration in sentence final and medial position (Table 4.3).

	Estimate	**Std. Error**	***t*-value**
R1 Difference	0.001776	0.003371	0.527
R2 Difference	0.024237	0.018666	1.298
V1 Difference	0.001570	0.001706	0.920
V2 Difference	0.012135	0.008142	1.490
S1 Difference	0.002176	0.003585	0.607
S2 Difference	0.025235	0.019593	1.288

Table 4.3: Summary of the results for six mixed effects regression models for type of bilingual as an independent variable, the difference between rhyme, vowel and syllable in both syllables in sentence final and medial position (i.e. R1F - R1M, R2F - R2M, V1F - V2M, V2F -V2M, S1F - S1M, S2F - S2M) as different dependent variables and speaker and word as random factors in Indian English. Here values t>|2| can be informally considered significant (Baayen et al. 2008)

4.3.2 Hindi

In Hindi we find that like Indian English, overall the penultimate and final syllables are longer in sentence final position when compared to sentence medial position (Fig. 4.5). Final syllables get more lengthening than the penultimate syllable.

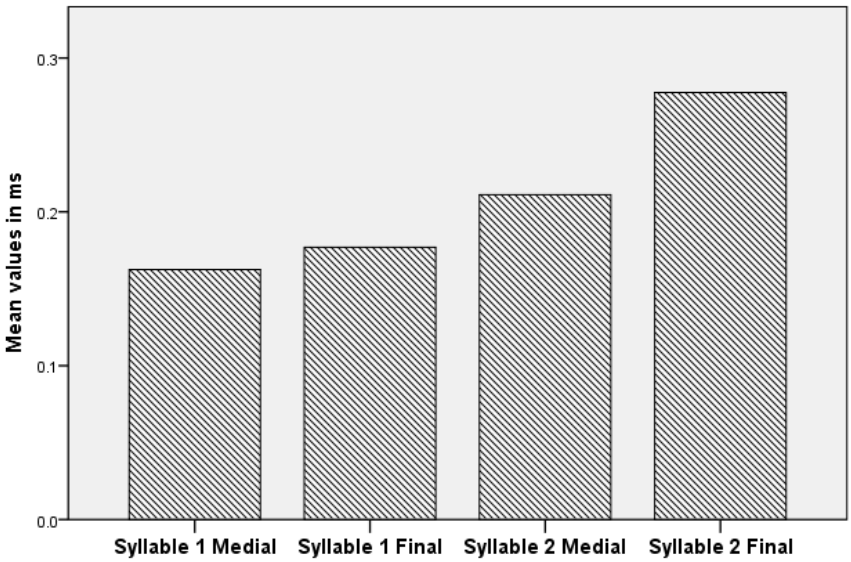

Fig. 4.5: Overall mean length of the penultimate and final syllable in sentence medial and final position in Hindi.

Paired Sample *t*-tests were conducted to see if there is a difference between R1, R2, V1, V2, S1 and S2 in sentence medial and final positions. The results of a paired sample *t*-test show that there are statistically significant differences between the duration of phrase-final vs. phrase-medial rhyme, vowel and syllable are listed in Table 4.4. The effects of lengthening can be seen more on the utterance final rhyme, syllable and vowel. However, the non-final rhyme, syllable and vowel of the utterance final word also have statistically significant lengthening. Because the outcome measures were tested in six contexts where PBL was predicted, a Bonferroni-adjusted significance level of 0.0083 was calculated to account for the increased possibility of type-I error.

	Paired Differences	***t*-values**	**Sig.**
R1F - R1M	.012250876	6.856	$p < 0.0001$
R2F - R2M	.062014460	18.575	$p < 0.0001$
V1F - V1M	.005221605	4.854	$p < 0.0002$
V2F – V2M	.060795380	10.733	$p < 0.0001$
S1F - S1M	.014503312	7.526	$p < 0.0001$
S2F - S2M	.066408478	19.035	$p < 0.0001$

Table 4.4: Paired sample t-test for R1F and R1M, R2F and R2M, V1F and V1M, V2F and V2M, S1F and F1M and S2F and S2M.

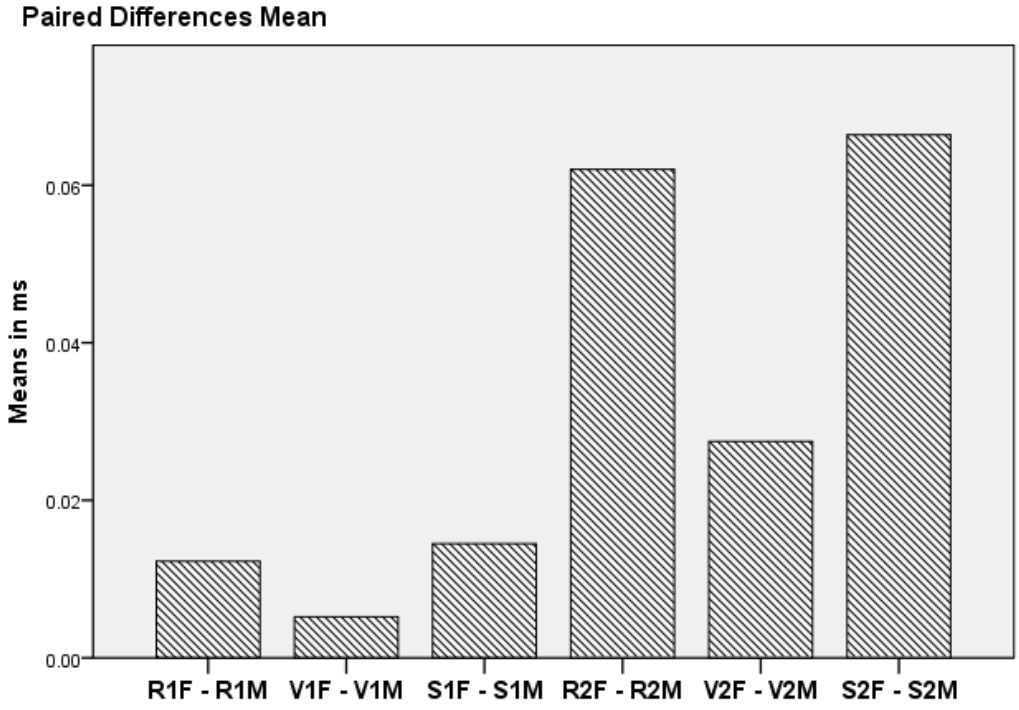

Fig. 4.6: Mean difference in duration between R1F and R1M, R2F and R2M, V1F and V1M, V2F and V2M, S1F and F1M and S2F and S2M in Hindi.

Figure 4.6 shows the differences between the means of the rhyme, vowel and syllables in sentence medial and final position. The figure shows that the highest effect of PBL can be seen on the final syllable, followed by final rhyme, followed by final vowel. There are significant differences between the duration of penultimate rhyme, vowel and syllable in sentence final and medial position. Here again the syllable has greater durational differences than the rhyme, followed by the vowel.

Position in word and sentence

Two way ANOVAs were conducted to see how the duration of rhyme, vowel and syllable are affected by the position in word (syllable 1/syllable2) and how are they affected by position in sentence (medial /final). For rhyme, significant results were found for position in word (F (1,3444)= 341.28; p=0.000); position in sentence (*F* (1,3444)= 112.34; *p*=0.000); and the

interaction between position in word and position in sentence (F (1,3444)= 50.44; p=0.000). For vowel significant results were found for position in word (F (1,3444)=823.09; p=0.000); position in sentence (F (1,3444)=111.28; p=0.000); and the interaction between position in word and position in sentence (F (1,3444)=51.54; p=0.000). For syllable, significant results were found for position in word (F (1,3444)= 437.18; p=0.000); position in sentence (F (1,3444)= 128.23; p=0.000); and the interaction between position in word and position in sentence (F (1,3444)=52.77; p=0.000).

Stress and position in word

Two way ANOVAs were conducted to see how the duration of rhyme, vowel and syllable are affected by the position in word (syllable 1/syllable2) and how are they affected by stress. For rhyme, significant results were found for position in word (F (1,3444)= 674.11; p=0.000); stress (F (1,3444)=66.44; p=0.000); and for the interaction between position in word and stress (F (1,3444)= 2297.69; p=0.000). For vowel, significant results were found for position in word (F (1,3444)= 839.68; p=0.000); and for the interaction between position in word and stress (F (1,3444)= 187.50; p=0.000). For syllable, significant results were found for position in word (F (1,3444)= 645.88; p=0.000); stress (F (1,3444)= 60.95; p=0.000); and for the interaction between position in word and stress (F (1,3444)= 1194.06; p=0.000).

Type of bilingual and position in word

Two way ANOVAs were conducted to see how the durational difference is affected by the type of bilingualism of the speaker and position in word. For rhyme, significant results were found for position in word (F (1,3444)= 274.12; p=0.000); type of bilingual (F(1,3444)=5.17; p=.02). For vowel, significant results were found for type of bilingual (F (1,3444)=4.08; p=0.04); position in word (F (1,3444)=658.77; p=0.000). For syllable, significant results were found for type of bilingual (F (1,3444)= 9.68; p=0.002); and position in word (F (1,3444)= 345.74; p=0.000).

Stress and type of bilingual

Two way ANOVAs were conducted to see if there is an effect of stress and bilingual on duration and do these effects interact. For rhyme, significant results were found for stress (F (1, 3444) = 27.69; p=0.000); type of bilingual (F (1,3444)=4.38; p=0.03). For syllable, significant results

were found for stress (F (1,3444)= 29.76; p=0.000); and the type of bilingual (F (1,3444)=8.09; p=0.004).

Figure 4.7 shows the plot for R1, R2, V1, V2, S1 and S2 differences. This figure shows that when stress increases the effect of PBL on the penultimate rhyme, vowel and syllable and also the final syllable and rhyme but not the vowel. This also shows us that late bilinguals have longer penultimate syllables, but there is no clear difference in the final syllable between the two groups.

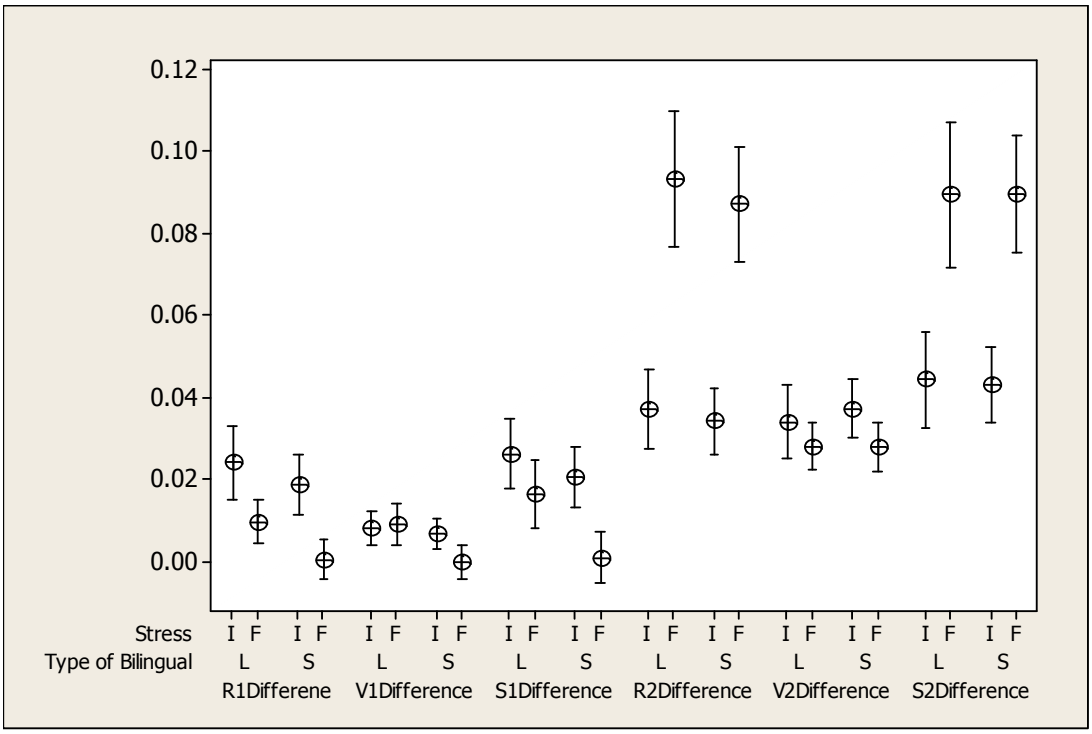

Fig 4.7: The difference between sentence medial and final position for R1, R2, V1, V2, S1 and S2 for both stress (I=initial; F=final) and type of bilingual (L=Late; S=simultaneous) in Hindi.

Six mixed effects regressions were conducted with stress as an independent variable, the difference between rhyme, vowel and syllable in both syllables in sentence final and medial position (i.e. R1F - R1M, R2F - R2M, V1F - V2M, V2F -V2M, S1F - S1M, S2F - S2M) as dependent variables and subject and word as random factors. The models with the random effects were better fits than models without the random effects. The results of the mixed effects regression show that for R1, R2, S1 and S2 stress has a significant effect on the difference between the duration in the sentence medial and final position (Table 4.5).

	Estimate	**Std. Error**	***t* value**
R1Difference	-0.017032	0.003497	**-4.871**
R2Difference	0.053534	0.005966	**8.974**
V1Difference	-0.004153	0.002139	-1.942
V2Difference	-0.007010	0.003592	-1.952
S1Difference	-0.016441	0.003697	**-4.447**
S2Difference	4.571	6.391	**7.151**

Table 4.5: Summary of the results for six mixed effects regression models for stress as an independent variable, the difference between rhyme, vowel and syllable in both syllables in sentence final and medial position (i.e. R1F - R1M, R2F - R2M, V1F - V2M, V2F -V2M, S1F - S1M, S2F - S2M) as different dependent variables and subject and word as random factors in Hindi. Here values $t>|2|$ can be informally considered significant (Baayen et al. 2008)

In terms of percentage of mean difference in R1F and R1M, R2F and R2M, V1F and V1M, V2F and V2M, S1F and F1M and S2F and S2M, when stress is on the final syllable and when stress is on initial syllable we find that stress causes an increase in pre-boundary lengthening effects. However, even if there is no stress on the syllable, we can still see pre-boundary lengthening effects. These effects can not only be found in the final syllable, but also in the initial syllable (Fig. 4.8).

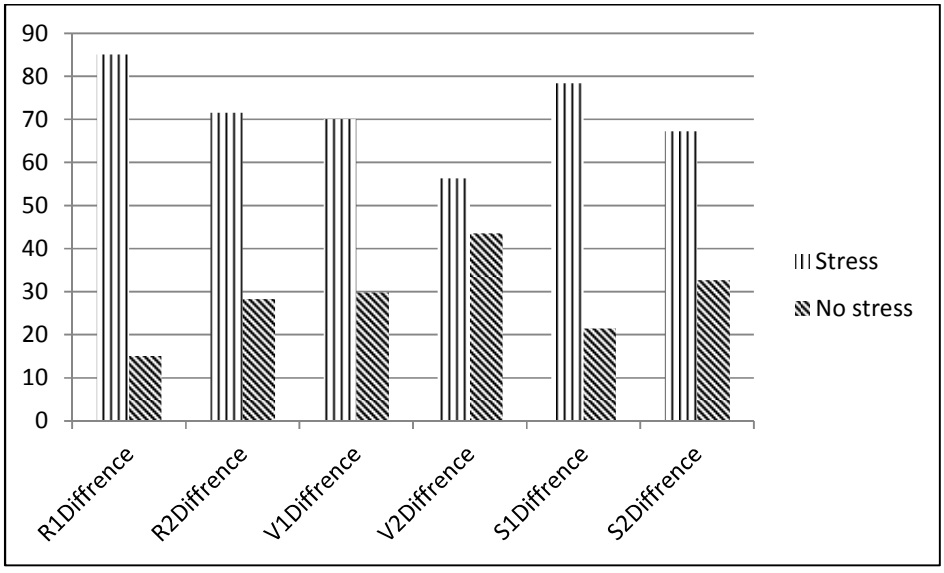

Fig. 4.8 Percentage of mean difference in R1F and R1M, R2F and R2M, V1F and V1M, V2F and V2M, S1F and F1M and S2F and S2M when stress is on the final syllable (stress condition) and when stress is on initial syllable (non-stress condition) in Hindi.

Six mixed effects regressions were conducted with type of bilingual as an independent variable, the difference between rhyme, vowel and syllable in both syllables in sentence final and medial position (i.e. R1F - R1M, R2F - R2M, V1F - V2M, V2F -V2M, S1F - S1M, S2F - S2M) as dependent variables and subject and word as random factors. The models with the random effects were better fits than models without the random effects. The results of multivariate regression (Table 4.6) shows, that being a late bilingual has a significant effect only on the difference in duration of the first syllable and first vowel in sentence final and medial position.

	Estimate	**Std. Error**	**t value**
R1Difference	-0.007121	0.003712	-1.918
R2Difference	-0.003939	0.010627	-0.371
V1Difference	-0.005113	0.002270	**-2.252**
V2Difference	-0.003191	0.006823	-0.468
S1Difference	-0.011469	0.005227	**-2.194**
S2Difference	2.795	1.117	0.003

Table 4.6: Summary of the results for six mixed effects regression models for type of bilingual as an independent variable and the difference between rhyme, vowel and syllable in both syllables in sentence final and medial position (i.e. R1F - R1M, R2F - R2M, V1F - V2M, V2F -V2M, S1F - S1M, S2F - S2M) as different dependent variables in Hindi. Here values $t>|2|$ can be informally considered significant (Baayen et al. 2008)

Although not all measures were significantly different, late bilinguals seem to have slightly longer duration differences between R1, R2, V1, S1 and S2 in sentence final and medial position than simultaneous bilinguals (see Fig 4.9).

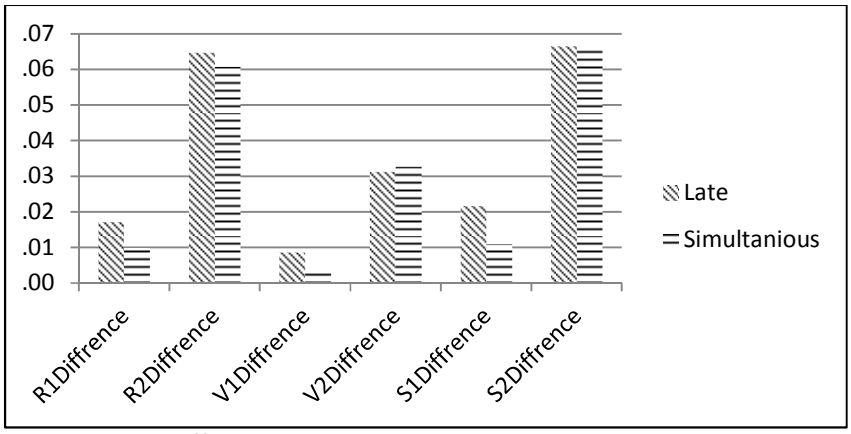

Fig 4.9: Mean difference in duration between rhyme, vowel and syllable in both syllables in sentence final and medial position (i.e. R1F and R1M, R2F and R2M, V1F and V2M, V2F and V2M, S1F and S1M, S2F and S2M) for late and simultaneous bilinguals in Hindi.

4.4 Discussion

Thus, we find that like American English (Beckman and Edwards 1990; Turk and Shattuck-Hufnagel 2006), British English (Cutler and Butterfield, 1990), Singapore English (Low and Grabe, 1999), Dutch (Hofhuis, Gussenhoven and Rietveld, 1995; Cambier-Langeveld, 2000), Swedish (Horne, Strangert and Heldner, 1995); Russian (Volskaya and Stepanova, 2004) and Hungarian (Hockey and Fagyal, 1999). both Hindi and Indian English have PBL. What is surprising is that both Hindi and English are relatively different in terms of syllable structure, prosody and intonation, yet both languages seem to have similar domains for PBL. This study shows that like American English (Turk and Shattuck-Hufnagel 2006) and Dutch (Cambier-Langeveld, Nespor and Heucen 1997) in both Hindi and Indian English the highest effects of pre-boundary lengthening can be seen in the final syllable. Pre-boundary seems to have the highest effect on the syllable, followed by the rhyme, and followed by the vowel. In both Hindi and IE, the vowels don't seem to get a lot of lengthening effects.

Another interesting finding is that like Dutch and Southern British English (Cambier-Langeveld 1997), and American English (Turk and Shattuck-Hufnagel 2006), the domain of PBL is not limited to the final syllable, both the final and the penultimate syllable see lengthening effects. The final syllable is lengthened more than the penultimate syllable i.e. the elements closer to the boundary are lengthened more than the elements further away from it. This is contrary to what was suggested by Cambier-Langeveld, Nespor and Heuven (1997) that the non-final syllables get PBL effects when the final syllable has a non-expandable vowel. In this study all the final stressed vowels were expandable, in spite of which there were PBL effects on the penultimate syllable.

Stress seems to significantly increase the effects of pre-boundary lengthening on rhyme and syllable but not vowel. The greatest effects of PBL can be seen on the stressed final syllable. However, even the unstressed final syllables get PBL. If the penultimate syllable is stressed, it has lengthening in the sentence final position. However, unlike American English (Turk and Shattuck-Hufnagel 2006), even if the penultimate syllable is not stressed, it still has lengthening, although not as much as the final syllable. This establishes that Hindi has stress.

Also, here the final rhyme of the syllable has higher lengthening effects than the final vowel in both Hindi and Indian English. Although the coda and onset consonants were not separately measured, this means that the consonants have more lengthening effects near the boundary than the vowels. A possible reason could be that the expandable vowels are displaying a ceiling effect where they cannot expand any further and the burden of the final lengthening is on the consonants. Although in this study, all the final stressed syllable vowels were expandable, it is possible that this happens so that the distinction between the short (lax) and long (tense) vowels can be maintained so that the short vowels don't sound like long vowels due to boundary lengthening (e.g. /mɪl/ 'meet' and /mi:l/ 'mile'; / ʊn/ 'those' and /u:n/ 'wool'). This is unlike American English where even expandable vowels get lengthened in pre-boundary positions.

In both Hindi and Indian English, if the penultimate syllable is stressed then we see greater lengthening effects on the penultimate syllable, than if the stress was on the final syllable. This is probably because the final syllable also gets word final lengthening effects in both the sentence medial and final position. Since the penultimate syllable doesn't get the word final lengthening, the difference between penultimate vowel, rhyme and syllable in sentence medial and final position is more than the final vowel, rhyme and syllable.

Although not all measures showed statistically significant differences, the difference in duration between medial and final position in terms of rhyme, vowel and syllable length for simultaneous bilinguals is more than that of late bilinguals for IE. However, in Hindi, although statistically significant only for the penultimate syllable, the late bilinguals have slightly longer durational differences in the rhyme, vowel and syllable in sentence medial and final position. Thus, it seems that simultaneous bilinguals don't have same kind of lengthening effects in both their L1s. However, their domains of PBL are the same in both languages. In fact there is little difference in the domains of PBL between the late and simultaneous group: both groups show PBL not only on the final syllable but also on the penultimate syllable; and both the groups show PBL effects more on the rhyme than on the vowel. Also, both show the effect of stress on PBL.

Like Turk and Shattuck-Hufnagel (2007) the results of this experiment also support the hybrid view. This study shows that PBL affects the final word (final syllable more than the

penultimate), but the phonological properties (i.e. position of stress) of the final word determine if earlier lengthening would have strong effects or not. Unlike Cambier-Langeveld, Nespor and Heuven's (1997) claim that only non-expandable final vowels force PBL effects on non-final syllables, that restriction doesn't seem to be true here. In terms of further research, looking at 3 or 4 syllable words with varying stress would help in understanding the domain and effects of PBL in Hindi and IE better.

Chapter 5

Pitch Accents

5.1 Introduction

The main objective of this experiment is to investigate if simultaneous bilinguals of Hindi-Indian English differ in their use of pitch accents from late bilinguals of Hindi-Indian English and if simultaneous bilinguals maintain two different systems of pitch accents for Hindi and English. As mentioned in Chapter 2, every non-final content word in Hindi has a LH contour (see Fig. 5.1) i.e. there is a dip in F0 followed by a rise (Harnsberger, 1994; Rajendran and Yegnanarayana, 1996; Patil, 2008). Standard British English (SBE) is the variety that is usually taken as a model by non-native speakers and New Englishes such as Indian English. There are many studies on the intonation system of SBE, however, most of these studies use the British system of labeling intonation which is different from the Autosegmental Metrical system developed by Pierrehumbert (1980) and Beckman and Pierrehumbert (1986, 1988). Grabe, Kochanski, and Coleman (2005) conducted a study on the intonation patterns of various dialects of British English. This study is based on the intonational variation in English (IViE) corpus which contains 36 hours of speech from seven urban dialects of English spoken in London, Cambridge, Leeds, Bradford, Newcastle, Belfast, and Dublin (Grabe, Post and Nolan, 2002).[7] Grabe, Kochanski, and Coleman (2005) found that Southern British English (Standard British English), speakers produce six different intonation patterns in declarative statements. Five ended in a fall (H*L %) and one ended in a fall-rise (H*L H%).[8] The most popular patterns consisted of a fall preceded by one or more pre-nuclear falls (H*L (H*L) H*L %) or preceded by one or more high pre-nuclear accents (H* (H*) H*L %).[9]

[7] The IViE transcription convention used in this study is slightly different from traditional ToBi annotation system. For instance the phonological tier (like ToBi's tone tier) collapses phrase accents and boundary tones into boundary tones alone. Unlike TOBi, in IViE, the phonetic tier gives an extremely fine-grained representation.

[8] Any tone with a % is a boundary tone.

[9] The nuclear pitch accent is the head of a prosodic phrase. It is perceived as the most prominent pitch accent in a prosodic phrase. In English it is the last pitch accent in a prosodic phrase. If there is only one pitch accent in a phrase, it is automatically the nuclear pitch accent. This term is mostly used in the British system of intonation.

Similar results were found by Estebas-Vilaplana (2000) who conducted an acoustic analysis on 72 declarative sentences produced by native speakers of BE. Estebas-Vilaplana suggests the most common pitch accent is the H* (a rising contour; see Fig. 5.2) or the H*L (rising falling contour; see Fig. 5.3). This contour could be realized either on the stressed syllable or could have a delayed peak.

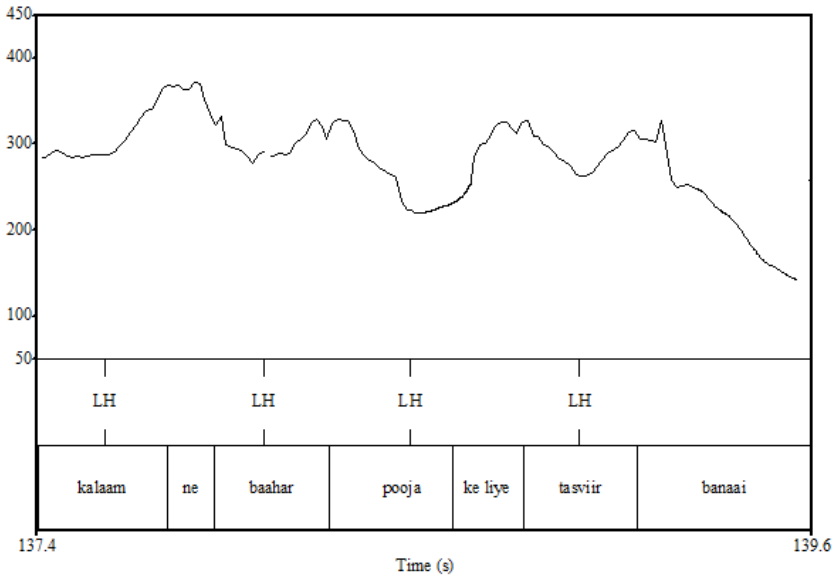

Fig. 5.1: LH on non-final content words in Hindi

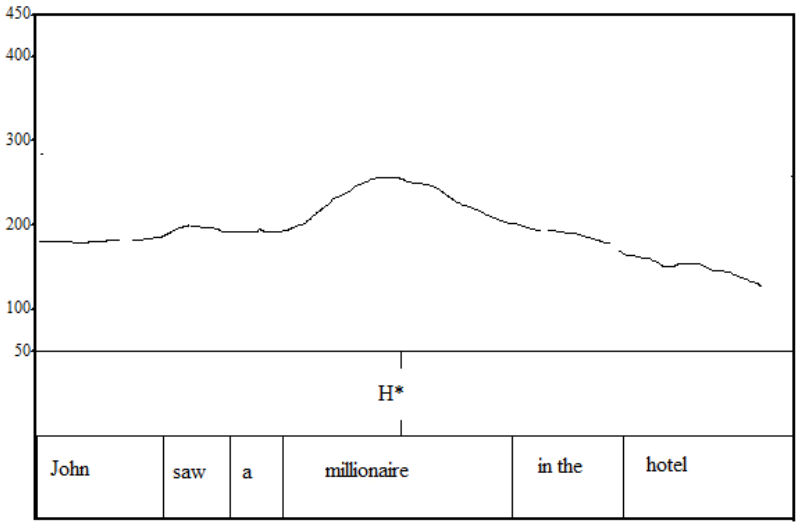

Fig. 5.2: H* Pitch accent in British English

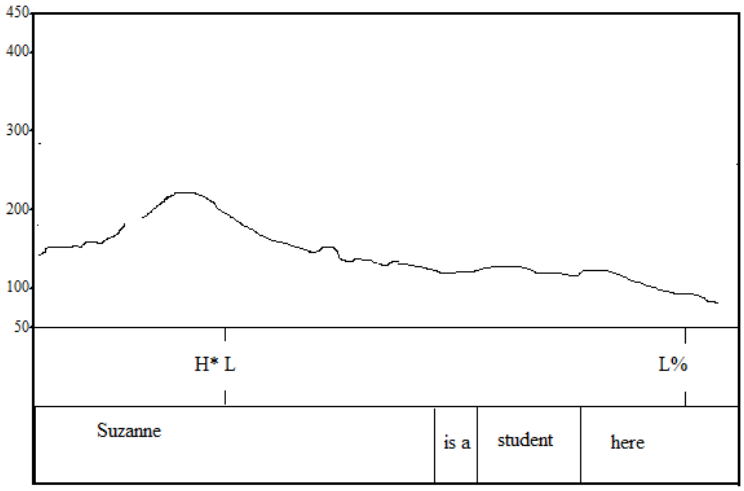

Fig. 5.3: H*+L in British English

This study aims to investigate if simultaneous bilinguals of Hindi and Indian English use only the Hindi pitch accent (LH) or a combination of the Hindi pitch accent and the most common British English pitch accent (H* or H*L) and if there is a difference between the use of pitch accents by late bilinguals and simultaneous bilinguals. The prediction is that late bilinguals use the Hindi LH contour in both Hindi and IE.

5.2 Methods

5.2.1 Speech Material

The words selected for this experiment are based on the assumptions mentioned in Chapter 3 (Section 3.5). Thirty declarative sentences were chosen for the Hindi and IE experiment. These sentences consisted of one, two and three syllable content words. Fifteen sentences consist of only one object (see 1-3 below) and fifteen sentences consist of both the direct and indirect objects (see 4-6 below). All the names used in the English sentences, were non-Indian names so that there is no influence of Hindi in the speech material.

5.2.2 Analysis

Since in Hindi, every non-final content word is known to have a pitch accent associated with it, for this study all non-final content words were selected for analysis. In American/ British English

on the other hand, pitch accents make a word more prominent than the others in a prosodic phrase. Hence the technique used for Hindi could not be used for English. For selecting English target words, two independent researchers trained in ToBi labeling were asked to label the English sentences for each speaker. The words that had any pitch accent labeled on them by both labelers were selected for the study (Kappa = 0.92, $p < 0.001$).

F0 was extracted every 5m.s. using the autocorrelation method in Praat (Boersma and Weenink, 2012) starting at the beginning of the vowel of the stressed syllable till the end of the word. The F0 counters were manually checked for errors by visually checking if the waveform, spectrogram and pitch analysis were lining up. If the precision of the pitch analysis was questionable the cycles were measured by hand using the method in Andruski & Costello, (2004). The pitch contour was smoothed using the Praat smoothing algorithm (frequency band 10 Hz) in order to avoid micro-prosodic perturbations. Linear interpolation was conducted in order to interpolate any missing F0 curves. These F0 values were then converted to the semitone scale. It is possible to convert hertz to many scales like Mels, ERB etc, however, according to Nolan (2003) semitone is the best possible option if we wish to normalize for gender. The formula used for semitone (in Fant et al., 2002):

$$\text{Semitone} = 12[\log (\text{Hz}/100)/\log 2]$$

A quadratic polynomial equation ($ax2 + bx + c$) was calculated for each pitch contour (in Hz) using a Mathematica script (Wolfram Research, 2008). The *a*, *b* and *c* coefficients for a polynomials were extracted. Using a polynomial provides a mathematically sound way of comparing rates of change in F0 for different speakers. According to Andruski & Costello, (2004) and Simonet, (2009) the three coefficients in a quadratic equation have a straightforward interpretation. The *b*- and *a*-coefficients together indicate the shape and direction of the curve and the *c*-coefficient is the *y*-intercept. The *a*-coefficient indicates how wide or narrow a curve of the parabola is and whether the parabola is convex or concave and the *b*-coefficient describes the slope of the tangent to the pitch contour at the *y*-intercept. The Hindi LH contour can be described as a concave curve and the combination of the coefficients would be +a -b (Fig. 5.4). The H* or a H*L pitch accents that are characteristic of BE can be described as a convex curve

and the combination of the coefficients would be -a +b (Fig. 5.5). The +a +b is a rising curve (Fig. 5.6) and –a –b is a falling/convex falling curve (Fig. 5.7).

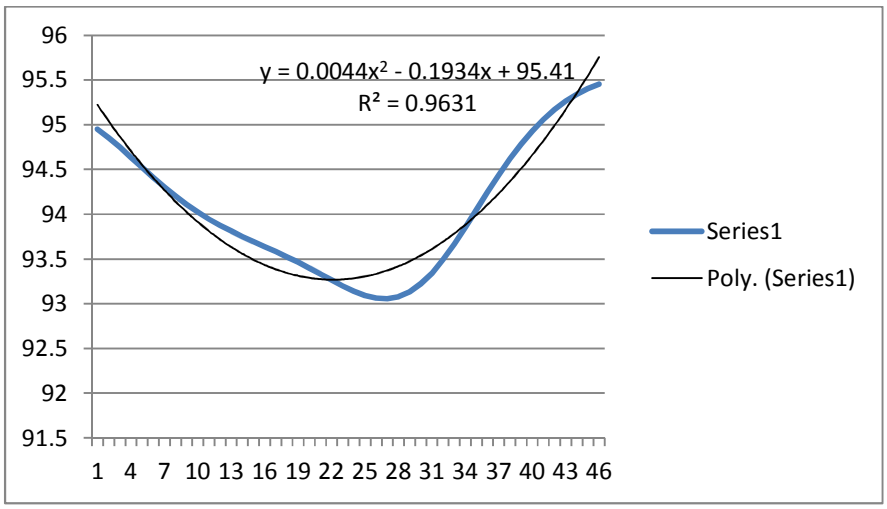

Fig.5.4: +a –b → concave curve like Hindi LH for '*ki:n*' in the word *nəmki:n*

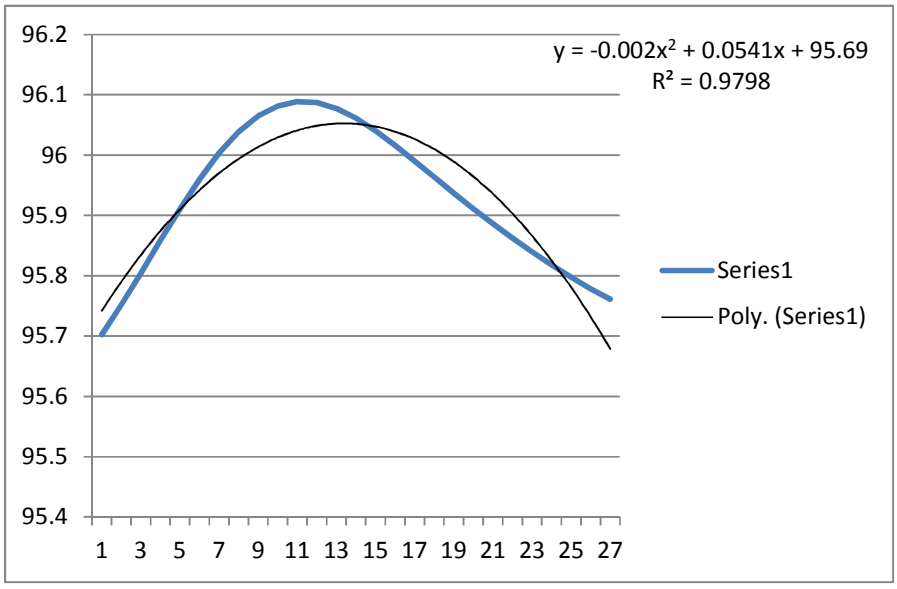

Fig. 5.5: - a + b→ convex curve/ rising convex like English H* / H*L in the word '*pu:məm*'

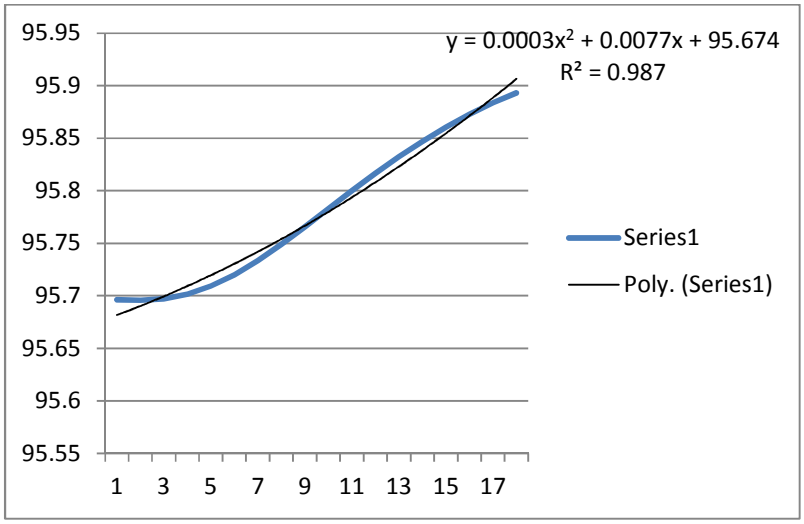

Fig. 5.6: +a +b → rising curve on the word '*gi:ta:*"

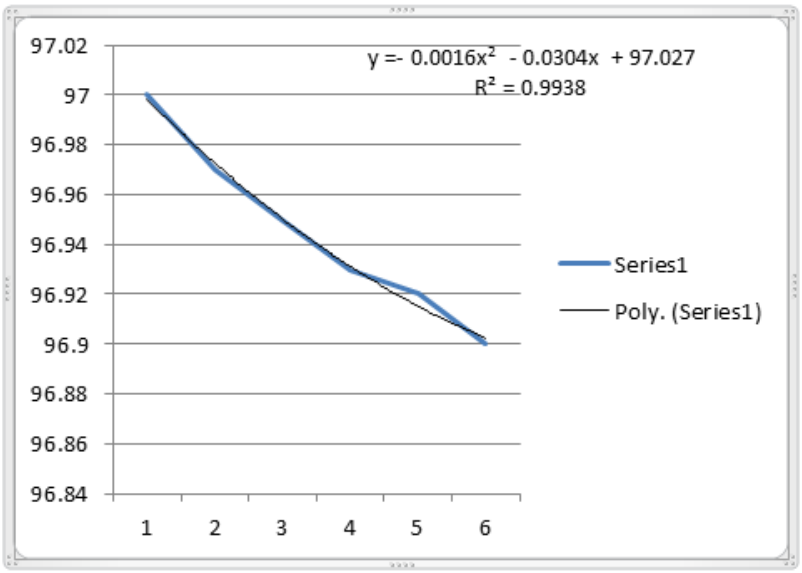

Fig 5.7: -a –b → falling / convex falling curve on the word "*ri:na:*"

These polynomial equations do not directly translate into pitch accents however they provide a quantitative model. R^2 values were analyzed to find the goodness of fit of the polynomials. The R^2 value (also referred to as the coefficient of determination) for the fit, indicates the percent of the variation in the data that is explained by the model. R^2 varies between 0 and 1, with values near 1 indicating a better fit to the actual pitch contour. R^2 values below 0.9 were rejected. Thus, in Hindi, 203 tokens were excluded for either pitch halving/ doubling or low R^2 values (n=1957). For IE 56 tokens were excluded due to low R^2 values and the words that had pitch

halving/doubling errors were automatically not included by the labelers (n=1462). The total number of tokens are much less in IE than Hindi because in Hindi every non-final content word was selected, but in IE only the words with any pitch accent on them were selected.

5.3 Results

5.3.1 Hindi

The results of the chi-square show that there is no difference between the late and simultaneous group (χ^2 = 6.071, 3; *p*-value = 0.108). The results show that in Hindi, both the late and simultaneous bilinguals use only the LH pitch contour, which is typical of Hindi (see Fig. 5.8).

	Concave +a –b	**Convex - a + b**	**Slope up +a +b**	**Slope down -a-b**
Late	98.93%	0.6069%	0.4552%	0
Simultaneous	94.60%	1.0785%	3.7750%	0.5392%

Table 5.1: Percentage of type of curves used by late and simultaneous bilinguals in Hindi

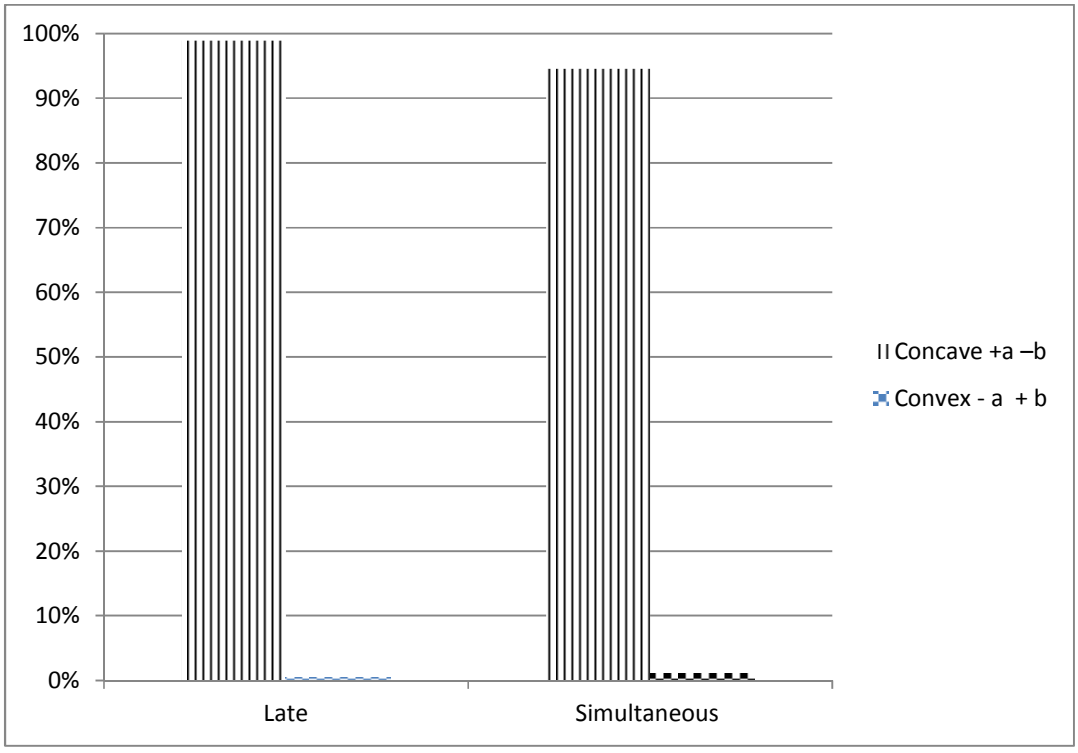

Fig. 5.8: The use of concave and convex curves by late and simultaneous bilinguals in Hindi

5.3.2 Indian English

The results of the chi-square show that there is the late and simultaneous group are different in their use of convex and concave curve (χ^2 = 84.887, 3; *p*-value = 0.0001). The results show that in Indian English, both the late bilinguals use only the LH pitch contour, but the simultaneous bilinguals use both the Hindi LH pitch contour and the British English H*/H*L pitch contour (see Fig. 5.9). Looking at the data it seems that the (+a +b) were probably LH contours that failed to produce a dip.

C`	**Concave +a –b**	**Convex - a + b**	**Slope up +a +b**	**Slope down -a-b**
Late	90.52%	1.4%	7.78%	0.21%
Simultaneous	77.81%	17.02%	3.85%	1.31%

Table 5.2: Percentage of type of curves used by late and simultaneous bilinguals in Indian English

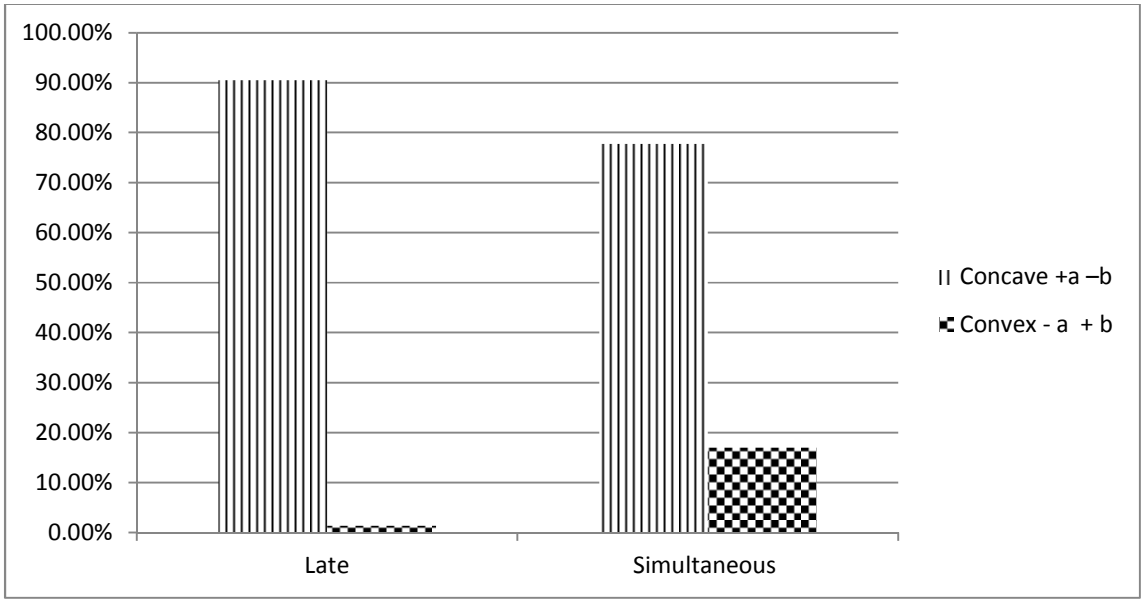

Fig. 5.9: The use of concave and convex curves by late and simultaneous bilinguals in Indian English

5.4 Discussion

We see that in Hindi both late and simultaneous bilinguals use only the Hindi LH pitch accent (i.e. +a –b coefficients). In Indian English, the late bilinguals still use the LH pitch contour typical of Hindi (Fig. 5.10), but the simultaneous bilinguals use both the Hindi LH and in a limited way (17% of the time) use the British English H*/H*L.

The results of this study show that the late bilinguals are restricted to the contour that has a positive *a*- coefficient and a negative *b*- coefficient in both Hindi and Indian English. This contour is what is described as a scoop or a concave curve in Figure 5.10.

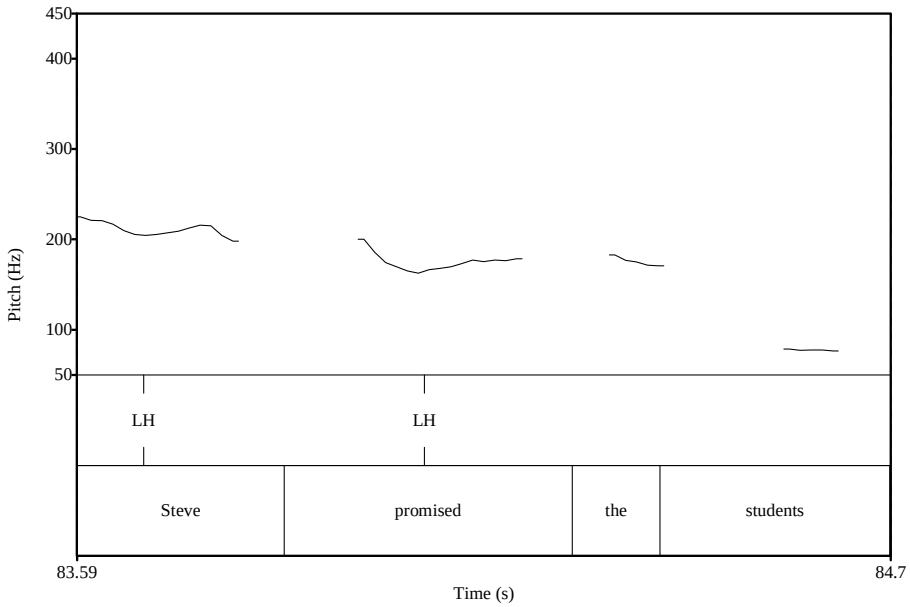

Fig. 5.10: LH pitch contour used in Indian English by a late bilingual.

There are three main patterns in the use of the H*/H*L by the simultaneous bilinguals: First, H*/H*L occurs on non-final content words, as in British English, and parallel to the use of LH in Hindi on every non-final content word (Fig. 5.11).

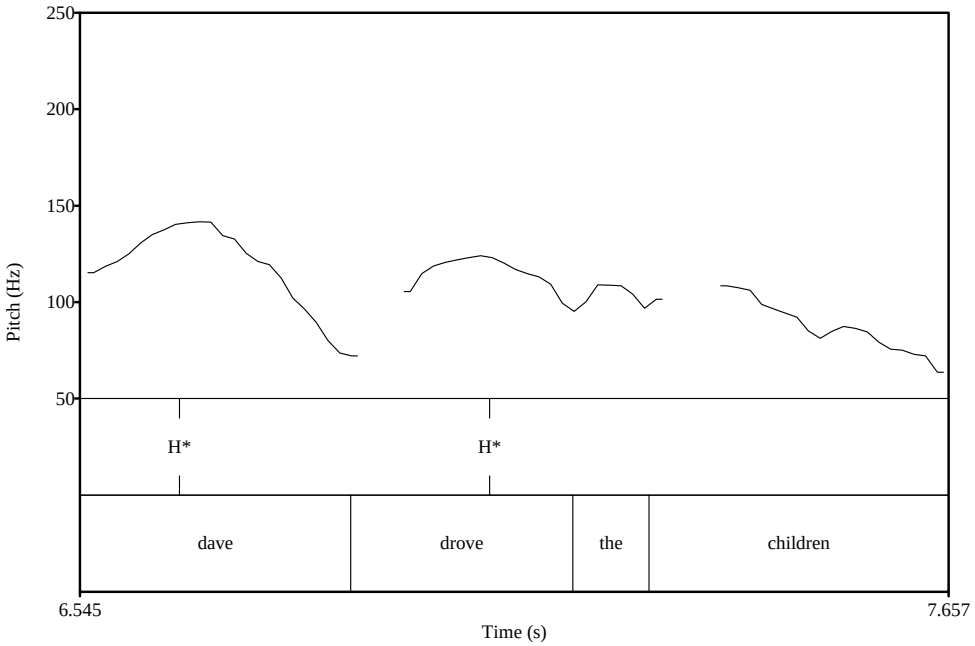

Fig 5.11: H*/H*L on every non-final content word in Indian English by a simultaneous bilingual.

Second, H*/H*L occurs in combination with LH (Fig. 5.12 and 5.13)

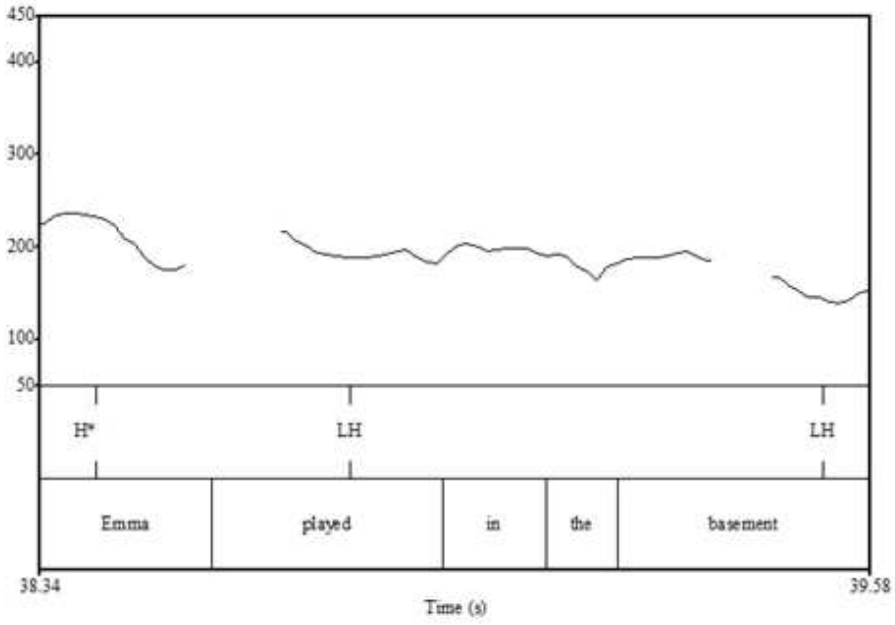

Fig 5.12 H* in the speech of a simultaneous bilingual in Indian English

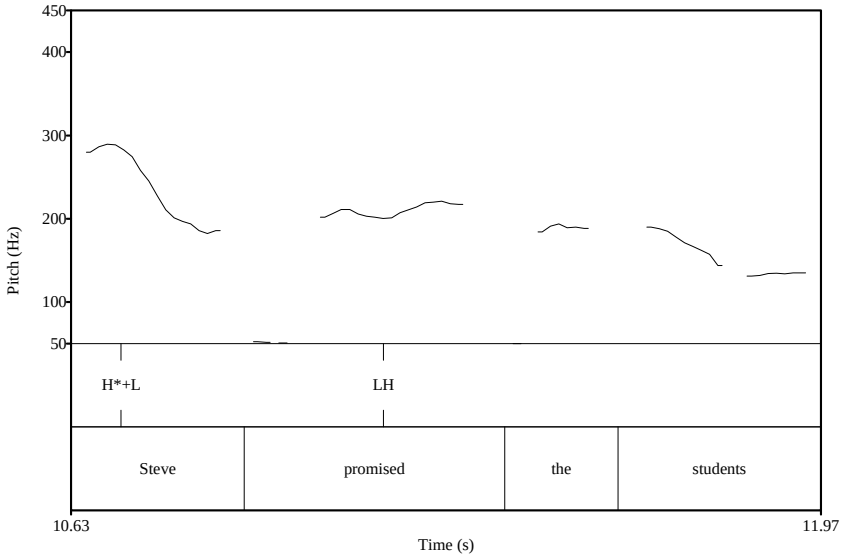

Fig 5.13 H*+L and LH in the speech of a simultaneous bilingual in Indian English

The third context in which H*/H*L occurs is as the only pitch accented word in the sentence (Fig. 5.14, 5.15)

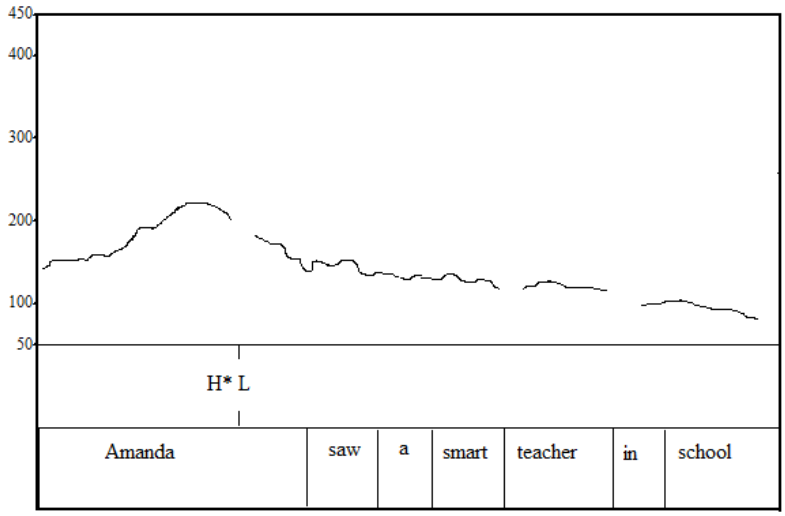

Fig 5.14 H*+L in the speech of a simultaneous bilingual in Indian English

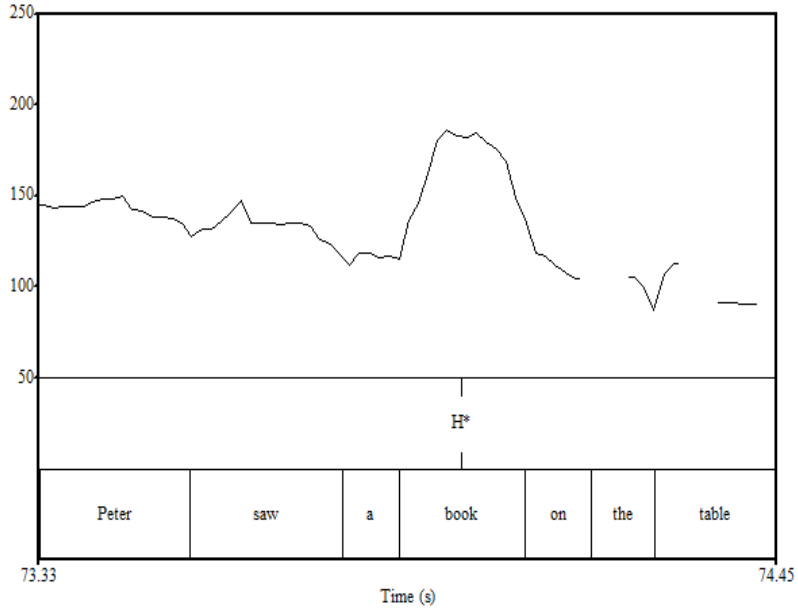

Fig 5.15 H* in the speech of a simultaneous bilingual in Indian English

When we look at the data carefully, only 5 simultaneous bilinguals seem to be using the combination of LH and H*/H*L in their speech. All these participants went to convent schools in Delhi. As mentioned earlier, many convent schools in India are very particular about English pronunciation and diction. Also, in some cases the teachers are British. Possibly, there are still some remnants of British English in India that are a part of the educated Indian English. The use of H*/H*L could also reflect on the exposure to American and British English speakers in broadcast music, movies and TV shows, which these simultaneous bilinguals enjoyed as reported in the language questionnaire (Appendix 1).However, there were 2 other simultaneous bilinguals who were from convent schools and were fond of American/British music, TV shows and movies but did not have any H*/H*L in their speech. These two speakers also reported using comparatively less English than the other participants (Participant 17 and 23 in Table 5.3). Thus, it seems that many factors contribute in the use of both LH and H*/H*L in IE. In the next section I outline some of the observations made about the Hindi LH contour.

Participant	Simultaneous/Late	Gender	age	School Type	Hindi use	English use
2	Simultaneous	Male	34	Convent	11.1%	88.9%
4	Simultaneous	Female	31	Convent	22.3%	77.7%
9	Simultaneous	Female	34	Convent	11.2%	88.8%
17	Simultaneous	Female	23	Convent	33.3%	66.6%
23	Simultaneous	Female	26	Convent	44.5%	55.5%
25	Simultaneous	Male	19	Convent	11.2%	88.8%
28	Simultaneous	Male	22	Convent	22.3%	77.7%

Table 5.3: Participant profile of Simultaneous bilinguals who went to Convent schools

Observations about Hindi LH contour

For Hindi, it has been reported in the literature that every non-final content word has a LH on it, however it was noted that for the simultaneous bilinguals sometimes the final content word also has a LH. Another important observation is that in Hindi for all the speakers, the L part of the LH contour always anchors on the metrically strongest syllable in the word (on 'taar' in 'sitaar' musical instrument in Fig. 5.16; on 'taap' in 'Prataap Fig. 5.17; on 'baa' in 'dabaane' Fig. 5.18 and on 'raa' in 'raanu' Fig. 5.19). Some words that have more than one super-heavy syllable in a word, sometimes get two LH contours. In monosyllablic words, the entire word gets a LH. In two syllable words that have two light syllables, then again the entire word gets the LH and the L is anchored on the penultimate syllable.

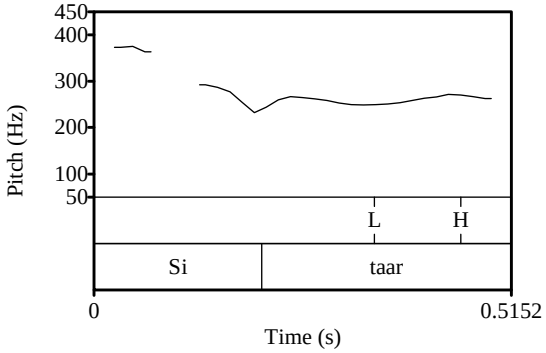

Fig. 5.16: L anchored on 'taar' in the word "sitaar" (musical instrument).

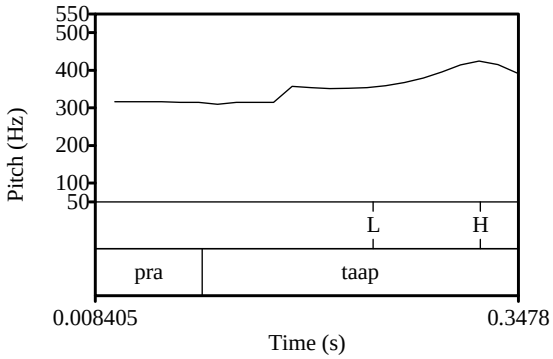

Fig. 5.17: L on ‘taap’ in ‘Prataap’ (proper name)

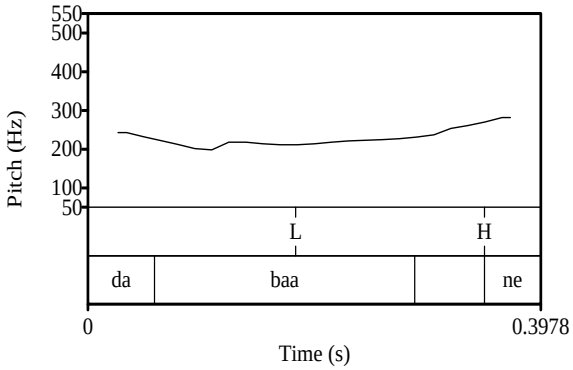

Fig. 5.18: L on ‘baa’ in ‘dabaane’ (to suppress)

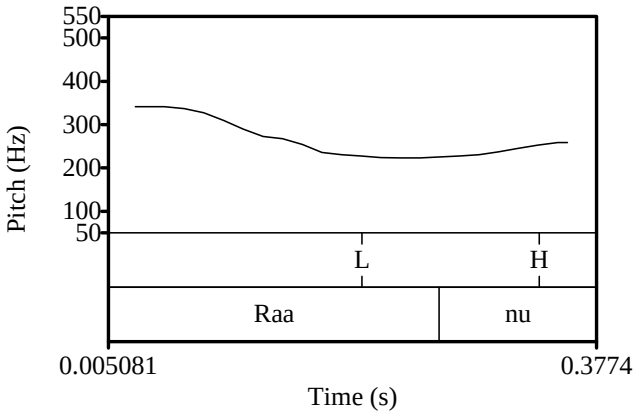

Fig. 5.19: L on ‘raa’ in ‘raanu’ (proper name)

A monosyllable word or a final super-heavy syllable that is followed by a one-word post-position, then the H part of the LH contour is realized on post-position (Fig. 5.20, Fig. 5.21). If

there is no post position, then in a super-heavy final syllable, the H part of the contour is realized within the syllable (Fig. 5.16). Two word post-positions sometimes get their own LH contour but in some cases they don't get any contour.

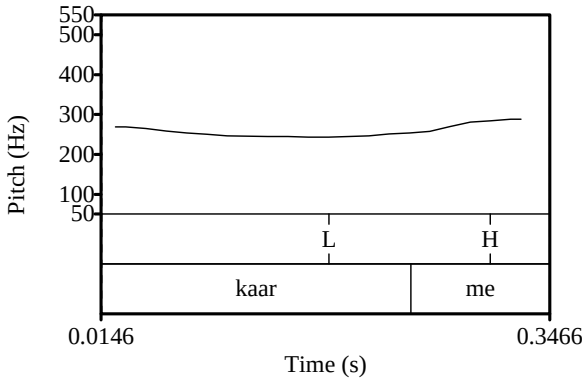

Fig. 5.20: L on 'car' (car) an H on the post position 'me' (in)

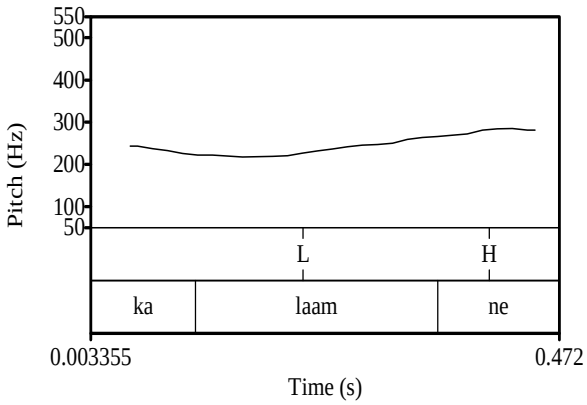

Fig. 5.21: L on 'laam' and H on the post position 'ne' in kalaam ne (Proper name Erg.)

If the syllable is super-heavy and penultimate, the H part of this contour is achieved on the next syllable (Fig. 5.22).

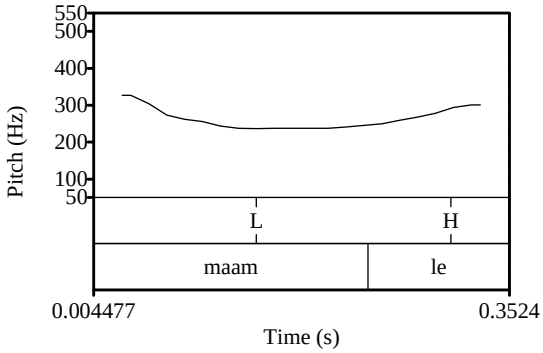

Fig. 5.22: L on ‘maam’ in ‘maamle’ (matter)

In words with two heavy syllables the penultimate syllable gets the L (Fig. 5.23).

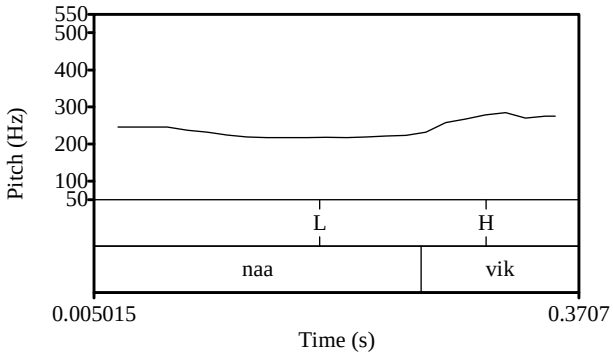

Fig. 5.23: L on ‘naa’ in ‘naavik’ (boat man)

Chapter 6
Focus

6.1 Introduction

Focus highlights some information in a given utterance as more important (Gussenhoven, 1983; Ladd, 1996). It indicates to a listener that the focused element should be paid attention to. Ladd (1996) distinguishes between narrow focus and broad focus. N*arrow focus* is focus on a particular part of an utterance. For instance, if the answer to the question "What did they give you for this experiment?" is "they gave me MONEY", here the word "money" is new information and hence gets the *narrow focus*. This is in contrast with *broad focus* which can occur on the level of the larger constituent or the whole utterance (Ladd, 1996). Ladd explains that "the difference between broad and narrow focus is a matter of degree" p. 215. He further explains that this difference can only be understood in a context and is based on the communicative intent of the speaker. A subset of narrow focus is *contrastive focus* (Ladd, 1996). Contrastive focus indicates an exclusive selection of a word/phrase out of other possibilities. For instance, if the answer to the question "Did John buy this book" is "No BILL did" then "Bill" indicates an exclusive selection out of other possibilities (here *John*) and hence is contrastive focus. Words or phrases that carry new or important information in a given discourse are focused either by syntactic, morphological or intonational means.

In languages like English, focus manifests itself via a process of placing a pitch accent on the focused element. [10] When a pitch accent occurs on a word containing more than one syllable, the accent occurs on the lexically stressed syllable, making it more salient in terms of increase in duration (Cooper et al., 1985), amplitude (Wells, 1986; Toledo, 1989) and an increase in

[10] In order to explain why sometimes a single word is selected to get a pitch accent when the focus is intended to be on the whole sentence, different theories have been proposed: Bolinger's (1972, 1985) theory is called the "radical Focus-To-Accent view" by Ladd 1996. This theory claims that there is no focus projection beyond the word on which the focus is placed on. Another view proposed by Gussenhoven (1983), Ladd (1983), and Selkirk (1984) called the "Restricted Accent to Focus projection" suggests that arguments can project focus to adjacent predicates but these predicates can remain unaccented. Another view proposed by Schmerling (1976) called the "Extended focus projection" allows focus to be projected upward to larger constituents and ultimately to the sentence.

fundamental frequency (Fry 1958, Gay 1978) in comparison with other constituents in the utterance (see Rietveld, Kerkhoff, and Gussenhoven, (2004) for Dutch; Dohen and Loevenbruck, (2004) for French). Xu and Xu (2005) found that in American English declarative sentences, narrow focus is realized by expanding the pitch range of the on-focus stressed syllables, suppressing the pitch range of post-focus syllables, and leaving the pitch range of pre-focus syllables largely intact. It has also been shown that words in the post-focal position are shorter than the same word in broad focus conditions (Erickson and Lehiste 1995).

In languages such as Greek (Arvaniti and Baltazani, 1999) and European Portuguese (Frota, 1993) narrow and broad focus is differentiated by the use of different pitch accents. For instance, Frota (1993) suggests that European Portuguese uses HL* for the nuclear accent on broad focus and H*L for narrow focus (in Estebas-Vilaplana, 2000). In English interrogatives, focus is realized with a low tone (L*) followed by a high plateau (the sequence of H- and H%). Here the F0 reaches its peak near the end of the following word. In declarative sentences on the other hand focus is realized with a high tone (H*) followed by a low plateau (the sequence of L- and L%). In both cases, any pitch accent after the focused element is deaccented (Beckman, and Pierrehumbert, 1986; Pierrehumbert, 1980; Ueyama and Jun 1998). [11] According to Ladd (1996) deaccenting is the "reversal of relative strength in a metrical tree" (p.229). It is indicated by a lack of a pitch accent.

As mentioned earlier, Hindi is a head-final language with SOV word order. The pre-verbal position is usually considered the focus position. In terms of acoustic correlates of focus in Hindi, focus has been associated with bigger pitch excursion and longer duration on the stressed syllable of the focused word (Dyrud, 2001; Genzel and Kügler, 2010) and post focal pitch compression (Patil et al 2008). However, unlike English, amplitude doesn't seem to be an acoustic correlate of focus in Hindi (Dyrud, 2001). It has been suggested that like English, it is the stressed syllable that exhibits the greatest acoustic effects of focus. For instance, Genzel and Kügler, (2010) suggest that in di- and trisyllabic Hindi focus words the quantitatively strong syllables contribute more to the lengthening effects than the unstressed syllables. It has also been

suggested that the pitch range becomes compressed after the focused element (Harnsberger and Judge, 1996; Moore, 1965; Harnsberger, 1994; Patil et al. 2008). However, it is still possible to have a rising pitch accent on content words in post-focal position (Patil et al. 2008). Patil et al. suggest that this contrasts with other languages like English, German and Dutch where deaccentuation of post-focal material is compulsory. However, in certain languages like Spanish (Garcia-Lecumberri, 1995); Maltese (Vella, 1995); and Neopolitan Italian (D'Imperio 1997), post-focal material is not obligatorily deaccented.

There is disagreement in the literature about a bigger pitch excursion being a correlate of focus in Hindi. Genzel and Kügler (2010) report, that in a focused word, the LH pitch contour has a lower L and higher H tone when compared to non-focused words. This results in a bigger pitch spam. On the contrary, Patil et al. (2008) suggest that with the exception of initial subject focus in SOV sentences, focus does not affect the pitch excursion and duration of the focused elements. Patil et al. suggest that each constituent forms its own prosodic domain, of the size of a prosodic phrase. Non-final prosodic-phrases have a rising pattern (LH) and the final ones have a falling pattern. This structure is not changed by focus. Thus, focus does not introduce a different pattern of phrasing; the prosodic phrases are in a strict downstep relationship that cannot be disturbed. They suggest that focus is expressed with post-focal compression of the pitch range and that the global downstep pattern is more important than local register changes introduced by focus. This is unlike other intonational languages like German where the downstepped accents are always interrupted by focus which is realized with an upstep or the raising of the high tone on the focused word.

Patil et al.'s (2008) argument seems to be based on only one type of sentence structure in Hindi, namely the perfect aspect with transitive verbs. The perfect aspect with transitive verbs, obligates a post-position after the subject and after an animate object. All the sentences used in Patil's study have the same post-position after the subject (*ne*- ergative case) and after the object (*ko*- accusative case). On the other hand, Genzel and Kügler (2010), examined the perfect aspect sentences, but the objects were preceded by an adjective. Genzel and Kügler, tested the F0 patterns of the adjectives whereas Patil et al. tested the F0 patterns on the main object or subject.

This could be one of the reasons why the results of Patil et.al. (2008) are different from those of Genzel and Kügler, (2010).

There is very little said about focus in Indian English. Sailaja (2003) notes a tendency of Indian speakers to focus on all the content words of an utterance. Sailaja does not provide any data or references for this observation. It is possible that this could have been suggested because as Wiltshire and Harnsberger (2006) note, every non-final content word is assigned a LH pitch accent. This pitch accent assignment could have been confused with focus.

As we have seen in Chapter 2 there can be language interaction in bilinguals in focus conditions as well. For instance McGory (1997) conducted a study on the production of American English by Korean and Mandarin L1 speakers. McGory used various words that differ in stress placement in focus and non-focus conditions. The results of this study show that both Korean and Mandarin speakers produced stressed syllables in both accented and unaccented conditions with higher pitch values when compared to American English speakers. Similarly, O'Rourke's (2005) comparison of native monolingual Quechua and monolingual Spanish speakers with Quechua-Spanish bilinguals in broad and contrastive focus sentences suggests that Spanish monolingual speakers have a late peak alignment in pre-nuclear accents (as reported in the literature) and Quechua speakers have early peak alignments. Bilingual speakers show pre-nuclear peak alignment, peak alignment, and a compressed post focal range, some of which have not been reported for Spanish but are present in Quechua. Thus, according to O'Rourke Quechua-Spanish bilinguals show evidence of language interaction in focus positions. Similarly, Simonet's study on (2008) Catalan-dominant and Spanish-dominant bilinguals show that there is evidence of language interaction in broad focus read-aloud declarative sentences. These bilinguals use intonational patterns that are intermediate between those used in their L1 and in their L2 by other subjects.

Thus, the objective of this experiment is to investigate the acoustic correlates of focus used by late and simultaneous bilinguals of Hindi and English and to explore if there is any difference between the late and simultaneous group. This study also aims to explore if simultaneous bilinguals of IE-Hindi use one or two systems for their two L1s (qualitatively from overall

observations). As mentioned earlier, the main acoustic correlates of focus in American/British English are duration, amplitude and F0 and in Hindi are duration, F0 excursion and post-focal pitch compression. In the present study, I look at duration, RMS amplitude and F0 excursion in broad focus, narrow focus and post-focus declarative present tense, past tense and perfect aspect (both transitive and intransitive verbs) Hindi and English sentences, to explore if there are any differences in the two bilingual groups and to understand the acoustic correlates of IE and Hindi.

6.2 Methods

Speech Material

In order to elicit broad focus, narrow focus and post-focus, in this experiment I use the data elicitation method in Cole et al. (2010). For each target word, the data set consists of 3 question-answer pairs that the speakers read in quick succession. The first question-answer pair consists of a broad focus condition which elicits 'new information'. The second question-answer pair consists of the narrow focus condition. The third question-answer pair consists of focus on the adjective preceding the target noun. This would elicit given information on the target word in post-focus condition. For instance see 1 and 2 where the underlined words are the target words and the words in bold are the focused words.

English

1. Broad Focus (new information):
   Q: What happened?
   A: The man bought a white cap for this wife

Contrastive focus:
   Q: Did you say the man bought a white dress for his wife?
   A. No, the man bought a white **cap** for his wife.

Postfocus (given information):
   Q: Did you say the man bought a black cap for his wife?
   A. No, the man bought a **white** cap for his wife.

Hindi

2. Broad Focus (new information):
   Q: "kja: hʊa:?"
      What to be-past
      What happened?
   A: "a:d̪mi: ne ʌpni: bi:ʊi: ke lɪje ik səfeɖ̪ 'sa:bʊn k^{h}əri:d̪a:"
      Man Erg. own-fem.sg. wife for one white soap bought-mas.sg.
      The man bought a white soap for his wife.

Contrastive focus:

Q: kja: tʊmne kəha: kɪ a:d̪mi ne ʌpni: bi:ʋi: ke lɪje ik səfeɖ̪ kʊrtɑ: k^{h}əri:d̪a:?
Did you-Erg. say that man-Erg. own wife for one white shirt-mas.sg. bought-mas.sg.
Did you say the man bought a white shirt for his wife?

A: nəhĩ a:d̪mi ne əpni: bi:ʋi: ke lɪje ik səfeɖ̪ '**sa:bʊn** k^{h}əri:d̪a:
No man-Erg. own wife for one white soap bought-mas.sg.
No, the man bought a white SOAP for his wife.

Postfocus (given information)

Q: kja: tʊmne kəha: kɪ a:d̪mi ne ʌpni: biʋi: ke lɪje ka:la: sa:bʊn k^{h}əriɖ̪a:
Did you-Erg. say that man-Erg. own wife for black soap bought-mas.sg.
Did you say the man bought a black soap for his wife?

A. nəhĩ a:d̪mi ne ʌpni bi:ʋi: ke lɪje ik **səfeɖ̪** 'sa:bʊn k^{h}əri:d̪a:
No man-Erg. own wife for one white soap bought-mas.sg.
No, the man bought a WHITE soap for his wife.

In all the three conditions (broad focus, narrow focus and post-focus), I extract the same target word (here 'cap' in English and 'sa:b**ʊ**n' in Hindi). There are a total of 25 target words (25*3 focus positions) for each language: 10 two-syllable (5 with stress on final and 5 with stress on penultimate) and 15 three-syllable target words (5 with stress on final, 5 with stress on penultimate and 5 with stress on antepenultimate). In Hindi the location of the target words in the sentence was the same for the target words i.e., pre-verbal in Hindi. All the target words are nouns and are direct objects. The response sentences varied from present tense, past tense and perfect aspect (transitive and intransitive verb). Although obtaining duration measures following a voiced consonants is not as clear cut as between voiceless consonants, in this study voiced consonants were included in the coda of target syllables in order to not lose the F0 contour due to voicelessness (F0 measures were taken starting at the vowel). The target syllables also consisted of nasal consonants.

Measurements

The duration and amplitude measures were extracted from the stressed vowels of the target words in all three conditions using Praat (Boersma and Weenink, 2012). Duration measures were extracted from the start to the end of the stressed vowels. The target vowels were identified from the onset and offset of voicing from the spectrogram. For vowels flanked by nasal consonants, the edge of the vowel was specified as the period whose amplitude was 20% the maximum

amplitude of the vowel (Shosted, 2012). Duration measures for vowels in CVV or CV were measured till the location where Praat's formant tracker fails to find a second formant. For vowels that follow stop consonants, the consonant release burst and any aspiration were considered part of the vowel's duration. However, the following stop consonant's closure and release were excluded. Here n=2250 for both Hindi and IE.

RMS Amplitude is a common technique used in measuring amplitude in focus conditions (Ménard et al. 2007). RMS amplitude is calculated by first taking a square of each sample; then the mean of the squares is calculated; and then, the square root is taken. RMS amplitude was calculated for vowels of the stressed syllable of all the target words in each condition. Here n=2250 for both Hindi and IE.

In order to measure F0 excursion, F0 measurements were extracted from the start of the beginning of the stressed syllable's vowel and ending at the end of the syllable in each focus condition. The F0 was smoothed and linear interpolation was conducted using Praat. Then the minimum and maximum F0 was calculated. The mean and standard deviation of the utterance for each speaker was calculated. The minimum and maximum F0 were then normalized using the following formula:

$$Normalized\ F0 = \frac{\text{F0} - \text{mean}}{\text{Standard Deviation}}$$

F0 range was calculated by subtracting the normalized maximum F0 from the normalized minimum F0:

F0 range= Normalized maximum F0- Normalized minimum F0

In order to exclude F0 maximums due to spillover from a preceding H tones (of a LH), only F0 maximum that followed a F0 minima were measured. Also, words that had pitch halving/doubling were excluded. Thus for F0 excursion n= 1917 in Hindi and n= 1965 in English.

6.3 Results

Indian English: Duration

Overall there is a difference between the duration of broad focus, narrow focus and post-focus in Indian English (Fig. 6.1). Although as we see in Table 6.2 a statistically significant difference is found between narrow focus and post-focus but not narrow focus and broad focus.

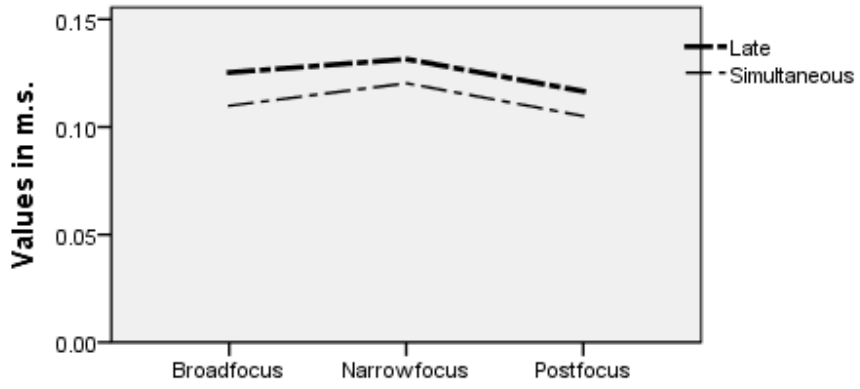

Figure 6.1: Overall mean duration for IE in broad focus, narrow focus and post-focus in Indian English

A two-way ANOVA was conducted with type of bilingual and focus conditions as independent variables and duration as the dependent variable (n=2250). For Indian English the results of ANOVA show that there is a significant difference between late and simultaneous bilinguals in the duration. There is also an overall difference between broad focus, focus and post-focus duration, but there is no interaction between the type of bilingual and focus conditions (Table 6.1).

	Df	Sum Sq.	Mean Sq.	*F* value	Pr (>F)	Sig.
Type of bilingual	1	0.08071	0.08071	10.32	0.0033	**0.01**
Focus conditions	2	0.08682	0.04341	43.434	4.08e-12	**0.001**
Focus conditions: Type of bilingual	2	0.00188	0.00094	0.942	0.396	

Table 6.1 Results of ANOVA for IE duration

A mixed effects regression was conducted with type of bilingual and focus conditions as independent variables and duration as the dependent variable. Here we see the duration of focused vowels is longer than that of post-focus vowels but not broad focus vowels (Table 6.2).

Here the model with the random effects was a better fit than the model without the random effects.

	Estimate	Standard Error	*t*-value*
Intercept (Narrow focus)	0.1315111	0.0037522	35.05
Narrow focus: Broad focus	-0.0062086	0.0033017	-1.88
Narrow focus: Post-focus	-0.0149544	0.0033017	**-4.53**
Type of bilingual	-0.0112278	0.0045961	**-2.44**
Narrow focus: Broad focus: Type of bilingual	-0.0042431	0.0040451	-1.05
Narrow focus: Post-focus: Type of bilingual	-0.0002647	0.0040451	-0.07

Table 6.2: Results of mixed effects regression of IE duration with narrow, broad and post focus and type of bilingual as an independent variables, duration as dependent variable and speaker and word as random factors. Here values t>|2| can be informally considered significant (Baayen et al. 2008).

Indian English: RMS Amplitude

Overall there is no difference in means of the RMS amplitude of focused vowels and broad focus vowels. However both the narrow and broad focus vowels have higher RMS amplitude than post-focus vowels (Figure 6.3).

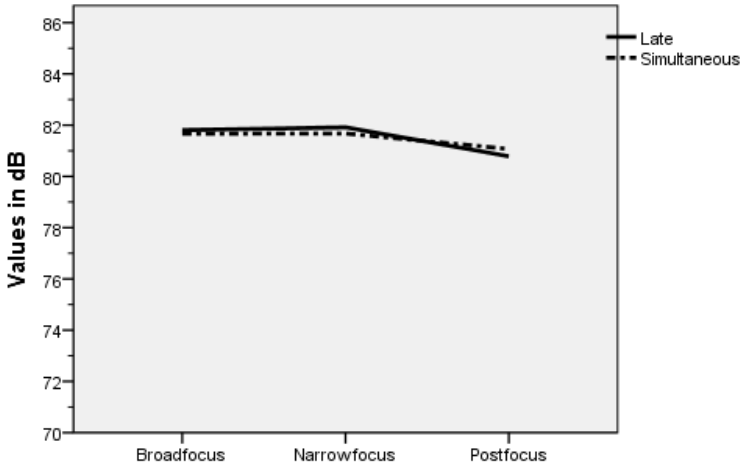

Figure 6.2: Overall mean RMS Amplitude for IE in broad focus, narrow focus and post-focus in Indian English

A two-way ANOVA was conducted with type of bilingual and focus conditions as independent variables and RMS amplitude as the dependent variable (n=2250). The results of ANOVA show

us that there is no significant difference between late and simultaneous bilinguals in the RMS amplitude of broad focus, narrow focus and post-focus conditions. There is an overall difference between RMS amplitude of the renditions, but the type of bilingual does not have an effect on whether the word is spoken in broad focus, narrow focus or post-focus condition (Table 6.3).

	Df	Sum Sq.	Mean Sq.	*F* value	Pr (>F)	Sig.
Type of bilingual	1	0	0.4	0.001	0.978	
Focus conditions	2	263.1	131.56	12.25	4.35e-05	**0.001**
Focus conditions: Type of bilingual	2	22.7	11.37	1.059	0.354	

Table 6.3: Results of ANOVA for IE RMS Amplitude

	Estimate	Standard Error	*t*-value*
Intercept (Narrow focus)	81.9131	0.9414	87.01
Narrow focus: Broad focus	-0.1059	0.1857	-0.57
Narrow focus: Post-focus	-1.1263	0.1857	**-6.06**
Type of bilingual	-0.3389	1.1137	-0.30
Narrow focus: Broad focus: Type of bilingual	0.0985	0.2169	0.45
Narrow focus: Post-focus: Type of bilingual	0.5240	0.2169	1.42

Table 6.4: Results of mixed effects regression of Indian English RMS amplitude with RMS amplitude as a dependent variable, focus conditions and type of bilingual as an independent variable and speaker and word as random factors. Here values t>|2| can be informally considered significant (Baayen et al. 2008).

A mixed effects regression was conducted with type of bilingual and focus conditions as independent variables, RMS amplitude as the dependent variable and speaker and word as random effects. Here the model with the random effects was a better fit than the model without the random effects. The results of the mixed effects regression show that there is difference between the RMS amplitude of narrow focus and broad focus (Table 6.4).

Indian English: F0 Excursion

Overall the focused words have a much bigger F0 excursion than the broad focus and post-focus (Figure 6.3) i.e. the L is much lower and the H is much higher in the focused condition.

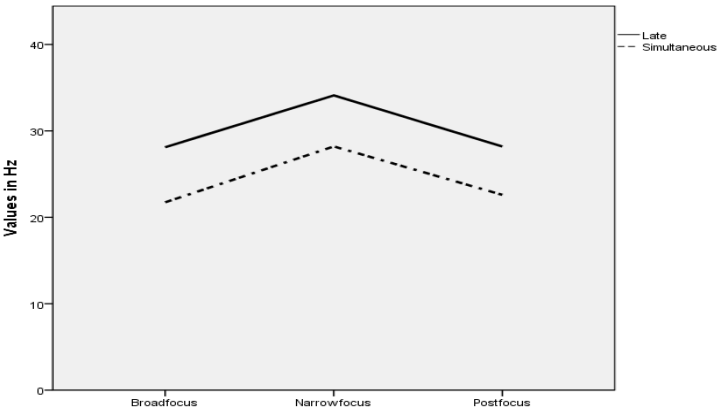

Figure 6.3: Overall mean F0 excursion for IE in broad focus, narrow focus and post-focus

A two-way ANOVA was conducted with type of bilingual and focus conditions as independent variables and F0 range as the dependent variable. The results of ANOVA show that there is no difference between late and simultaneous bilinguals in the F0 excursion of broad focus, narrow focus and post-focus conditions. However, there is a statistically significant difference between broad focus, narrow focus and post-focus in terms of F0 excursion (Table 6.5).

	Df	Sum Sq.	Mean Sq.	*F* value	Pr (>F)	Sig.
Type of bilingual	1	15372	15372	3.602	0.0681	
Focus conditions	2	16036	8018	9.333	0.0003	**0.001**
Focus conditions: Type of bilingual	2	43	22	0.025	0.9752	

Table 6.5 Results of ANOVA for Indian English F0 range.

	Estimate	Standard Error	*t*-value*
Intercept (Narrow focus)	34.7738	2.7505	12.643
Narrow focus: Broad focus	-5.9987	1.7183	**-3.491**
Narrow focus: Post-focus	-5.9101	1.7183	**-3.439**
Type of bilingual	-6.1665	3.3608	-1.835
Narrow focus: Broad focus: Type of bilingual	-0.4646	2.0872	-0.223
Narrow focus: Post-focus: Type of bilingual	0.3019	2.0872	0.145

Table 6.6: Results of mixed effects regression F0 range as a dependent variable, focus conditions and type of bilingual as an independent variable and speaker and word as random factors. Here values t>|2| can be informally considered significant (Baayen et al. 2008).

A mixed effects regression was conducted with type of bilingual and focus conditions as independent variables and F0 range as the dependent variable. Here the model with the random

effects was a better fit than the model without the random effects. The results of the mixed effects regression show that broad focus is significantly different from narrow focus and narrow focus is significantly different from post-focus (Table 6.6).

Hindi: Duration

Overall the duration of focused vowels is longer than that of broad focus and post-focus. We also see that the broad focus vowels are longer than post-focus vowels (Figure 6.4)

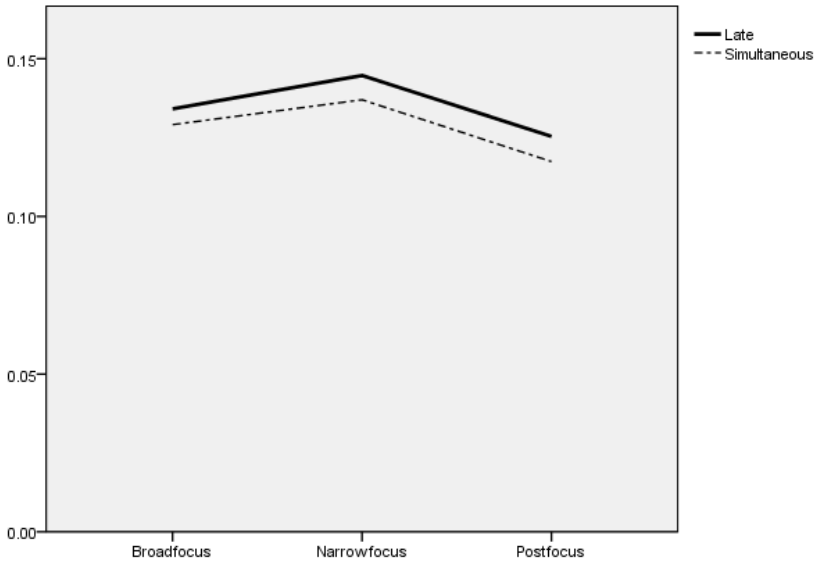

Figure 6.4: Overall mean duration for Hindi in broad focus, narrow focus and post-focus

A two-way ANOVA was conducted with type of bilingual and focus condition as independent variables and duration as the dependent variable (n=2250). For Hindi, the results of ANOVA show that there is no a significant difference between late and simultaneous bilinguals in the duration of broad focus, narrow focus and post-focus conditions. There is an overall difference between broad focus, focus and post-focus duration, but the type of bilingual does not have an effect on whether the word is spoken broad focus, narrow focus or post-focus condition (Table 6.7).

	Df	Sum Sq.	Mean Sq.	F value	Pr (>F)	Sig.
Type of bilingual	1	0.0246	0.02464	1.419	0.244	
Focus conditions	2	0.14254	0.07127	56.138	4.17e-14	**0.001**
Focus conditions: Type of bilingual	2	0.00093	0.00047	0.368	0.694	

Table 6.7 Results of ANOVA for Hindi duration

	Estimate	Standard Error	*t*-value*
Intercept (Narrow focus)	0.1446326	0.0048021	30.118
Narrow focus: Broad focus	-0.0105818	0.0024336	**-4.348**
Narrow focus: Post-focus	-0.0193361	0.0024336	**-7.945**
Type of bilingual	-0.0076432	0.0060326	-1.267
Narrow focus: Broad focus: Type of bilingual	0.0027005	0.0030519	0.885
Narrow focus: Post-focus: Type of bilingual	-0.0002709	0.0030519	-0.089

Table 6.8: Results of mixed effects regression with Hindi duration as a dependent variable, focus conditions and type of bilingual as an independent variable and speaker and word as random factors. Here values t>|2| can be informally considered significant (Baayen et al. 2008).

A mixed effects regression was conducted with type of bilingual and focus conditions as independent variables and duration as the dependent variable. The model with the random effects was a better fit than the model without the random effects. The results of the mixed effects regression show that the duration of focused vowels is longer than that of post-focus vowels and broad focus vowels (Table 6.8).

Hindi: RMS Amplitude

Overall there is little difference between the means of the RMS amplitude of focused vowels and broad focus vowels. However both the narrow and broad focus vowels have higher RMS amplitude than post-focus vowels (Figure 6.5).

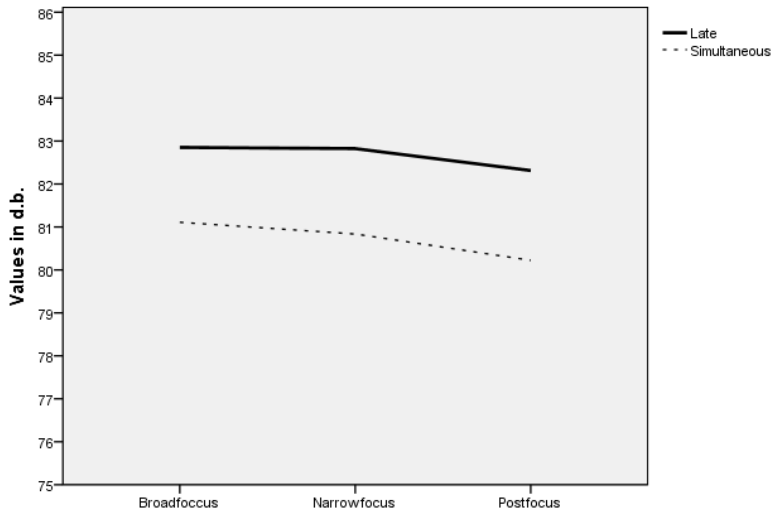

Figure 6.5: Overall mean RMS Amplitude for Hindi in broad focus, narrow focus and post-focus

A two-way ANOVA was conducted with type of bilingual and focus conditions as independent variables and RMS amplitude as the dependent variable (n=2250). The results of ANOVA show that there is a significant difference between late and simultaneous bilinguals in the RMS amplitude of focus conditions. There is an overall difference between the three conditions but the type of bilingual does not have an effect on whether the word is spoken focus condition (Table 6.9).

	Df	Sum Sq.	Mean Sq.	F value	Pr (>F)	Sig.
Type of bilingual	1	1953	1952.8	4.441	0.0442	**0.05**
Focus conditions	2	234.6	117.32	14.893	6.51e-06	**0.001**
Focus conditions: Type of bilingual	2	11.1	5.57	0.708	0.497	

Table 6.9: Results of ANOVA for Hindi RMS Amplitude

	Estimate	Standard Error	*t*-value*
Intercept (Narrow focus)	82.82377	0.73404	112.83
Narrow focus: Broad focus	0.02577	0.13282	0.19
Narrow focus: Post-focus	-0.51175	0.13282	**-3.85**
Type of bilingual	-1.98716	0.92234	**-2.15**
Narrow focus: Broad focus: Type of bilingual	0.24757	0.16656	1.49
Narrow focus: Post-focus: Type of bilingual	-0.10140	0.16656	-0.61

Table 6.10: Results of mixed effects regression of Hindi with RMS amplitude as a dependent variable, focus conditions and type of bilingual as an independent variable and speaker and word as random factors. Here values t>|2| can be informally considered significant (Baayen et al. 2008).

A mixed effects regression was conducted with type of bilingual and focus conditions as independent variables and RMS amplitude as the dependent variable. Here the model with the random effects was a better fit than the model without the random effects. The results of the mixed effects regression show that there is difference between the RMS amplitude of narrow focus and post-focus and between late and simultaneous bilinguals (Table 6.10). However, there is no effect of the type of bilingual on the focus conditions.

Hindi: F0 Excursion

Overall the focused words have a much bigger F0 excursion than broad focus and post-focus (Figure 6.6).

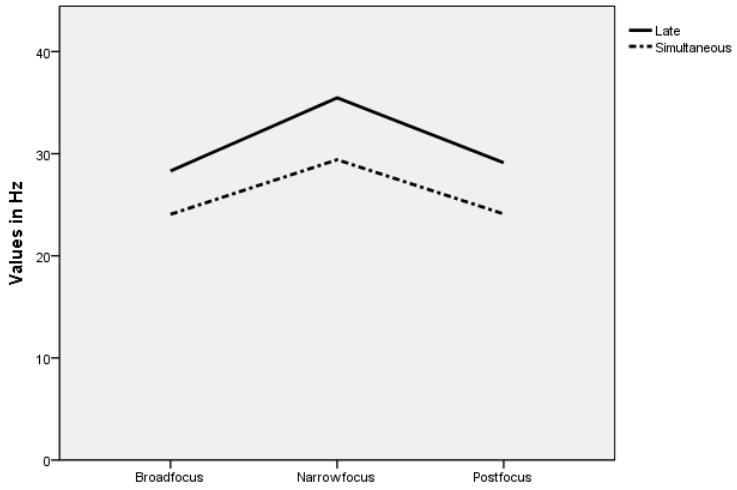

Figure 6.6: Overall mean F0 excursion for IE in broad focus, narrow focus and post-focus

A two-way ANOVA was conducted with type of bilingual and focus conditions as independent variables and F0 range as the dependent variable. The results of ANOVA show that there is a statistically significant difference between broad focus, narrow focus and post-focus in terms of F0 excursion (Table 6.11).

	Df	Sum Sq.	Mean Sq.	*F* value	Pr (>F)	Sig.
Type of bilingual	1	20443	20443	2.428	0.13	
Focus conditions	2	28760	14380	7.848	0.0009	**0.001**
Focus conditions: Type of bilingual	2	850	425	0.232	0.793640	

Table 6.11 Results of ANOVA for Hindi F0 range

	Estimate	Standard Error	*t*-value*
Intercept (Narrow focus)	42.438	3.914	10.843
Narrow focus: Broad focus	-10.153	2.246	**-4.520**
Narrow focus: Post-focus	-10.132	2.244	**-4.510**
Type of bilingual	-10.318	4.792	**-2.153**
Narrow focus: Broad focus: Type of bilingual	2.547	2.753	0.925
Narrow focus: Post-focus: Type of bilingual	3.296	2.753	1.197

Table 6.12: Results of mixed effects regression of Hindi F0 range with F0 range as a dependent variable, focus conditions and type of bilingual as an independent variable and speaker and word as random factors. Here values t>|2| can be informally considered significant (Baayen et al. 2008).

A mixed effects regression was conducted with type of bilingual and focus conditions as independent variables and F0 range as the dependent variable. Here the model with the random effects was a better fit than the model without the random effects. The results of the mixed effects regression show that broad focus is significant different from narrow focus and narrow focus is significantly different from post-focus. It also shows that there is a significant difference between the late and simultaneous bilinguals (Table 6.12).

Figure 6.7 shows box plots of F0, duration and RMS amplitude for Hindi and Indian English for both late and simultaneous bilinguals. Here we find that late bilinguals have longer duration and F0 excursion for both Hindi and IE than simultaneous bilinguals. Late bilinguals have a limited range for RMS amplitude in Hindi when compared to simultaneous bilinguals. There is not a big difference between RMS amplitude of late and simultaneous bilinguals for broad and narrow focus, but the post focus has a lower amplitude for both groups.

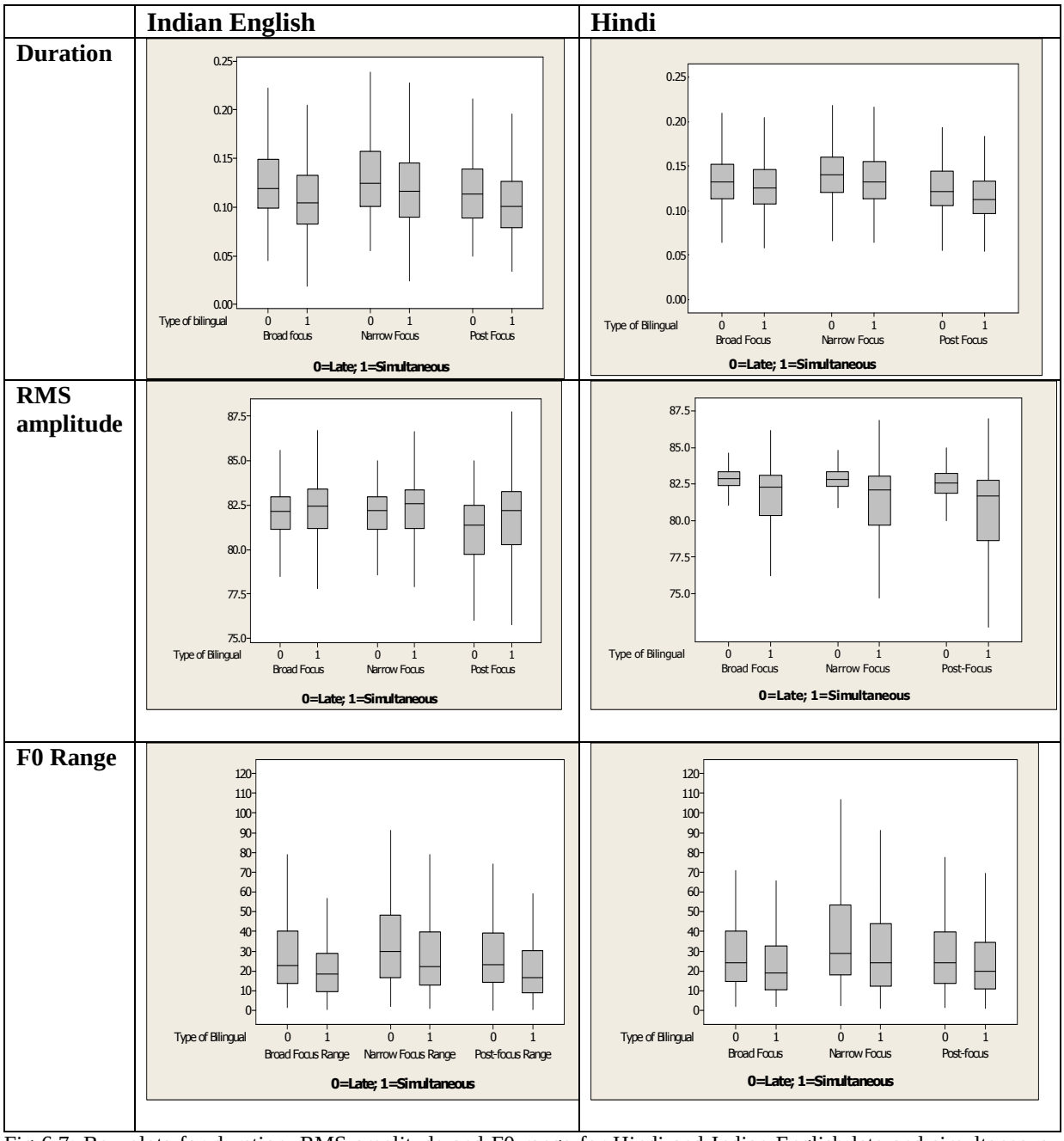

Fig 6.7: Box plots for duration, RMS amplitude and F0 range for Hindi and Indian English late and simultaneous bilinguals.

6.4 Discussion

We find that in Indian English, in terms of the effect of focus on vowel duration, there is statistically significant difference in focus and post-focus vowel duration but not broad focus and narrow focus. Since duration is one of the main acoustic correlates of focus in American/British

English, and in Hindi narrow focus vowels have longer durations than broad focus vowel, the fact that the difference in duration between broad focus and narrow focus did not reach a statistically significance level in Indian English is surprising. Although not statistically significant, narrow focus still seems to have the longest duration out of the three focus conditions (Fig. 6.1). What is interesting is that late bilinguals have longer vowel durations than simultaneous bilinguals. On the other hand, in Hindi, although there is no difference between the two types of bilinguals, there is a statistically significant difference in duration of stressed vowels in broad focus and narrow focus conditions and also between stressed vowels in narrow focus and post focus conditions. These results are similar to what was found in Dyrud (2001) where the words had longer durations than when placed in [+focus] conditions than [–focus] conditions.

In Pickering and Wiltshire's (2000) it was found that in IE stressed syllables there is no reliable increase in amplitude. However, in Wiltshire and Moon (2003) find that the stressed syllables in IE increase in amplitude when compared to the unstressed syllables, but amplitude in Indian English does not increase as much as it does in American English. The results of the present study show that in terms of RMS amplitude, in Indian English and Hindi, narrow focus and broad focus don't exhibit a statistically significant difference. However, both narrow focus and broad focus have higher RMS amplitude than post-focus. In Indian English there is no statistically significant difference between the late and simultaneous bilinguals. These results are different from that found in American English and British English, where amplitude is one of the main acoustic correlates that distinguishes narrow focus not only from post-focus but also broad focus. In Hindi there is a statistically significant difference between late and simultaneous bilinguals. Although they have a limited range, late bilinguals seem to have an overall higher RMS amplitude than simultaneous speakers in Hindi. However being a late or simultaneous bilingual does not affect the RMS amplitude in the three focus conditions. Thus, it seems that RMS amplitude does not seem to distinguish between narrow and broad focus; however since post-focus elements have lower RMS amplitudes than broad and narrow focus, it seems that this is a strategy to deaccenting the post-focal element in both Hindi and Indian English.

In terms of F0 excursion, there is a statistically significant difference between broad focus, narrow focus and post-focus in both Indian English and Hindi. In both languages, narrow focus seems to have a greater pitch excursion than broad and post-focus. This means that focus makes the L of the LH lower and the H higher. In Hindi, there is also a difference between late and simultaneous bilinguals in terms of pitch excursion. The late bilinguals have a bigger F0 excursion than simultaneous bilinguals. These results are similar to the results of Genzel and Kügler (2010) where the focused word has a lower L and higher H tone in the LH contour when compared to non-focused words. However, the results of the current study are different from that of Patil et al. (2008) where it is suggested that except in initial subject focus in SOV sentences, focus does not affect the pitch excursion and duration of the focused elements. The difference in results could be because in Patil et al's study the target utterances consisted of only one type of sentence structure with a transitive verb and two arguments, with subject arguments in ergative case and objects in accusative case. In the current study the target sentences were not restricted to just the perfect aspect. There were sentences in present tense, past tense and perfect aspect (both transitive and intransitive verbs). This could be the main reason for the difference in results in the two studies. However, like Patil et al's study, in the present study, post focal pitch compression was found in both Hindi and Indian English. Also, unlike Patil el al.'s study, a strict downstep relation between the subject, object and verb was not found in this study.

Thus, overall we find that Indian English is different from AE/BE in that narrow focus is not different from broad focus in duration and RMS amplitude but narrow focus is different from post-focus in terms of duration and RMS amplitude. In Hindi however, broad focus is different from narrow focus in duration and F0 but not in RMS amplitude. Thus in Indian English, the main acoustic correlates of focus are a bigger pitch excursion on the focus element and post-focal reduction in duration, RMS amplitude and pitch range. In Hindi on the other hand, the main acoustic correlates of focus are duration, pitch excursion on the focused element and post-focal reduction in pitch range, duration and RMS amplitude.

In both Indian English and Hindi there is a post-focal reduction in pitch range, duration and RMS amplitude indicating that there is some sort of post-focal compression process at work like suggested in Patil et al. However, Patil et al. suggested this post-focal reduction in pitch range as

the only acoustic correlate of focus in Hindi. Post-focal compression is found in many other languages such as Greek (Botinis, Fourakis, and Gawronska 1999), French (Dohen and Loevenbruck, 2004), German (Féry and Kügler, 2008), American English (Xu and Xu, 2005) and Korean (Lee, and Xu, 2010). Post-focal compression is important to make the focused element more salient. According to Xu (2011) post focus lowering of F0 is just as consistent as F0 raising on the focused word, suggesting at least equal importance of the post-focus "tail" as the on focus F0 movement and that much of the nuclear tone is actually the F0 movement of post-focal compression. Also, perception studies show that focus can be perceived only when later occurring F0 peaks are very small in comparison with the focus peak (Mixdorff, 2004).

In terms of type of bilingual and focus, we observe that both simultaneous and late bilinguals use a bigger F0 excursion in narrow focus when compared to broad and post-focus and both groups have post focal compression due to lower duration, RMS amplitude and F0 range than narrow focus in both Hindi and IE. We also see that both groups don't have a difference between narrow and broad focus in terms of RMS amplitude. The presence of higher amplitude, duration and F0 in British/American English, but the absence of increase in amplitude from broad focus to narrow focus in IE shows that this has not come from British/American English into IE but rather from Hindi to IE. We also observe that there is a statistically significant difference between late and simultaneous bilinguals in duration in Indian English and RMS amplitude and pitch excursion in Hindi. Although, not statistically significant in all the aspects (like English F0 range and Hindi duration) this experiment shows that with the exception of RMS amplitude in English, late bilinguals have higher duration, RMS amplitude and F0 range than simultaneous bilinguals in both English and Hindi (Fig. 6.7). It is possible that an inherent property of Hindi prosody, like no vowel reduction, is being transferred from the L1 to the L2 of these late bilinguals. Although it is difficult to pin point the exact cause of this trend at this point.

Chapter 7
Conclusion

In this dissertation we have looked at three facets of Hindi and Indian English Intonation as spoken by late and simultaneous bilinguals from Delhi, India. The simultaneous bilinguals acquired the nativized variety of English with Hindi as an L1 before the age of 3 and the late bilinguals first acquired Hindi and then acquired English after the age of 3. Looking at both these groups of bilinguals and three different features of intonation in Hindi-IE has helped us get insight into the processes employed by the bilingual brain and about the processes that lead to variation within a variety of New Englishes. Also, this helps in bridging a gap in the lack of acoustic and quantitative literature on this topic. Thus, the main objectives of this study are to understand the intonation system of Indian English and Hindi spoken in Delhi, India; to explore if simultaneous bilinguals of Indian English and Hindi have two different systems of intonation; and to explore if the intonation system of simultaneous bilinguals is different from late bilinguals. Three experiments that were conducted in both Indian English and Hindi examine pre-boundary lengthening, pitch accents and focus.

This dissertation shows that age of acquisition of a New English can be one of the factors that contribute in the variation found in the variety. As we saw in Chapter 2, the limited literature on simultaneous bilingual adults suggests the possibility of variation among simultaneous bilinguals. Some suggest that simultaneous bilinguals are always dominant in one of their languages. Others suggest that these bilinguals do have two independent systems for their two L1s. Still other studies suggest that they have an intertwined phonological system, which has phonological categories of both languages. These studies also show that simultaneous bilinguals are not completely identical to monolinguals and that they are intermediate between native speakers and second language learners. This study shows that simultaneous bilinguals of Hindi and Indian English have a largely merged system probably because they acquired a nativized variety; however, there are some subtle features that they use to mark their identity as separate from the late bilinguals (e.g. the use of H*/H*L pitch accent).

With respect to the question of the difference between late and simultaneous bilinguals, we find that in pitch accents, late and simultaneous bilinguals have the same system in Hindi but different systems in IE; in PBL, both late and simultaneous bilinguals have the same domains of PBL but different lengthening effects and in the focus experiment, we find that there are statistically significant differences between late and simultaneous bilinguals in RMS amplitude and F0 excursion in Hindi and duration in IE. Here the late bilinguals are louder in their production, have a bigger F0 excursion and longer duration than simultaneous bilinguals in terms of expressing focus.

Despite these findings understanding cross linguistic influence in the speech of late and simultaneous bilinguals of a New English like Indian English is not straightforward. The variation that we see cannot be categorized simply into *static* and *dynamic* interference (Grosjean, 1989; Paradis, 1993, 2004) or simply *substratum interference (*Thomason & Kaufman, 1988). Neither can the concept of *fusion* alone explain this language interaction in all aspects of intonation of these bilinguals (Queen, 1996). For late and simultaneous bilinguals of New Englishes like Indian English, a combination of all these concepts are needed to explain language interaction. It is possible that Indian English might have at first developed from *substratum interference.* However, in the pitch accents experiment simultaneous bilinguals display a *fusion* system of intonation i.e. having both the Hindi and the British English pitch accents in their IE. Not only that, but in some sentences they use the British H*/H*L pitch contour on every non-final content word, which is non-normative to either of their L1s, thus displaying a *fusion* of both Hindi and British/American English. The speech of late bilinguals in this study shows that there is *static interference* (L1→L2). For instance, they use only the Hindi LH pitch contour in both Hindi and IE. Further evidence of static interference can be seen in the focus experiment. Here we see both simultaneous and late bilinguals use a bigger F0 excursion in narrow focus when compared to broad and post-focus and both groups have post focal compression due to lower duration, RMS amplitude and F0 range than narrow focus in both Hindi and IE. We also see that both groups don't have a difference between narrow and broad focus in terms of RMS amplitude. Prior studies of BE/AE focus prosody show the presence of higher amplitude, duration and F0 on the focused element. The absence of increase in amplitude from broad focus to narrow focus in IE shows that this pattern of focus marking has not come

from British/American English into IE but rather from Hindi as shown here. All these factors show that there are similar strategies used by both groups in terms of expression of focus. Similarly, in PBL, these bilinguals use the same domains of PBL, PBL is affected by stress and there are PBL effects on the penultimate syllable even when it is not stressed. For simultaneous bilinguals, this could be a facet of the language that they have acquired from the nativized variety of English that they acquired as an L1. In the context of simultaneous bilinguals of New Englishes, I propose the term *inherited influence* to explain this. This is not *static interference* where the L1 is influencing the L2, nor is this *dynamic interference* that are performance errors that can be corrected. *Inherited influence* is where certain features that became part of the New English due to *static interference* at an earlier stage are inherited by the native speakers of New Englishes as consistent features of their language. Thus, this is not necessarily interference, but just part of the language that they acquired. Thus, one theory alone cannot explain the dynamics of language contact of New Englishes. It is important to look at New Englishes from various perspectives in order to explain the cross linguistic influence. In what follows, I summarize the results of the three experiments.

The pre-boundary lengthening experiment was conducted to understand the processes that take place to indicate that a prosodic boundary (here IP) has been reached in Hindi and Indian English; if late and simultaneous bilinguals have different ways of expressing a prosodic boundary; and if there are any differences in the two languages of a simultaneous bilingual in expressing a prosodic boundary. The results of the pre-boundary lengthening experiment show that like many other languages Hindi and Indian English have pre-boundary lengthening. Both the final and the penultimate syllable see lengthening effects, however, the highest effects of pre-boundary lengthening can be seen on final stressed syllable. Although unstressed syllables also get pre-boundary lengthening, stress seems to significantly increase the effects of lengthening on rhyme and syllable but not vowel in both Hindi and IE. This shows that Hindi does have stress. Simultaneous bilinguals have the same domains of pre-boundary lengthening in both their languages and there doesn't seem to be any difference in the domain of pre-boundary lengthening between simultaneous and late bilinguals: in both groups the pre-boundary lengthening effects can be seen both of the final syllable and penultimate syllable, however, the final syllable gets more lengthening than the penultimate; Stress seems to increase the effects of

pre-boundary lengthening for both late and simultaneous bilinguals in both English and Hindi; also, both the groups show pre-boundary lengthening effects more on the rhyme than on the vowel in both English and Hindi. Simultaneous bilinguals and late bilinguals don't have same kind of lengthening effects in both their L1s, however, their domains of PBL are the same in both languages.

The results of the pitch accent experiment show that in the main pitch contour used in Hindi is a LH on every non-final content word by both late and simultaneous bilinguals. Two types of pitch contours are used in Indian English: the Hindi LH and the American/British English H*/H*L. However, only simultaneous bilinguals use both the LH and H*/H*L pitch contours in Indian English not late bilinguals. Thus, simultaneous bilinguals use a fusion system of pitch accents in their use of English, but not in Hindi. The three main patterns in the use of the H*/H*L by the simultaneous bilinguals are: H*/H*L on every non-final content word like the use of LH on every non-final content word in Hindi; the use of a combinations of H*/H*L with the LH; and, only one H*/H*L on a word in the sentence. Only 5 simultaneous bilinguals were observed to use this fusion system. All these participants went to convent schools and are fond of American and British music, TV shows and movies. However, there were 2 other simultaneous bilinguals who were from convent schools and were fond of American/British music, TV shows and movies but did not have any H*/H*L in their speech. However, these two speakers also reported using comparatively less English than the other participants. Thus, it seems that many factors contribute in the use of both LH and H*/H*L in IE. This innovation on the part of these simultaneous bilinguals shows that Indian English might be in the differentiation stage of Schneider's dynamic model of New Englishes where the individual's identity construction has narrowed down to the immediate community and new group identities are being formed.

The results of the focus experiment show that in Indian English, the main acoustic correlates of focus are a bigger pitch excursion on the focus element and post-focal reduction in duration, RMS amplitude and pitch excursion. In Hindi on the other hand, the main acoustic correlates of focus are duration, a bigger pitch excursion on the focused element and post-focal reduction in duration, RMS amplitude and pitch excursion. In Hindi broad focus is different from narrow focus in duration but not in RMS amplitude, however, in Indian English narrow focus is not

different from broad focus in terms of duration and RMS amplitude, but narrow focus is different from post-focus in terms of duration and RMS amplitude. In terms of pitch excursion, both in Indian English and Hindi there are statistically significant differences between broad focus, narrow focus and post-focus. In both Indian English and Hindi there is a post-focal reduction in pitch range, duration and RMS amplitude indicating that there is some sort of post-focal compression process at work here. In terms of type of bilingual and focus, this experiment shows that there is a difference between late and simultaneous bilinguals in duration in Indian English and RMS amplitude and pitch excursion in Hindi. Although, not statistically significant in all the aspects, this experiment shows that, late bilinguals have higher duration, RMS amplitude (in Hindi) and F0 range than simultaneous bilinguals in both English and Hindi. Since we see that late bilinguals also have longer durations in Hindi in the PBL experiment when compared to simultaneous bilinguals, it is possible that an inherent property of Hindi prosody, like no vowel reduction, in the speech of late bilinguals at work here.

In terms of further research it would be interesting to see if the effect of PBL can be seen in antepenultimate and ultimate syllables in 3 and 4 syllables words and to see if the type of syllable and consonant has an effect on PBL in Hindi and IE. It would also be interesting to see the effect of PBL on different levels of boundaries in both Hindi and Indian English. This would help in understanding if Hindi indeed has only two levels of prosodic boundaries as suggested in the literature (p-phrase/accentual phrase/phonological phrase and IP) or are there any more layers. It would be interesting to see the relationship of PBL, the LH pitch contour and these prosodic boundaries. It would also be interesting to understand the pitch accents in Hindi and Indian English questions and vocatives.

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Appendix A

Language background questionnaire

Personal History

1. Name:
2. Age:
3. Place of Birth:
4. Languages known:

   Can speak:

   Can write:

   Can understand:
5. Education: Elementary school High school College Other (specify)……..
6. Which city did you attend:

   School:

   College:

   Masters:
7. Father's occupation…….
8. Mother's occupation…….
9. Languages spoken at home…….
10. Which type of school did you attend? Public/Government/Convent

Language background

1. At what age did you acquire English?
2. At what age did you acquire Hindi?
3. Which language did you acquire first? Hindi English Both

4. Did you acquire them together at home? Yes/No

5. What is/are your native languages? Hindi English Both

6. Do you think you speak English as well as Hindi? Yes/No

7. Which language did you speak at home as a child? Hindi English Both

8. Which language do you use mostly in your everyday life? Hindi English Both

9. Rate the percentage of use of Hindi and English with your:

   a. Father Hindi- English-

   b. Mother Hindi- English-

   c. Siblings Hindi- English-

   d. Grandparents Hindi- English-

   e. Spouse Hindi- English-

   f. Children Hindi- English-

   g. At work/school Hindi- English-

   h. With strangers Hindi- English-

   i. With friends Hindi- English-

10. List of languages you have used in the past and that you use now.

	From year…to year…	Where learned	When used
Hindi:			
English:			
Other:			

Appendix B

Speaker profile

Participant	Simultaneous/Late	Gender	age	School Type	Hindi use	English use
1	Simultaneous	Female	25	Public	33.4%	66.6%
2	Simultaneous	Male	34	Convent	11.1%	88.9%
3	Late	Female	33	Government	77.7%	22.3%
4	Simultaneous	Female	31	Convent	22.3%	77.7%
5	Simultaneous	Female	28	Public	44.5%	55.5%
6	Simultaneous	Female	29	Public	44.5%	55.5%
7	Late	Female	32	Public	77.8%	22.2%
8	Late	Female	31	Public	33.3%	66.7%
9	Simultaneous	Female	34	Convent	11.2%	88.8%
10	Simultaneous	Female	27	Public	33.3%	66.6%
11	Late	Male	30	Public	66.6%	33.3%
12	Late	Female	34	Public	66.7%	33.3%
13	Simultaneous	Female	24	Public	44.5%	55.5%
14	Late	Female	21	Public	66.6%	33.3%
15	Simultaneous	Female	20	Public	44.5%	55.5%
16	Late	Female	31	Public	55.5%	44.5%
17	Simultaneous	Female	23	Convent	44.5%	55.5%
18	Simultaneous	Female	21	Convent	33.3%	66.6%
19	Simultaneous	Female	34	Public	11.2%	88.8%
20	Simultaneous	Female	29	Public	44.5%	55.5%
21	Simultaneous	Female	23	Convent	33.3%	66.6%
22	Late	Female	30	Government	88.8%	11.2%
23	Simultaneous	Female	26	Convent	44.5%	55.5%
24	Simultaneous	Female	25	Public	55.5%	44.5%
25	Simultaneous	Male	19	Convent	11.2%	88.8%
26	Simultaneous	Male	24	Public	55.5%	44.5%
27	Simultaneous	Female	29	Public	33.3%	66.6%
28	Simultaneous	Male	22	Convent	33.3%	66.6%
29	Late	Female	26	Government	77.8%	22.2%
30	Late	Male	24	Government	66.6%	33.3%

Appendix C
Pre-boundary lengthening: target words

Initial Stress	Final Stress
1. 'Peter	Ja'pan
2. 'Tapster	Su'zanne
3. 'Potsdam	Can'teen
4. 'Password	Car'toon
5. 'Peephole	Do'nate
6. 'Pattsburg	Tech'nique
7. 'Napkin	Chi'nese
8. 'Pattern	Eigh'teen
9. 'Cattle	Mal'tese
10. 'Candy	Rou'tine
11. 'Mattress	De'mand
12. 'Comet	Res'ponse
13. 'Poppet	Fore'feet
14. 'Topaz	De'ceit
15. 'Popcorn	Hen'coop

Appendix D

Pitch accent Experiment: speech material

English

1. Dave drove the children
2. Mike described the globe
3. Steve promised her students
4. Amber cleaned the room
5. Lauren surveyed the block
6. Brooklyn is near the Hudson
7. Max was looking at the sea
8. Mathew judged an exam
9. Leena proposed a project
10. Chris meets the students
11. Emma played in the basement
12. Alex was swimming in the ocean
13. Austin arrived in Boston
14. Laura answered his questions
15. Tina recognized the actor
16. Jo was keeping the carpets in the basement
17. Lily explained the problem to the members
18. Su was played with some friends in London
19. The children found some marbles in the garden
20. Sam showed me her house in Mumbai
21. Justin sold his Jaguar to Tim
22. Laura prepared some meet in her kitchen
23. Maya postponed her trip to Bhutan
24. Mary lost her dress in the hotel
25. John told Bill about the leader
26. Amy destroyed the maps in her garden
27. Sebby teaches Chinese in Bangkok
28. Karen talks in thirteen accents in school.

29. Richard lied about the intruders to the police
30. Maggi bought flowers at the market

Pitch accent Experiment: speech material

Hindi

1. Ra:dʒi:ʊ bətʃo: se: ba:ʈ̪ kərʈ̪a: hɛ:
Rajeev children with talk do-hab.mas sg be.pr.
Rajeev talks to the children.
2. ʋɪʋa:n ba:ga:n me: ʧəl rəha: hɛ:
vivaan tea garden in walk prog. be.pr.
Vivaan was walking in the tea garden
3. Ni: ʈ̪a: ne: ɖ̪i: ʋa:r raŋgi: ʈ̪ʰi:
Nita Erg wall color.perf fem be.past.fem sg
Neeta had painted the wall.
4. abi:r ʊja:pa:r kərta: ʈ̪ʰa:
Abiir business do-hab.mas sg be.past.mas sg
Abiir use to do business
5. biirbəl ne: siʈ̪a:r bədʒa:ja: ʈ̪ʰa:
Biirbal sitar played-perf. be.past.mas sg
Birrbal played the sitar
6. si:ma: ne amru:ɖ̪ ʈ̪ol kər khəri:de
Seema Erg. guava weight bought-perf.
Seema weighed the guavas and bought them.
7. Reena kəl sɔ:ga:ʈ̪ la:i:
Reena yesterday gift got-perf.
Reena got a gift yesterday
8. prəʈ̪a:p nɔ:kər ko uʧʰa:ʈ̪a: hɛ:
Prataap servant wakes up Pr. hab.
Prataap wakes up the servant
9. Suʃi:l ɖ̪uka:n gəja: ʈ̪ʰa:
Susheel store went-past perfect be.past.mas sg
Susheel went to the store
10. Hiten tərki:b sotʃ rəha: ʈ̪ʰa:
Hiten plan think prog. be.past.mas sg
Hiten was thinking of a plan
11. Sulta:n ne ɖ̪i:pak budʒʱa:ja:
King Erg. lamp turn off-perf.
The king turned off the lamp
12. Puni:ʈ̪ na:vik se mila:
Punit sailor with met-perf.
Punit met the sailor
13. Prəmod ne bi:ma:r a:dmi: dekha:
Pramod Erg. sick man saw-perf.

Pramod saw a sick man

14. bəlji:t ne ma:ri:tʃ suna:
    baljit Erg. maariich heard-perf
    Baljit hear the word maariich
15. gɔ:təm ma:nəv se mila:
    gautam manav with met-perf.
    Gautam met Maanav
16. avta:r sa:ma:n ka:r me rakh rəha: ʈʰa:
    Avatar things car in keep prog. be.past.mas sg
    Avtar was keeping the things in the car
17. si:ma: apne bətʃõ ke sa: ʈʰ jɛ:pur se a:ti: ʈʰi:
    Seema her own kids with Jaipur from come-hab. be.past.fem sg
    Seema used to come with her kids from Jaipur
18. gi:ta: ne sita:r gəri:b ko dija:
    Gita Erg. sitar poor to give-perf.
    Gita gave a sitar to a poor (person)
19. gula:b ne tʃa:vəl ko bərba:d kija:
    gulab Erg.rice waste to do-perf.
    Gulab wasted the rice
20. ni:ti: ne ik bəlva:n a:dmi: se ʃa:di: ki:
    niti Erg. one strong man with marriage to do-perf.
    Niti married a strong man
21. Nu:tən ne beka:r ka: ka:m kija:
    Nutan Erg. useless work to do- perf.
    Nutun did useless work
22. Ni:radʒ goɖa:m me bəva:l mətʃa: rəha: ʈʰa:
    Niraj warehouse in ruckus make prog. be.past.mas sg
    Niraj was creating a ruckus in the warehouse
23. Su:dʒəl behoʃ ko məka:n me le a:ja:
    Sujal unconscious (person) house in got-perf.mas.sg.
    Sujal got the unconscious person in the house
24. kəla:m apne pu:rvədʒõ ke liye pu:dʒa: kərta: hɛ:
    kalam his own ancestors for pray to do-hab.mas.sg be.pr.mas sg
    Kalam prays for his ancestor
25. su: dʒəl ne ma:mle ko dəba:ne ki koʃiʃ ki:
    sujal Erg. matter press try to do perf.
    Sujal tried to hide the matter
26. gula:b adʒi:t se va:stu si:khta: hɛ:
    Gulab ajit from vastu learn-hab.mas.sg be.pr.mas sg
    Gulab learns vastu from Ajit.
27. Kuna:l kəma:l ki filme dikha:ta: hɛ:
    Kunal amazing film-fem.pl. show-pr.hab. be.pr.mas sg
    Kunal shows amazing movies
28. Gomti: ra:t ko həlva:i: se nəmki:n la: rəhi ʈʰi:
    Gomti night sweet maker from snacks to get-prog.fem.sg. be-past-fem.sg
    Gomti was getting snacks from the sweet maker at night

29. manodʒ ne hɛːvaːn ko peɽ ke niː tʃe dekhaː
Manoj Erg. evil tree under see-perf.mas.sg.
Manoj saw an evil under a tree

30. milaːp ne ghər me maːtʃis dʒəlaːi
Milap Erg.house in matchstick light-perf.fem.sg
Milap lit the matchstick in the house

Appendix E

Focus experiment: target words

Hindi

Two syllable words with final stress

1. kɪ 'taːb ‘book’
2. dʊ'kaːn ‘store’
3. hɪ'saːb ‘calculation’
4. sʊl'taːn ‘king’
5. gʱə'ʈaː ‘cloud’

Two syllable words with initial stress

1. 'saːbʊn ‘soap’
2. 'baːlək ‘child’
3. 'ʃaːnti: ‘peace’
4. 'biːmaː ‘insurance’
5. 'maːnəv ‘human’

Three syllable words with final stress

1. hənʊ'maːn ‘name of a Hindi deity’
2. bəlɪ'daːn ‘sacrifice’
3. kəraːmaːt ‘miracle’
4. səmaːdʰaːn ‘solution’
5. anʊmaːn ‘estimate’

Three syllable words with penultimate stress

1. saː'maː dʒɪk ‘pertaining to the society’
2. sɔː'daːgər ‘trader’
3. ʃɪ'kaːri: ‘hunter’
4. kə'toːri ‘bowl’
5. aː'dhuːnik ‘modern’

Three syllable words with initial stress

1. 'taːnpʊraː ‘type of musical instrument’
2. 'saːdʰanaː ‘meditation’
3. 'maːrʊti ‘name of a Hindu deity and a car brand’
4. 'maːpuːaː ‘type of Indian dish’
5. ‘kaːrkaːnaː ‘factory’

Focus experiment: target words

English

Two syllable words with final stress

1. De'mand
2. Ja'pan
3. Ce'ment
4. Ma'chine
5. Ma'ssage

Two syllable words with initial stress

1. 'Necklace
2. 'Beagle
3. 'Teacher
4. 'Cheesecake
5. 'Pencil

Three syllable words with final stress

1. Vietnamese
2. Portuguese
3. Employee
4. Guarantee
5. Magazine

Three syllable words with penultimate stress

1. Com'puter
2. Con'sumer
3. Me'morial
4. Ca'nadian
5. A'ssumption

Three syllable words with initial stress

1. 'Politics
2. 'Government
3. 'Passenger
4. 'Calendar
5. 'Daughter