VOWELS IN HINDI AND INDIAN ENGLISH BILINGUALS' CODE-MIXED SPEECH

Dissertation submitted to Jawaharlal Nehru University in partial fulfillment of the requirements for the awards of the degree of

MASTER OF PHILOSOPHY

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CERTIFICATE

This dissertation titled **"VOWELS IN HINDI AND INDIAN ENGLISH BILINGUALS' CODE-MIXED SPEECH"** submitted by **Ms. SAKSHI KALRA**, at Centre for Linguistics, School of Language, Literature and Culture Studies, Jawaharlal Nehru University, New Delhi, for the award of the degree of Master of Philosophy in LINGUISTICS, is an original work and has not been submitted so far in part or in full, for any other degree or diploma of any University or Institution.

This may be placed before the examiners for evaluation, for the award of the degree of Master of Philosophy.

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DECLARATION

Dated 19-7-18

This dissertation titled "**VOWELS IN HINDI AND INDIAN ENGLISH BILINGUALS' CODE-MIXED SPEECH**" submitted by me for the award of the degree of Master of Philosophy, is an original work and has not been submitted so far in part or in full, for any other degree or diploma of any University or Institute.

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Information is knowing water is H_2O,
Wisdom is being able to make it rain.

Shamanic teaching
cited by Alberto Villoldo, Ph.D
medical anthropology

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~ Sakshi

Chapter 1. INTRODUCTION

1.1 Background

Bilingualism

Bilingualism is a state of being, both linguistic as well as cognitive, which shapes and is shaped by our sociocultural reality. It is a product of language contact which can take place due to many factors such as colonization, resettlement, changes in language policy of a country, desire to learn a new language etc. Globalization has been one of the most powerful channels of language contact, bringing together different societies, cultures and languages. Crystal(2003:69) observed that two-thirds of the world's children grow up in a multilingual environment. His statistics indicate that of the approximately 750 million people that speak English worldwide, about 41% are multilingual, speaking English and some other language(s).

Bilingualism spans a multidimensional continuum and its development has to be understood in terms of psychological, sociocultural and linguistic factors(see Wei, 2000; Hamers and Blanc, 1989, 2000). And we cannot deny that these factors cause certain implications on cognitive development, identity formation, and language usage of a bilingual. So who is a bilingual? A lot of academic speculation has led to the understanding that a bilingual is someone who actively uses more than one language. Some individuals acquire both languages from birth (early or simultaneous bilinguals) while others learn a second language sometime after fully or partially acquiring the native(first) language(late or sequential bilinguals).

Modern research claims that bilingual human beings experience advanced linguistic, metalinguistic and sociolinguistic skills.Today, there is unanimous acceptance in the bilingual research community that bilingualism is the norm rather than the exception. A bilingual has a unique linguistic configuration and is not the sum of two monolinguals in one (Grosjean, 1982). Bilingualism has also been associated with better cognitive abilities, especially, enhanced executive function across the life span. Bialystok et al.'s (2007) work concludes that bilingualism defers the onset of dementia by 4 years. This is a particularly pivotal finding which shows that speaking more than one language leads to better cognitive control. Overall, the extensive cognitive, psycholinguistic and linguistics studies on bilingualism and multilingualism over many decades have produced a more nuanced picture of the bilingual human mind and the human language faculty.

Code-mixing and Code-switching

A natural consequence of bilingualism is code-mixing and/or code-switching. As mentioned above, bilingualism is a product of language contact and when two(or more) languages come into contact with each other, various kinds of phenomenon

emerge. Some of the most prominent include language mixing, language convergence and lexical borrowing which in turn give birth to pidgins, creoles and code-mixing/code-switching. Code-mixing refers to intra-sentential switches whereas code-switching refers to inter-sentential switches[1].Chloros(2009:4) defines code-switching as "*the use of several languages or dialects in the same conversation or sentence by bilingual people*".Code-switching has been the focus of researchers for many decades now.

The higher levels of linguistics boast of a robust body of research work, however, the level of phonetics and phonology is still a relatively unexplored area (see Bullock, 2009). Nonetheless, there is a small but consistently growing literature which investigates the consequences of code-switching at the level of phonetics and phonology. This extant literature has put forth variable but interesting results. Many studies tested multiple bilingual groups differing in language dominance and reported distinct results for the different groups. Some studies reported no interaction between the native language(L1) and second language(L2) of a bilingual (Grosjean & Miller, 1994; Muldner et al.,2017), some studies found interference from L1 in L2, in their L1 dominant groups (Bullock & Toribio, 2009a; Gu et al., 2008) or even in the L2 dominant groups (Bullock et al., 2006; Bullock & Toribio, 2009a; Khattab, 2002, 2009; Antoniou et al., 2011; Piccinini & Arvaniti, 2015), some bilingual groups showed phonetic convergence (Bullock & Toribio, 2009a; Olson 2016) while others illustrated divergence (Bullock & Toribio, 2009a; Piccinini & Arvaniti, 2015). Some studies reported bilingual groups where L2 influenced L1 (Bullock et al., 2006; Bullock & Toribio, 2009a; Olson, 2013; Simonet, 2014) while another study reported L2 influence on L1 in case of L1 dominant late bilinguals (Olson, 2016).

1.2 Research Questions

The present study is inspired by this emerging body of extant literature and aims to add to this body of work, in order to understand the effects of code-mixing[2] in case of early Hindi and Indian English(IE) bilinguals. Hindi is primarily used in the north-west and north-central parts of India whereas English is now the pan-Indian link language, giving rise to bi-/multi-lingualism. In addition, code-mixing and code-

[1] Due to a lack of consensus, the terms code-switching and code-mixing have overlapping definitions in the literature (see section 2.2).

[2] The term 'code-switching' has been used for both insertional(intra-sentential) (Grosjean & Miler, 1994; Olson, 2016; Muldner et al., 2017; Antoniou et al., 2011) as well as alternational(inter-sentential) switching (Bullock et al., 2006; Bullock & Toribio, 2009a; among others) in previous work. The present study utilizes stimuli constructed from two languages, with a word from the guest language mixed(embedded) in the carrier phrase from the matrix language, hence, the term code-mixing has been used.

switching are highly usual practices in the Indian multilingual society and therefore they demand attention and investigation at all levels of language.

Following Muldner et al.(2017), who studied vowels rather than Voice Onset Time(VOT) of obstruents (like most other studies on the phonetics of code-switching), the present study addresses two research questions regarding vowels:

Research Question 1 - Do the formant frequencies F1 and F2 of the vowels (vowel quality) in Hindi and Indian English change during code-mixing and is this change influenced by the dominant language of the participant?

Research Question 2 - Does the duration and pitch(F0) of code-mixed vowels of early Hindi-IE bilinguals show signs of hyperarticulation?

1.3 Hypotheses& its Justification

It is hypothesized,in relation to research question 1,that the dominant language of a bilingual influences her non-dominant other language. Therefore, the formants F1 and F2 of the code-mixed (Hindi & IE)vowels of a Hindi dominant bilingual should be similar to the formants of her monolingual Hindi vowels and the formants F1 and F2 of the code-mixed (Hindi & IE)vowels of an IE dominant bilingual should be similar to the formants of her monolingual IE vowels.This hypotheses is contrary to the results of Muldner et al.(2017), who did not take into account the language dominance of their participants and admitted that their experiment might be influenced by the English dominant environment of their study.Language dominance of a bilingual has held importance in the language switching literature (Flege et al., 2006; Flege, Frieda, & Nozawa, 1997; Flege et al., 1995; Flege et al., 2003; Flege, Mackay & Piske, 2002; inter alia) as well as in the code-switching literature (Bullock et al., 2006; Bullock & Toribio, 2009a; Antoniou et al., 2011; Khattab, 2002, 2009; Piccinini & Arvaniti, 2015; inter alia) but it has failed to prove its deterministic nature in code-switching (Bullock et al., 2006). Despite this, the present study hypothesizes that the dominant language of a bilingual influences her non-dominant language, solely for the purpose of clarifying the findings in the literature and to understand any phonetic interaction language dominance may lead to.

In case of research question 2, it is hypothesized that similar to previous work (Olson, 2012, 2016; Muldner et al., 2017)the duration and pitch of vowels in the code-mixed context would be higher than that of vowels in the monolingual context, providing evidence for hyperarticulation.

1.4 Methodology

In order to investigate the research questions, an oral production task was undertaken where early Hindi-IE bilinguals, both Hindi dominant and IE dominant read a contextualizing paragraph and monolingual as well as code-mixed sentences. Target vowels were analyzed in terms of F1, F2, pitch(F0) and duration.

Participants

A controlled laboratory experiment was conducted and an oral production taskwas administered to 17 Hindi-IE bilinguals to investigate the effects of code-mixing on 7 vowels (in Hindi and IE each). The bilinguals were divided into two groups, Hindi dominant and IE dominant based on their general language dominance. The language dominance was tested using an online questionnaire, *Bilingual Language Profile: An Easy-to-Use Instrument to Assess Bilingualism* (Birdsong, Gertken, & Amengual, 2012).The speakers' code-mixed utterances were compared to their non-mixed utterances, i.e. varying the context (monolingual or bilingual) as well as target token language (dominant or non-dominant).

Stimulus

The experiment undertakes the phonetic study of 7 monophthongal vowels of Indian English namely, /i i: u u: e: o: ə/ (Bansal, 1976, 1978; Wells, 1982; Pandey, 2014; among others) and 7 vowels of Northern Hindi, specifically Delhi Hindi, /i i: u u: e: o: ə/. The motivation behind selecting only these vowels is the fact that all 7 of these vowels are present in both the languages being studied, which facilitates their comparison and secondly, to limit the scope of the study. Each of these vowels is embedded in two different monosyllabic words(CVC structure) in both Hindi and IE and these monosyllabic words are further embedded in two different carrier phrases. The final stimuli comprised of 14 lexical items in Hindi (2 words per vowel) and 14 lexical items in English (2 words per vowel), all nouns representing single word lexical insertions in the code-mixed contexts (Chan, 2003). In addition to the target words, 28 non-target(filler) items, 14 in Hindi and 14 in English were also included in the stimulus.

Contextualizing paragraph

Research has shown that differing amounts of language(s) in an experimental setup can induce different language modes (see section 2.1.1; Grosjean, 1982) as well as impact phonetic production (Olson, 2013, 2016; Simonet, 2014).The contextualizing paragraph therefore, was presented as part of the stimulus to control and manipulate the language mode of the participant. All paragraphs were small stories(average number of words/paragraph = 105). The paragraphs preceded the main task to prime the participant and place them in the required language mode but were not included in the analysis.

Procedure

The experiment was conducted in a sound proof studio in the language lab premises of Jawaharlal Nehru University, New Delhi.The experiment was divided into 3 sessions, monolingual Hindi, monolingual IE and code-mixed. The objective of these three different sessions was to keep the participant in the particular language mode (monolingual or bilingual) while eliciting data.For each part, instructions were presented visually and the language of the instructions corresponded to the language of the session (e.g. Session A = monolingual Hindi, Session B = monolingual IE, Session C = bilingual/code-mixed).Each participant received a different randomized order of the target tokens in each part. This was accomplished with software Linger v2.88 which has an inbuilt feature of randomizing the target and non-target(filler) tokens. The session order was counter-balanced across subjects.

Measurements

A total of 112 productions were elicited from each participant (7 vowels x 2 tokens per vowel x 8 sessions) thus in all, a total of 1,904 tokens were examined, out of which less than 5% of tokens were eliminated for disfluencies. The remaining tokens were annotated for duration(sec.), pitch(Hz), formant F1(Hz) and formant F2(Hz) using Praat v5.3.82 (Boersma & Weenink, 2014).All statistical analysis was conducted using R 3.4.3 (R Core Development Team 2017), and all linear mixed effects models (Winter, 2012) were performed with the *lme4*package (Bates et al. 2015). Duration, pitch, F1 and F2 were the dependent variables(DV). A mixed effects model was conducted for each DV separately for both Hindi and IE dominant groups. Language context and gender were entered as the fixed effects (without interaction term) into the model, however, gender was only the control variable in the model. As random effects, intercepts for subjects and vowels, as well as by-subject and by-vowel random slopes for the effect of DVs were included.

The results obtained from this study will serve to create a clearer picture of the effect of code-mixing on vowels in native Hindi speakers. More broadly, these results will enhance the current understanding of the code-mixing mechanism in relation to language dominance.

1.5 Chapter Organization

This dissertation is divided into 6 chapters. The second chapter gives a selective overview of the literature on bilingualism(section 2.1), code-mixing and code-switching(section 2.2), the phonetic consequences of bilingualism(section 2.3) and Indian English(section 2.4). It is of vital importance to understand that Indian English is no longer a variant of British(or American) English. It is a language variety in its own right, with its own complexities and nuances. Therefore, in section 2.4 the author will try to convince the reader to acknowledge the same and then to

understand the current study in that light. Chapter 3 discusses the current experiment in detail. Chapter 4 lays out the results of the experiment. Chapter 5 discusses the results in detail and finally chapter 6 concludes the study proposing avenues for future work.

Chapter 2. LITERATURE REVIEW

The review of the literature concentrates on three key areas related to this study: Bilingualism (section 2.1), code-mixing and code-switching (section 2.2 & 2.3) and Indian English (section 2.4). A selective overview is given of all three areas. Section 2.3 focuses solely on the experimental studies related to bilingual speech production(also the topic of the current experiment). Whereas only some of the most prominent psycholinguistic and sociophonetic studies are discussed, almost an exhaustive review is given of studies related to the phonetics of code-switching.

2.1 BILINGUALISM

[3]

Bilingualism(and multilingualism) is an experience that alters the linguistic, metalinguistic, social and cognitive configuration of a person. It is a state of being that can lead to enhanced living. Grosjean(1982) defined bilingualism as *"the regular use of two or more languages (or dialects)"*. Bilingualism is a natural consequence of language contact which can take place due to many factors such as political acts of colonization, resettlement, changes in language policy etc., natural disasters which encourage mass movement of population, desire to integrate into or alienate a culture, learning a language through formal education, temporary residence in another country etc. And each of these factors in turn, can introduce a different set of social, cognitive, linguistic and personal conditioning.

Bilingualism(and multilingualism) exists at the level of individual as well as at the level of society. Individuals of a community may be bilingual or multilingual while

[3] Picture Courtesy - Google images. Original comic by Darrin Bell(2008). http://www.cartoonistgroup.com/subject/The-Bilingual-Comics-and-Cartoons.php

the community recognizes only one or two languages in its legislation, likewise the society may have different languages, spoken by different groups of people but the individuals may not themselves be bilingual or multilingual. According to Wei(2013), there are three types of bi-/multi-lingualism at the societal level: territorial, diglossic and widespread multilingualism. Territorial bi-/multi-lingualism is where the speakers of a specific language are within their own geographically defined territory. Examples include India, Canada, Switzerland etc. Diglossia pertains to situations where two(or more) languages are used in a complementary fashion, one having a higher status than the other. However, the relationship between the two(or more) languages can change over time. Examples include Guarani versus Spanish in Paraguay, Swahili versus English in Tanzania, complex triglossia of standard French and Dutch vs. Belgian French and Belgian Dutch vs. local dialects (Walloon and Flemish) in the Belgian capital of Brussels etc. And widespread multilingualism refers to the coexistence of different indigenous languages with multiple languages of wider communication. Asia, Africa and Latin America are currently witnessing this situation. However, at the individual level, the outcome of bi-/multi-lingualism cannot be segregated in a similar manner yet. This is because some individuals become bi-/multi-lingual by acquiring two(or more) languages from birth, in multilingual families while others learn a second language later in life due to schooling or other life experiences. This may lead to different bilingual behaviour and cognitive organization of the brain, which have still not been investigated in a systematic manner.

From a wider perspective, bilingualism spans a multidimensional continuum and its development has to be understood in terms of psychological, sociocultural and linguistic factors(see Wei, 2000; Hamers and Blanc, 1989, 2000). Hamers and Blanc(1989; 2000) presented different dimensions of bilingualism in order to examine the term in a broader perspective and to analyze how some factors may exert an influence over our perception of bilinguals and how they function. These dimensions are: relative language competence, presence of second language(L2) in the environment, cognitive organization, age of acquisition, sociocultural status of the languages and cultural identity of the bilingual. Assuming that bilingualism is indeed composed of multidimensional aspects, we cannot deny that those aspects cause certain implications on cognitive development, identity formation, and language usage of a bilingual.

So who is a bilingual? A lot of academic speculation has led to the understanding that a bilingual is someone who actively uses more than one language. Some individuals acquire both languages from birth (early or simultaneous bilinguals) while others learn a second language sometime after fully or partially acquiring the native(first) language(late or sequential bilinguals). Encompassing all these

definitions of bilinguals, researchers (Bloomfield, 1935; Macnamara, 1967;Grosjean, 1982; Paradis, 1997; Baker, 2001; Hamers and Blanc, 2000; among others) over the years, have proposed many factors that contribute to bilingual characteristics. These characteristics can be defined in terms of level of competence in both languages, age of learning onset, sequence of acquisition of the languages, socioeconomic status of the bilingual, language status, opportunity for formal study, language backgrounds, language combinations etc. And the various combinations of these factors lead to the many differences amongst the bilinguals.

Since bilingualism is a vast concept, with multiple dimensions, it is not possible to review it thoroughly in this work. Therefore, the remaining part of this section will provide only a selective overview of the relevant models and cognitive as well as linguistic approaches to bilingualism.

2.1.1 Approaches to Bilingualism

Two approaches to bilingual acquisition that have received most attention in the bilingualism literature relate to the mental representation of the bilinguals' languages. Although there is no consensus in the literature till date regarding the representation of languages in the bilingual brain, both these approaches are necessary to understand the perspectives that have paved the way for current and future bilingual research. Volterra & Taeschner(1978) claimed that bilingual children go through 3 stages in their linguistic development from birth uptil 3 years of age. The first stage represents a fusion of both languages with one lexical system. The second stage represents partial separation, with separate lexicon but undifferentiated syntactic component. And finally during the third stage, two systems emerge with separate syntax and vocabulary. This hypotheses has been named *Unitary Language System Hypotheses* by Genesse(1989). This 3 stage model has been supported by other researchers as well (Redlinger & Park, 1980; Swain & Wesche, 1975; among others) and basically proposes that language competence is more general than the knowledge of any particular language. It leads to the understanding that bilingual children are not really bilingual until about 3 years of age (Genesse, 2001:155). The basis of their claim is that bilingual children, during the early stages of language acquisition, engage in code-mixing, using lexical, phonological or morphosyntactic elements from both their languages in the same conversation or utterance. This indicates their incapability of storing and using the two languages separately.

Conversely, in the other hypotheses called the *Dual Language Systems Hypotheses*, researchers claim that bilingual children from the one-word stage onwards(or even before) differentiate their two languages and use them appropriately, according to the language context and the interlocutor. This differentiation has been evidenced at

different levels of language such as phonology (Celce-Murcia, 1978; Johnson & Lancaster, 1998; Paradis, 1996; Schnitzer & Krasinski, 1994; Paradis, 2001), syntax (DeHouwer, 1990; Ingram, 1981/82; Meisel, 1989, 1994; Paradis & Genesee, 1996, 1997), pragmatics(Genesse, Nicoladis & Paradis, 1995; Genesee, Boivin & Nicoladis, 1996; Lanza, 1997a; Meisel, 1989; among others) etc. These researchers explain the bilingual children's code-mixing in terms of the language input they receive and their proficiency in both the languages. According to the input hypotheses, bilingual children code-mix depending upon the amount of code-mixed input they receive from their parents or other adults. According to the proficiency hypotheses, code-mixing takes place either when children are using their less proficient language or when they do not have translation equivalents of the words they want to use (for a review see Genesse, 2001). Although both these hypotheses are supported by many studies, code-mixing by these bilingual children is generally viewed in terms of their performance i.e. proficiency. Another challenge that the dual language systems hypotheses faces and has tried to answer is the autonomy or interdependence of the linguistic systems. The question they try to answer is "whether young children exposed to two languages acquire abstract constraints (or “rules”) that are different for and specific to each of the target languages" (Genesse, 2001:158). While Paradis & Genesse(1996) reported no transfer, delay or acceleration in the syntactic development of French-English bilinguals as compared to monolingual controls, many others such as Flege(1995), Muller(1998), Dopke(2000), Yeni-Komshian, Flege, & Liu(2000), Paradis(2001), Fabiano-Smith and Barlow(2010) etc. have evidenced cross-language influences, indicating non-autonomy of the two systems. However, the extent to which these two systems interact is not yet clear.

Nonetheless, even though these findings pave the way towards bilingual language faculty, further investigation is needed to conclusively posit any theory or explanation regarding the linguistic development of young bilingual children.

Another dichotomy that appeared in the bilingualism literature is the fractional versus wholistic view of bilingualism proposed by Grosjean (1985c, 1989). This proposal basically emerged to steer the research community in the appropriate direction when investigating bilinguals or any aspect of bilingualism. Grosjean(1985c, 1989) stated that the *fractional or monolingual view* of bilinguals evaluates them as 'two monolinguals in one person'. Under this view, the research that has taken place has judged bilinguals to have two separate and isolable language competencies, and these competencies should be similar to those of the two corresponding monolinguals (Grosjean, 2008:10). Therefore, the methods of investigation of monolingual speech and language have been used to study bilingual acquisition. This has led to fallacious conclusions such as the expectation of balanced bilingualism where the bilingual is fully fluent in both the languages and

contact between the bilinguals two languages seen as anomalous or accidental. However, this line of research has come out with results that do not reflect true bilingual nature.

Consequently, Grosjean(1985c, 1989) proposed a *wholistic or bilingual view* of bilingual acquisition. This view claims that "the bilingual is an integrated whole which cannot be easily decomposed into two separate parts" (Grosjean, 1989:6). Bilinguals differ from monolinguals in many respects. They use their languages for different purposes, with different people and in different domains of life (Complementarity Principle[4], Grosjean, 2008, 2016). Therefore, the bilingual has a unique linguistic personality based on the structure and organization of the bilingual's languages, the nature of language development and the context of acquisition. According to Grosjean(1989), under the wholistic view, the comparison of monolinguals and bilinguals has to be fairer, stressing the specificities of the bilingual, taking into account the stability of the second language and the language mode that the bilingual is in at any given time and the amount and type of language mixing(code-switching or borrowing) that takes place in the bilinguals communication. Grosjean's hypotheses has found support from empirical work at all levels of language as well as from cognitive studies proving that a bilingual is a unique and specific speaker-hearer in her own right and cannot be tested according to the monolingual norms.

And in order to appropriately understand the bilinguals' mental representation of the languages during production and perception,Grosjean(1982, 1985c, 1989, 1994, 1997a, 1998a) proposed the *Language Mode* continuum. Grosjean(2008:38) defines language mode as "the state of activation of the bilinguals' languages and language processing mechanisms, at a given point in time". Towards the monolingual end of the continuum, the bilingual deactivates one language (but never totally) and at the bilingual end, the bilingual speaker chooses a base language, activates the other language, and calls on it from time to time in the form of code-switches and borrowings (Grosjean, 2008:38). Figure 1 shows this schemata as proposed by Grosjean(1998a).

[4] Complementarity Principle states that "Bilinguals usually acquire and use their languages for different purposes, in different domains of life, with different people. Different aspects of life often require different languages." (Grosjean, 2008:23)

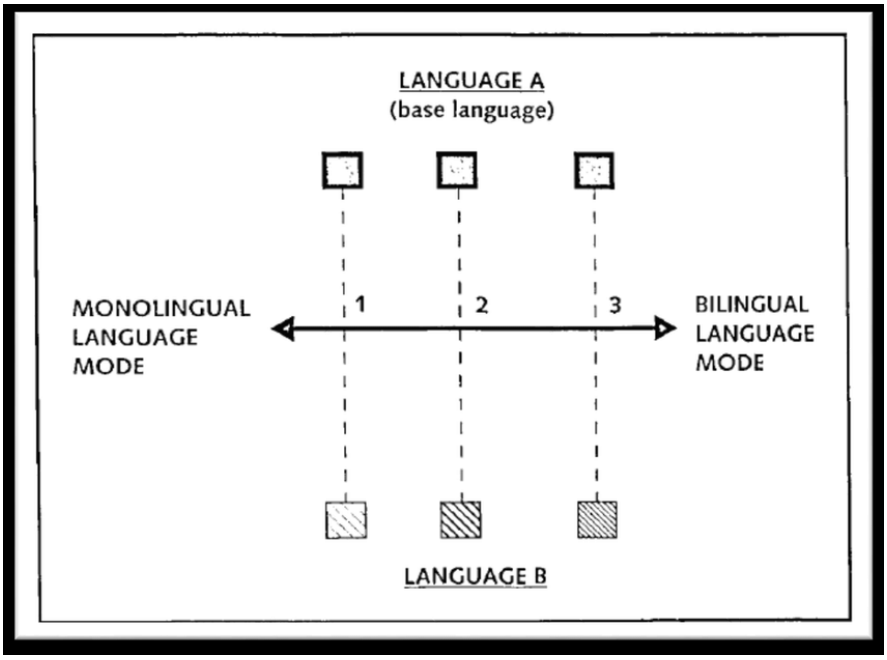


Figure 1. Visual representation of the language mode continuum. The bilingual's positions on the continuum are represented by the discontinuous vertical lines(1,2,3). Language A is the base language and language B is the guest language.

Language mode depends on various factors such as the interlocutors (their language proficiency, language outlook, socioeconomic status, relation between the interlocutors, language mixing habits etc.), the context of conversation (language(s) used, topic etc.), the situational context (location, presence of monolinguals, degree of formality or intimacy etc.), research study factors etc. Grosjean(2008:39) insists that in bilingualism research, language mode has to be taken into account as it gives a truer reflection of how bilinguals process their two languages, separately or together. The present study makes use of the language mode continuum to test the participants in a particular mode (monolingual or bilingual). Further details are provided in chapter 3.

2.1.2 Cognitive dimension of Bilingualism

The effect of bilingualism on the cognitive and linguistic development was not seen in a positive light till about the middle of 20th century. Bilingualism was discouraged on the grounds of mental confusion and cognitive or linguistic deficit amongst children as well as by the puritanical view of language. Saer(1923) conducted an intelligence(IQ) test with 1400 monolingual and bilingual children(7 to 14 years of age) and found a 10 point difference between them on the IQ test. He concluded that bilinguals were mentally confused and at a disadvantage compared to the monolinguals. Baker(2001:136-139) outlines the many reasons which invalidate such a study and its conclusions regarding the bilinguals. The reasons include -

- definition of intelligence : hereditarian view or a multi-dimensional view of intelligence?
- language of the IQ test : bilinguals should be tested either on both their languages or on their dominant language.
- use of statistical tests rather than simple averages : reanalysis of Saer's(1923) results by Jones(1966) revealed no statistically significant difference between the monolinguals and the bilinguals.
- basis of classification of bilinguals : all four language abilities(speaking, reading, writing, listening), fluency, age of acquisition etc.?
- generalization of the sample results to the entire population of bilinguals
- language and cultural context of the subjects of the study : minority language groups in subtractive environments (where the child's first language is in danger of being replaced by a more prestigious second language) may lead to negative cognitive findings as compared to additive environments(where both languages complement each other).
- necessity to match monolingual and bilingual groups in the study on variables such as sociocultural class, gender, age, type of school attended and urban/rural and subtractive/additive environments.

In sum, cognitive studies conducted on bilinguals till 1960s presented a unanimous conclusion that bilinguals were inferior to monolinguals, mostly on verbal IQ tests. However, starting with Peal and Lambert's(1962) myth-breaking study(discussed below), there has been an upsurge of bilingual research which highlights the cognitive advantages as well as the multidimensional nature of bilingualism using a systematic approach.

In 1975, another study vilified the capability of bilinguals, labeling them 'Semilinguals'. Hansegård (1975; see Skutnabb-Kangas, 1981 for a detailed review)concluded that bilingual children suffered from *semilingualism* as compared to monolinguals in six language competencies namely vocabulary size, correctness of language, unconscious processing of language, language creation, mastery of the functions of language and meanings and imagery (see Hamers and Blanc, 1989, 2000; Baker, 2001 for details). Semilingualism referred to the language ability of a group of individuals who are often regarded as not having sufficient competence in either language. The notion of semilingualism or double semilingualism found opposition from many researchers (Skutnabb-Kangas, 1981; Wiley, 1996a; MacSwan, 2000; Baker, 2001; among others). The methodology employed by the studies which supported semilingualism included factors such as language competence, socio-economic status, gender, type of school attended etc. which were 'not equal' between the monolingual and bilingual groups chosen for these studies

and therefore their results and conclusions are questionable. Baker(2001:9-10) lists six major problems with the concept of semilingualism, which are, unfair comparison with monolinguals, deficiencies in the educational tests used to measure language proficiency, arbitrary cut-off points to decide who is or is not a semilingual, context specific usage of language, the economic, political and social conditions which lead to undeveloped language competence and the belittling overtones that this term acquired for the scandinavian immigrant groups in the US.

However, the avant-garde work of Peal and Lambert(1962) revealed the true character of bilingualism. With a systematic approach to research methodology and considering factors such as language competency and socio-economic status of the participants, Peal and Lambert(1962) concluded that bilingualism can lead to cognitive advantages over monolingualism. Their study compared 110 French-English bilingual children with monolingual children on verbal and non-verbal tasks and found that bilinguals performed significantly better than monolinguals on 15 out of 18 tasks. On the other 3 tasks, both the groups performed equally. Therefore, the authors concluded that bilingualism endows greater 'mental flexibility' and reorganization as compared to monolingualism. Although, Baker(2001:141-142) outlines a few shortcomings of Peal and Lambert's(1962) study, the research on bilingualism since then has confirmed the positive findings of their study.

Since then, several studies have been conducted to understand the relationship between bilingualism and the brain. This body of work shows enhanced cognitive flexibility (Ianco-Worrall, 1972; Ben-Zeev, 1977; Hakuta, & Diaz, 1985; among others), stronger attentional and executive control (Bialystok, 1999, 2001, 2007, 2011; Bialystok et al., 2008; Costa, Hernádez & Sebastián-Gallés, 2008; Costa, Hernádez, Costa-Faidella& Sebastián-Gallés, 2009;Bialystok, Craik, & Luk, 2008a, 2008b; Emmorey et al., 2008b; among others), greater metalinguistic awareness (Bialystok, 1997; Ben-Zeev, 1977; Lauchlan, Parisi & Fadda's, 2012; among others) and enhanced creative skills (Kessler & Quinn, 1987; Saxe, 1988; Ricciardelli, 1993; among others) amongst the positive bilingual effects on cognitive development. The only exception being the somewhat smaller vocabulary size bilinguals have in both their languages (see section 2.1.3),the authors of these studies unanimously claim the cognitive advantages bilinguals have over monolinguals especially in terms of executive function.

Ellen Bialystok has been one of the prominent researchers in the field of bilingualism and cognition. Her pioneering work (Bialystok, 2001, 2007, 2011; Bialystok et al., 2005; Bialystok et al., 2007; Bialystok, Craik, & Luk, 2008a, 2008b; Bialystok & Feng, 2009; inter alia) has led her to the observation that " … the constant use of two languages by bilinguals leads to changes in the configuration of

the executive control network and results in more efficient performance on executive control tasks, even those that are completely nonverbal" (Bialystok, 2011:6). From her work with children and adults (for a review, see Bialystok, 2011), she generalizes that enhanced performance in executive control tasks is found at all stages of life of a bilingual, that the executive control exerted during a linguistic experience can be evidenced during non-verbal tasks and finally, there is no single core component of the executive control structure that decides the results of a task, rather the control network works holistically. Additionally, her work (Bialystok, Craik, & Freedman, 2007; see Bialystok, 2011) with monolingual and bilingual Alzheimer's patients has shown a significant delay(4 years) in the onset of symptoms of dementia in case of lifelong bilinguals and an increased cognitive function in case of bilingual patients with significantly more atrophy than monolinguals patients of dementia. In summary, her work reveals the modified cognitive networks and cognitive abilities of bilinguals leading to better cognitive performance, all because of the ordinary experience of bilingualism (Bialystok, 2011:8).

In addition to all this, the past two decades of research on cognitive consequences of bilingualism have led to the remarkable discovery of associations between language use, cognition and the brain. Three main conclusions have been drawn regarding the influence of bilingualism. First, both the languages of the bilingual are active when listening to speech, reading words in either language and planning speech in each of the two languages. This parallel activation of the two languages indicates that the language not in use exerts some influence even though the bilingual is unaware of it. This cross language activation also leads to competition between the two languages requiring the bilingual to control or regulate the competition in order to correctly and fluently use the intended language. Second, there is bidirectional interaction between the two languages of a bilingual. Not only does the L1 influence L2, but with increasing proficiency even L2 comes to influence the native language. This influence of L2 has been observed at all levels of language, lexicon, grammar as well as phonology and it proves Grosjean's(1989) observation that a bilingual is not 'two monolinguals in one brain'. Third is the consequence of bilingualism on not just language processing but domain general cognitive processes as well. The experience of bilingualism shapes the brain networks and provides neural support during early development as well as in old age against cognitive decline or the presence of disease. Kroll et al.(2015) and Kroll, Bobb & Hoshino(2014) provide a brief review of the literature that has led to the above three conclusions. According to the authors, the research on bilingualism has demonstrated "... a remarkable level of plasticity across the bilingual's two languages, with evidence that the two languages engage directly within a single language system that is stretched in different

directions by the conflicts and convergences present across each level of language use."(p.15)

2.1.3 Linguistic dimension of Bilingualism

In contrast to the cognitive approaches to bilingualism which primarily investigate the effect of bilingualism on the mind and brain, the linguistic approaches typically focus on the structural patterns of the bilinguals' languages. The predominant questions that linguists have been trying to answer relate to the grammar in the bilinguals' mind (co-existence and interaction of the two languages), acquisition of two grammatical systems and the use of two systems in bilingual speech production. Therefore, most of the existing linguistic studies of bilingualism and multilingualism focus on the bilingual acquisition and linguistic development of children and bilingual speech production. And as with any kind of research, different opinions exist amongst the researchers on these topics.

With regards to the linguistic development, Macnamara (cited in Bialystok, 2001) pointed out that “bilinguals have a weaker grasp of language than monoglots”. After reviewing studies on linguistic development of bilingual children, Macnamara suggested that bilingualism delays the acquisition of linguistic skills, including grammatical awareness. However, many other studies have provided contradictory evidence. Meisel(2004), Paradis & Genesee(1996), Genesee & Nicoladis(2006), Bialystok et al.(2009) and many others argue that bilingual children follow the same developmental path, acquire the same level of grammatical competence and achieve linguistic milestones in the same pattern and pace as their monolingual peers. Furthermore, Paradis, Crago, Genesee & Rice’s (2003) work suggests that bilingual children with SLI share the same developmental path as monolingual children with SLI. Burns, Yoshida, Hill, & Werker(2007) and Sebastian-Galles & Bosch(2005) (cited in Bialystok et al., 2009) have shown that 14 month old infants raised in bilinguals environments maintain and develop the categorical distinctions for the phonetic system in both languages as compared to monolingual babies of the same age who lose the ability to detect contrasts that are not part of their language environment. Therefore, bilingual infants develop the phonological basis for both their languages at the same pace as monolingual infants do for their only language.

When it comes to word learning, the basic milestones are same for children learning one or more languages (Pearson, Fernandez, & Oller, 1993) in spoken or sign modality (Petitto et al., 2001). However, the strategies of word learning and the extent and rate of vocabulary acquisition may be different for monolingual and bilingual children (Bialystok, 2009). In case of strategies of word learning by bilingual children, some studies report a difference between monolinguals and bilinguals (Bialystok, Barac, Blaye, & Poulin-Dubois, 2010; Davidson & Tell, 2005)

whereas others do not (Au & Glusman, 1990; Merriman & Kutlesic, 1993). Bialystok et al.(2009) conclude that bilingual children employ different mechanisms than monolingual children when learning new words however, the time at which a child produces the first meaningful words is similar for both monolingual and bilingual children. In case of development of vocabulary in monolingual and bilingual children, there is evidence that although bilingual children hold a larger total vocabulary, they have smaller vocabulary in each of their languages compared to monolingual children of that language (Ben-Zeev, 1977; Pearson et al., 1993; Bialystok, 2001; Michael & Gollan, 2005; Bialystok, Craik & Luk, 2008b; Bialystok & Feng, 2009).

Bialystok et al.(2009) insist that to understand bilingual language ability and the bilingual mind we need to understand the interfaces between the linguistic and cognitive systems. They claim that language use in case of bilinguals must be intimately tied to a cognitive system unlike in monolinguals. In this regard they acknowledge two crucial differences between monolinguals and bilinguals. First is the knowledge base that underlies the processing systems in monolinguals and bilinguals. This knowledge base is less rich or less interconnected in case of each of the bilinguals' language because of less frequent use of each language (Gollan, Montoya, Cera, & Sandoval, 2008) than for a monolingual of either language. Hence, the difference in language performance(lexical retrieval) between monolinguals and bilinguals. Second, as is discussed in section 2.1.2 above, both the languages of a bilingual are active even when only one of them is in use. Evidence for this claim comes from many studies with the conclusion that "joint activation of the two languages creates a unique need for selection in bilinguals in which language processing must resolve competition not only from within language alternatives as monolinguals do to select among close semantic neighbors but also from between-language alternatives for the same concepts" (Bialystok, 2009:93). And this kind of selection points to a different set of attention and control networks necessary for bilingual speech production than for monolingual production. In sum, the differences in the linguistic representations and in the selection mechanisms create differences between monolingual and bilingual speech production and perception.

Therefore, as noted by Bialystok et al.(2009) although the acquisition of language(sounds, lexicon, grammar) by monolinguals and bilinguals follows the same path showing the same milestones, there are differences between cognitive and linguistic development. Whereas the cognitive abilities keep language acquisition process on a common time course, the variable input and use of language(s) affects the linguistic development both qualitatively and quantitatively. This also points to the interactions and interdependence between the cognitive and the linguistic networks. These interactions can be attributed to the joint activation

of the two languages which require the bilingual to select from the target system in the presence of other active alternatives. The bilingual thus engages the executive control system to attend to the required language, to avoid interference from the non-target language and to monitor the two simultaneously active languages. This in turn leads to modification of the nature and efficiency of the executive processes, thereby differentiating them from the monolingual speakers' system. Thus, linguistic processes are able to redefine and restructure the executive function of bilinguals and inspite of somewhat lower vocabulary levels, give them cognitive advantages over monolinguals.

Coming to the acquisition of second language phonology, various proposals have been made regarding the acquisition of new phonetic categories by bilinguals. One of the prominent models was proposed by Flege(1995) called *Speech Learning Model*(SLM). According to Flege(2005), the chief aim of the SLM is to account for variation in the extent to which individuals learn or fail to learn to accurately produce and perceive phonetic segments in an L2. The main assumptions of SLM are -

1. L2 speech learning is not constrained by a critical period, however, SLM does admit that children are more likely to form phonetic categories for L2 sounds as compared to adults as their L1 categories are less fully developed and are less powerful attractors for L2 sounds.

2. The capacities needed by monolingual children to learn the language specific properties of their L1 are preserved across the life span and remain accessible to L2 learners of all ages i.e. L2 learners, regardless of their age when first exposed to the L2, can establish new phonetic categories for L2 sounds if given the right kind of input and time to do so.

3. The categories making up the L1 and L2 phonetic subsystems of a bilingual exist in a "common phonological space" and will mutually influence each other. The two mechanisms through which the L1 and L2 phonetic categories interact are: phonetic category assimilation and phonetic category dissimilation. Both these mechanisms affect the vowels and consonants of the L1 and L2.

Phonetic category assimilation states that those L2 sounds which are perceived to be similar to L1 sounds are subsumed by the L1 sounds as they develop through childhood. Thus, equivalence classification blocks L2 category formation. On the other hand, if an L2 sound is perceived to be dissimilar from the closest L1 sound then it is likely that a new phonetic category will be formed for that sound. And if this newly established L2 phonetic category is relatively close in the vowel space to

the pre-existing L1 category, then they move away from each other in the phonetic space to minimize perceptual confusion, leading to phonetic category dissimilation. This process may make the production of L1 sounds or L2 sounds or both different from the productions of the respective monolingual speakers' sounds. This process also shows that category formation of L2 sounds depends on the perceived L1-L2 dissimilarity.

Flege and colleagues have undertaken numerous studies to investigate the phonetic and phonological features of second language learners' L1 and L2. They provide many examples in support of SLM illustrating phonetic assimilation(Flege, 1987; Mackay et al., 2001), phonetic dissimilation (Flege & Eefting, 1987, 1988; Flege, Schirru & Mackay, 2003) as well as bi-directional influence(Flege, Yeni-Komshian & Liu,1999; Yeni-Komshian, Flege & Liu,2000). One of their studies (Flege, 1991) even falsifies the SLM, however they call for more research to confirm those findings. Additionally, Flege's work has tried to understand the relation between L2 speech production and age of acquisition of second language, input in L2 speech learning and the amount and kind of L2 use. He insists that age related effects on L2 pronunciation are still unclear and more productive research is needed to determine the effects of these factors on L2 speech performance (Flege, 2007:376).

The other area of investigation which has received most attention in bilingualism literature is bilingual speech production. As mentioned above, bilingualism is a product of language contact and when two(or more) languages come into contact with each other, various kinds of phenomenon emerge. Some of the most prominent include language mixing, language convergence and lexical borrowing which in turn give birth to pidgins, creoles and code-switching. Whereas, in case of bilingual language acquisition, it is still not clear if the dual systems emerge as a consequence of a single system which then splits into two autonomous systems (Unitary Language Systems Hypotheses, see section 2.1.1) or as dually developing systems (Dual Language Systems Hypotheses, see section 2.1.1), in bilingual speech production research, there is some consensus that young bilinguals separate their two phonetic systems from early on. Although there are two phonetic systems, these systems have been proposed to reside in a 'common phonological space' (Flege, 1995) and to occupy a common representational network (Dijkstra, 2007). In addition, many studies have reported interlingual interaction between the bilinguals' two languages (Flege, 1987; Flege et al., 2003; Bullock & Toribio, 2009a; Amengual, 2011; Olson, 2013, 2016; Simonet, 2014; among many others).

At the lexical and syntactic levels of language, there is categorical representation of contrasting lexical items and syntactic structures of one language or the other, whereas at the phonetic level, because of its gradient nature, the interlanguage

interaction is fine-grained. A few studies have reported interlingual phonetic interaction in non-switched contexts and during acquisition (Caramazza et al., 1973; Flege, Mackay & Piske, 2002; Fowler et al., 2008). However, the nature of this interaction is still not clear (Fabiano- Smith & Barlow, 2010). If phonetic interaction can occur when bilingual speakers are tested on only one of their languages (e.g. Caramazza et al., 1973) then contexts which make use of both the languages of a bilingual, such as code-switching or code-mixing, may provide the impetus for interaction. Therefore, code-switching or code-mixing may be a unique opportunity to better understand this interlingual phonetic interaction. And this precisely, is the goal of the present experiment detailed in chapter 3. Since bilingual speech production has received much attention in literature and boasts of a robust body of work and it is also the focus of the present study, it is discussed in section 2.3 giving an overview of the research on bilingual production in non-switched as well as code-switched contexts, whereas code-mixing and code-switching is discussed in the following section(2.2).

2.2 CODE-MIXING AND CODE-SWITCHING

(1) "*Isliye abh har* schools *me ye* activities start *ho kardiya,* because tenth is based on that only, class ten, you have to do lot of debate, declamation, recitation.."('Therefore, now, in every school, they have started these activities…') (old speaker)

(2) "*To mujhe* call *karna, ānē ke bād*" ('So call me after you've arrived') (Young speaker)

(3) "*tū mere ko usme bhējnā, phir* reply *karnā, thīk hai*?" ('You send me [an email] on that [email address], and then reply, ok?') (Young speaker)

(4) "*agar yahan ke lōg khudi apne ko apni* help *karnai ke sōcle…*" ('if the people from here started to think about helping one another…') (Old speaker)

The dialogues (1) to (4) above (cited in Klingler(2017:46)) represent instances of code-switching in old and young Hindi-English bilinguals' repertoires. Code is the neutral umbrella term for languages, dialects, styles/registers etc. (Chloros, 2009:11) and code-switching[5](henceforth CS),in the broadest sense, can be defined as the mixing of two languages in a discourse, as seen above. Chloros(2009:4) defines CS as *"the use of several languages or dialects in the same conversation or sentence by bilingual people"*. Furthermore, research has demonstrated that code-switching is an intentional practice (Zentella, 1997), is used for a number of pragmatic functions (Gumperz, 1982), is representative of highly proficient bilingual abilities (Poplack, 1980) and can take place at all levels of language (phonetic, phonological, lexical, semantic, syntactic, pragmatic) and in all modalities(spoken or written). Of all of the various forms of bilingual linguistic behavior, language mixing is the most natural and immediate declaration of a speaker's bi-/multi-lingualism.

Uptill about a couple of decades ago, CS was thought to be a stigmatized form of conversation. Scholars considered CS to be random bilingual behaviour (Weinreich, 1953, 1968) and bilinguals to have less than ideal competence in either of their languages. Weinreich(1953), in his now classical work on language contact phenomenon, described the ideal bilingual as the one who switches from one language to the other according to appropriate changes in the speech situation(interlocutors, topics, etc.) but not in an unchanged speech situation and certainly not within a single sentence(p. 73). However, research over the last few decades has shown that CS can take place within the same conversation, even the

[5] Due to a lack of consensus in the literature regarding the terms code-switching and code-mixing, they will be used interchangably in this section.

same sentence, follows complex functional and grammatical principles and is a complex rule-governed phenomenon.

Two approaches to CS most widely known and investigated are the structural approach(Pfaff, 1979; Poplack, 1980, 1987; Myers-Scotton, 1993, 2008; Bhatt, 1997; Muysken, 2000; Bhatia & Ritchie, 2016; among many others) and the sociolinguistic approach (Treffers-Daller, 1992; Myers-Scotton, 1993b; Auer, 1998; Lüdi, 2003; Bhatt, 2008; inter alia). The structural approach to CS has been majorly concerned with the grammatical aspects of CS relating to the formulation of structural constraints on where switching can take place *within* the sentence whereas the sociolinguistic approach focuses its attention on how meaning is created through CS and what kind of discourse functions it serves. The structural approach has tried to identify the patterns underlying the grammar of CS and whether these patterns belong to both the languages being mixed or do the mixed codes have additional/separate rules of their own. The sociolinguistic approach tries to explain why bilinguals talk the way they do. These two approaches to CS complement each other with one supporting the other to build an overall theory of bilingual speech.

The sociolinguistic research has proposed many reasons for the occurrence of code-switching in bilingual and multilingual communities. Baker(2001:102-104) delivers a brief overview of the overlapping purposes of CS as:

- to emphasize a particular point in a conversation
- substitution of a word in another language when that word is not known in the language being used
- to express a concept that has no equivalent in the culture of the other language
- to reinforce a command. For ex - a teacher repeating a command to the students.
- clarification of a point by repeating it in the other language
- to re-tell a conversation to a monolingual individual
- to interrupt a conversation
- to ease tension and inject humor into a conversation
- to exclude someone from a conversation
- to express solidarity with a particular ethnic group

All these purposes(and probably more) suggest that CS is not just a linguistic phenomenon but indicates important social and power relationships in a community.

Amongst the different structural theories of CS, two stand out. Poplack's(1980) work provided the initial momentum for the exploration of bilingual data. She proposed the equivalence and free morpheme constraints(Poplack, 1980). Equivalence constraint states that CS takes place at syntactic boundaries which occur in both the languages and the free morpheme constraint prohibits switches after bound morphemes. Poplack(2000) identifies three types of code-switching: extrasentential, intersentential and intrasentential. Extrasentential CS refers to insertion of tag elements in the monolingual discourse of the base[6] language. Intersentential CS refers to switching between sentences and intrasentential CS refers to switching within a sentence(earlier proposed as 'constituent insertion'(Poplack & Sankoff, 1988)). Myers-Scotton(1992, 1993a), on the other hand, proposed the Matrix Language Frame model. Under this model, she defines CS as "... the selection by bilinguals or multilinguals of forms from an embedded[7] language (or languages) in utterances of a matrix language during the same conversation"(p. 4). Some of the main assumptions of this model are that there is no distinction between borrowing and code-switching (discussed below), that the matrix language determines the order of elements in language mixing i.e. there is an asymmetry between the matrix language and the embedded language and that only certain embedded language elements can participate in code-switching, such as content morphemes.

Over the years a fundamental disagreement between the researchers of language contact phenomenon has been the status of words or fragments from a donor language inserted into the recipientlanguage. These language contact phenomenon have been termed as code-switching, code-mixing, code-alternation and borrowings, among others. The heart of the problem has been the distinction between code-switching and borrowing(Poplack, 1980, 1981; Myers-Scotton, 1992, 1993b; among others) and code-switching and code-mixing(Kachru, 1978, 1983; Sridhar & Sridhar, 1980). Myers-Scotton(1993b) uses code-switching as a cover term, defining it as alternations of linguistic varieties within the same conversation. Gumperz(1982) refers to the term as juxtaposition within the same speech exchange of passages of speech belonging to two different grammatical systems or subsystems(p. 56). Auer(1995) prefers the term code-alternation as the umbrella term in place of CS. Others (e.g. Pfaff, 1979; Muskyen, 2000) do not use the term code-switching as a cover term. Instead, they use the term code-mixing as a hyponym to include borrowing and code-switching(intra-sentential only). Muysken(2000) proposed 3 different processes constrained by different structural conditions: insertion,

[6] The author considers base language same as the recipient language and matrix language. These terms will be used interchangably in this work.

[7] The author considers embedded language same as guest language and donor language. These terms will be used interchangably in this work.

alternation and congruent lexicalization. Insertion signifies material (lexical items or entire constituents) from one language into a structure from the other language, alternation is between structures from [different] languages and congruent lexicalization requires material from different lexical inventories into a shared grammatical structure (Muysken, 2000:3).

Still others such as Kachru(1983), Singh(1985), Sridhar & Sridhar(1980) and Bokamba(1988) distinguish between code-switching and code-mixing. Code-switching refers to inter-sentential switching only whereas code-mixing refers to intra-sentential switches. Bokamba(1988) writes, "the two phenomenon make different linguistic and psycholinguistic claims.....[code-switching] does not require the integration of the rules of the two languages involved in the discourse whereas codemixing does". These inter- and intra-sentential switches have also come to be known as insertional CS and alternational CS respectively (Myers-Scotton, 1993a; Muysken, 2000; Olson, 2012, 2016) and have been associated with Hypo- and Hyper-articulation theory(Olson, 2012, 2016). Olson(2012) argues that insertional CS takes place when the speakers are towards the monolingual end of the language mode continuum (1982, 1985c, 1989, 1994, 1997a, 1998a). Alternational CS, on the other hand, takes place when the speakers are operating in a more bilingual mode. Thus, insertional CS may incur lower local predictability, whereas in alternational CS, code-switching may be more predictable.

There has been much debate in literature over the difference and/or similarity between borrowings and code-switching (Bentahila & Davies, 1992; Myers-Scotton, 2002; Winford, 2003; Poplack & Dion, 2012; among others). Poplack and her group (1978, 1980, 1981) defined borrowings as 'morphosyntactic and phonological integration of foreign words into the recipient language'. Based on their work, they proposed three criteria to clarify the status of guest words in the base language. These included phonological integration, morphological integration and syntactic integration into the base language. They claimed that if a lexical item showed (a) only syntactic integration or (b) only phonological integration or (c) no integration at all, it denotes an instance of CS. On the other hand, if a lexical item shows all three types of integration, then it constitutes borrowing. However, the criteria of phonological integration was later dismissed due to its gradient nature(Poplack et al., 1988). Another category has since been identified, called Nonce borrowings(Poplack et al., 1988). Nonce borrowings have been defined as syntactically and morphologically integrated lexical items or bound morphemes which may or may not show phonological integration. Unlike established borrowings, they do not fulfill the criteria of frequency of use or degree of acceptance. Thus, lexical borrowing spans a continuum from established borrowings to nonce borrowings. Other researchers, amongst them mainly Myers-

Scotton(1992, 1993a) do not accept the criteria of integration to distinguish borrowing from CS. Myers-Scotton believes that borrowing and CS are universally related concepts and part of a single continuum. She has proposed frequency as the only criteria to relate borrowed items to the matrix language. Following Kachru(1978), she also disagrees with the view that all borrowed items fill lexical gaps in the matrix language. She insists that some borrowings are *cultural borrowings* where the guest lexical items are new to the matrix language and without any equivalent lexemes in the matrix language and others are *core borrowings* where the guest lexical items have equivalents in the matrix language and do not meet any lexical need in the matrix language.

Many studies (Muysken 2000, Gardner-Chloros. 2009, Poplack and Dion 2012 etc.) therefore, conclude that it is not easy to decide these categories especially for single word insertions without looking at diachronic data and the inherent fuzziness of the distinction itself. In general, it is believed that there exists a sort of continuum between code-mixing and borrowings where the edges might be clearly distinguishable but it is difficult to disambiguate the vast majority in the middle especially for single words.

There is now a formidable body of research on code-switching, from grammatical constraints on CS at different levels of linguistics to socio-linguistic/socio-cultural impact of CS, in different language pairings. However, the effect of CS at the level of phonology and phonetics is still a relatively unexplored area. See Bullock(2009) for a comprehensive view of the extant literature on phonetics of CS. The next section provides a brief account of psycholinguistic and socio-phonetic bilingual studies and a detailed account of CS studies.

2.3 THE PHONETIC CONSEQUENCES OF BILINGUALISM

Bilingual speech production has been a topic of debate and investigation since many decades now. During the last three decades of the 20th century, most studies investigated the two languages of the bilingual in terms of *'language switching'*, comparing them to the monolinguals. Olson(2012:7) defines language switching as '.... any change in language, potentially void of a larger discursive unit'. This body of work shed light on the different aspects of L1-L2 interactions, amongst them a number of psycholinguistic (Caramazza et al., 1973; Elman et al., 1977; Soares & Grosjean, 1984; Grosjean & Soares, 1986; Grosjean, 1988; Hazan & Boulakia, 1993; inter alia) and sociophonetic studies (Flege, 1987; Flege & Eefting, 1987, 1987a; Flege & Hillenbrand, 1986; Sancier & Fowler, 1997;Flege et al., 2003; inter alia), probing into the various psychological, social and phonological factors and bringing to light the interactions between the bilinguals' two languages. Rather than giving a detailed overview of psycholinguistic and socio-phonetic bilingual studies (which is not the focus of this work), this section sketches out some prominent work in the respective fields and the following section(2.3.1) provides a complete overview of the phonetic CS studies.

Lisker & Abramson(1964) have demonstrated that phonetic features such as voicing, aspiration and articulatory force, which individually or in combination, can differentiate between stop phonemes such as /p, t, k, b, d, g/, can be derived from the single articulatory feature of Voice Onset Time(henceforth VOT) defined as the lag between the release of the stop consonant and the onset of vocal fold vibrations(Lisker & Abramson, 1964). Therefore, a large number of the following studies have exploited this feature amongst various kinds of bilinguals, to investigate the shifts in VOT between the component languages in order to determine the influence of one language over another.

One of the earliest psycholinguistic study was conducted by Caramazza et al.(1973) which concluded among other results that language switching is easier for production than for perception. The study investigated VOT of 6 voiceless and voiced stops of French-English bilinguals dominant in their L1(French). The authors reported that in production, the bilinguals' L1 interferes with their L2 showing a unidirectional effect from the stronger(L1) to the weaker(L2) language. In contrast, Hazan & Boulakia(1993) conducted a production task with French-English bilinguals. For all four groups they tested(monolingual French, monolingual English, French dominant bilinguals and English dominant bilinguals) it was found that the base language had no effect on the guest language.

Flege(1987) tested the voiceless stop /t/ of two groups of French-English bilingual

females. One group had English as their native language and moved to France as adults, the other group had French as their native language and moved to the United States as adults. The analysis revealed that the English /t/ of French-English bilinguals in the US had shorter VOT values than the English monolinguals and the French /t/ of English-French bilinguals in Paris had longer VOT values than French monolinguals. Thus, both the groups approximated the VOT norm for /t/ in their L2 but did not achieve it thereby illustrating VOT values that were intermediate to the monolingual English and French mean values. In addition, the French /t/ of French-English bilinguals in the US had longer VOT values than French monolinguals indicating an influence of English(L2) and the English /t/ of English-French bilinguals in Paris had shorter VOT values than English monolinguals indicating an influence of French(L2). Therefore, this study not only showed phonetic category assimilation(L2 /t/ was assimilated by the L1 /t/), it also demonstrated that the two systems are in a 'common phonological space' (Speech Learning Model, Flege, 1995) and interact with each other.

Flege & Eefting(1987) in their sociophonetic study discovered that native Spanish speakers of English produced voiceless obstruents /p, t, k/ in English with VOT values that were influenced by their Spanish. They tested three groups of bilinguals (children, late childhood bilingual adults and early childhood bilingual adults) differing in age and number of years of exposure to English as a second language. For all three groups the VOT values of Spanish and English were significantly different, however, for children and late childhood bilinguals, their English VOT values were almost intermediate to the VOT values of monolingual Spanish and monolingual English speakers. For the early childhood bilinguals, the English VOT values were closer to the English monolingual values than Spanish. This result demonstrates L1 influence on L2, however, to different degrees in all three groups. Flege & Eefting(1987a) also reported similar results for Dutch-English bilinguals. These bilinguals' productions in Dutch and English differed from the productions of monolingual speakers of both the languages. In addition, the authors report a bidirectional L1-L2 interaction. These results by Flege & Eefting(1987, 1987a) show support for the Speech Learning Model(Flege 1995, 1999, 2002; see section 1.1.3 above) that the bilinguals have a common phonological space for their two languages and thus the interaction between the two languages is inevitable.

An interesting result was discovered by Sancier & Fowler(1997) who proposed a phenomenon called *'gestural drift'* i.e. a gradient change in VOT, based on their study of a Portugese-English bilingual female. They noticed that the VOT values of stops changed in both the L1(Portugese) and L2(English) of their bilingual speaker depending on the speech environment. When the speaker was in America, her Portugese VOTs drifted towards those of American English and when she in Brazil,

her English VOTs drifted towards the Portugese VOTs. This study demonstrated that temporary language-context dependent changes can occur at the phonetic level in a bilingual speakers' L1 as well as L2 productions.

Flege, Yeni-Komshian & Liu(1999) and Yeni-Komshian, Flege & Liu(2000) tested foreign accents(Korean and English respectively) of 240 native Korean speakers. Flege, Yeni-Komshian & Liu(1999) observed that native Korean participants who arrived in the US before the age of 12 had better English pronunciation (i.e. relatively less Korean accent) than those who arrived in US after the age of 14 but their accents still differed considerably from the native English monolinguals (L1 influence on L2). Conversely, Yeni-Komshian, Flege & Liu(2000) observed that the Korean(L1) sentences of these native Korean participants were also influenced by their English(L2). These findings prove that phonetic interference can be bi-directional as well. Infact, the authors claimed that this bi-directional effect is the rule rather than the exception in case of majority of bilinguals(Flege, 2007:365).

In sum, the psycholinguistic and socio-phonetic bilingual studies have revealed that even though code-switches affect only the low-level phonetic properties of the sound system and, even then, only as temporary perturbations,this low-level, gradient nature of phonetics can offer insights into how bilinguals process and produce in two languages that differ along a given acoustic-phonetic dimension.

2.3.1 The phonetic consequences of Code-Switching

The insights from the above mentioned studies (and many others) are a result of laboratory experiments testing the bilinguals in one of their two languages and/or comparing the bilinguals to corresponding monolinguals. Today, code-switching is a direct and a natural consequence of bilingualism and constitutes the norm in almost every stable bilingual community(Poplack, 1980). Consequently, a small body of work has emerged which has explored the interactions between a bilinguals' two languages employing code-switching as the investigative tool. These studies are discussed in the following paragraphs.

Grosjean & Miller(1994) is the first study which addressed the phonetics of cod-switching. They conducted two experiments with 5 French-English bilinguals. They tested the VOT of three voiceless plosives /p, t, k/ in onset position by inserting the word carrying the voiceless plosive from the guest language into the matrix language carrier phrase. Their results illustrated no phonetic momentum from the base language to the guest language(p. 203). The authors concluded that there is no effect of the matrix language on the base language and that there is a complete and clean transition at the phonetic level. In other words, in case of these bilinguals, there was no processing cost involved in the simultaneous processing of their two

languages.

This was an interesting result at that time which opened the doors to the investigation of the phenomenon of code-switching at the phonetic level. However, over the years their results have been challenged by many studies. Bullock & Toribio(2009a) asserted that a single guest word in a matrix language carrier phrase may represent a loanword or an element receiving contrastive focus rather than representing code-switching adequately. They also reasoned that as the guest words being proper names (Carl, Paul and Tom) are homonyms in both the languages, the participants in Grosjean & Miller's(1994) study might have hyper-articulated the guest words to differentiate them from the base language homonym, leading to no phonetic transfer between the two languages. Additionally, Antoniou et al.(2011) argued that the participants of this study differed fairly widely in the age at which they had acquired their L2(English) and also the authors do not clarify the language dominance of their participants. Language dominance and age of L2 acquisition are both important factors in L2 speech production, especially with respect to L1 influence on L2 production (Flege et al., 1995; Flege et al., 2003; Flege et al., 2006; Flege, Yeni- Komshian, & Liu, 1999). Without identifying these parameters about their bilingual participants, the authors might have missed out on the interactions, if any, at the phonetic level.

Extending Grosjean & Miller's(1994) work, Bullock et al.(2006) and Bullock & Toribio(2009a) conducted experiments adapting a comparatively more naturalistic code-switching design(alternational code-switching instead of insertional code-switching) to investigate phonetic interactions between a bilinguals component languages.

Bullock et al.(2006) compared two groups of bilinguals, Spanish dominant(15 subjects) and English dominant(10 subjects), mismatched in L2 proficiency. Their main objective was to see whether the asymmetry(only L1 affects L2 in code-switches and not vice-versa) in bilinguals' behaviour is due to dominant L1 phonetic categories, which have become stable or is there any other factor in play. Their results indicated that asymmetry was present in both the groups, however, it was in the same direction. Code-switching between Spanish and English provoked convergence toward more Spanish-like VOTs regardless of which language was the base language. The explanation authors provide is related to the inherent differences between English and Spanish. English is a long lag language with the VOT range ~ 30-120ms (Lisker & Abramson, 1964) compared to Spanish(VOT range ~ 0-30ms, (Lisker & Abramson, 1964)), signifying that there is a wider range of VOT values for voiceless stops available in English, in contrast, a higher gestural precision is required to maintain the short lag Spanish stops. Thus, there is *room* for

convergence in English but not in Spanish(p. 14). Additionally, the authors take into account the higher proficiency of L1 English speakers in their L2 Spanish, which could have led them to *over-control* their Spanish VOT and influence English during code-switching. Also, the authors dismiss the concepts of gestural drift, precursor-guest language effect and bilingual mode, in relation to their results and posit, contra Grosjean & Miller(1994) that code-switching has a direct influence on a bilingual's phonetic production.

Bullock & Toribio(2009a) illustrated comparable results. They worked with three groups of bilinguals, L1 Spanish-late L2 English, L1 English-late L2 Spanish and early Spanish-English, to test their phonetic production during code-switching. Their objective was to determine whether evidence of cross-linguistic influence of a more subtle nature would be revealed in bilingual code-switching at the sentential level and they hypothesized that this influence might be bi-directional rather than uni-directional, as shown by previous psycholinguistic language switching studies. Their results demonstrated that bilinguals do maintain separate phonological categories for voiceless obstruents /p t k/ across languages, however, code-switching does promote low-level phonetic interaction in bilingual production. Additionally, the direction of influence between the bilinguals' two languages is not uniform or predetermined. The L1 Spanish group showed interference, L1 -> L2, the L1 English group showed hypercorrection, L2 -> L1(when switching into Spanish) as well as divergence L1<-->L2(when switching into English). For both these groups, the English values moved towards but did not merge with the Spanish values, irrespective of the L1 of the participants. The authors again explain this in terms of linguistic internal differences between English and Spanish. English is a long lag language with the VOT range ~ 30-120ms(Lisker & Abramson, 1964) in comparison to Spanish which is a short lag language with VOT range ~0-30ms (Lisker & Abramson, 1964) indicating that a lot more precision is required to maintain short lag Spanish stops. Therefore, English has more room for convergence towards Spanish than vice-versa. In terms of the linguistic external differences, the authors claim that in case of L1 Spanish group, the English proficiency was relatively low in comparison to other groups and that could be the reason why the speakers could not control their English VOT during code-switching and experienced interference from Spanish. The L1 English bilinguals were also Spanish language instructors so they could have over-controlled their Spanish VOT thereby producing Spanish accented English. The early bilingual group showed phonetic convergence L1 <-> L2, i.e. each language merged towards the other. The authors argue that these early bilinguals have the phonetic latitude to converge toward English-like VOT in Spanish and this convergence was a result of their equal proficiency in both the

languages. Thus, the authors refute the matrix language effect on guest language and conclude that L1 is not impermeable to influence from L2.

Antoniou et al.(2011) demonstrated that code-switching is a sensitive test of L1-L2 interaction. The authors conducted this second study following Antoniou et al.(2010) to test the Greek-English bilinguals' VOT of voiced and voiceless stops during code-switching. They recruited the same 16 bilinguals as in their first study, dominant in their L2(English) and who produced Greek and English stops in unilingual[8] mode comparable to Greek and English stops of monolinguals of the respective languages. Their study tested the stops in initial position of the target syllable, embedded in a carrier phrase of the opposite language. Half of the participants who had produced Greek in the unilingual mode in their previous study produced Greek target syllables in English carrier phrases in this study and the other eight participants had produced English in the unilingual mode in their previous study, now produced English target syllables in Greek carrier phrases in this study. Their results showed a clear difference between the VOT of Greek and English stops and contra Flege, Mackay & Piske(2002), demonstrated an asymmetric influence of the non-dominant L1(Greek) on their dominant L2(English) when switching into English only.

Their main claim was that code-switching is a sensitive test of L1-L2 interaction and they provide two explanations for their results. First, they proposed that at some abstract level, the phonetic categories of each language must be perceived as similar or linked (e.g., Greek [p] and English [p^h] are language-specific phonetic variants of the interlanguage /p/ category). They extended this by claiming that the early bilinguals of their study, even though they acquire L2 early on, still establish categories that are linked to their L1 categories and that their L1 influences their L2, even after years of immersion in the L2. This line of reasoning is convincing as it illustrates that the bilinguals have a common phonological space (Flege, 1995) wherein the phonemes might manifest as different phonetic variants in the languages of a bilingual and thus phonetic bleeding becomes highly likely. Secondly, they explained their results in terms of language use. They argue that because of the consistent use of English in the everyday communication, these bilinguals are far more likely to insert Greek words in English sentences than the other way around and thus after years of practicing code-switching the influence of English on Greek becomes limited. However, this line of reasoning seems counterintuitive. If at all the language use pattern should dictate the influence of one language over another, it should be English influencing Greek as the speakers had been immersed in the

[8] The authors have replaced the term 'monolingual' with 'uniligual' in their work as they do not agree with Grosjean's (1989, 2001, 2008) terminology.

English environment for the last two years.

Many of the studies exploring the L1-L2 phonetic interaction have manipulated the language mode of the bilinguals, testing them in the monolingual as well as bilingual modes(Grosjean & Miller, 1994; Bullock et al., 2006; Bullock & Toribio, 2009a; Antoniou et al., 2011; Olson, 2012, 2016; Muldner et al., 2017). However, Olson(2013) differentiates between language mode and language switching arguing that language switching paradigms incur language switches that are free from discursive constraints, interlocutor effects, pre-modulation or advanced planning of productions and thus provide a clear picture of the phonetic transfer. He conducted a language switching experiment utilizing the cued picture naming technique with twenty Spanish-English bilinguals, out of which ten were Spanish dominant(L1 Spanish) and ten were English dominant(L1 English). He tested the VOT of voiceless plosive /k/ in English as well as Spanish. The participants were shown six target pictures mixed with 113 pictures as fillers. These pictures (three with English words and three with Spanish words) had mono- or bi-syllabic names with the target token /k/ in the initial position. The entire experiment was divided into 3 sessions, monolingual English(95% English tokens, 5% Spanish), monolingual Spanish(5% English tokens, 95% Spanish) and bilingual session(50% English tokens, 50% Spanish).

Olson(2013) reported that in both the monolingual contexts, VOT in the L1 of the speakers was affected by the L2 i.e. when switching into the L1, the L1 dominant speakers showed VOT values that shifted towards their L2. However, L2 of both the groups did not show any effect of the L1. In the bilingual context, neither of the groups was affected by language switching i.e. there was no difference between the VOT's of monolingual or switched tokens. The author explains this result in the light of Inhibitory Control Model (Green, 1986, 1998; Kroll & Stewart, 1994) which says that L1 being the stronger language requires greater levels of inhibition than the L2 and this results in the greater switch costs incurred in the L1. He proposes that in addition to the greater difficulty of inhibiting the L1, the retrieval of L1 while switching into it is even harder and therefore leads to transfer from L2 while switching. Whereas while switching into the L2, because of little inhibition required on the L2 system, it is seamless, without any bleeding of L1 onto the L2. Therefore, inhibition at the phonetic level results in asymmetrical phonetic transfer. With regards to the difference between the two contexts, the author proposes a gradient view of inhibition. In the monolingual context, the degree of inhibition of the languages depends on the language context, which is not balanced at all whereas in the bilingual context, both the languages are in equal ratio thus both of them are partially inhibited and this leads to limited transfer. The author concludes by proposing a tentative phonetic-level Inhibitory Control Model, urging for more

research to confirm his findings.

Similar to Olson(2013), Simonet(2014) makes use of the bilingual context without using code-switching as a tool to investigate the interaction between a bilinguals' languages. He presents auditory stimulus to his participants which is a mix of Catalan and Spanish sentences(with the target token embedded) in the bilingual session and only Catalan sentences in the unilingual session.He tested first formant frequencies of Catalan mid vowels /o/ and /ɔ/ in unilingual and bilingual modes. He also compared the Catalan vowels to Spanish mid-vowel /o/ in the bilingual session. The author recorded thirty early Catalan-Spanish bilingual females. They were divided into three groups of ten each. One group was Catalan dominant, second group was moderately Spanish dominant and the third group was strongly Spanish dominant. The most important finding that he reported is that of raising of both Catalan vowels in the bilingual session. In other words, the Catalan vowels /o/ and /ɔ/ showed lower F1 frequencies, which were similar to Spanish vowel /o/, in the bilingual contexts. He argues "that [this] assimilation (or acoustic attraction) of the Catalan mid-back vowels to Spanish [o] is in part due to performance-based, circumstantial interference processes." (p. 35). By this he means that these interlingual phonetic interactions are not due to long-term phonological representations(Competence) but rather take place during speech processing(Performance).

As for the group differences, all three groups maintained a robust acoustic difference between the two Catalan vowels, however, the magnitude of the acoustic difference between the two vowels varied across the groups. The Spanish dominant groups showed a smaller acoustic difference than the Catalan dominant group. Between the two Spanish dominant groups, the strongly Spanish dominant group showed even smaller acoustic difference compared to the moderately Spanish dominant group. Thus, dominance in Spanish(L2) affects the pronunciation of the Catalan(L1) contrast depending on the degree of Spanish dominance i.e. the effect is gradient in nature. It is important to note here that this work again shows influence of L2 on L1(Antoniou et al., 2011; Olson, 2013), however, it is difficult to say if it is uni-directional or bi-directional in nature as the author has not tested the Spanish unilingual mode. It would be rather interesting to see if the Spanish bilingual values are different from or similar to Spanish unilingual values for these bilinguals, providing a complete picture of the L1-L2 interaction. As such, the interlanguage phonetic interaction found can be attributed not to a local point of dual activation (i.e. code-switching), but rather to the presence of both languages in the experimental setting, i.e. bilingual language context (Olson, 2016).

Like Olson(2013), Simonet's (2014) study is not exactly similar to the above

mentioned body of work because both these studies makes use of the bilingual context without using code-switching as a tool to investigate the interaction between a bilinguals' languages. Olson(2013) presented visual stimulus whereas Simonet(2014) presented auditory stimulus to his participants. However, both these studies present opposing results from the bilingual session. Where Olson(2013) reports no interaction, Simonet(2014), despite not using the code-switching paradigm, still finds evidence of the influence of one language of the bilingual over the other. Even the short period of the recording session, when the participants were exposed to both Catalan and Spanish accented auditory input, was enough to induce influence of Spanish over Catalan vowels(for Spanish dominant groups) is a strong indication of the transient or short-term interference which is likely to be performance based(as posited by Simonet 2014 himself). This result can be unambiguously extended to the code-switching paradigm where bilinguals are exposed to their two languages within the same utterance or conversation, making it a playground for phonetic interaction between the languages. Thus, in addition to Antoniou et al.(2011), Simonet(2014) also provides evidence, although indirectly, of the sensitivity of code-switching as a test for L1-L2 interaction.

Extending the work on language switching and language mode(Olson, 2013; Simonet,2014) Olson(2016) examined the impact of code-switching and code-switching combined with bilingual language mode on the VOT of fourteen Spanish-English late bilinguals. Seven English dominant and six Spanish dominant bilinguals participated in an oral production task. They were tested in three sessions, monolingual non-switched, monolingual code-switched and bilingual code-switched. Monolingual non-switched session had monolingual sentences, monolingual code-switched session represented insertional code-switching where one word from the guest language was embedded into the base language and the bilingual code-switched session had equal amounts of both languages.

With respect to code-switching, the author reports phonetic transfer between the code-switched and non-code-switched tokens, with un-identical results between the two groups. The English dominant group evidenced unidirectional transfer, short to long lag i.e. Spanish(L2) to English(L1). This result finds explanation in the previous work of Bullock et al.(2006) that long lag languages allow room for more phonetic transfer(see above). In case of Spanish dominant speakers, bi-directional transfer is seen. This is explained as a result of 'phonetic latitude' provided by the shortest Spanish VOT's in non-switched contexts which licensed convergence and thus the VOT of both the languages converged towards each other. With respect to the impact of code-switching combined with bilingual language mode on VOT, the study presents a lack of cumulative effect. The author had hypothesized that code-switching in a bilingual mode would increase the level of phonetic transfer as

compared to code-switching in a monolingual mode. However, the study did not show such results. The author argues that the dual activation of languages during code-switching represents the maximal phonetic interaction that can take place. The VOT values are already at the boundary of what is considered English-like or Spanish-like. Therefore, there is no more room for an additive effect without the tokens being non-normative(p.280).

With this study, Olson renders a clearer picture of the L1-L2 phonetic interactions in a bilinugals' productions. This work has not only provided evidence that phonetic transfer can take place from L2 to L1 in late bilinguals but has also revealed the limits of phonetic transfer that can take place in bilingual speech. Tentative as they might be, these results should be enough to motivate further investigation into the combined effect of code-switching and language mode, across various languages, different kinds of bilinguals, phonetic features beyond VOT and in naturalistic settings.

Talking of naturalistic experimental setting, most of the research on phonetics of code-switching has used stimuli which does not resemble natural conversational code-switching. Most of the studies have employed carefully controlled stimuli (sentences) representing insertional code-switching or alternational code-switching, which the participants read out during the recording session(s). Exceptions being Khattab(2002, 2009), Piccinini & Arvaniti(2015) and Balukas & Koops(2015) who conducted experiments in a naturalistic setup and their results resonate with the results of the laboratory experimental settings.

Khattab(2002, 2009) presented a naturalistic study that examined three Arabic-English bilingual children's phonetic productions. The children were born and raised in UK by Lebanese parents. The parents were native Arabic speakers whereas the children were English dominant, although they were exposed to Arabic at home. The children were recorded in different settings including free play with monolingual English friends, picture naming and story telling in English with the researcher and similar tasks in Arabic with their mothers.The study showed that these bilingual children often code-switched while speaking to their parents(Arabic dominant) and that their English(L2) productions during code-switching displayed phonetic features corresponding to Arabic(L1), whereas these Arabic features were absent when the same children spoke English in English monolingual environment. This is a clear evidence of L1 influencing L2 however, more than that it representsthe fine phonetic control that these children exercise to modulate their productions according to the language context and environment.

Piccinini & Arvaniti(2015) alsoused a naturalistic setting rather than a laboratory

setup to compare monolingual and code-switched contexts of early Spanish-English bilinguals, dominant in their L2(English). They recorded 14 bilinguals in two different tasks, Conversation task and Puzzle task. In the conversation task, pairs of participants(who knew each other) conversed with each other on pre-assigned topics and pictures. In the Puzzle task, the same pair of participants had to speak to each other on the pre-assigned topics, while doing 4 different simple jigsaw puzzles independently. For both the tasks the participants were not restricted as to which language to use or about turn-taking. The objective of the puzzle task was to increase the cognitive load of the participants while using both their languages. The unit of examination was VOT of voiceless obstruents /p t k/ in monolingual and code-switched instances from the conversations of both the tasks.

One of the important conclusions that the authors reach is " … at least among early bilinguals, code-switching effects reported in earlier studies are not an experimental artifact but apply in spontaneous speech as well."(p. 132). This is based on the fact that in this study, the bilinguals are in a bilingual mode throughout i.e. both their languages are active mentally and in use, which indicates that code-switching in such a mode does affect the phonetic production. Their results reinforce conclusions of previous work that the bilinguals maintain different phonetic categories for Spanish and English. However, in both the tasks, code-switching resulted in shorter VOT values for both English and Spanish. For English, the authors had expected this result arguing that L1 influences L2 even when L2 is dominant, as proposed by previous studies (Bullock et al., 2006; Antoniou et al., 2011; Olson, 2013). But for Spanish, their hypotheses failed. The Spanish values, instead of lengthening (due to influence from English), were shorter. They explain this result in light of monolingual Spanish VOT values which were already relatively long and so were less likely to lengthen further and thus diverged to maintain the contrast. Another explanation the authors provide is that these bilinguals being dominant in English, might have hyperarticulated while switching to Spanish thus affecting the VOT values. With respect to the cognitive load manipulation, the authors found effects for only English. They had expected the code-switched VOT values for English to shorten further compared to the Conversation task. Instead, the results showed lengthening of the VOT compared to the Conversation task. They attribute this to decrease in speaking rate because of the distraction from the puzzle however, they admit to not having a coherent explanation. For Spanish, they did not find any effect of the cognitive load manipulation stating the same reason that Spanish monolingual VOT's were long enough to not be able to accommodate further lengthening. Nonetheless, they note that the difference between code-switching and monolingual tokens (with the former having shorter VOT than the latter) was not only present but enhanced in the Puzzle Task, attributing this to the bilingual

language mode, in which all conversations took place.

With this study, Piccinini & Arvaniti(2015) have again provided evidence in favor of code-switching as a sensitive test for L1-L2 interaction. They go a step further in that, they do not compare monolingual sentences with code-switched sentences, rather they look at monolingual and code-switched instances in the same conversation of the bilingual. This is a strong evidence of phonetic interaction in a naturalistic setting indicating that bilinguals employ various strategies to keep their two languages apart during speech processing.

Balukas & Koops(2015) tested naturalistic speech of Spanish–English early sequential bilinguals. They found that during code-switching the English tokens were produced with significantly shorter VOT as compared to the monolingual English tokens. This indicated an influence of Spanish(L1) on English(L2). However, there was no effect of code-switching on Spanish productions. Although the language dominance of the participants is not clear and the age of the participants varied significantly, this study illustrates L1 influence on L2.

Expanding the code-switching paradigm are three studies, Gu, Lee & Ching(2008), Olson(2012) and Olson(2016), which have investigated the suprasegmental level during code-switching instead of the segmental level like in the above mentioned studies. These studies also report interlanguage interaction at the suprasegmental level, supporting findings from the segmental level.

Gu, Lee & Ching(2008) is one of the earliest studies to investigate the effects of code-mixing at the supra-segmental level. Their choice of the phonological level and the language pair outlines the novelty of their study. They examined the suprasegmental level of two linguistically different languages, one being a stress timed language, English and the other being a tonal language, Hongkong(HK) Cantonese. They conducted an experiment to examine the rhythmic pattern and F0 of English words code-mixed in HK Cantonese carrier phrases. They recorded four late HK Cantonese-English bilinguals. Their results showed L1 interference on L2. The rhythmic pattern of English, which is stressed timed, shifted towards the rhythmic pattern of HK Cantonese, which is syllable timed. Secondly, the F0 of the English embedded words was raised and the variation in the F0 pattern of the embedded word was seen only in the word final syllable. For the stressed English syllables in word final position, the F0 contour turned flat instead of an F0 contour with a falling end as in monolingual English while for the post-tonic unstressed syllable the F0 contour falls more steeply compared to F0 contour of English monolingual sentences. The prosody of the matrix language i.e. HK Cantonese did not show any effects of code-mixing.The interaction between these two languages of

the late bilinguals has shown an asymmetric effect. L1 affects the L2 even at the suprasegmental level, bringing the prosody of the guest language closer to the prosody of the matrix language.

Another attempt to study phonetics of code-switching at the suprasegmental level is the work by Olson (2012) where he studied 6 early Spanish-English bilinguals' monolingual and code-switched utterances. At the suprasegmental level, he looked at pitch height and duration of three point vowels /i a u/ in monolingual English, monolingual Spanish and code-switched English(Spanish -> English) contexts.He reported that code-switched tokens were produced with a significantly greater pitch height and greater duration than non-code-switched tokens. By-speaker results demonstrated that speakers hyper-articulated code-switched tokens either through increased pitch or duration or a combination of both. He explained his results with reference to Hyper- and Hypo-articulation theory(H&H) and local lexical predictability. In his words, "Within Hyper- and Hypo-articulation... theory (Lindblom, 1990), speakers constantly adjust their production effort on the basis of constraints in the communicative situation. These constraints can consist of difficulties in the environment (e.g. low signal-to-noise ratio, hearing impairment) or processing demands (e.g. low word frequency, low word predictability). In situations in which communicative constraints are great, speakers tend to hyper-articulate. ..... Conversely, when faced with lower levels of communicative constraints, speakers economize the effort of their productions and hypo-articulate."(p.452) Therefore, the increased pitch and duration of code-switched tokens in his study are indicative of hyper-articulation during communication. The author also establishes that code-switched tokens are less predictable by nature in a discourse than non-code-switched tokens and thus may represent a communicative difficulty. This lower local predictability is what makes the speakers produce hyperarticulated code-switched tokens.

Extending his work on suprasegmental features, Olson(2016) conducted an experiment with 13 Spanish-English late bilinguals, dividing them into two groups of 6 Spanish dominant and 7 English dominant bilinguals. He measured pitch height and stressed vowel duration in 3 language contexts, monolingual non-switched, monolingual code-switched and bilingual-switched. Monolingual non-switched context consisted of morphemes from only one language, monolingual code-switched context represented insertional code-switching with a guest word embedded into a base language and bilingual-switched context referred to an equal mix of both languages.

Unlike Olson(2012), the objective of this study was to investigate the effects of code-switching on suprasegmental features with respect to language mode and language

dominance. As mentioned above, Olson(2012) reported that code-switched tokens have higher pitch height and vowel duration than non-code-switched tokens. This was in the case of early balanced Spanish-English bilinguals switching into their L2(English). Olson(2016) in contrast reported that code-switched tokens were produced with significantly higher pitch height and greater stressed vowel duration than their non-switched counterparts only when both the groups switched into their L1 in the monolingual context i.e. during insertional code-switching. Olson explains this result on the basis of Hyper- and Hypo-articulation theory and local predictability. He argues that code-switched tokens are less predictable than non-switched tokens and thus they may create a cognitive difficulty for the speakers leading to prosodic prominence or hyper-articulation. In case of insertional code-switching, the guest word is less predictable and thus leads to hyper-articulation. With respect to language mode of the bilinguals, the study reported significant differences between code-switches in the monolingual mode and code-switches in the bilingual mode. The author explains this result too in terms of H&H theory. In the bilingual mode, the more number of code-switches makes them slightly more predictable than the single code-switch in the monolingual mode, thereby, inducing a greater degree of hyper-articulation in the monolingual mode as compared to the bilingual mode. Finally, with respect to language dominance, the study reported hyperarticulation only when both the groups switched into their L1. This counter-intuitive result is explained in terms of Inhibitory Control Model(ICM). L1 being the stronger language requires greater effort for inhibition and consequently greater effort for activation. Therefore, the already less predictable code-switches into the L1 represent code-switches into a strongly inhibited system resulting in greater degree of suprasegmental prominence.

The most recent study to further broaden the empirical domain of code-switching examines, unlike all other studies, the segmental as well as the suprasegmental level of 'vowels' for vowel quality, pitch and duration (Muldner et al., 2017:3). Muldner et al.(2017) represents the study which investigated vowels instead of consonants in monolingual versus code-switched contexts. They examined 12 early Canadian French-Canadian English bilinguals' vowel productions and analyzed them in terms of formant frequencies F1, F2, and suprasegmental features, pitch and vowel duration. They created two contexts, French and English, both further subdivided into monolingual non-switched mode and monolingual code-switched mode(Olson 2016). Monolingual non-switched mode comprised of sentences made up of only one language whereas monolingual code-switched mode represented insertional code-switching with a guest word in the matrix language. They tested three vowels in English and four vowels in French.

With respect to formant frequencies, their results showed that the English

formants(F1 & F2) and French formant F2 were similar in monolingual and code-switched contexts whereas the French F1 showed a marginally significant trend towards English. The authors speculate that this slight influence of English(L2) over French(L1) could be because of the 'English-dominant' setting in which the experiment took place. Thus, this study supports the view that there are no phonological consequences of code-switching on vowels. In other words, their study has shown, like Grosjean & Miller(1994) that there is a complete and clean phonetic switch from one language to the other. In regards to vowel duration, the study provides evidence for hyper-articulation, demonstrating that code-switched vowels have longer duration than their non-switched counterparts. In terms of pitch, the authors found that the pitch of code-switched words approached the pitch of non-switched words of the opposite language. In other words, pitch of English code-switched vowels approached the pitch of French non-switched vowels and vice-versa. The authors conclude that this is an intuitive result because the matrix language may exert influence over the intonation contour of the entire sentence, including the pitch of the guest word(p.11).

The extant literature described above, on the phonetics of code-switching has shown variable but interesting results. Many studies tested multiple bilingual groups differing in language dominance and reported distinct results for the different groups. Some studies reported no interaction between the L1 and L2 of a bilingual (Grosjean & Miller, 1994; Muldner et al.,2017), some studies found interference from L1 in L2 in one of their L1 dominant groups (Bullock & Toribio, 2009a; Gu et al., 2008) even when the bilinguals were dominant in their L2 (Bullock et al., 2006; Bullock & Toribio, 2009a; Khattab, 2002, 2009; Antoniou et al., 2011; Piccinini & Arvaniti, 2015), some bilingual groups showed phonetic convergence (Bullock & Toribio, 2009a; Olson 2016) while others illustrated divergence (Bullock & Toribio, 2009a; Piccinini & Arvaniti, 2015). Some studies reported bilingual groups where L2 influenced L1 (Bullock et al., 2006; Bullock & Toribio, 2009a; Olson, 2013; Simonet, 2014) while another study reported L2 influence on L1 in case of L1 dominant late bilinguals (Olson, 2016).

Even though these variable results are a consequence of different methodologies (different tasks, different language dominance of participants, difference in age of learning L2, laboratory versus naturalistic studies) employed by different studies, all of the above studies provide clear evidence that code-switching is a sensitive test of L1-L2 interaction. Additionally, naturalistic studies confirm the results of laboratory studies that code-switching has an effect on the phonetic production of bilinguals,providing a window into the phonetic workings of the bilingual brain. Consequently, the present study is a controlled laboratory experiment testing Hindi-Indian English bilinguals' monolingual and code-switched utterances. Like Muldner

et al.(2017), the current study investigates vowels. Muldner et al.(2017) admit that the English environment of their experiment could have led to the observed results(i.e. no L1-L2 interaction) however, of greater importance is the fact that their results are based on a group of bilinguals whose language dominance is not clear. Language dominance is one of the principal factors when it comes to a bilinguals' production(Bullock & Toribio, 2009a; Bullock 2009; Antoniou et al., 2011; Piccinini & Arvaniti, 2015; Olson, 2016 inter alia) and perception (Caramazza et al., 1973; Hazan & Boulakia, 1993; Li, 1996 inter alia) of language and therefore these results could obscure the differences, if any, between subjects with different language dominance. It could be possible that half the participants of their study were English dominant and the other half, French dominant and by combining them into a single group and collapsing across their values, important findings about these bilinguals' L1-L2 interaction remained concealed. It could also be that all of the participants were English dominant and thus these results represent no L1-L2 interaction, in line with Grosjean & Miller(1994) and the trend found in the French F1 formant could be because of the English dominance of the entire group. And if all the participants were French dominant, then again this represents no L1-L2 interaction and the marginally significant trend in French F1 could be attributed to the English dominant environment of the experiment.

Nonetheless, all of this remains conjecture until proven empirically and therefore the present study addresses this concern by examining the vowels of two groups of bilinguals, Hindi dominant and Indian English dominant. The vowels are analyzed with respect to their formant frequencies F1 & F2, pitch(F0) and vowel duration. Section 2 describes the current experiment in complete detail. Before heading to the present study, the following section talks briefly about Indian English, its history and development in the Indian subcontinent and a comparison of its phonemic inventory with the phonemic inventory of British English. It is of vital importance to understand that Indian English is no longer a variant of British(or American) English. It is a language variety in its own right, with its own complexities and nuances. Therefore, in the next section the author will try to convince the reader to acknowledge the same and then to understand the current study in that light.

2.4 INDIAN ENGLISH

2.4.1 History

English language and English architecture(in some parts of India) have been the most conspicuous British heirlooms in India post-independence. In 1950, similar to the status of Hindi in India, English was declared an official language. Although English does not appear in the Eighth Schedule of the Constitution(2003) amongst the 22 scheduled languages, it enjoys equal if not more importance in the Indian Constitution. It is primarily used in the domains of administration, law, media, science & technology, trade & commerce and education. Pandey(1981, 1994) attributes the rise of English in India to "... a slow decline in the prestige of British Received Pronunciation (RP) as a socially acceptable spoken variety of native English (nE), and a concomitant realization that it is too ideal a model for Indian learners of English to acquire". In addition, one of the main consequences of globalization has been the ascent of English as a lingua franca within the country. India has around 122 major languages and 1599 other languages, according to the Census of India(2001), divided between 4 major language families (Indo-Aryan, Dravidian, Austro-Asiatic and Tibeto-Burman). This diverse linguistic profile of the country has made English a pan-Indian link language.

Kachru's(1985) circles model (Figure. 2) classified varieties of English into three broad categories: Inner Circle varieties, Outer Circle varieties and Expanding circle varieties. The Inner Circle consists of countries that have English as a Native Language (ENL), these varieties are norm providing. For example, the varieties spoken in UK, USA, Australia and New Zealand. The Outer Circle English varieties are considered as a second language (ESL) in their respective countries which have their own spoken norms but tend to rely on the Inner Circle for models of formal written English especially. These countries form a large speech community with great diversity and distinct characteristics. English is used in many domains with varying degrees of competence by the members of the society. India along with Malaysia, Sri Lanka, Singapore, Hong Kong etc. belongs to the Outer Circle. The Expanding Circle uses English as a Foreign Language (EFL) without internal norms and therefore rely on external norms. Japan, Germany etc. are Expanding Circle countries.

While Kachru's(1985) circles model classified varieties of English into three broad categories and considers India as an Outer circle variety, Schneider's (2003, 2007) model elucidates the 5 phases of language development and stabilization. Schneider (2003, 2007) in his dynamic model of evolution of postcolonial Englishes described five phases in the development of new varieties of English. These are foundation, exonormative stabilisation, nativisation, endonormative stabilisation and

differentiation. Applied to the Indian scenario, the first phase, foundation, took place when Britishers came to non-English speaking India and settled. During the phase of exonormative stabilisation, the British English standards took roots and determined the norms and standards of the language. During the nativisation phase, English became semi-autonomous in India, diverging from British English in terms of syntactic innovations, phonological change, an expanding lexicon and competent bilingual Indians (L2 speakers of English).

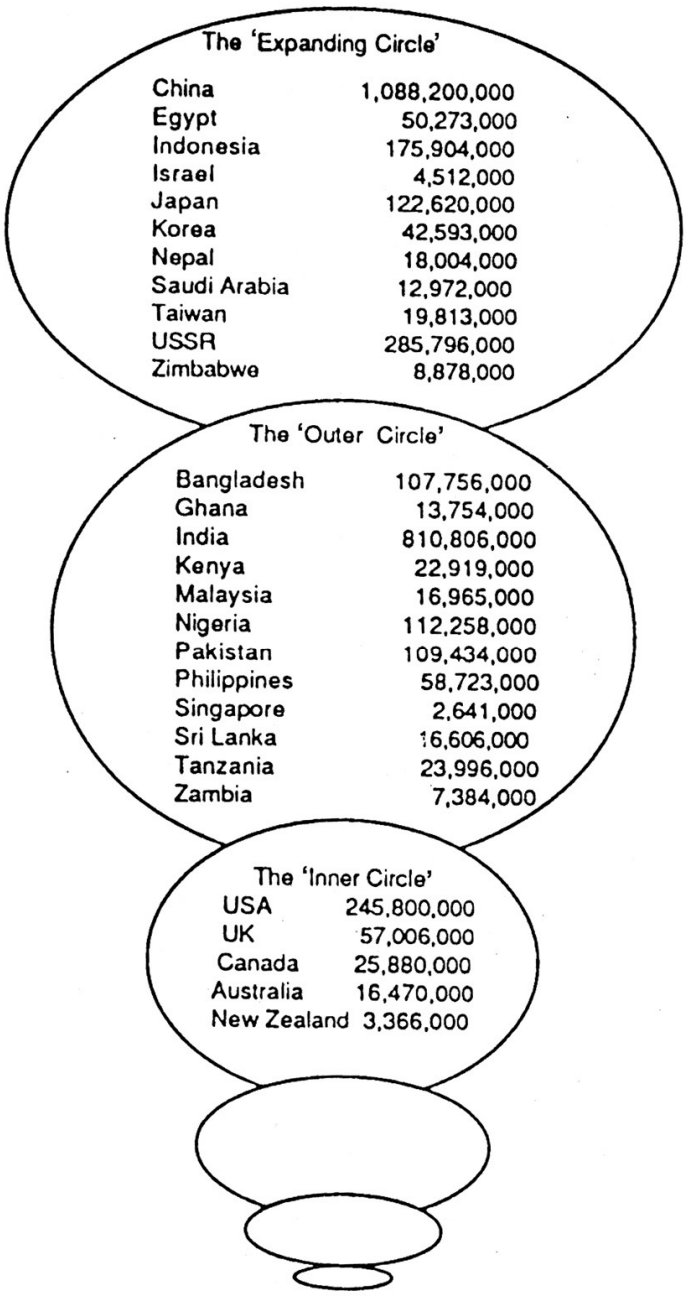


Figure 2. Braj Kachru's Circles model of World Englishes (Kachru, 1988:5; cited in Mesthrie & Bhatt, 2009)

Language riots of the 1960s in India led to the adaptation of the three language formula with Hindi, a regional language and English to be taught in schools. Also, English retained its official language status. Mukherjee (2007:166–170) regarded the language riots and the three language formula to be the pivotal events which steered in the fourth phase of Schneider's model, endonormative stabilisation. In this current, post political independence phase, English is used widely across different domains such as education, media, science & technology etc. It has emerged as a new norm, distinct from the norms of British English and accepted as adequate in formal and informal usage.

Endonormative stabilisation has converted the 'English in India' to what many scholars now fittingly call, 'Indian English'. To ascertain the character of Indian English, Central Institute of English and Foreign Languages(CIEFL), Hyderabad(now English and Foreign Languages University(EFLU), Hyderabad) conducted a seminar to reach definite conclusions regarding this fast evolving variety of English in India. According to Ramesh(1978), the seminar concluded, though tentatively, that "Indian English is neither substandard nor Pidgin English nor just British English with a few Indian species added to it. Indian English has its own identity". A number of studies on different linguistic levels, over the last few decades have proven this identity of Indian English (for phonetics & phonology, see CIEFL, 1972; Bansal, 1976; Chaudhary, 1989; Gargesh, 2004; for morphosyntax see Agnihotri et al., 1988; Bhatt, 2004; Verma, 1978; for lexis and lexicons, see Kachru, 1975; Nihlani et al., 2005; for general works, see Aggarwal, 1982; Kachru, 1983, 1989, 1994; Sridhar, 1989; Dasgupta, 1993; Krishnaswamy & Burde, 1998; Bolton & Kachru, 2007a; among many others)[9]. However, scholars such as Krishnaswamy and Burde (1998; cited in Sailaja, 2009:13) maintain very strongly that there is no such thing as Indian English. They base their argument on written English which according to them is no different from standard English (British or American). They also compare the so-called Indian English with American English. The use of Indian phonology and some lexical items does not make a distinct variety, according to them. They prefer to use the expression 'Indians' English'. Similarly, Dasgupta (1993; cited in Sailaja, 2009:13) maintains that Indian English does not exist and that what we have are 'Indian Englishes'. Dasgupta might be partially right in that there are different Indian Englishes based on the different mother tongues present in India, for example, Hindi English, spoken by people with Hindi as their native language, Tamil English, spoken by people with Tamil as their native language, similarly Malayali English, Oriya English, Bengali English etc. However, all these Englishes have certain

[9] A detailed list of studies on Indian English with a brief description of each is provided by Pingali Sailaja(2009:120-132).

features in common which pertain to a standard Indian English, therefore all these varieties are Indian English first (General Indian English(GIE) model proposed by CIEFL, Hyderabad(1972)). For scholars such as R. K. Agnihotri, Anju Sahgal, Aditi Mukherjee, Braj Kachru, Yamuna Kachru, S. N. Sridhar, Rakesh Bhatt et al., Indian English is an acceptable term, based on the characteristics of the language of the educated Indians, that these scholars have uncovered in their respective works.

Regarding the last phase of Schneider's model, there is consensus (Schilk, 2006; Mukherjee 2007, 2010; Schneider, 2007) that Indian English has not yet entered the differentiation stage. It has a lot of internal variation, firstly because of different levels of language competence (cline of bilingualism, Kachru, 1983) and secondly, because of first language interference(Mukherjee, 2010). In addition, it is not the dominant first language of the majority of population and hasn't given rise to stable and distinctive subvarieties, for example, like American English (Mukherjee, 2010).Table 1 illustrates Schneider's (2003, 2007) process of language development in case of English in India, as proposed by Mukherjee(2007, 2010).

	Phase	Start Date	Event
Phase 1	Foundation	1600	Establishment of East India Company
Phase 2	Exonormative Stabilisation	1757	Battle of Plassey
Phase 3	Nativisation	1835	Macaulay's Minute on Indian Education
Phase 4	Endonormative stabilisation	1968	Three-Language formula following language riots
Phase 5	Differentiation	--	--

Table 1. Schneider's(2003, 2007) process of language development in case of English in India, as proposed by Mukherjee(2007, 2010).

Kachru(2005) considers Indian English as a *functionally native* variety as compared to *genetic native* varieties. He gives the example of Hindi and Bengali belonging to the Indo-Aryan language family having a genetic relationship whereas Indian English being functionally native as part of the linguistic repertoire of the multilingual country. He claims that functional nativeness can be ascertained by the range and depth of a language in a society. *Range* alludes to the domains of function and *depth* to the social penetration of the language. In case of range of Indian English, as already mentioned above, it is used in administration, law, science & technology, film & television, literature, domestic and international communication and mainly education (for details on domains of use, see Sailaja, 2009:5-13). The

range of Indian English can especially be measured through the domain of education in India. The use of Indian English as a medium of instruction in schools and universities today, outranks even Hindi (Mohanty, 2006:275–276).A 2004-05 survey by Desai et al.(2010) suggested that private schools are popular and account for the greater part of English-medium education. The children studying in these schools receive the spoken English input from other Indians (teachers and also their parents and community in general) and written English input from English textbooks, written by Indians and published in India. This indicates that Indian English has effectively reproduced itself and continues to do so, and Indian standards of English are passed on to Indian children when learning English, further expanding its range, generation after generation. This is also one of the main reasons that Indian English as a second language in India is different from English as a second language in European countries or as a foreign language in Expanding Circle countries such as Japan, Greece, Egypt etc. Also, not just through the domain of education, Indian English has been effortlessly promoted by the arts as well. Poetry, fiction, cinema, television and other forms of art have reshaped and reconfigured English to serve their needs. They have, in effect, Indianized the English language, making it Indian English.

The depth of social penetration of Indian English can be understood with the help of Census of India reports and a recent article by Sajith Pai(2018). In 1971, 191,595 number of Indians reported Indian English as their first language, in 1981, 202,440, in 1991, 178,598 and in 2001 the native speakers of Indian English rose to 226,449 (Growth of Non-scheduled languages-1971, 1981, 1991, 2001). According tothe Census of India 2001, the population of India was counted as 1,028,737,436(over 1 billion). Linguistic survey of India 2001 reported English spoken by about 12.18% of the population of India (~125 million speakers). For a majority of this population (12.16%) English is a second language, learnt at school and through higher education. However, for about 226,449 (0.02%) number of people, it is a first language.

In an engaging online article, Pai(2018) identifies a group of Indians or families who are affluent, urban, usually in intercaste or inter-religious unions, highly educated and who predominantly speak English at home, assigning them the moniker *Indo-Aglians*[10]. Although Pai(2018) does not clarify the variety of English used by this group, it is assumed that he is talking about Indian English. He claims that these Indo-Anglians reside in the top seven metropolitan cities of India (Mumbai, Delhi, Bangalore, Chennai, Pune, Hyderabad and Kolkata) and make up around 400,000

[10] According to Pai(2018), the previous usage of the word 'Indo-Anglian' has been in the context of the term 'Indo-Anglian literature', describing Indian writing in English.

households. They comprise 1% of India economically, send their kids to international schools, are not opposed to intercaste marriages, are more spiritual than religious in the traditional sense, consume 'signal[11]' products and do not affect policy or politics directly. He divides the English speaking population of India into 3 groups, English Comfortables(ECs), who make up about 130-140 million people who speak English as a second language. English Firsts(EFs) constitute 25-30 million and Indo-Anglians(IAs) are around 1.5 million[12]. Figure 3 depicts this dissection of the English speaking Indians. ECs speak and write in English but do not think in English and do not prefer to communicate in English. EFs on the other hand, read, write, speak and think in English, preferring it over their other language(s). Indo-Anglians, from the point of view of the author, are an emerging caste of their own, although they do not fulfill the conditions for being considered a caste. The author claims that the only criteria for being an Indo-Anglian are superior English skills and confidence to move in IA circles. Pai's observation of the English speaking population of India is a truth that is manifesting itself with all its might and shows the depth to which Indian English has already made way into the Indian society. Nonetheless, it remains to be seen how the IA community evolves and shapes up (and is shaped by our country), hopefully with the support of more empirical work.

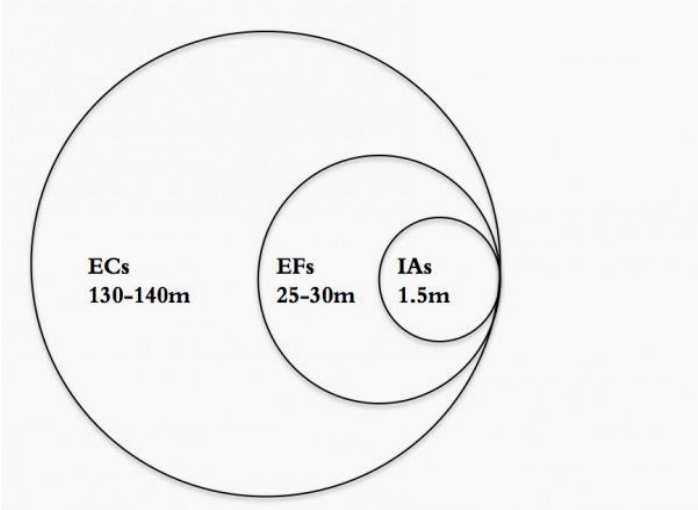


Figure 3. Division of English speaking population of India, according to Pai(2018). ECs - English Comfortables, EFs - English Firsts, IAs - Indo-Anglians.

Apart from the Indo-Anglians, young elite Indians also feel strongly about the English they speak. In sociolinguistic interviews conducted in Hyderabad, Fuchs(2012; cited in Fuchs, 2015d) spoke to 35 young Indians about their

[11] Cultural products that signal your status in the society to the world. For ex - Apple, Netflix, FabIndia, Anokhi, organic food products like 24 Mantra, Conscious Food etc.

[12] The author arrives at the population figures by projecting the numbers for 2017 based on the Census of India 2001 reports. Refer to the article for a detailed account of the calculations.

preference for an English accent and their attitude towards an Indian, born and brought up in India, who would speak with a British or American accent. The responses were unanimous. The participants admitted that mother tongue influence on (Indian)English was acceptable as long as the accent was intelligible. However, regarding the British or American accented Indian English, the participants called them 'fake' and that they were unacceptable (Sridhar, 1996; Sonntag, 2011; cited in Fuchs, 2015). This attitude of young Indians (in addition to the above discussion) not only points at the stability of Indian English as a variety in its own right but also its acceptance (endonormative stabilisation) amongst the youngest generation of India.

In conclusion, following Sailaja(2009), the term 'Indian English' is used without apology in this work because it is a variety of English that is identifiable as Indian with several different facets to it. There are different Indian Englishes no doubt but they are all Indian English (henceforth IE) first.

2.4.2 Previous Work

As the focus of this work is segmental phonology and phonetics, this section provides a description of the phonemic inventory of IE, comparing it to British English(henceforth BE).

In order to present a detailed description of the phonology of IE, CIEFL, undertook studies on the basis of data gathered from educated speakers belonging to different parts of the country. (Bansal & Harrison, 1972, 1990; Bansal, 1976; and CIEFL, 1972). These studies collectively present a picture of a uniform variety of IE in a model known as General Indian English(GIE). GIE comprises 11 monophthongs, 6 diphthongs and 22 consonant phonemes. Some vowels are similar to BE while others show deviation. In case of consonants, most differences are at the phonetic level. The following paragraphs provide a description of the phonemic inventory of IE, comparing works and conclusions of different theoretical as well as experimental acoustic-phonetic studies. The view emerging from most of these studies is that there is a standard IE spoken by educated speakers from across the country while many non-standard varieties also exist shaped by the regional differences in the mother tongue(s).

Vowels

Following many researchers who have worked on the phonetics and phonology of IE, this work also utilizes the Wells(1982) lexical sets for the comparison of IE sounds with BE sounds. Wells(1982) developed a system of sounds to compare sounds across English dialects without describing them as a deviation from a

particular (British or American) standard. In his system, each vowel is characterized by a key monosyllabic word in which it occurs in a wide number of English varieties.

Amongst the 11 monophthongal vowels, there is consensus that the vowels /i/ (KIT), /i:/ (FLEECE), /u/ (FOOT), /u:/ (GOOSE), /ɛ/ (DRESS) and /æ/ (TRAP) are similar to BE (Bansal and Harrison, 1994[1972]:16–17; Bansal, 1978:25, 1990:223; Gargesh, 2004:234-236; Sailaja, 2009: 24–25; Pandey, 2014:305). However, Gargesh(2004:234-236) points out some variations in the use of DRESS /e ɛ ə/ and TRAP /ɛ/ vowels across Indian states.

In BE, the START/BATH vowel is realized as [ɑ] but according to some researchers it produced with the quality of the front vowel /a/ in IE (Bansal, 1978:23, 1990:223; Nihalani et al., 1979; Wells, 1982:211). However, in contradiction, the acoustic studies of Maxwell and Fletcher(2009) and Wiltshire and Harnsberger(2006) illustrate that this vowel is realized similar to the BE vowel [ɑ].

The BE vowels /ʌ/ (STRUT), /ɜ/ (NURSE) and /ə/ (COMMa) are said to have neutralized in IE (Bansal and Harrison, 1994[1972]:16–17; Bansal, 1978:25, 1990:223; Sailaja, 2009: 24–25; Pandey, 2014:305). However, Maxwell and Fletcher's(2009) acoustic study showed that only some of their participants had this merger. For the L1 Hindi speakers, in particular, the NURSE and COMMa vowels differed by duration, but not by quality. Wiltshire and Harnsberger's(2006) acoustic study reported that the L1 Tamil and Gujarati speakers maintained differences between the NURSE and STRUT vowels (the COMMa vowel was not studied), although they were closer to each other in quality than in BE.

One of the most perceptible phonetic difference between the vowels of IE and BE is that the GOAT and FACE vowels are not realized as diphthongs /əʊ, ei/, as in BE, but as monophthongs /o:/ and /e:/. (Bansal and Harrison, 1994[1972]:16–17; Bansal, 1976:17, 1990:223; Trudgill and Hannah, 2002:130; Sailaja, 2009:25, 2012:360; Pandey, 2014:305; confirmed in acoustic studies by Maxwell and Fletcher, 2009; and Wiltshire and Harnsberger, 2006). Pandey(2014:305) reports that the vowel /o:/ has a wide distribution. In addition to replacing the diphthong, it can also replace the BE NORTH vowel /ɔ:/ in words such as *court, coat, core* etc. Pandey(2014:306) notes that the absence of the diphthong /əʊ/ from GIE can be attributed to the fact that this diphthong had not emerged in the BE inventory when English was transplanted in India.

For the NORTH (/ɔ/ in BE) and LOT (/ɒ/ in BE) vowels, some researchers have suggested a merger (Bansal and Harrison, 1994[1972]:16–17; Bansal, 1976:15; Bansal, 1978:25; Trudgill and Hannah, 2002:130) while others claim that both the

vowels are realized identically in IE with NORTH vowel being long and LOT vowel short (Nihalani et al., 1979:211; Bansal, 1990:223; Sailaja, 2009:25). Pandey(2014:305) suggests that the long and short variants of this vowel are neutralized to /ɔ:/. The short variant /ɔ/ exists but does not contrast with /ɔ:/ like in BE. Sahgal and Agnihotri (1988) in their study of L1 Hindi speakers from Delhi found that the educated speakers(especially older ones and females) in formal (reading) contexts, sometimes realized the NORTH vowel as /ɔ/ as in BE. This led them to conclude that the NORTH vowel /ɔ/ is the prestige form in IE. In contrast, Maxwell and Fletcher(2009) did not find any consistent difference between NORTH and LOT vowels. Wiltshire and Harnsberger(2006) on the other hand, reported that their L1 Tamil and Gujarati speakers showed very minute difference in quality between the two vowels.

The distinction between lax and tense vowels seems to be inconsistent in IE (Bansal and Harrison, 1994[1972]:21–22; Gargesh, 2004:234–235). Bansal (1990:224) insisted that unlike in BE, IE speakers do not consistently pronounce tense vowels longer than lax vowels regardless of their L1. Maxwell and Fletcher's (2009) study supports Bansal's(1990) claim illustrating that IE speakers with L1 Hindi do not consistently use duration to mark the tense-lax contrast. However, L1 Gujarati and Telugu speakers from Wiltshire and Harnsberger's (2006) study did make some length distinctions. The tense vowels belonging to the FLEECE and FACE sets were on average pronounced twice as long as their lax counterparts in the KIT and DRESS sets, but the difference between the durations of the GOOSE – FOOT and START – STRUT vowels was smaller.

With regards to the 6 diphthongs, most variation has been reported for the CURE vowel. Nihalani et al. (1979:211) stated that the CURE vowel is pronounced as in BE i.e. /ʊə/, Gargesh (2004: 234–236) reported alternative pronunciations, most common being /ijo:/ having variants such as /iju: ijuə ijɔ:/. Pandey(2014:305) proposes that a better example of the CURE vowel would be POOR as CURE could have variants such as /jo:/. Even Bansal and Harrison(1994[1972]:16-17) choose POOR as the example for the vowel /ʊə/. The rest of the diphthongs PRICE /ai/, CHOICE /ɔi/, MOUTH /aʊ/, NEAR /iə/, SQUARE /eə/ are similar to BE (Bansal and Harrison, 1994[1972]:21–22; Gargesh, 2004:234–235; Pandey(2014:305) except NEAR /i:jə eə i:/ and SQUARE /ɛ: æ e:/ vowels which show considerable variation across speakers (Gargesh, 2004:234–235; Pandey, 2014:305) and PRICE, MOUTH AND CHOICE vowels /ai aʊ ɔi/ being the most stable (Pandey, 2014:305). Pandey(2014:306) also speculates the nature of these diphthongs. He argues that these diphthongs might represent a sequence of two vowels(hiatus) rather than a single vowel phoneme and calls for a closer examination of these to ascertain their nature. However, until further empirical work sheds light on these phonemes,

nothing can be said about their nature with certainty.

To summarize, the vowel inventory of educated Indians consists of 11 monophthongs and 6 diphthongs(Table 2) as compared to 11 monophthongs and 8 diphthongs of BE (Wells 1982).

	IE	BE		IE	BE
MONOPHTHONGS			**DIPHTHONGS**		
KIT	ɪ	ɪ	PRICE	ai	ai
FLEECE	i:	i:	MOUTH	aʊ	aʊ
FOOT	ʊ	ʊ	SQUARE	ɛə~eə	ɛə
GOOSE	u:	u:	CHOICE	ɔi	ɔi
DRESS	ɛ	ɛ	NEAR	iə	iə
TRAP	æ~ɛ	æ	CURE	ʊə~ijo:~ jo:	ʊə
STRUT, NURSE, COMMa	ə~ʌ	ʌ, ə, ɜ			
NORTH, LOT	ɔ~ɔ:	ɔ, ɒ			
GOAT	o:	əʊ			
FACE	e:	ei			
START, BATH	a	ɑ			

Table 2. Vowels of educated speakers of IE compared to BE using Wells's (1982) lexical sets notation. Alternative pronunciations in IE are marked by ~. BE sounds are separated by commas where IE has a merger.

Consonants

Plosives - p, b, t^h d, ʈ ɖ, k, g

In BE, the voiceless plosives /p t k/ are strongly aspirated when they occur initially in a stressed syllable and weakly aspirated in most other contexts /p^h t^h k^h/. However, they have unaspirated allophones /p t k/ in consonant clusters and sometimes at the end of a word (Gimson, 1980:153–155; Gimson and Cruttenden, 1994:139–142; Kachru, 1994:514–515; Hughes et al., 2013:42). In IE, these plosives are always unaspirated (Bansal and Harrison, 1994[1972]:54–56; Bansal, 1976:17,

1978:47, 1990:224; Sailaja, 2009:23; Gargesh, 2004:237, Pandey, 2014).

The alveolar sounds /t d/ of BE are not always realized as alveolar but as retroflex plosives /ʈɖ/ (Bansal and Harrison, 1994[1972]:54–56; Bansal, 1978:39, 1990:224; Kachru, 1994:514; Trudgill and Hannah, 2002:130, Gargesh, 2004:998). Sailaja (2009:21-22) concluded that /t/ and /ʈ/ phonemes are variable across and within speakers, with voiceless /t/ more frequently realised as alveolar /t/ and voiced /d/ more often as retroflex /ɖ/. Moreover, Agnihotri and Sahgal(1985) and Sahgal and Agnihotri(1988) stated that sociolinguistic factors might also determine some of the variation with educated speakers using alveolar pronunciations than less educated speakers. Variation between speakers may also depend on the degree of retroflexion of sounds with retroflexion being greater in the Dravidian languages as compared to the Indo-Aryan languages(Sailaja, 2009:23).

The BE dental fricatives /θ ð/ are replaced in IE by the dental plosives /t d/. The voiceless plosive /t/ is often aspirated /t^h/ due to the influence of orthography (Bansal and Harrison, 1994[1972]:55, 61–62; Sailaja, 2009:21; Bansal, 1976:17, 1978:39; Kachru, 1994:514; Gargesh, 2004:238; Pandey, 2014). In contrast to other authors, Kachru (1994:514) explicitly included a variant /d^h/ for /ð/ and Pandey(2014:304) includes 3 phonemes with restricted realizations /b^h/ (a**bh**or), /$ɖ^h$/ (a**dh**ere) and /g^h/ (**gh**ost) based on orthographic representations of the words in which they occur.

Fricatives - f, s, z, ʃ, ʒ, h

The fricatives present in IE include /f s z ʃ ʒ h/. The BE fricative sound /v/ is replaced by labio-dental /ʋ/ in IE. The status of palato-alveolar sound /ʒ/ is not clear. Sailaja(2009) claims that although /ʒ/ is not present in Indian languages still it has been acquired by most Indians. Pandey(2014:303) mentions that the voiced alveolar fricative /z/ replaces both /z/ and /ʒ/ with no post-alveolar fricative in IE.

Nasals - m, n, ŋ

There are 3 nasal sounds in IE, /m n ŋ/. /n/ can be syllabic in BE (example - /bʌtn/ but in IE it is generally be replaced by /ən/, for example, /bətən/ (Bansal and Harrison, 1994[1972]:66-68) The velar nasal /ŋ/ occurs as a homorganic variant of /n/ before velars. It does not occur word initially (Bansal and Harrison, 1994[1972]:68; Sailaja, 2009:21; Gargesh, 2004:998; Pandey, 2014).

Affricates - tʃ, dʒ

The affricate sounds /tʃ/ and /dʒ/ are similar in IE and BE with hardly any variation

(Bansal and Harrison, 1994[1972]:57-58; Sailaja, 2009:22; Gargesh, 2004:998; Pandey, 2014).

Approximants - ʋ, w, j

The labio-dental fricative /v/ and the labial approximant /w/ of BE are substituted by a single phoneme, labio-dental approximant /ʋ/ in IE (Sailaja, 2009:20; Bansal, 1976:18, 1978:39, 1990:225; Kachru, 1994:515; Gargesh, 2004:238). Sailaja (2009: 20) noted that only the non-standard varieties of IE show a neutralization of /v/ and /w/ into /ʋ/, whereas educated IE differentiates between /ʋ/ and /w/. Similarly, Sahgal and Agnihotri(1988) found that L1 Hindi speakers use /w/ in less than 30% of all cases and concluded that /w/ is associated with little or no prestige. /j/ in IE is realised similar to /j/ in BE (Bansal and Harrison, 1994[1972]:71; Sailaja, 2009:24; Gargesh, 2004:999; Pandey, 2014).

Liquids - l, r

BE differentiates between non-contrastive clear lateral /l/ and dark velarized lateral /ɬ/, however, dark l is non-existent in IE. Only the clear l /l/ is used in all contexts (Bansal, 1990:224; Kachru, 1994:514; Sailaja 2009:23; Gargesh, 2004:998; Pandey, 2014).

In IE, post-vocalic /r/ is pronounced thereby describing the language variety as rhotic (Bansal, 1976:18, 1978: 39; Nihalani et al., 1979:210–212; Wells, 1982; Gargesh, 2004:238). In contrast, it is termed non-rhotic by Trudgill and Hannah (2002:130) and (Sailaja 2009:19). Agnihotri and Sahgal(1985) and Chand(2010) have shown empirically that rhoticity is variable across and within subjects. Based on Agnihotri and Sahgal(1985) and Sahgal and Agnihotri's(1988) analysis of 1980s Delhi IE, Bansal (1990: 222) and Sailaja (2009: 19, 2010) suggested that educated or standard IE is non-rhotic, while many non-standard varieties of IE are rhotic. Agnihotri and Sahgal(1985) and Sahgal and Agnihotri's(1988) work indicated that women, educated speakers and formal contexts elicited lower rate of pronunciation of /r/ as compared to a higher rate of rhotic pronunciations in less educated speakers, among men and in casual speech. With regards to the quality of the rhotic present in IE, there are again different observations. Trudgill and Hannah(2002:130) and Pandey(2014:303) mentioned flaps/taps /ɾ/, Bansal(1976:17) approximants [ɹ] and flaps, Gargesh(2204:998) trills /r/ and Chand (2010) approximants, trills and flaps. Wiltshire and Harnsberger (2006:99–100) found, in addition to the previous three variants, a fricativised approximant used by speakers with L1 Tamil.

The above mentioned consonants and their realizations form a part of the phonemic

inventory of standard IE, majorly spoken by educated Indians. However, researchers have observed some regional variations for some of these sounds. For ex - In case of fricatives, Bansal and Harrison(1994[1972]:59-60) and Gargesh(2004:998) observed that for most speakers of Oriya, Bangla, Assamese and Hindi speaking regions, /f/ is realised as /p^h/, Sailaja(2009:22) adds the same for Gujarati and Marathi speakers. In Orissa, Assam and Bengal, /ʋ/ may also be pronounced as /b^h/ (Gargesh, 2004:998; Sailaja, 2009:22). Some Bengali, Punjabi, Assamese and Bihari Hindi speakers replace /s/ with /ʃ/ and use only one of these phonemes consistently across all contexts (Bansal and Harrison, 1994[1972]:63-64; Gargesh, 2004:998; Sailaja, 2009:22) while some Bihari Hindi and Assamese speakers do the opposite i.e. replace /ʃ/ with /s/ (Bansal and Harrison, 1994[1972]:66). /z/ may also be realised as /dʒ/ in Bengal and Bihar. Gargesh(2009:998) claims that the glottal fricative /h/ is realised mostly in North India and in South India it is replaced by the approximants /j/ and /w/. Gargesh(2004:998) reports a retroflex nasal /ɳ/ which occurs when the alveolar nasal is articulated before a retroflex stop. Sailaja(2009:22) reports the retroflex nasal in case of South Indians. In case of affricates, Bansal and Harrison(1994[1972]:58) note that some Assamese speakers replace /tʃ/ by /s/ and some Hindi, Telugu and Bengali speakers replace /dʒ/ by /z/ and some Bihari Hindi speakers replace it by /dz/.

From the above discussion, the major differences between IE and BE seem to be largely phonetic. The only phonological differences are the frequent merger of /w/ and /v/ and the variable rhoticity in IE. In summary, the consonant inventory of standard IE comprises mainly 22 phonemes (Table 3) with /w/ and /ʒ/ appearing only in some educated speakers' repertoire some of the time.

	Bilabial	Labio-Dental	Dental	Alveolar	Post-alveolar	Retroflex	Palatal	Velar	Glottal
Plosive	p b		t^h d			ʈ ɖ		k g	
Fricative		f		s z	ʃ				h
Nasal	m			n				ŋ	
?				ɾ*					
Lateral Approx.				l					
Approx.		ʋ					j		
Affricate					tʃ dʒ				

Table 3. Consonant inventory of IE

* there is no consensus in the literature regarding the place and manner of articulation of the rhotic sound. Therefore, its manner in not mentioned in this chart and its place of articulation is randomly selected.

In conclusion, Indian English is an endonormatively stabilized variety in its own

right. Its standard variant refers to the variety used by English-medium educated Indians(mostly upper and middle class) who are competent and regular users of IE. As discussed above, its range of functions and depth of social penetration indicate its growing acceptance at various levels of Indian society. The inter- and intra-speaker (or community) variations that IE witnesses is owed to the different levels of competence as well as the influence of the regional L1 of the speaker. Kachru's(1983) *'cline of bilingualism'* is explained by Mukherjee(2010) in terms of the creole continuum concept borrowed from creole studies. The standard IE of upper and middle class speakers with English-medium educational background can be called the *acrolect*or the 'high' variety. The middlepart of the continuum, called *mesolect* is occupied by people having non-English educational backgrounds and lower competence and proficiency in English. The lower part of the continuum is represented by *basilects*, reduced or pidginised forms of English which have also been called Babu English or Butler English, used by local tourist guides, men and women selling local goods to foreign tourists, vendors, domestic staff etc. It is the acrolect that has been the subject of investigation of most linguistic studies. Although there is a wide spectrum of studies on IE especially in the empirical domain of syntax, lexis and pragmatics, there is still a lack of empirical and acoustic studies on the phonetics and phonology of Indian English. The small number of studies that exist, lack generalizability mainly due to the small number of participants whose results can be generalized only to a small population but are still not representative of all the speakers of that region (Sailaja, 2009:361). In order to rectify this situation, future research should focus on the phonetics and phonology of standard IE, especially investigating the Indo-Anglian community (see section 2.4.1 above) and the young elite of India, examining a large enough sample size whose results can be generalized to all the speakers of that region.

2.4.3 Code-switching in the Indian context

Post-independence, English was given the status of associate official language in the Indian constitution and it has since become an important part of administration, law, media, science & technology and mainly education. Earlier, English was used majorly for socio-economic purposes, for professional and official communication but the rise of English as the global lingua franca has attached a certain prestige to it, which amongst most upper and middle class Indians today is irreplaceable. Education sector has been the major force in the transition of English as a foreign language to English as a second language for a large number of Indians. Srivastava and Sharma(1991:189) note that "The higher we move in education, the fewer are the languages employed as media of instruction, so much so that for higher education and technical training the only medium left for use is English." In addition, the significant role of English in print and social media, the publishing sector and the

television and film industry has worked as a catalyst in promoting English as an indispensable part of our lives.

A lot of older studies on Hindi-English CS (Verma, 1976; Gumperz, 1977; Kachru, 1978; Malhotra, 1980; among others) have identified Hindi as the language of intimacy and English as the language of prestige. However, in modern bi-/multi-lingual India, where language mixing is a natural consequence of bilingualism, this dichotomy does not hold true anymore(Bhatia & Ritchie, 2016; Bhatia, 2011; Kathpalia & Keng Wee Ong, 2015; among others). And this seems to be a direct result of the exponential rise of English in the Indian society. In a most recent study, Klingler(2017) illustrates quantitatively and qualitatively, the increased amount of English (than Hindi) being used by the younger generation in comparison to the older generation, which is a result of English-medium education and the easy accessibility to English language. Consequently, the indexing of Hindi and English for mutually exclusive communicative purposes has disappeared over time. Additionally, the fact that a large number of Indians are now proficient speakers of English(in addition to their native Indian language) has led to a substantial amount of code-switching in the Indian subcontinent. The reasons for this rise in CS have also increased over time. Some of them being ((a) to (d) cited in Si(2010:391)):

(a) Register identification (e.g. administrative, political and technical registers), style identification (‘sanskritized’, ‘persianized’ or ‘englishized’ Hindi) and elucidation/interpretation (e.g. through the use of words like *ma:ne* (Persian), *artha:t* (Sanskrit) for ‘meaning’ [to reduce ambiguity in a construction]) (Kachru, 1978).

(b) Neutralization: English lexical items are often perceived as being attitudinally and contextually neutral, and may be used to conceal social or regional identity (cited in Kachru, 1978).

(c) A range of discourse-related functions, including repeating, emphasizing, heightening contrast, creating surprise, making parenthetical remarks, teasing, challenging or reporting others’ speech (Gupta, 1991).

(d) Reasons suggested by speakers themselves, such as: ‘if I do not get the appropriate word in Hindi’, ‘easy to communicate’, ‘when we are short of words’, ‘to speed up communication’, ‘habit’, ‘unintentional’, ‘makes me feel comfortable’, ‘interesting and funny’, ‘scope of expression’ and ‘cos it gives me a feeling of Indianism [*sic*]’ (Eilert, 2006).

(e) to modulate one's socio-cultural identity (Bhatt, 2008).

(f) To achieve maximum efficacy from the two linguistic systems at their disposal (Bhatia, 2011).

(g) Social roles and relationships of participants; situational factors: discourse topic and language allocation; message-intrinsic considerations; and language attitudes including social dominance and security. (Ritchie & Bhatia, 2013a)

Structural and sociolinguistic approaches to CS are not the focus of the present work, therefore this discussion rests here. Selected literature on Hindi-English CS in India, relevant to the present work is discussed below.

Previous work on CS between English and an Indian language(Kachru, 1978; Sridhar, 1978; Gumperz, 1982; Pandharipande, 1990; Pandit, 1986; Bhatia, 1989; Bhatt, 1997; Bhatia & Ritchie, 2016; among others) has looked at structural and social aspects of CS. However, an emerging body of recent work(Si, 2010; Dey & Fung, 2012; Bali et al., 2014; Kathpalia & Keng Wee Ong, 2015; Klingler, 2017) on CS in the Indian context is a preliminary step in the direction of *quantitative research* on CS. It has provided some insights into the increase and kind of language mixing taking place in the Indian language context. These studies provide evidence for, amongst other results, the massive increase of CS between English and Hindi.

Si(2010) through his study of Bollywood films, has shown that through three decades:1980s, 1990s and 2000s, the Indian Hindi movies have revealed an enormous increase in the overall use of English, particularly evident among the younger generation of actors in the movies. The most significant result that he reported was that the younger speakers in the most recent films he studied(from 2000s) inserted Hindi words into English clauses and alternated between purely Hindi and purely English clauses, at a much higher rate than actors in the older films. Dey & Fung(2012) created a Hindi-English CS corpus by examining the speech of 9 bilingual speakers. They studied the points of code-switching in the discourse and concluded that intra-sentential CS is more prevalent than inter-sentential CS in their corpus. Despite being a small corpus, this study is a reflection of the kind of CS that might be prevalent in the Indian code-switching communities. Bali et al.(2014) analyzed written data gathered from Facebook in order to classify mixed language into code-mixes, borrowings, nonce borrowings and other language contact phenomenon. Their purpose was to aid the computational modelling of social media content by multi-lingual users, which is replete with language mixing. They concluded that the embedded words can be divided into 3 categories: code-mixing, borrowings and ambiguous words where the distinction between code-mixing and borrowing becomes fuzzy. It is this ambiguous category of words which presents a problem for NLP and needs to be handled differently. The authors demonstrated

another notable finding through their corpus. Their analysis showed a significant amount of code-mixing in the data with Hindi words in English sentences mainly being formulaic expressions but English embeddings in Hindi were at different linguistic levels and of different types. This study, in addition to supporting the NLP industry, also provides clear evidence of the increase in language mixing, especially English words inserted into Hindi clauses, in the Indian scenario. Kathpalia & Keng Wee Ong(2015) studied Amul[13] Billboards in northern India for the amount of CS, kind of CS and the motivation behind CS between Hindi and English. They analyzed data with greater amount of intra-sentential CS(code-mixing) than inter-sentential CS. They reported various language contact phenomenon(figures of speech: alliteration, allusions, blending, compounding, irony, metaphor, onomatopoeia, oxymoron, parody, puns, and rhyme) present in the billboard advertising and that code-mixing was systematic, following the grammatical rules of the matrix language(Hindi or English). They put forward various reasons for CS between Hindi and English including the aim to achieve maximum efficacy from the two linguistic systems at their disposal(Bhatia, 2011) and the motivation to juxtapose two different cultures(Bhatt, 2008). Klingler(2017), following Si(2010) investigated the changes in CS patterns but unlike Si(2010), Klingler studied natural code-switched data from 6 bilingual speakers from north India. As mentioned above, she reported results similar to Si(2010). The younger participants in her study showed a greater affiliation towards English than Hindi, as compared to the older generation. Another important pattern she outlined is that the younger generation of participants preferred alternating between fully Hindi and fully English clauses as opposed to the older generation who frequently inserted English words into Hindi clauses.

These above mentioned studies, directly or indirectly, come to the same conclusion that the younger generation of Hindi speakers in India have a greater affiliation towards English than Hindi and code-switch between the two languages comfortably. Nonetheless, further quantitative research into the typeof CS widespread in the Indian subcontinent, studying different language pairs and different generation of speakers is necessary to corroborate these results.

The next section discusses the current study followed by general discussion and conclusion.

[13] Amul is a butter brand, established in 1957 in India and its billboard advertising began in 1966 (from Kathpalia & Keng Wee Ong(2015)).

Chapter 3. EXPERIMENTAL INVESTIGATION OF BILINGUALISM

The present study is inspired by the emerging body of extant literature on the phonetic interaction between a bilinguals' two languages during code-switching (see section 2.2). The experiment was designed to examine the effects of code-switching on bilinguals' vowel production in an attempt to observe any interaction between the two phonetic systems of the bilinguals, to assess the level of activation of the two languages of the bilinguals at a given time, and to add to the growing body of literature on the phonetics of code-switching. In the experimental oral production paradigm administered, the 17 Hindi-Indian English(henceforth IE) bilinguals' code-mixed utterances were compared to their non-mixed utterances, i.e. varying both the context (monolingual or bilingual) and target token language (dominant or non-dominant). The bilinguals were divided into two groups, Hindi dominant and IE dominant based on their general language dominance. The language dominance was tested using an online questionnaire, *Bilingual Language Profile: An Easy-to-Use Instrument to Assess Bilingualism* (Birdsong, Gertken, & Amengual, 2012; detailed in section 3.2.1 below). Language dominance of a bilingual has held importance in the language switching literature (Flege et al., 2006; Flege, Frieda, & Nozawa, 1997; Flege et al., 1995; Flege et al., 2003; Flege, Mackay & Piske, 2002; inter alia) as well as in the code-switching literature (Bullock et al., 2006; Bullock & Toribio, 2009a; Antoniou et al., 2011; Khattab, 2002, 2009; Piccinini & Arvaniti, 2015; inter alia) but it has failed to prove its deterministic nature in code-switching (Bullock et al., 2006). Despite this, the present study hypothesizes that the dominant language of a bilingual influences her non-dominant language, solely for the purpose of clarifying the findings in the literature. The results obtained from this study will serve to create a clearer picture of the effect of code-mixing on vowels. More broadly, these results will serve to enhance the current understanding of the code-mixing mechanism in relation to language dominance.

The term 'code-switching' has been used for both insertional(word level) (Grosjean & Miler, 1994; Olson, 2016; Muldner et al., 2017; Antoniou et al., 2011) as well as alternational(sentence level) switching(Bullock et al., 2006; Bullock & Toribio, 2009a; among others) in previous work. The present work utilizes stimuli constructed from two languages, with a word from the guest language mixed(embedded) in the carrier phrase from the matrix language, hence, the term code-mixing has been used throughout this section.

3.1 Research Questions

Previous research (Bullock & Toribio, 2009a; Antoniou et al., 2011; Olson, 2012; Balukas & Koops, 2015; Piccinini & Arvaniti, 2015; Muldner et al., 2017) has shown

that early bilinguals show subtle low level phonetic interaction, either unidirectional or bi-directional in nature, during the use of their two languages. Moreover, some other studies (Bullock et al., 2006; Bullock & Toribio, 2009a; Olson, 2016) have shown phonetic interaction even in the case of late bilinguals. As discussed in section 2.3.1, most of this body of work has examined differences in Voice Onset Time(VOT)of voiceless obstruents, defined as the lag between the release of the closure of a stop consonant and the subsequent onset of voicing. However, a recent study by Muldner et al.(2017) has looked at the phonetic interaction in the vowels of early French-English bilinguals (see section 2.3.1). Adding to this emerging body of work on phonetic transfer between a bilinguals' languages, the present work investigates the following questions :

RQ1 - Do vowels of early Hindi-Indian English bilinguals change(phonetically or phonologically) as a function of language dominance during code-mixing? In other words, does the quality (formants F1-F2) of Hindi and IE vowels change during code-mixing and is this change influenced by the dominant language of the participant?

H1 - In light of the only previous work on code-mixed vowels (Muldner et al., 2017), which shows that F1 and F2 of vowels do not change significantly under code-mixing, the present work tries to further broaden this domain by comparing the vowels of a group of Hindi dominant bilinguals with the vowels of a group of IE dominant bilinguals.
Despite the results of Muldner et al.(2017), it is hypothesized that the dominant language of a bilingual influences her non-dominant other language. Therefore, the formants F1 and F2 of the code-mixed (Hindi & IE)vowels of a Hindi dominant bilingual should be similar to the formants of her monolingual Hindi vowels and the formants F1 and F2 of the code-mixed (Hindi & IE)vowels of an IE dominant bilingual should be similar to the formants of her monolingual IE vowels.

Apart from the segmental production, the present work, following Muldner et al.(2017) and Olson(2012, 2016) also looks at suprasegmental features of vowel duration and pitch to examine any effects of code-mixing. The following research question ensues -

RQ2 - Does the duration and pitch(F0) of code-mixed vowels of early Hindi-IE bilinguals show signs of hyperarticulation?

H2 - As evidenced by previous studies (Olson, 2012, 2016; Muldner et al., 2017) the duration and pitch of vowels in the code-mixed context is expected to be higher than that of vowels in the monolingual context, providing evidence for hyperarticulation.

The comparison of Hindi vowels with IE vowels in a code-mixed(bilingual) context first calls for a comparison of monolingual Hindi with monolingual IE of these bilinguals. Consequently, RQ1 incorporates a comparison of Hindi with Indian English in the monolingual context, thus presenting a comprehensive phonetic picture of the bilinguals' vowel space.

3.2. Methodology

In order to investigate the research questions detailed in section 3.1 above, an oral production task was undertaken where early Hindi-IE bilinguals, both Hindi dominant and IE dominant read a contextualizing paragraph and monolingual as well as code-mixed sentences, further detailed below. Target vowels were analyzed in terms of F1, F2, pitch(F0) and duration.

3.2.1 Participants

The main criteria for the selection of participants for this study was English-medium school education from one of the schools in New Delhi. English-medium here alludes to the language of teaching in schools, which, when identified linguistically, is Indian-English rather than British English (see section 2.4). This criterion is a reflection of the fact that the selected participants have studied both Hindi and IE throughout their school life, making them early Hindi-IE bilinguals. The other important criterion was place of residence. Those participants were selected who have not lived out of India for more than 4 months at a time. This was necessary in order to eliminate the subjects whose perception and production of Indian English had been influenced by foreign varieties of English.And lastly, it was made sure that none of the selected participants had worked in a BPO[14], where the employees are trained on foreign English accents.

Twenty one early Hindi-IE bilinguals from New Delhi, India were recorded, out of which data from four subjects had to be discarded due to reasons such as creaky voice, highly disfluent speech and partial Hindi-medium education. Out of the final 17 participants, two participants were students of Jawaharlal Nehru University, New Delhi, ten were students of Indian Institute of Technology, New Delhi and the remaining five were volunteers from different areas of New Delhi. Only the students

[14]Business process outsourcing (BPO) is a subset of outsourcing that involves the contracting of the operations and responsibilities of a specific business process to a third-party service provider(this definition is provided by the online Wikipedia page).

were compensated for their participation. All the participants have completed their schooling (primary school till 12th standard) in 'English-medium' schools of New Delhi, India. They all have studied Hindi and IE from primary school till their highest level of education. They all report their mother tongue(L1) as Hindi. Thirteen of the participants are born and brought up in Delhi while the remaining four were born in different Indian states (North Indian states) but had moved to Delhi before the age of 7. All participants reported normal speech and hearing.

The participants were divided into two groups, Hindi dominant(9 participants) with mean age 20.9 years and IE dominant(8 participants) with mean age 29.5 years, according to their language dominance, which was determined based on a modified version of the questionnaire, *Bilingual Language Profile: An Easy-to-Use Instrument to Assess Bilingualism* (BLP) proposed by Birdsong, Gertken, & Amengual(2012). The BLP calculates a language dominance score for each participant based on their responses on the questionnaire. The questionnaire is divided into an introductory section and 4 different modules to assess the different dimensions of dominance. The introductory section collects biographical information, module 1 gathers information on language history of the participant, module 2 focuses on language use, module 3 inquires into the language proficiency of the participant and finally module 4 tests their attitude towards their languages. The last three modules rely on self-ratings of the participants. A positive final score indicates dominance in Hindi while a negative score indicates dominance in IE. Researchers have claimed that self-ratings are a measure of linguistic ability (Bachman & Palmar, 1985; MacIntyre, Noels, & Clement, 1997; Shameem, 1998; Stefani, 1994), and they correlate reliably with linguistic performance (Flege, Mackay & Piske, 2002). The BLP includes only multiple-choice scalar responses and can be used both as a descriptive bilingual profile and as a dominance measure.The questionnaire is available freely and can be accessed at https://sites.la.utexas.edu/bilingual/.

The current study slightly modified the BLP with respect to the Indian context. In the introductory section, three additional questions were asked namely, Mother Tongue, Birth Place and Languages Known. These were important to clarify as many families have a regional language(other than Hindi) as the language of the home and even though the youngest generation of the family(the participants in question for this study) has studied Hindi and IE throughout their school life, might use the regional language more than Hindi or IE and thus identify more with their regional language. These subjects were not selected. Another important change was made in module 4. In every question, the term 'English' was replaced by 'Indian English' to make it clear to the participants that their language outlook has to be with respect

to English spoken in India and not any other variety of English. The last table of **Appendix A** displays this change in questions.

Hindi dominant participants were dominant in Hindi relative to their English. This means they were regular users of English as well, as shown by the scores in the language profile form (**Appendix A**), however, the usage patterns indicate the dominance of Hindi in most scenarios. Same is the case with IE dominant participants. Language proficiency of the participants, in all 4 skills (speaking, understanding, reading and writing) is not significantly different for both the groups. This indicates that the salient factor influencing language dominance is the language use pattern of the participants (Flege, 2007).

The questionnaire was taken by the participants online, before the recording session. **Appendix A**summarizes the language profile of both groups. **Appendix B** gives the dominance scores of all the participants.

3.2.2 Stimulus

Target Vowels

This experiment undertakes the phonetic study of 7 monophthongal vowels of Indian English namely, /i iː u uː eː oː ə/ (Bansal, 1976, 1978; Wells, 1982; Pandey, 2014; among others) and 7 vowels of Northern Hindi, specifically Delhi Hindi, /i iː u uː eː oː ə/. The motivation behind selecting only these vowels is the fact that all 7 of these vowels are present in both the languages being studied, which facilitates their comparison and secondly, to limit the scope of the study. Each of these vowels is embedded in two different monosyllabic words(CVC structure) in both Hindi and IE and these monosyllabic words are further embedded in carrier phrases, detailed in the next section. The words were selected in such a manner that the target vowel precedes a voiced consonant (e.g. /l/, /d/, /g/, /z/ etc.). This is done in order to maintain consistency across the words in both languages as previous work has shown that vowels are shorter before voiceless than voiced consonants (House & Fairbanks, 1953; Peterson & Lehiste, 1960; among others). The initial consonant was either voiced or unvoiced depending on the availability of a lexical item that followed the target word criteria of the study. The target tokens in Hindi and IE are given in **Appendix C**.

The final stimuli comprised of 14 lexical items in Hindi (2 words per vowel) and 14 lexical items in English (2 words per vowel), all nouns representing single word lexical insertions in the code-mixed contexts (Chan, 2003). All 28 target tokens were neither cognates nor homophones. In addition to the target words, 28 non-target(filler) items, 14 in Hindi and 14 in English were also included in the stimulus.

These were monosyllabic as well as bisyllabic words. The filler items were distinct for each part of every session (see section 3.2.3 below on the structure of sessions). The selected words were subjected to a word norming task in order to establish that the words represented code-mixes and not loanwords, complete or partial, borrowed in the opposite language (Poplack & Sankoff, 1984). Three early Hindi-IE bilinguals (average age of acquisition, Hindi=0.0 years, IE=3.5 years), different from the participants of this experiment, participated in this word norming task. The participants were provided with a list of 14 Hindi target words, 14 English target words and 40 non-target words (20 each in both languages). For each word, they were asked two questions, as given below -

(1) Is this a word in (a)Hindi or (b)English or (c)Both?
(2) What is the Hindi/English equivalent of this word?

Native language synonym displacement was proposed as a criteria for the characterization of loanwords by Hasselmo(1970) and Mackey(1970) and was also implicit in Weinreich's discussion of lexical integration (cited in Poplack & Sankoff, 1984). In simple words, it states that, "if a borrowed item can be shown to displace in usage an indigenous term for the same concept, it can be considered to have taken over the latter's role in the lexicon."(Poplack & Sankoff, 1984:104). In other words, loanwords can be thought of as not having an equivalent term in the recipient language. For the present study, the word norming task tested if a lexical item from Hindi has an equivalent term for the same concept in the opposite language (Indian English) and vice-versa. The absence of the equivalent lexical item categorized it as a loanword or borrowing and its presence classified it as a code-mix. The results showed that the participants could easily provide equivalents in the opposite language for the Hindi target words and IE target words whereas according to them the non-target words were possible in both languages, signifying that they represented loanwords or some other phenomenon but not code-mixes.

Language Contexts

The stimuli for this experiment consisted of a contextualizing paragraph(detailed below), monolingual sentences and code-mixed sentences in Hindi as well as IE. The target tokens were embedded in two different carrier phrases(CP), in both Hindi and IE leading to monolingual and code-mixed/bilingual contexts. The carrier phrases are given below and the examples in 1(a-d) illustrate the resulting stimuli in all four contexts with the target tokens in bold.

Hindi carrier phrases -
(i) -अगलाशब्द**XYZ** है।

(ii) -उसने**XYZ**कहा।

English carrier phrases -
(i) - They said ABC again.
(ii) - Say ABC twice.

1(a) - Hindi Monolingual context(HML)
(1) -अगलाशब्द**झील**है।

(2) -उसने**झील**कहा।

1(b) - IE Monolingual context(EML)
(1) - They said **peel** again.
(2) - Say **peel** twice.

1(c) - Hindi Bilingual context(HBL)
(1) - They said **झील** again.

(2) - Say **झील** twice.

1(d) - IE Bilingual context(EBL)
(1) -अगलाशब्द**peel**है।

(2) -उसने**peel**कहा।

The control for the experiment is the monolingual context produced by these same bilinguals. This is because, firstly, the objective of this work is to study bilingual speakers in the monolingual and bilingual language modes rather than to compare them to monolinguals. Secondly, as shown by much previous work, a bilingual is very different from a monolingual in her linguistic configuration (Flege & Eefting, 1987; Grosjean, 1989, 1998a, 2008; Bullock, 2009; among others), infact, Elman et al.(1977) have shown in their study that the highest proficiency bilinguals performed differently from the corresponding monolingual groups. Also, in addition to a lot of inter-speaker variation in the production of vowels (Yallop, 2007; McAuliffe and Babel, 2011), the bilingual phonetic performance is highly variable(Bullock, 2009). Thus, it does not seem prudent to compare the monolingual production of a monolingual speaker with the code-mixed production of a bilingual speaker, as both of them might have distinct phonetic and/or phonological units.

Contextualizing paragraph

Research has shown that differing amounts of language(s) in an experimental setup can induce different language modes (see section 2.1.1; Grosjean, 1982) as well as

impact phonetic production (Olson, 2013, 2016; Simonet, 2014). Since it is almost impossible to induce a purely monolingual mode/context in an experiment (Grosjean, 1998a, 2008), the language contexts in the present experiment are likely to be both bilingual. However, based on Grosjean's(2008) observation that a position on the language mode depends on the amount of languages used as well as the amount of language mixing, the monolingual context in this experiment is relatively more monolingual as compared to the bilingual context. The contextualizing paragraph therefore, was presented as part of the stimulus to control and manipulate the language mode of the participant. All paragraphs were small stories(average number of words/paragraph = 105) selected from online webpages. The paragraphs preceded the main task to prime the participant and place them in the required language mode but were not included in the analysis.The contextualizing paragraphs are given in **Appendix D**.

3.2.3 Procedure

The experiment was conducted in a sound proof studio in the language lab premises of Jawaharlal Nehru University, New Delhi. The experiment took approximately 45 minutes that included the introduction, explanation of the procedure, debriefing and signing of the consent form. All the participants interacted with the same bilingual researcher throughout. The participants were asked to read aloud the stimulus presented on a laptop using the software Linger v2.88(Rohde, 2001)[15]. They were told to read as if they were speaking to a good friend, maintaining normal speed and pace. In case of any disfluency, they were permitted to re-read the sentence. The recordings were made using Audio Technica ATR 20 microphone connected to a H1 Zoom, 16 bit handy recorder at the sampling rate of 44.1khz.

The experiment was divided into 3 sessions, monolingual Hindi, monolingual IE and code-mixed. The objective of these three different sessions was to keep the participant in the particular language mode (monolingual or bilingual) while eliciting data. The monolingual sessions were divided into two parts, each corresponding to one carrier phrase (see section 3.2.2 above). The code-mixed session had four parts, two for Hindi carrier phrases and two for IE carrier phrases. For each part, instructions were presented visually and the language of the

[15]Linger is an application that performs a variety of language experiments, particularly self-paced reading. It is easily modified and runs on all major platforms: Unix, Windows, and Mac. A lot of psycholinguistic experiments make use of this software. It handles true/false, multiple choice questions, and difficulty ratings, as well as audio playing and recording (http://tedlab.mit.edu/~dr/Linger/readme.html#masked-self).

instructions corresponded to the language of the session (e.g. Session A = monolingual Hindi, Session B = monolingual IE, Session C = bilingual/code-mixed). Each part started with general instructions then moved on to the contextualizing paragraph. For monolingual Hindi and monolingual IE sessions, a distinct contextualizing paragraph was presented for each of the 3 parts, but for the code-mixed session, only 1 contextualizing paragraph was presented at the start of the session. After the paragraph, the participants were again instructed on how to embed the given word on the screen in the carrier phrase and read aloud the sentences. Each participant received a different randomized order of the target tokens in each part. This was accomplished with Linger v2.88 which has an inbuilt feature of randomizing the target and non-target(filler) tokens. The session order was counter-balanced across subjects. Sessions were blocked as shown in Table 4 below. A sample of the instructions (given in Session B(E1a)) is provided in **Appendix B**.

Session	Stimuli Block
Session A	H1a - Hindi monolingual context, CP - अगलाशब्दXYZहै।
	H1b - Hindi monolingual context, CP -उसनेXYZकहा।
Session B	E1a - IE monolingual context, CP - They said ABC again.
	E1b - IE monolingual context, CP - Say ABC twice.
Session C	CM-H1a - Hindi bilingual context, CP - अगलाशब्दABCहै।
	CM-H1b - Hindi bilingual context, CP - उसनेABCकहा।
	CM-E1a - IE bilingual context, CP - They said XYZ again.
	CM-E1b - IE bilingual context, CP - Say XYZ twice.

Table 4. Session and Stimuli blocks

How much time does it take for a language to be activated or for how long a language is active in the bilingual mode, are questions on which there is no clarity in the literature. Nonetheless, some studies have shown, albeit indirectly, that a particular language mode can be activated in least possible time. Toribio et al.(2005) in their pilot study presented the Spanish and English sentences together to their participants, in one randomized block, without separating the monolingual and the code-switched context. This study as well as the ones that followed (Bullock et al.,2006; Bullock & Toribio, 2009a), which separated the stimuli into appropriate blocks based on language context, provided evidence of phonetic transfer. This is a strong indication that language mode can be induced in the least time necessary. The present study, therefore, conducted all 3 sessions on the same day, depending

on the language of the visually presented instructions and the contextualizing paragraph, to induce the required language mode.

3.2.4 Measurements

A total of 112 productions were elicited from each participant (7 vowels x 2 tokens per vowel x 8 sessions) thus in all, a total of 1,904 tokens were examined, out of which less than 5% of tokens were eliminated for disfluencies. The remaining tokens were annotated for duration(sec.), pitch(Hz), formant F1(Hz) and formant F2(Hz) using Praat v5.3.82 (Boersma & Weenink, 2014). The vowel tokens were segmented by hand by the author using the acoustic waveform and wideband spectogram. Pitch and Duration measurements were extracted using an automated script provided online by Mietta Lennes(2017). F1 & F2 measurements were also initially extracted automatically using a script, from the mid-point of the vowel, however, when inspected visually, there was a mismatch between the tracks and the formant bands in the spectogram for a large percentage of tokens, consequently, all F1-F2 measurements were made by hand by the author. Figure 4 illustrates the waveform for a Hindi target token dʒʰi:l(lake). The blue vertical pillars in the Vowel tier correspond to the vowel boundary indicating vowel duration, the pitch contour is shown as the blue horizontal line in the spectogram and the vertical red dotted line, passing through the centre of the vowel points to the mid-point of the vowel from where formant measurements were extracted.

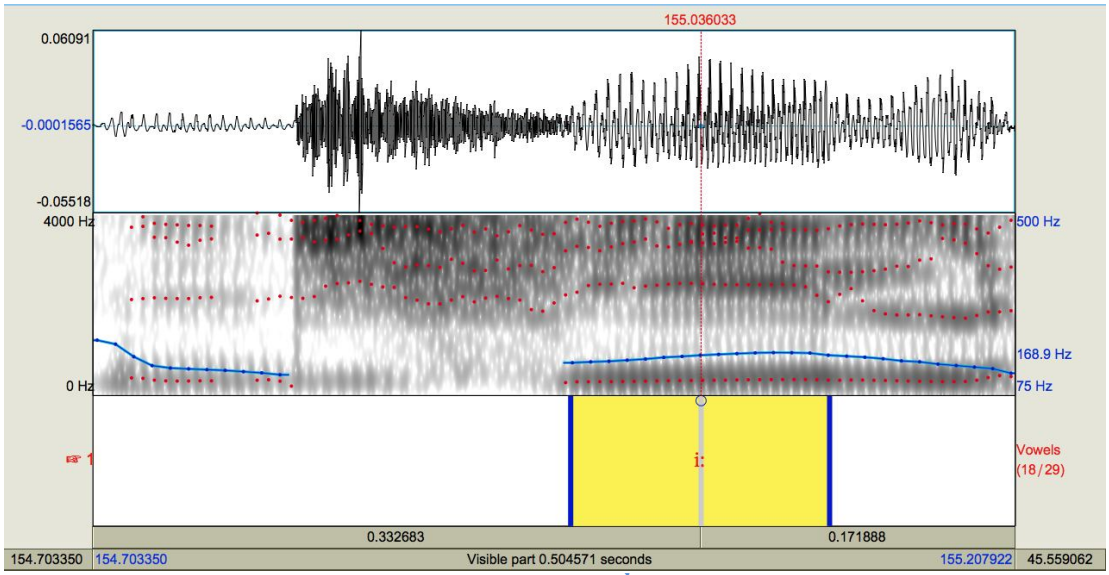


Figure 4. Waveform of a Hindi target token *dʒʰi:l(lake)*produced by a Hindi dominant speaker.

Chapter 4. RESULTS

All statistical analysis was conducted using R 3.4.3 (R Core Development Team 2017), and all linear mixed effects models (Winter, 2012) were performed with the *lme4*package (Bates et al. 2015). Duration, pitch, F1 and F2 were the dependent variables(DV). A mixed effects model was conducted for each DV separately for both Hindi and IE dominant groups. Language context and gender were entered as the fixed effects (without interaction term) into the model, however, gender was only the control variable in the model. As random effects, intercepts for subjects and vowels, as well as by-subject and by-vowel random slopes for the effect of DVs were included. Visual inspection of residual plots did not reveal any obvious deviations from homoscedasticity or normality. P-values were obtained by likelihood ratio tests of the full model with gender and the test variable in question against the null model with gender and without the test variable in question. For all mixed models, the significance level was set at $p<0.05$.

The main research question that this study tries to answer is concerned with the formants F1 and F2 of vowels in Hindi and IE in the bilingual context, however, this necessitates a comparison of Hindi and IE in the monolingual context as well. Therefore, the result section below will begin with a comparison of monolingual Hindi(HML) with monolingual IE(EML) and then move on to the bilingual context.

4.1 Segmental Features - Formants F1 & F2

4.1.1 Hindi dominant group

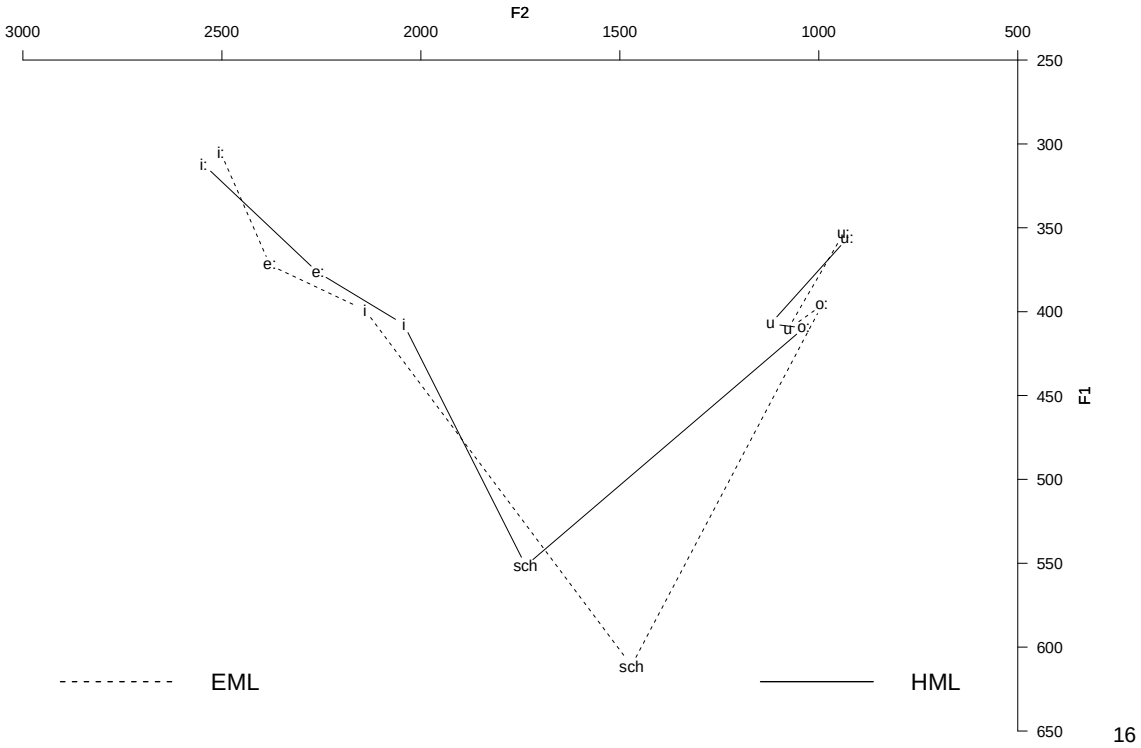
Monolingual Hindi versus Monolingual English context -

For both F1 and F2, a separate mixed effects model was conducted for the monolingual context in Hindi and IE produced by the Hindi-dominant group, with language and genderas the fixed effects and subject and vowelas the random effects with random intercepts and random slopes.

The overall model for both F1 and F2 does not show any significant effect of language on formant frequencies. In other words, F1 and F2 of Hindi and IE vowels do not differ significantly (F1: $\chi^2(1)=0.1562$, $p=0.6927$; F2: $\chi^2(1)=0.2219$, $p=0.6376$), with F1 frequency in Hindi about 4.015Hz lower than in IE with a standard error of ± 10.12 and F2 frequency in Hindi about 21.60Hz higher than in IE with a standard error of ± 45.52.

However, this result is obtained by collapsing across vowels and this could obscure

the inherently different characteristics of these vowels, if any. Also, looking at the vowel space for monolingual Hindi and IE (Figure 5 below) it can be hypothesized that some vowels may be significantly different in both the languages. Therefore, separate mixed effects models were conducted for each of the 7 vowels with language and genderas the fixed effects and subject as the random effect with random intercept and random slope. Table 5 below shows the vowels with significant difference in formant frequencies between the two languages.



16

Figure 5. Monolingual Hindi(HML) and monolingual IE(EML) vowel space of Hindi dominant group.

HML vs EML	F1	F2
Overall		
i		*
i:		
u		*
u:		
e:		*
o:		*
ə	*	*

Table 5. Vowels with significant difference in formant frequencies for monolingual Hindi and monolingual IE (Hindi dominant group).

16 "sch" represents the vowel schwa "ə" in all the plots.

Here, * implies statistical significance. It indicates that, in the monolingual context of both the languages, the vowel 'ə' is significantly different in terms of both height(F1) (χ^2(1)=6.2884, p=0.01215) and frontness/backness (F2) (χ^2(1)=15.205, p=9.646e-05) and the vowels 'i' (χ^2(1)=12.658, p=0.0003739), 'u' (χ^2(1)=4.2744, p=0.03869), 'e:' (χ^2(1)=9.8999, p=0.001653) and 'o:' (χ^2(1)=8.8802, p=0.002883) are different in terms of frontness/backness(F2) only.

According to Hypotheses 1, in case of Hindi dominant participants, the bilingual (Hindi & IE)vowels should be similar to the monolingual Hindi vowels. To test this, the bilingual Hindi vowels(HBL) and bilingual IE vowels(EBL) were compared to monolingual Hindi vowels(HML).

HML vs HBL -

Parallel analysis conducted on monolingual and bilingual Hindi tokens revealed what was expected. In other words, for Hindi dominant participants, the language context does not affect formant frequencies in Hindi, except in the case of height of vowel 'o:'. The results, compiled in Table 6 below, show that the overall models do not indicate statistical significance neither for F1 (χ^2(1)=1.1763, p=0.2781) nor for F2 (χ^2(1)=0.503, p=0.4782). In case of F1, the frequency in HML context is about 4.452Hz higher than in HBL context with a standard error of ± 4 and in case of F2, the frequency in HML context is about 9.955Hz higher than in HBL context with a standard error of ±13.971.

Additionally, in case of each vowel separately, except F1(height) of vowel 'o:'(χ^2(1)=4.3832, p=0.03629), there is no difference between monolingual Hindi and bilingual Hindi formant frequencies. Figure 6 illustrates the vowel space of monolingual Hindi and bilingual Hindi of Hindi dominant group.

HML vs HBL	F1	F2
Overall		
i		
i:		
u		
u:		
e:		
o:	*	
ə		

Table 6. Vowels with significant difference in formant frequencies for monolingual Hindi and bilingual Hindi (Hindi dominant group).

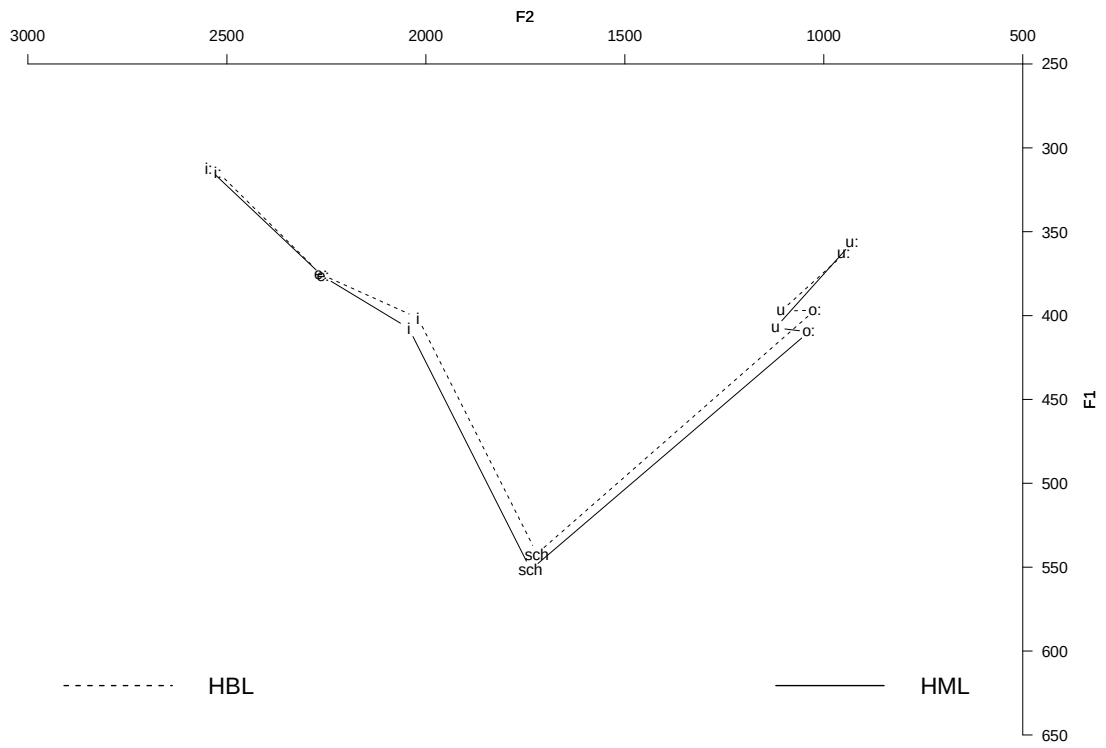


Figure 6. Monolingual Hindi(HML) and Bilingual Hindi(HBL) vowel space of Hindi dominant group.

HML vs EBL -

Similar analysis conducted on monolingual Hindi and bilingual IE tokens unveiled a distinct pattern. The results are tabulated below (Table 7). Like previous results, the overall model was not significant for both F1 ($\chi^2(1)=0.039$, p=0.8434) and F2 ($\chi^2(1)=0.3562$, p=0.5506). For F1, the frequency in HML context is about 1.645Hz lower than in EBL context with a standard error of ±8.320 and for F2, the frequency in HML context is about 27.51Hz higher than in EBL context with a standard error of ±45.57. Nevertheless, in case of some vowels, the results are contrary to our hypotheses. Height(F1) of vowel 'i:' ($\chi^2(1)=4.9918$, p=0.02547) and 'ə' ($\chi^2(1)=10.595$, p=0.001134) and frontness/backness(F2) of vowels 'e:' ($\chi^2(1)=7.1418$, p=0.007531), 'o:' ($\chi^2(1)=7.1937$, p=0.007316) and 'ə' ($\chi^2(1)=13.851$, p=0.0001978) are different for bilingual IE and monolingual Hindi. Figure 7 illustrates the vowel space of monolingual Hindi and bilingual IE of Hindi dominant group.

HML vs EBL	F1	F2
Overall		
i		
i:	*	
u		
u:		
e:		*
o:		*
ə	*	*

Table 7. Vowels with significant difference in formant frequencies for monolingual Hindi and bilingual IE (Hindi dominant group).

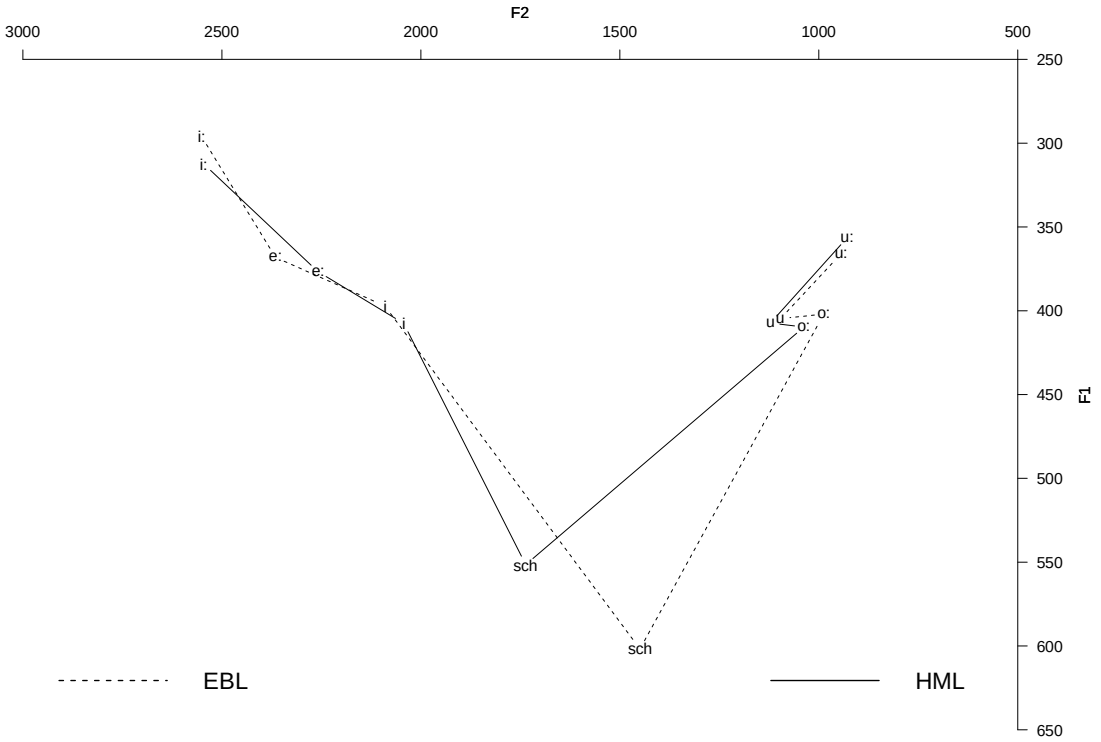


Figure 7. Monolingual Hindi(HML) and Bilingual IE(EBL) vowel space of Hindi dominant group.

In light of this result, comparable mixed effects models were conducted to compare bilingual IE vowels with monolingual IE vowels of this group, testing F1 of vowels 'i:' (F1 : $\chi^2(1)=0.9667$, p=0.3255) and 'ə' (F1 : $\chi^2(1)=0.2835$, p=0.5944) and F2 of vowels 'e:' (F2 : $\chi^2(1)=0.8117$, p=0.3676), 'o:'(F2 : $\chi^2(1)=0.0877$, p=0.7671)and 'ə' (F2 : $\chi^2(1)=0.4283$, p=0.5128). Interestingly, the results showed no significance, indicating that these bilingual IE vowels are similar to monolingual IE vowels rather

than monolingual Hindi vowels of Hindi dominant group. Figure 8 demonstrates the vowel space of monolingual IE and bilingual IE of Hindi dominant group.

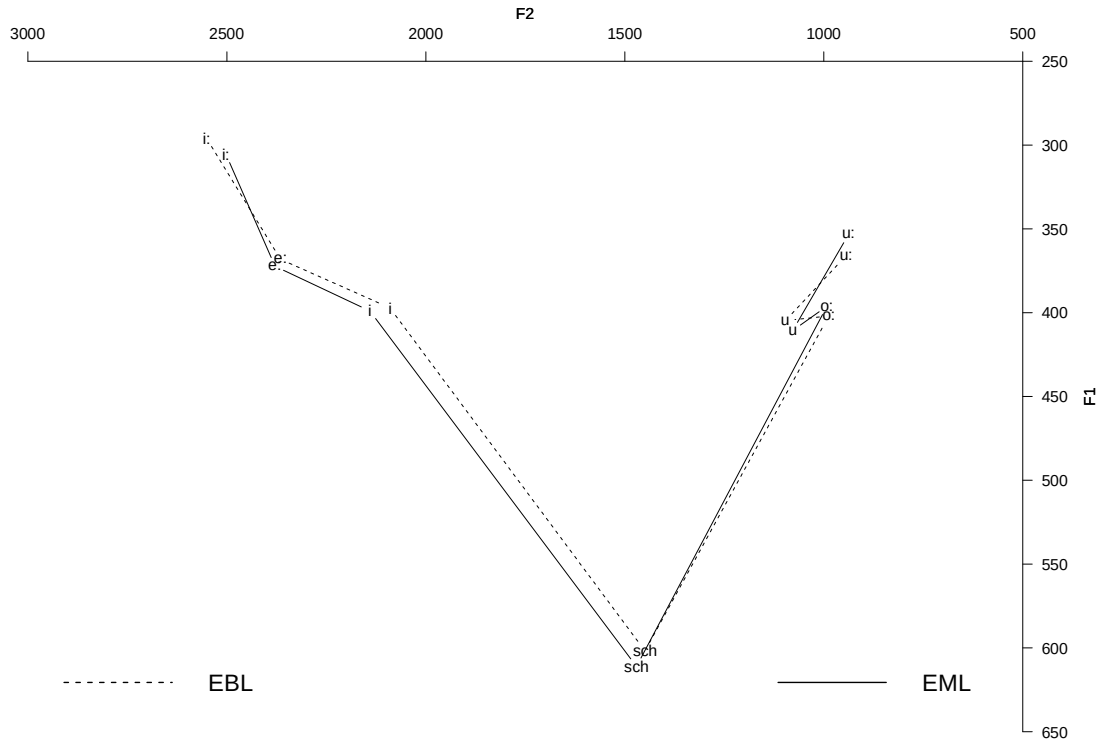


Figure 8. Monolingual IE(EML) and Bilingual IE(EBL) vowel space of Hindi dominant group.

4.1.2 IE dominant group

Parallel analysis conducted on IE dominant group revealed somewhat similar results.

HML vs EML -

Comparison of languages in the monolingual context showed that the overall model for both F1 and F2 does not show any significant effect. Language does not affect formant frequencies (F1 : $\chi^2(1)=1.845$, p=0.1744; F2 : $\chi^2(1)=0.0484$, p=0.8259), with F1 frequency in Hindi about 20.893Hz lower than in IE with a standard error of ±14.567 and F2 frequency in Hindi about 9.076Hz lower than in IE with a standard error of ±41.187. Figure 9 represents the vowel space of monolingual Hindi and monolingual IE of this group. It indicates that some vowels might show significant differences in formant values in the two languages. Consequently, after testing the vowels individually, some significant differences were found. The results are summarized in Table 8.

The vowel 'u' (F1 : χ^2(1)=6.5109, p=0.01072) is different in terms of height(F1), the vowels 'i' (F2 : χ^2(1)=11.172, p=0.0008302), 'i:' (F2 : χ^2(1)= 8.2044, p=0.004179) and 'e:' (F2 : χ^2(1)= 7.8243, p=0.005155) are different in terms of frontness/backness(F2) and the vowel 'ə' (F1 : χ^2(1)=11.354, p=0.0007527; F2 : χ^2(1)=9.1922, p=0.00243)is different in terms of both height and frontness/backness in the two languages.

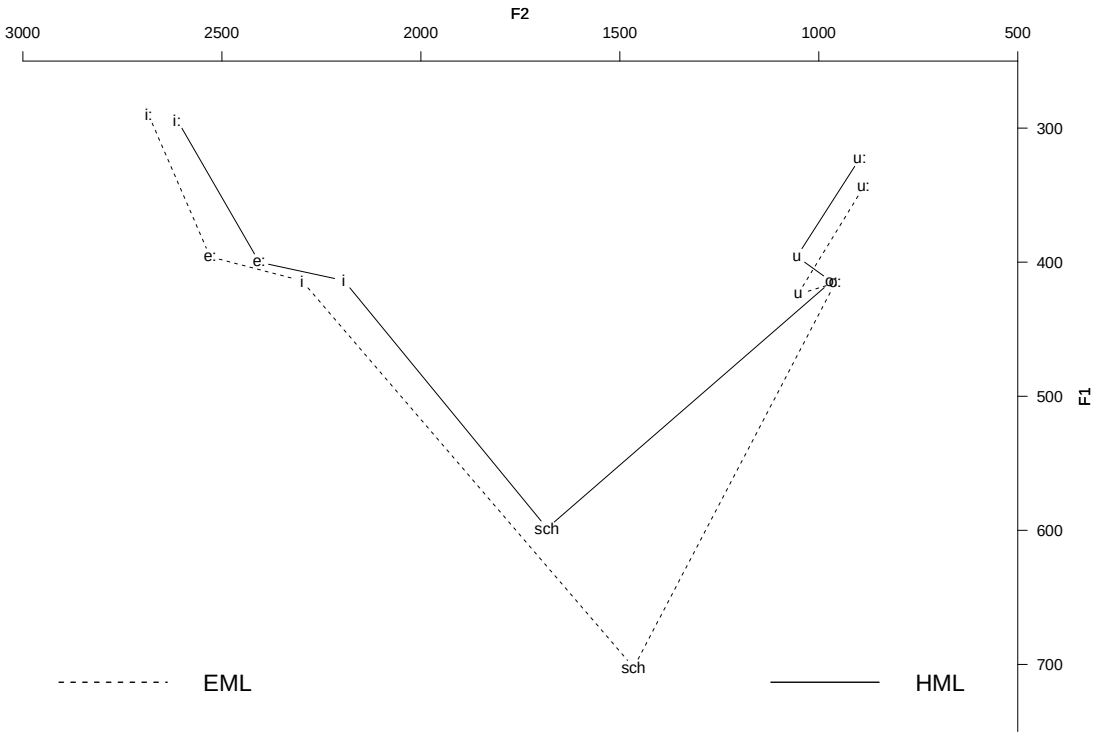


Figure 9. Monolingual Hindi(HML) and monolingual IE(EML) vowel space of IE dominant group.

HML vs EML	F1	F2
Overall		
i		*
i:		*
u	*	
u:		
e:		*
o:		
ə	*	*

Table 8. Vowels with significant difference in formant frequencies for monolingual Hindi and monolingual IE (IE dominant group).

EML vs EBL -

Mixed effects models conducted on monolingual and bilingual IE tokens reconfirmed our hypotheses. In this case, the language context does not affect formant frequencies, except in the case of height of vowel 'u'. The results in Table 9 below, show that the overall models do not indicate statistical significance neither for F1 ($\chi^2(1)=2.2932$, $p=0.1299$) nor for F2 ($\chi^2(1)=0.05$, $p=0.823$). In case of F1, the frequency in EML context is about 6.562Hz higher than in EBL context with a standard error of ±4.173 and in case of F2, the frequency in EML context is about 2.865Hz lower than in EBL context with a standard error of ±12.799.

Additionally, in case of each vowel separately, except F1(height) of vowel 'u'($\chi^2(1)=5.2698$, $p=0.0217$), there is no difference between monolingual IE and bilingual IE formant frequencies. Figure 10 illustrates the vowel space of monolingual IE and bilingual IE of IE dominant group.

EML vs EBL	F1	F2
Overall		
i		
i:		
u	*	
u:		
e:		
o:		
ə		

Table 9. Vowels with significant difference in formant frequencies for monolingual IE and bilingual IE (IE dominant group).

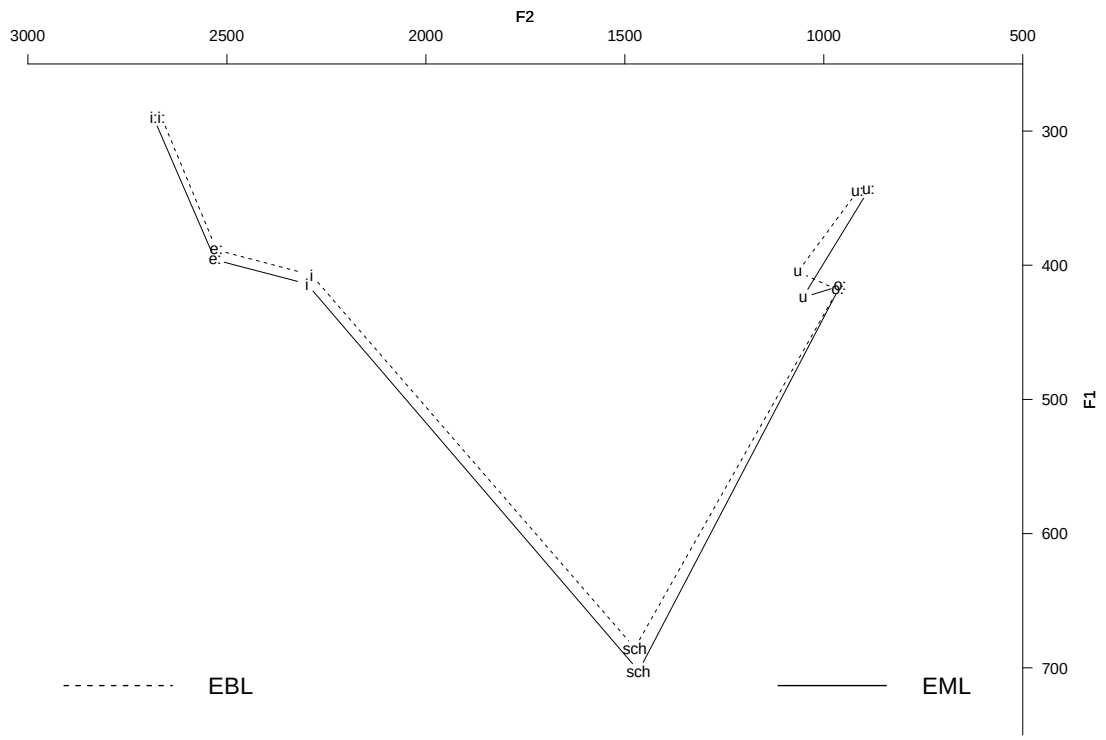


Figure 10. Monolingual IE(EML) and Bilingual IE(EBL) vowel space of IE dominant group.

EML vs HBL -

Analysis conducted on monolingual IE and bilingual Hindi tokens revealed a distinct pattern, like that of Hindi dominant group. The results are shown in Table 10 below. Like previous results, the overall model was not significant for both F1 ($\chi^2(1)=1.522$, p=0.2173) and F2 ($\chi^2(1)=0.1217$, p=0.7272). For F1, the frequency in HBL context is about 17.59Hz lower than in EML context with a standard error of ±13.61 and for F2, the frequency in HBL context is about 15.56Hz lower than in EML context with a standard error of ±44.41. Nonetheless, in case of some vowels, the results are in contrast to our hypotheses. Height(F1) of vowel 'ə' ($F1 : \chi^2(1)=10.98$, p=0.0009208) and frontness/backness(F2) of vowels 'i' ($\chi^2(1)=12.054$, p=0.0005169), 'i:' ($\chi^2(1)=9.1268$, p=0.002519), 'e:' ($\chi^2(1)=10.437$, p=0.001235), 'o:' ($\chi^2(1)=4.935$, p=0.02632) and 'ə' ($\chi^2(1)=9.2868$, p=0.002308) are different for bilingual Hindi and monolingual IE. Figure 11 illustrates the vowel space of monolingual IE and bilingual Hindi of IE dominant group.

EML vs HBL	F1	F2
Overall		
i		*
i:		*
u		
u:		
e:		*
o:		*
ə	*	*

Table 10. Vowels with significant difference in formant frequencies for monolingual IE and bilingual Hindi (IE dominant group).

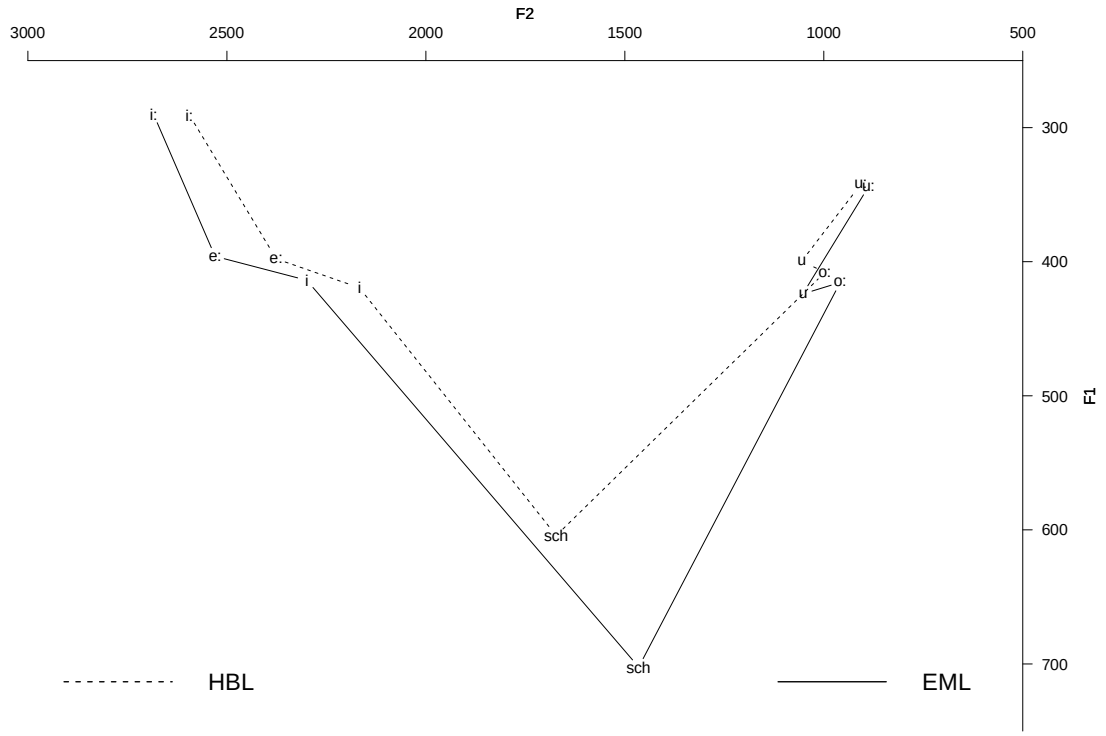


Figure 11. Monolingual IE(EML) and Bilingual Hindi(HBL) vowel space of IE dominant group.

In light of this result, comparable mixed effects models were conducted to compare bilingual Hindi vowels with monolingual Hindi vowels, testing F1 of vowel 'ə' (F1 : $\chi^2(1)=0.127$, p=0.7216) and F2 of vowels 'i' (F2 : $\chi^2(1)=1.0924$, p=0.2959), 'i:' (F2 : $\chi^2(1)=0.4119$, p=0.521), 'e:' (F2 : $\chi^2(1)=1.186$, p=0.2761), 'o:' (F2 : $\chi^2(1)=3.068$, p=0.07985) and 'ə' (F2 : $\chi^2(1)=0.5194$, p=0.4711). Interestingly, the results showed no significance, indicating that these bilingual Hindi vowels are similar to monolingual Hindi vowels rather than the monolingual IE vowels, of IE dominant

group. Figure 12 demonstrates the vowel space of monolingual Hindi and bilingual Hindi of IE dominant group.

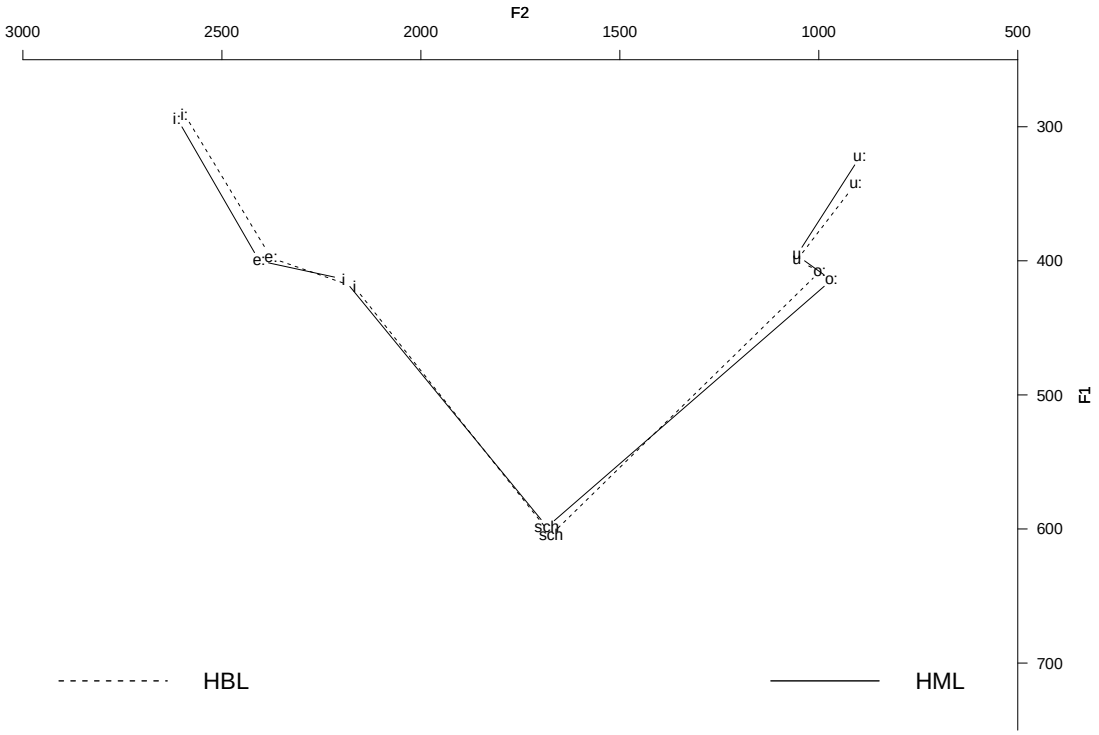


Figure 12. Monolingual Hindi(HML) and Bilingual Hindi(HBL) vowel space of IE dominant group.

For a visual comparison, vowel space of all four language contexts of both the groups is given below in Figure 13&Figure 14.

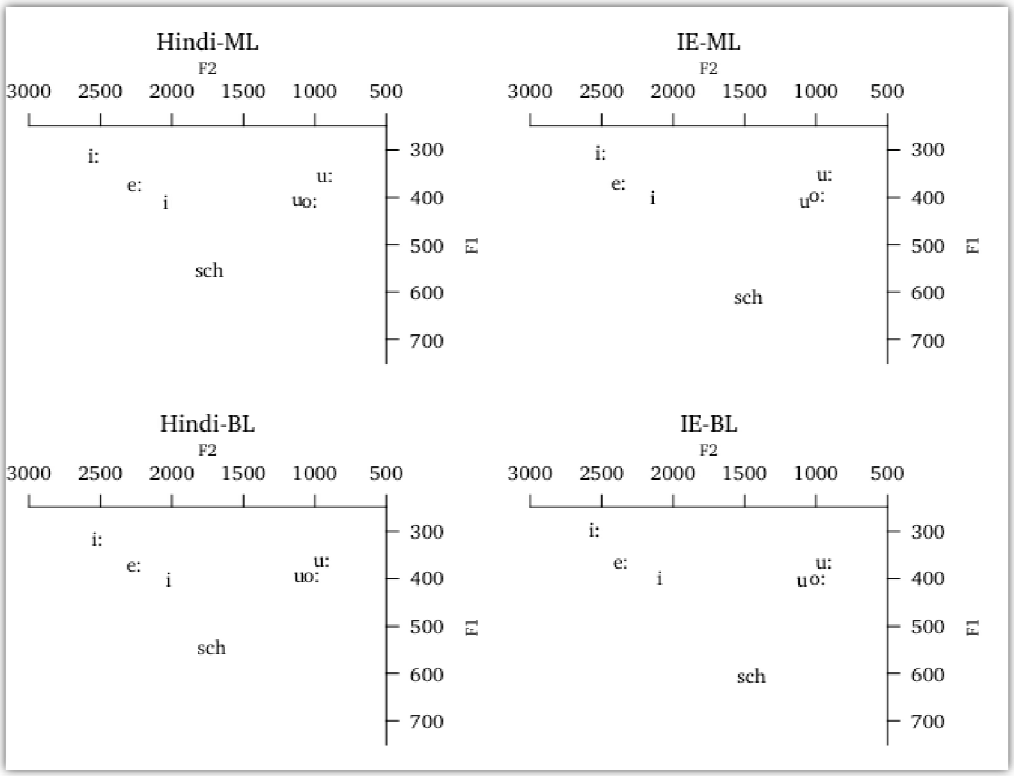


Figure 13. Vowel Space of Hindi dominant group in all four language contexts.

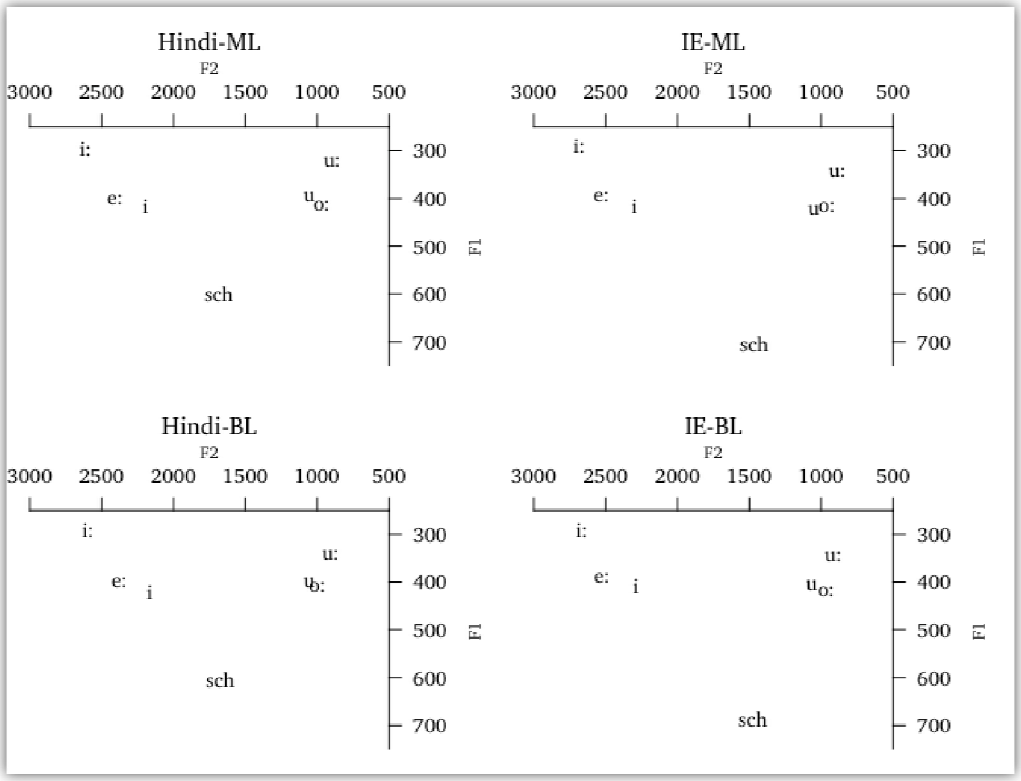


Figure 14. Vowel Space of IE dominant group in all four language contexts.

4.1.3 Discussion

Monolingual Hindi vs monolingual IE

The monolingual context of the two languages shows significant difference in the F1 & F2 of only some of the vowels. In the Hindi dominant group, F1 of vowels 'i', 'i:', 'u', 'u:', 'e:' and 'o:' and F2 of vowels 'i:' and 'u:' are similar in both the languages i.e. they do not show any significant difference in the formant frequencies whereas 'ə' shows a significant difference in both height(F1) and frontness/backness(F2) and the vowels 'i', 'u', 'e:' and 'o:' are significantly different in terms of only the frontness/backness(F2). In the IE dominant group, F1 of the vowels 'i', 'i:', 'u:', 'e' and 'o:' and F2 of the vowels 'u', 'u:' and 'o:' are similar whereas 'u' and 'ə' are significantly different in terms of height(F1) and 'i', 'i:', 'e:' and 'ə' are significantly different in terms of frontness/backness(F2). In summary, most of the vowels across both the groups are similar in both the languages and only a few show significant difference in the formant frequencies. Infact, these differences in formant frequencies are indicative of low level phonetic interactions only (Bullock et al., 2006).

Overall, this is an intriguing result as it indicates that the Hindi and IE vowels of these early bilinguals do not differ phonologically and even at the phonetic level, there are only subtle differences in some vowels which could be attributed to various factors such as age of learning, amount and kind of usage of the languages, sociological factors etc. It can be argued here that these early bilinguals, irrespective of their dominant language, have a common phonological space (SLM, Flege, 1995) in which vowels from both their languages have converged phonologically and to a large extent, phonetically as well.

Monolingual context vs Code-mixed context

This result is based on those vowels which were statistically different in the monolingual Hindi and monolingual IE.

In the Hindi dominant group, as hypothesized, there is no significant difference between the Hindi code-mixed and Hindi monolingual values except in the height(F1) of vowel 'o:'. Because of the small number of participants, it is difficult to provide an adequate explanation of the behaviour of /o:/, however, it is probable that this difference in the height of 'o:' may disappear as the number of participants increase. In case of all the other Hindi code-mixed vowels (in the English carrier phrases), no influence of English is seen indicating no phonetic transfer but a complete phonetic switch from IE(L2) to Hindi(L1). Therefore, the dominant language, Hindi, did have an influence over code-mixed Hindi vowels. In the case of code-mixed IE vowels, the results are somewhat complicated. Formant F2 of 'i' and 'u' is similar to monolingual Hindi vowels. This indicates that Hindi(L1) exerts

influence over IE(L2) vowels bringing L2 closer to L1 in terms of formant F2. Alternatively, no phonetic switching takes place in case of these two vowels. However, F1 of 'i:' and 'ə' and F2 of 'e:', 'o:' and 'ə' are similar to monolingual IE vowels rather than monolingual Hindi vowels, not showing any influence of the dominant language Hindi, contrary to our hypotheses, implying phonetic switching but no phonetic transfer.

The IE dominant group also demonstrates similar results. Except height(F1) of vowel 'u', the rest of the vowels in code-mixed IE are similar to monolingual IE. Because of the small number of participants, it is difficult to provide an adequate explanation of this behaviour of /u/, however, it is likely that this difference in the height of 'u' may disappear as the number of participants increase. Additionally, in case of all other IE vowels embedded in the Hindi carrier phrases, no influence of Hindi is seen again indicating a complete phonetic switch from Hindi(L1) to IE(L2). This indicates that the dominant language, IE, did have an influence over code-mixed IE vowels. In case of code-mixed Hindi vowels, F1 of 'u' is similar to monolingual IE signifying influence of IE(L2) over Hindi(L1) i.e. phonetic transfer whereas F2 of 'i', 'i:', 'e:', 'o:' and F1-F2 of 'ə' are similar to monolingual Hindi vowels rather than monolingual IE indicating a phonetic switch, contrary to our hypotheses.

These results illustrate that for the vowels showing significant phonetic differences in the monolingual context of both languages, the early bilinguals show phonetic transfer for only a few vowels (in both groups) but switch phonetically for most. Therefore, our hypotheses stands only mildly corrected. The dominant language of the bilingual does influence (some) vowels of the non-dominant language but not all.

4.2 Suprasegmental Features

According to our hypotheses, duration and pitch of vowels is expected to be higher in the bilingual(code-mixed) context compared to the monolingual context, providing evidence for hyperarticulation. Therefore, for both the groups, linear mixed effects models were conducted to compare Hindi and IE in the two language contexts. Language and genderwere the fixed effects and subject and vowelthe random effects with random intercepts and random slopes. Gender was the control variable.

4.2.1 Duration

Hindi dominant group

Results indicate that there is no significant difference between the duration of code-mixed vowels and monolingual vowels in either Hindi ($\chi^2(1)=2.5207$, $p=0.1124$) or IE ($\chi^2(1)=1.7489$, $p=0.186$). Figure 15 below illustrates the non significant difference in the vowel duration of the two languages.

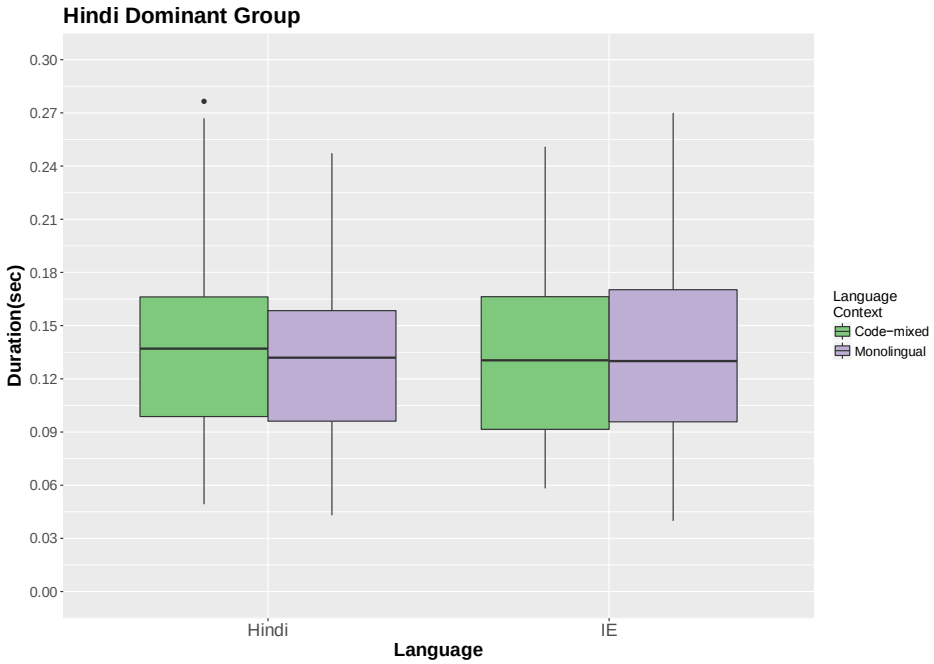


Figure 15. Comparison of vowel duration between the two language contexts in Hindi and IE for the Hindi Dominant Group.

Indian English dominant group

Results for this group are comparable to the Hindi dominant group. There was no significant difference in duration of code-mixed and monolingual vowels, for either Hindi ($\chi^2(1)=2.5558$, $p=0.1099$) or IE ($\chi^2(1)=0.0416$, $p=0.838$). Figure 16 below is illustrative of this non significant difference.

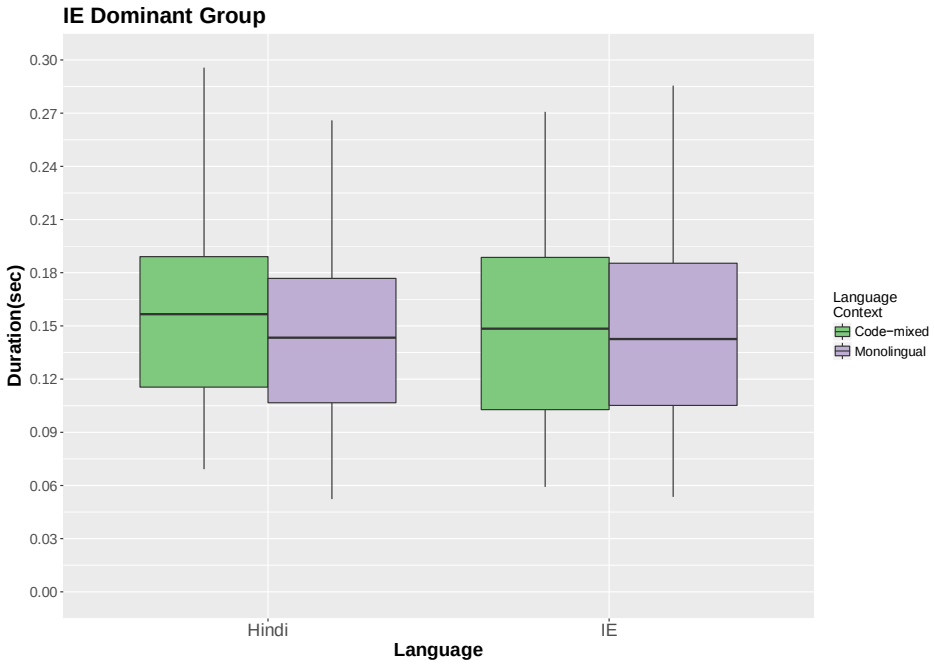


Figure 16. Comparison of vowel duration between the two language contexts in Hindi and IE for the IE Dominant Group.

4.2.2 Discussion

Contrary to previous work(Olson, 2012, 2016; Muldner et al., 2017), the present study illustrates no difference in duration between monolingual and code-mixed vowels of both the groups. This leads us to speculate about the mental representation of the vowels in these bilinguals. Like the results of the formant frequencies F1 and F2 (section 4.1.3 above) these results can be attributed to the fact that for these early bilinguals the suprasegmental feature of duration of vowels has converged for both their languages. Thus, the vowel phonemes in their common phonological space are linked together and are utilized for both their languages and thus code-mixing fails to produce any effect.

4.2.3 Pitch(F0)

Hindi dominant group

For this group, the comparison between monolingual and bilingual contexts shows no significant difference in pitch for Hindi ($\chi^2(1)=0.1312$, $p=0.7172$), however, there is a significant difference in pitch of IE contexts($\chi^2(1)=4.973$, $p=0.02575$).The pitch of IE code-mixed vowels is 8.846Hz higher than monolingual IE vowels with a standard error of ±3.458. Figure 17shows thecomparison of the two languages of this group of participants.

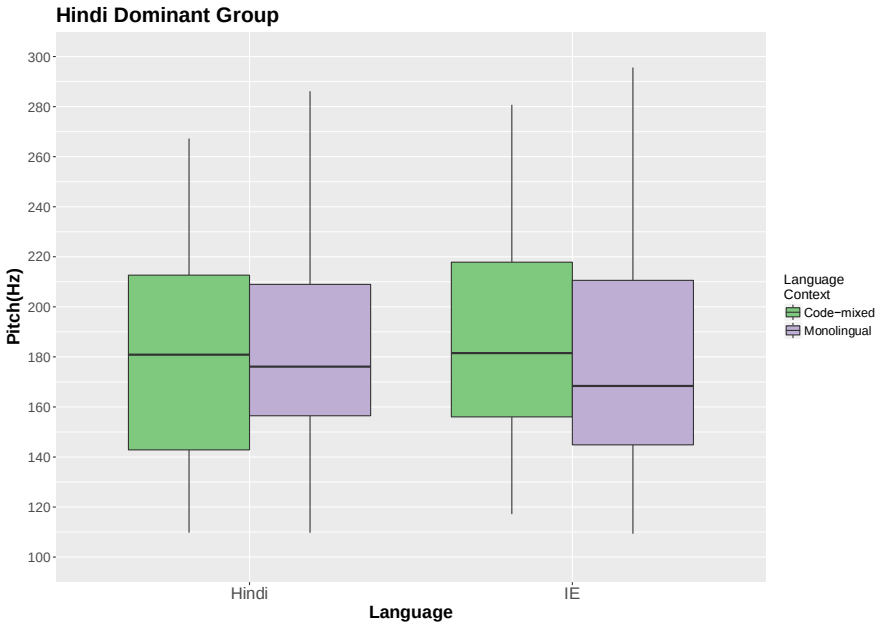


Figure 17. Comparison of pitch between the two language contexts in Hindi and IE for the Hindi Dominant Group.

Indian English dominant group

Results did not show any significant difference in pitch for either Hindi ($\chi^2(1)=0.4261$, $p=0.5139$) or IE ($\chi^2(1)=2.5341$, $p=0.1114$) for this group. Figure 18 below illustrates the comparison.

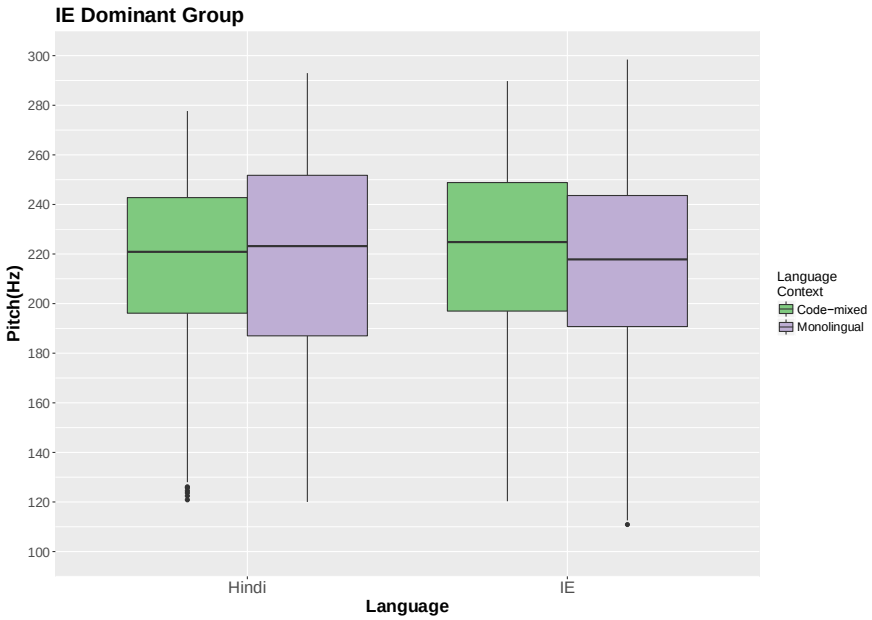


Figure 18. . Comparison of pitch between the two language contexts in Hindi and IE for the IE Dominant Group.

4.2.4 Discussion

The results show that in case of Hindi, our hypotheses is not substantiated. Neither the Hindi dominant group nor the IE dominant group shows hyperarticulation in pitch of Hindi code-mixed vowels indicating that these bilinguals do not adjust their production effort in case of insertional CS in Hindi (Olson, 2012).

In the case of IE(L2), the results indicate that the IE dominant group does not show hyperarticulation whereas the Hindi dominant group does. This could be based on an important distinction between the two groups. The IE dominant bilinguals (mean age=29.5 years) have more years of exposure and therefore more experience with both languages compared to the Hindi dominant group (mean age=20.9 years). This could mean that the phonemic inventory of this group is fully established and at the suprasegmental level, the vowels of both the languages are linked, leading to similar productions and no hyperarticulation. Whereas, for the Hindi dominant bilinguals, who are comparatively younger, with less experience in their L2, the vowels in their IE might still be converging towards Hindi (at the suprasegmental level of pitch), and thus are hyperarticulated during code-mixing, reflecting their transient nature.

Chapter 5. GENERAL DISCUSSION

The predominant goal of the present study was to contribute to the discussion on phonetic interaction between a bilinguals' two languages during code-mixing. Within this goal, one of the two questions that this study has tried to answer relates to the segmental level i.e. vowel quality and the other question relates to the suprasegmental level, i.e. duration and pitch of vowels. For both the questions, two groups of participants, one Hindi dominant and one IE dominant took part in an oral production task. Monolingual and code-mixed utterances of Hindi-IE bilinguals were compared. The first aim was to observe if the vowel quality (formants F1 and F2) changes in the code-mixed context as compared to the monolingual context and if this change was influenced by the dominant language of the speaker. The second aim was to observe if the vowels showed increased duration and pitch in the code-mixed context indicating hyperarticulation.

5.1 The segmental Level

Before comparing the monolingual context to the bilingual(code-mixed) context, a comparison was made between monolingual Hindi and monolingual IE, for both the groups. The vowel space diagram of Hindi and IE for both the groups are reproduced below (Figure 5 & 9).

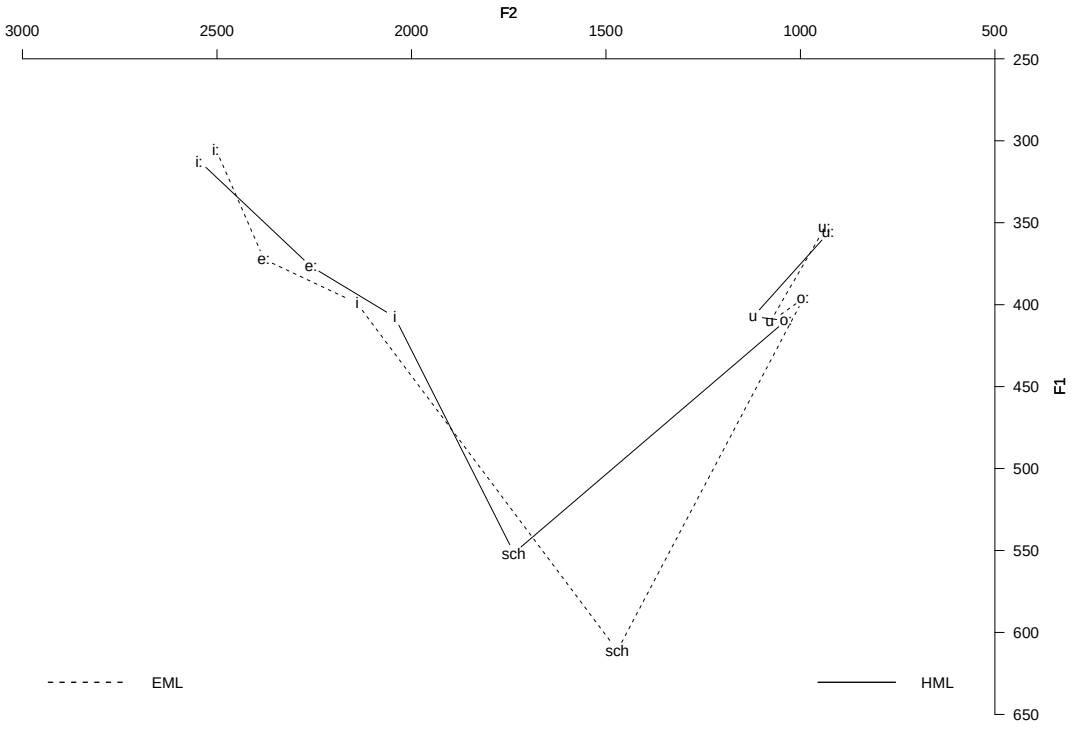


Figure 5. Monolingual Hindi and monolingual IE vowel space of Hindi dominant group

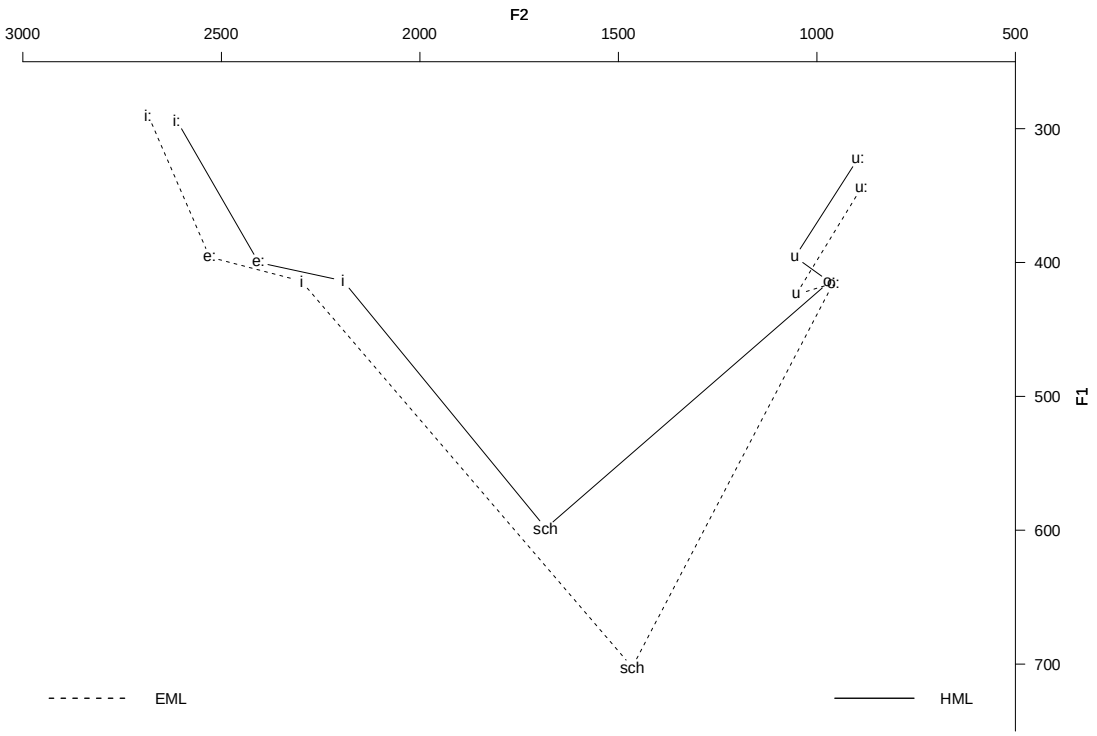


Figure 9. Monolingual Hindi and monolingual IE vowel space of IE dominant group.

For both the Hindi dominant as well as the IE dominant group, it is evident that the 7 vowels that were tested do not differ phonologically, only small phonetic differences are seen for some of the vowels, mostly in the frontness/backness of the vowels (formant F2). For the vowels which showed some significant phonetic difference, these small phonetic shifts in the vowel space can be taken as evidence in support of the Speech Learning Model (Flege, 1995) which proposed that the two phonetic subsystems of a bilingual reside in a common phonological space (see section 2.1.3). SLM also posited that those L2 sounds which are perceived to be similar to a L1 sound, are assimilated by that L1 sound as the sounds develop through childhood. It therefore appears that in case of these bilinguals, the L1 Hindi sounds subsumed the closest(similar) L2 IE sounds representing cross-linguistic assimilation, even collapsing the phonetic distinction across Hindi-IE, for some vowels. Since the participants of this study were early bilinguals, using both the languages on a regular basis, it can be said that the L1 Hindi sounds evolved to reflect a two language source of input (Flege, 2007).It is also proposed that the phonological space of these early Hindi-IE bilinguals comprises an *integrated phoneme set* which implies that the sounds of Hindi and IE are represented by the same abstract phonological units, and many of them are similar phonetically as well.

This result is not really unexpected because although Indian English was initially a transplanted variant of British English, after many decades of development and change, it has become a language variety in its own right (see section 2.4). Indian bilinguals learn it as a second language mostly through formal education from as early as 3 years of age. The spoken English input that Indian children receive is fromother Indians (teachers and also their parents and community in general) and written English input from English textbooks, written by Indians and published in India. This indicates that Indian English has in effect recreated itself and continues to do so, and therefore, Indian standards of English are passed on to Indian children when learning English. This kind of input is a strong indication of the fact that for the early Hindi-IE bilinguals, the L1 sounds evolve to reflect a two language source of input (Flege, 2007), thereby minimizing the difference between them. Furthermore, it can be hypothesized that the small phonetic differences seen for some vowels in this study might also be removed as a result of increased usage of Indian English and if and when the language enters the final stage of Schneider's model, the differentiation stage (Schneider's model of language development, 2003, 2007; see section 2.4).

These results also confirm the findings of earlier studies (theoretical and phonetic) of IE regarding the mid-vowels /e:/ and /o:/. In British English, the FACE and GOAT vowels (Wells, 1982; see section 2.4.2) are realised as diphthongs /ei/ and /əʊ/however, previous studies (Bansal and Harrison, 1972[1994]:16–17; Bansal, 1976:17, 1990:223; Trudgill and Hannah, 2002:130; Sailaja, 2009:25, 2012:360; Pandey, 2014:305; acoustic studies by Maxwell and Fletcher, 2009; and Wiltshire and Harnsberger, 2006) have reported these vowels to be monophthongs /e:/ and /o:/ in Indian English. The present study also supports these findings confirming that IE indeed has monophthongs in place of diphthongs. Figure 19 & 20 below illustrate the vowels.

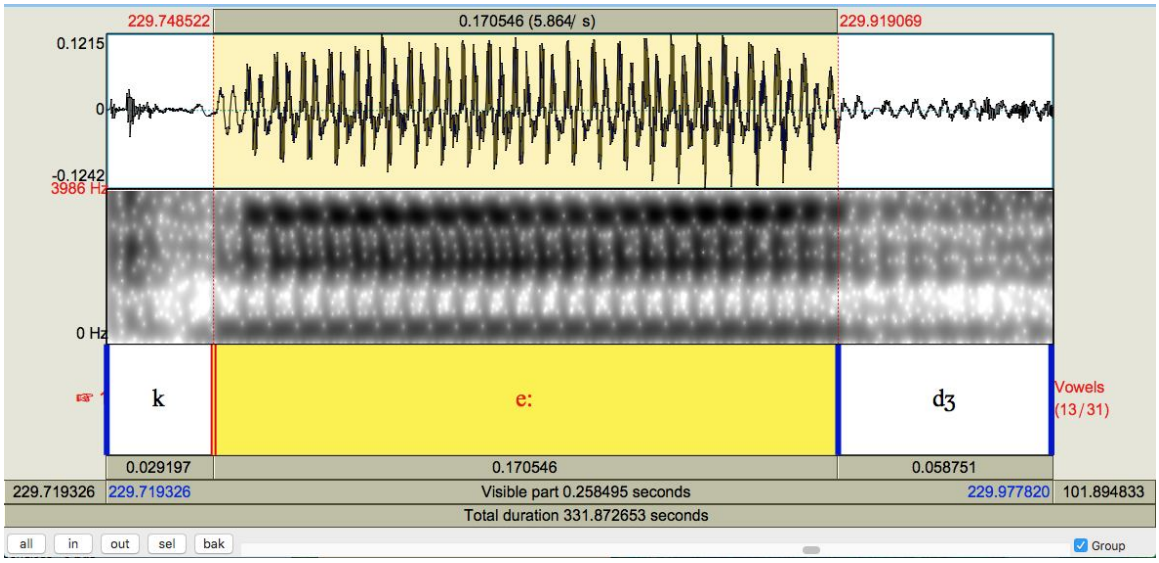


Figure 19. The monophthongal vowel /e:/ in the word 'cage' in IE.

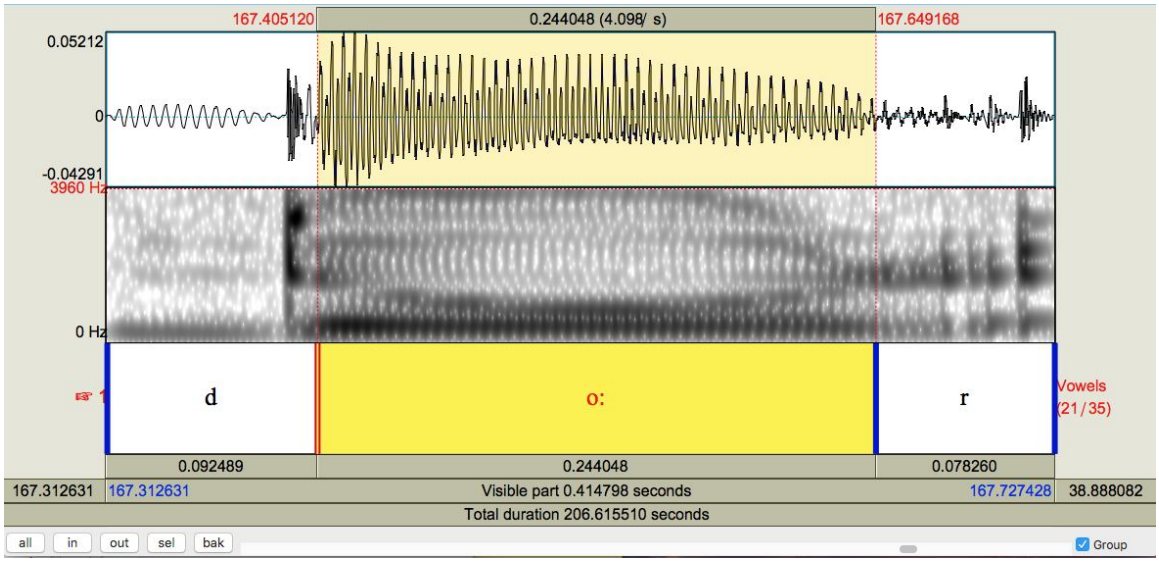


Figure 20. The monophthongal vowel /o:/ in the word 'door' in IE.

The above Figures 5 & 9 show that the vowel space of Hindi and IE of both the groups do not differ drastically. There are minor phonetic differences for some of the vowels whereas most vowels are similar phonetically. The most interesting observation that was made is that only those vowels which showed statistically significant phonetic differences between monolingual Hindi and monolingual IE, showed either phonetic transfer or phonetic switch between the two languages. The vowels which were similar in the monolingual context did not show any different phonetic behaviour in the code-mixed context, except F2 of vowel 'i:' in the Hindi dominant group and F2 of vowel 'o:' in the IE dominant group. These two vowels turned out to be similar in both the languages in the monolingual context however,

when compared with the code-mixed context these vowels showed significant difference i.e. a phonetic switch from the base language to the guest language. Since no other vowel showed this pattern it is difficult to explain this behavior at this moment. With further research and a bigger sample size we will probably get a better understanding of this result. Nonetheless, the discussion below mainly concerns those vowels who showed a significant difference between the two contexts, exhibiting either phonetic transfer or switch.

To address the rest of the findings of this study, it would be helpful to revisit the research questions :-

RQ1 - Do the vowels of early Hindi-Indian English bilinguals change (phonetically or phonologically) as a function of language dominance during code-mixing? In other words, does the quality (formants F1-F2) of Hindi and IE vowels change during code-mixing and is this change influenced by the dominant language of the participant?

It was hypothesized that the dominant language of the bilingual will affect her non-dominant language and thus the vowel quality will be affected during code-mixing. However, the results are contrary to our hypotheses except for a few vowels in the non-dominant language, which get influenced by the dominant language (see section 4.1.3 above). For the Hindi dominant group, the formant frequency F2 (frontness/backness) of IE vowels 'i' and 'u' is influenced by Hindi (L1 to L2 interference) and for the IE dominant group, only the formant frequency F1 (height) of Hindi vowel 'u' is influenced by IE (L2 to L1 interference). This minimal phonetic interference is difficult to interpret at this stage because of a lack of pattern and a bigger sample of participants.

For all the rest of the vowelswhich are significantly different in Hindi and IE (both F1 and F2) in both the groups (see section 4.1.3 above) there is evidence of phonetic switch from the matrix language to the embedded language. This result can be understood in terms of Grosjean's 'Bilinguals' language mode framework' (1982, 1989, 1998b, 1998a, 2001, 2008) and L2 attunement theory proposed by Antoniou et al.(2010) based on PAM-L2 (Perceptual Assimilation Model). Bilinguals' language mode framework (1982, 1989, 1998b, 1998a, 2001, 2008) posits that the communicative context affects the relative levels of activation of a bilinguals' languages and this activation strength of languages may affect the speech behaviour of bilinguals. The minimal phonetic interaction evidenced in this study can be understood under this framework. The bilinguals of this study are exposed to both their languages from early on in life, they are immersed in an environment where

both the languages are equally predominant and code-switching and code-mixing are the norm (see section 2.4.3). Therefore, under this framework, it can be assumed that the two languages are strongly activated during code-mixing. This strong activation helps the bilinguals in maintaining the phonetic contrast and switching between the languages with minimal phonetic transfer. Similar reasoning has been forwarded by cognitive studies (see section 2.1.3) and Antoniou et al.(2011). Cognitive studies of bilingualism have concluded that the bilinguals' two languages are active when listening to speech, reading words in either language and planning speech in each of the two languages (for a review see Kroll et al., 2015 and Kroll, Bobb & Hoshino, 2014). This parallel activation leads to competition between the two languages requiring the bilingual to control or regulate the competition in order to correctly and fluently use the intended language. Although this result has arisen from mostly non-verbal studies of bilingual cognition, it can be extended to the present study as well. The early bilinguals, because of the regular use of the two languages as well as consistent language mixing practices exhibit fine cognitive and linguistic control during speech production, down to the level of phonetics. The study by Antoniou et al.(2011) also claimed that because of the consistent use of the two languages and frequent code-switching over the years, the bilinguals evidence limited influence of L2 on L1, even when the L2 is the dominant language (see section 2.1.3).

According to PAM-L2, perceptual reattunement of L2 takes place when the speakers are immersed in the L2 environment. The predominance of the L2 in the communicative contexts, results in perceptual attunement to the contrastive segments of the L2, "setting the stage for the formation of language-specific phonetic categories in production as well"(Antoniou et al., 2010). Because of this formation of language specific units, bilinguals are able to switch from one language to the other, at the phonetic level, with ease.

In terms of language dominance of these bilinguals, it is observed that the dominant language of both the groups does not exert complete influence over the non-dominant language. Barring the F1 & F2 formant frequencies of three vowels, all other vowels show a phonetic switch from the matrix language to the guest language. For example, in case of Hindi dominant speakers, the IE vowels embedded in Hindi carrier phrases, do not show any influence of Hindi rather the formant values of those IE vowels resemble the formant values of monolingual IE values. This result confirms the observation Bullock et al.(2006) made, that language dominance is not deterministic in bilingual speech production. The bilinguals of this study are capable of fine phonetic control and of resisting the influence of their dominant language on the non-dominant language during code-mixing.

The fine phonetic control employed by the bilingual speakers during code-mixing is also supported by the cognitive mechanisms underlying bilingual language processing. As is discussed in section 2.1.2, cognitive studies on bilingualism have reached the conclusion that both the languages of the bilingual are active during language processing. According to Bialystok(2011:8), " The research with bilinguals … provides clear evidence for the plasticity of cognitive systems in response to experience. One possible explanation in the case of bilinguals is that the executive control circuits needed to manage attention to the two languages become integrated with the linguistic circuits used for language processing, creating a more diffuse, more bilateral, and more efficient network that supports high levels of performance". Therefore, in case of the bilinguals of this study because of the early and consistent use of both the languages, the neural networks encompassing linguistic and cognitive processing are fortified, representing a more distributed and a more robust network, which in turn helps in the fine phonetic control during language production. Conversely, it can be argued that the fine phonetic control evidenced in the current study is proof that the cognitive mechanisms underlying linguistic processing in such bilinguals make up for a highly distributed and robust network.

Another prominent dissimilarity between Hindi and IE vowel space is the difference between the formant frequencies of the vowel schwa. Schwa is significantly different between both the languages as well as the language contexts (monolingual and code-mixed). Figure 5, 7, 9 & 11 above show this difference. It is likely that this difference has emerged because of the environment of the vowel (‘dʒəl’ and ‘g^{h}ər’ in Hindi and ‘məɖ’ and ‘bəg’ in IE) however, further research is needed to confirm these findings.

In sum, this study has reported results comparable to Grosjean & Miller(1994) and Muldner et al.(2017) study, that is, phonetic switching takes place from one language to the other. While Muldner et al.(2017) tested the vowels, they did not test bilinguals based on language dominance. However, their results still showed that vowel quality was similar in monolingual and code-switched contexts. Grosjean & Miller(1994) tested bilinguals' consonants' VOT values and observed no phonetic momentum from the base to the guest language.

5.2 The suprasegmental level

RQ2 - Does the duration and pitch(F0) of code-mixed vowels of early Hindi-IE bilinguals show signs of hyperarticulation?

Unlike Olson(2012, 2016) and Muldner et al.(2017) this study does not show hyperarticulation. Results from the suprasegmental level confirm the findings from

the segmental level that the bilinguals seem to have an *integrated phoneme set* to represent both their languages. Duration of vowels is not significantly different in the monolingual and bilingual language contexts for both the groups. This indicates no hyperarticulation. In case of pitch in Hindi language, neither the Hindi dominant group nor the IE dominant group shows hyperarticulation of Hindi code-mixed vowels. Whereas, in the case of IE, the results indicate that the IE dominant group does not show hyperarticulation whereas the Hindi dominant group does.Therefore, the Hindi dominant group hyperarticulates pitch only when switching from Hindi(L1) to English(L2). The hyperarticulation evidenced in case of Hindi dominant group could be because of less experience with L2(IE) as compared to the IE dominant group who have approximately 10 more years of exposure to IE as well as Hindi. This could mean that the phonemes in the phonological space of IE dominant speakers are better integrated because of greater amount of exposure and experience with IE. Whereas, the IE vowels of the Hindi dominant group might still be converging towards Hindi (at the suprasegmental level of pitch), towards the integrated phoneme set and thus are hyperarticulated during code-mixing, reflecting their transient nature. It is possible that with an increased use of IE and further exposure to IE, the IE vowels of Hindi dominant bilinguals would get further integrated with the Hindi vowels in the phonological space thus, removing this hyperarticulation altogether. Nonetheless, this is a preliminary result and like Flege(2007) suggests, much further research is required to clarify the role of 'number of years of exposure to L2' (input) in a bilinguals' productions.

Olson(2012, 2016) explained hyperarticulation in vowel duration and pitch height in terms of Hyper- and Hypo-articulation theory and Local predictability theory. He proposed that code-switched tokens are less predictable than non-switched tokens and thus they may create a cognitive difficulty for the speakers leading to prosodic prominence or hyper-articulation. In case of insertional code-switching, the guest word is less predictable and thus leads to hyper-articulation. Based on the results from the current study, it could be speculated that the code-mixed tokens are not less predictable for early Hindi-IE bilinguals than the non-switched tokens. However, this is a very tentative observation requiring much further work on the predictability of code-mixes in the Indian languages scenario.

Chapter 6. CONCLUSION

The overarching goal of the present study was to investigate the phonetic interaction between the two languages of a Hindi-IE bilingual speaker and to contribute to the small but consistently growing body of work on the phonetic consequences of code-switching. Most of the previous work has studied consonants' (mainly obstruents /p t k/) Voice Onset Time (VOT) to observe any phonetic interactions and the results have been mixed. Some studies reported L1 influence on L2 (Bullock & Toribio, 2009a;Bullock et al., 2006; Bullock & Toribio, 2009; Khattab, 2002, 2009; Antoniou et al., 2011; Piccinini & Arvaniti, 2015; among others) and some reported the opposite results i.e. L2 influence on L1 (Bullock, 2006; Bullock & Toribio, 2009; Olson, 2013; Simonet, 2014). Only one study (Grosjean & Miller, 1994) reported no phonetic interaction between the two languages. Furthermore, the study (Muldner et al.,2017) which investigated vowels instead of consonants, concluded that at the segmental level, there was no phonetic interaction between French and English vowels of the bilinguals but at the suprasegmental level of duration and pitch, the code-mixed vowels displayed hyperarticulation.

6.1 Summary of Results

The results of the current study bring to light three salient insights from the Hindi-IE bilingual mind.First, the vowel phonemes of Hindi and IE of the bilinguals do not show major differences. Amongst the tested vowels, many of the vowels of the L2, that is, IE are linked to the L1(Hindi) vowels (SLM, Flege, 1995) in the phonological space and therefore are produced with much similarity. Those vowels which did show significant difference, the differences were basically micro-adjustments at the phonetic level only. Second, amongst the vowels which did show significant difference between the code-mixed and the monolingual contexts, the dominant language did not influence the non-dominant language, for both the groups. The results showed a phonetic switch from the dominant to the non-dominant language. Therefore, this study proposes that the Hindi-IE bilinguals, irrespective of their dominant language show comparable results. Language dominance is non-deterministic in bilingual speech behaviour (Bullock et al. 2006). In comparison to the previous work on the phonetics of code-switching, the results of this study support the results of Muldner et al.(2017) who tested vowels (without considering language dominance) and Grosjean & Miller(1994) who tested consonants, that code-mixing does not lead to phonetic transfer between a bilinguals two languages. Third, unlike previous work (Olson, 2012, 2016 and Muldner et al.,2017) the results from the suprasegmental level of duration and pitch also indicate that the vowel phonemes of these Hindi-IE bilinguals are connected at the abstract phonological level, hardly showing any difference (hyperarticulation) when going from one language to the other.

The similarity between Hindi and IE monolingual vowels, in both the groups also provided evidence for Speech Learning Model (Flege, 1995) which proposed that the two phonetic subsystems of a bilingual reside in a common phonological space and that those L2 sounds which are perceived to be similar to a L1 sound, are assimilated by that L1 sound as the sounds develop through childhood. Since the participants of this study were early bilinguals, using both the languages on a regular basis, it can be said that the L1 Hindi sounds evolved to reflect a two language source of input (Flege, 2007). This is again an important result as it implies that the sounds of Hindi and IE are represented by the same abstract phonological units, and many of them are similar phonetically as well. Therefore, it is proposed that the phonological space of these early Hindi-IE bilinguals comprises an *integrated phoneme set.*

This study also confirms the findings of previous studies of IE (Bansal and Harrison, 1994[1972]:16–17; Bansal, 1976:17, 1990:223; Trudgill and Hannah, 2002:130; Sailaja, 2009:25, 2012:360; Pandey, 2014:305; acoustic-phonetic studies by Maxwell and Fletcher, 2009; and Wiltshire and Harnsberger, 2006) that the FACE and GOAT vowels (Wells, 1982) which are diphthongs /ei/ and /əʊ/ in British English, are monophthongs /e:/ and /o:/ in IE.

6.2 Limitations

These results have to be considered with caution since like any experimental work, this study also has limitations. Experimental limitations include the small sample size and the study design. Since the results are derived from a small sample of participants, it is difficult at this moment to project these results for the entire population. In terms of study design, the participants of the two groups differ considerably in age and the groups are not gender balanced. As gender based comparisons were not the focus of this study, it would be interesting to observe if any gender based effects manifest themselves in future work. Also, even though different mean age of the two groups did not really produce distinct patterns (except the pitch of code-mixed IE vowels of Hindi dominant group) it is suggested for future work that a bigger sample size, comparable in age be tested. Language dominance is another factor which has to be considered carefully. The present study has classified the participants as Hindi dominant or IE dominant but not balanced bilinguals. The standpoint here is that balanced bilingualism is local that is, a bilingual can balance her two languages in a particular domain of life (work, home or with friends etc.) but not global, that is, a bilingual cannot be considered balanced in her two languages in all domains of life (Gasser, 2000; Jaccard & Civindin, 2001; Chiaro, 2009; Caroll & Luna, 2011; cited in Grosjean, 2016). Therefore, since this study was not concerned with global balanced bilingualism, overall general

language dominance of the participants has been considered, based on the language dominance scores obtained by utilizing a bilingual questionnaire (*Bilingual Language Profile: An Easy-to-Use Instrument to Assess Bilingualism;* Birdsong, Gertken, & Amengual, 2012). Future research should regard the notion of language dominance carefully, selecting the dominance measures with caution, depending upon the variable under investigation.

6.3 Desiderata

In addition to the above mentioned future research opportunities, there are some key avenues that should be considered by future studies. First and foremost, the present study should be replicated with a bigger sample size to confirm the results. Replication with different Indian language-Indian English pairings would help in expanding these claims providing a more coherent phonetic picture of the Indian bilingual mind. Secondly, the present work has investigated a limited number of vowels therefore, a comparison of the complete vowel inventory of the two languages is advisable to analyze and understand the complete vowel space of the bilinguals. In addition, not only vowels but consonants should also be tested, in terms of their VOT or other gradient phonetic features. Thirdly, although the present study has focused on production, it would be interesting to observe the perceptual mechanisms that bilinguals utilize for their two languages. And finally, since the present study was a controlled laboratory experiment, future studies should also be conducted with naturalistic data such as formal and informal conversations (Piccinini & Arvaniti, 2015) to confirm or deny these results.

In essence, the usefulness of this study is not just in providing a precise description of a sociophonetic phenomenon but in initiating a discussion around the phenomenon of code-mixing/code-switching at the phonetic and phonological level, in the bi-/multi-lingual Indian communities as well as to study the impact of Indian English in greater detail at the psycholinguistic, sociophonetic and sociocultural levels. The results of this study point at broad trends and provide novel hypotheses which can be and should be tested in future studies to understand the Indian bilingual or rather, the multilingual mind.

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APPENDICES

APPENDIX A. SUMMARY OF KEY FACTORS IN LANGUAGE PROFILE

Language History

	Age	AOL Hindi	AOL Indian English
Hindi dominant group	18-26(20.9)	0.0 years	2.9 years
English dominant group	26-34(29.5)	0.0 years	2.9 years

Age = Range(Mean age); AOL = Age Of Learning

Language Use (Total use for all languages equals 100% for each group)

with friends	**Hindi**	**Indian English**	**Other Languages**
Hindi dominant group	75.6	22.2	2.2
English dominant group	40	56.25	3.75
with family	**Hindi**	**Indian English**	**Other Languages**
Hindi dominant group	84.4	8.9	6.7
English dominant group	80	13.75	6.25
at work/university	**Hindi**	**Indian English**	**Other Languages**
Hindi dominant group	38.9	61.1	0.0
English dominant group	20	80	0.0
Talking with oneself	**Hindi**	**Indian English**	**Other Languages**
Hindi dominant group	70	26.7	3.3
English dominant group	36.25	63.75	0.0
Counting	**Hindi**	**Indian English**	**Other Languages**
Hindi dominant group	47.8	52.2	0.0
English dominant group	25	75	0.0

All values are in percentage.

Language Proficiency (0-not well at all ; 6-very well)

Speaking	**Hindi**	**Indian English**
Hindi dominant group	5.3	4.7
English dominant group	5.1	5
Understanding	**Hindi**	**Indian English**
Hindi dominant group	5.6	5.1
English dominant group	5.3	5.1
Reading	**Hindi**	**Indian English**
Hindi dominant group	4.6	5.4
English dominant group	4.4	5.6
Writing	**Hindi**	**Indian English**
Hindi dominant group	3.9	5.2
English dominant group	3.6	5.4

Language Outlook (0-not well at all ; 6-very well)

	I feel like myself when I speak Hindi.	**I feel like myself when I speak INDIAN ENGLISH.**
Hindi dominant group	5	3.23
English dominant group	4.25	5
	I identify with a HINDI speaking culture.	**I identify with an INDIAN ENGLISHspeaking culture.**
Hindi dominant group	5.12	2.89
English dominant group	4.125	3.75
	It is important to me to use (or eventually use) HINDI like a native speaker.	**It is important to me to use (or eventually use) INDIAN ENGLISH like a native speaker.**
Hindi dominant group	5.12	3.89
English dominant group	3.875	4.125
	I want others to think I am a native speaker of HINDI	**I want others to think I am a native speaker of INDIAN ENGLISH.**
Hindi dominant group	5.45	3.89
English dominant group	4.25	4.75

APPENDIX B. DOMINANCE SCORES OF ALL THE PARTICIPANTS

(Positive scores indicate dominance in Hindi and negative scores indicate dominance in IE)

Hindi dominant subjects	Dominance Score	Indian English dominant subjects	Dominance Score
1	4.912	1	-26.97
2	23.976	2	-3.996
3	40.32	3	-34.602
4	82.182	4	-17.166
5	37.146	5	-3.728
6	35.418	6	-13.89
7	25.154	7	-2.546
8	14.168	8	-30.152
9	16.168		

APPENDIX C. TARGET TOKENS USED IN THE EXPERIMENT

VOWELS	HINDI TARGET TOKENS	INDIAN ENGLISH TARGET TOKENS
i:	झील	peas
i:	कील	peel
i	तिल	kid
i	दिल	pig
u:	फूल	rule
u:	धूल	food
u	कुल	bull
u	गुड़	full
e:	सेब	cage
e:	रेल	maze
o:	चोर	door
o:	लोग	coal
ə	जल	bug
ə	घर	mud

APPENDIX D. INSTRUCTIONS & CONTEXTUALIZING PARAGRAPHS

Contextualizing paragraph[17] for monolingual Hindi session H1a -

गीतूऔरमीतूपाठशालापहुँचे।गीतूकोलिखनापसंदहैऔरमीतूकोपढ़ना।
चलोसुलेखलिखतेहैं - गीतूनेकहा।
सुलेखक्या? मीतूनेपूछा।
जबहमअक्षरोंकोधीरे-धीरेसुंदरबनाकरलिखतेहैंतबउसेसुलेखकहतेहैं- गीतूनेबताया।
अच्छा, औरजबअध्यापिकाबोलतीहैंऔरहमउसेसुनकरलिखतेहैंउसकोक्याबोलतेहैं? -
मीतूनेफ़िरपूछा।
उसकोश्रुतिलेखकहतेहैं - गीतूनेकहा।
अच्छाअच्छामुझेसुलेखऔरश्रुतिलेखदोनोंहीपसंदनहींहैं।मुझेकेवलकहानीपढ़नापसंदहै।-
मीतूनेकहा।
औरवहएककिताबखोलकरपढ़नेलगी।

Contextualizing paragraph[18] for monolingual Hindi session H1b -

एकबारबादशाहअकबरनेबीरबलकोबहुतसेकीमतीउपहारदेनेकावादाकियाऔरभूलगया।
कुछदिनबाददोनोंयमुनानदीपरघूमनेग
ए।एकऊंटकीगर्दनटेढ़ीदेखकरअकबरनेबीरबलसेइसकाकारणपूछा।बीरबलनेसोचायहीमौकाहैमहारा
जकोउनकावादायाददिलानेका।बीरबलनेकहा, "महाराज,
पिछलेजनममेंइसनेकिसीकोकुछदेनेकावादाकियाहोगाऔरभूलगया,
इसलिएइसजनममेंइसकीगर्दनटेढ़ीहोगई।"
अकबरकोयादआयाकिउसनेभीबीरबलकोवादाकियाथा।कहींउसकीगर्दनटेढ़ीनाहोजाए,
अकबरतुरंतमहलगएऔरबीरबलकोउपहारदेकरअपनावादापूराकिया।

Instructions & contextualizing paragraph[19] for monolingual IE session E1a -

INSTRUCTIONS -
Thank you for taking part in this study.
In this part, first you will read a small passage in English and then some sentences. Take your time and read everything at a normal pace. Speak as if you are talking to a friend who knows English well.

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[17] http://abhivyaktihindi.org/phulwari/kahani/chhoti_kahani/005sulekh.htm
[18] https://hindimind.in/akbar-birbal-ki-kahani-hindi-me/
[19] http://www.english-for-students.com/The-End.html

If you feel you have not read any sentence properly, you may read it again. Time is not a constraint.
If you have any confusion anywhere, you may speak to the facilitator.
You will be given examples before the start of each section.
Now, you will be presented with a passage in English. Please read it at a normal pace and volume.

Passage -
A young student of Zen happened to break a precious vase belonging to his teacher. When he heard his teacher's footsteps, he quickly held the broken vase behind him. As the teacher walked up to him, he asked, "Why does one die, master?"
"It's natural," said the teacher. "Everything has a beginning and an end. Everything has just so long to live and then has to die."
The student held out the pieces of the broken vase and said, "The time for your vase to die had come."

INSTRUCTIONS -
Thank you. Now you will be presented with some words. You have to put each of these words in the given sentence.

The given sentence is - They said XYZ again.
Here, you will replace XYZ with the word shown to you.

For example - when you see the word cat, you will say - They said cat again.
when you see the word jewel, you will say - They said jewel again.

Contextualizing paragraph[20] for IE monolingual session E1b -

Nazir had been sitting in the park since morning. He was staring at the flowers, they were in full bloom, a welcome sign of the spell cast by spring. These brightly coloured flowers with their heady fragrance were enticing all the tiny creatures who had made their homes in the shrubs, trees, flowers, and grass. Among these creatures, there were butterflies, all with brightly coloured wings, flitting among the flowers, each trying to outdo the other with their aerial acrobatics.
He had always been fascinated by the sights and smells of the park, here he reminisced about the past where it had seemed that there was peace, love, and prosperity all around.

Contextualizing paragraph[21] for code-mixed session -

[20]https://english-magazine.org/english-stories/3670-butterfly-wings-a-short-story

The following story was adapted into a code-mixed version, from its original monolingual English version.

Hozoएकप्रसिद्धzen teacherथे।एकदिनतूफ़ानकेबाद, एकfishermanनेउनकोbeachपरचलतेदेखा ।तूफ़ानकीवजहसेबहु तसारेstarfishकिनारेपरआग ईंथींand they were beginning to dry up. Soon all of themwould be dead. Hozo starfish कोउठाकरवापससमुद्रमेंफैंकरहेथे।

Fishermanनेteacherकेपासजाकरपूछा, “Surely, you cannot hope to throw all these starfish back into the sea?येहज़ारोंकितादातमेंयहींमरजायेंगी.I’ve seen it happen before. Your effort will make no difference."
“It will, to this one," Hozoनेकहा, एकऔरstarfishसमुद्रमेंफैंकतेहु ए।

[21] http://www.english-for-students.com/Making-a-Difference.html