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Phonological Category Perception for L3 Learning by Speakers of Punjabi

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Abstract:

The acquisition of a new language is influenced by the native language of the learner. The acquisition of second language is the first experience of a learner to interact with a new language apart from the mother tongue, but during the acquisition of third language, the learner already has experience to deal with a new language. Native phonetic categories or contrasts can be considered as a filter that removes specific acoustic cues for non-native sounds. Punjabi and English are from two different sub-families of languages, yet they present phonetic similarity between them. In this study, we have investigated how Punjabi speakers perceive features of non-native language (English) that are consistent with phonological category. We have presented results from the two listening task experiments show that similarity between stimuli of bVd type and Punjabi words can be better identifiable and perceived by participants, compared to the stimuli of hVba type.

Index Words: Third language acquisition, speech perception, Punjabi speaker, multilingual categorical perception, biasness in language learning.

1. Introduction

The understanding of third language acquisition is not that much prevalent among multilingual speakers because of less research in this field of area. The notion of second language acquisition can be understood in a wide sense where the L2 may refer to any language that the learner has learned after infancy. The term L3 is used to define the non-native language which a learner acquires after his/her second language (L2). If we talk about third language acquisition (TLA), we can consider it as a language that a learner acquires after his/her native and second language. This second language can be acquired along with native language simultaneously or separately as well. Earlier, most of the researches on third language acquisition (TLA) focused on the structure of mental lexicon, education as well as sociolinguistics. Third language (L3) can be influenced by both L1 and L2, and thus these languages have impact on learning/acquisition of third language. The acquisition of L3 is either similar to SLA or totally different, but there is no consensus about whether it is similar or different. Throughout the recent history, most linguists (Singh and Carroll 1979, Mitchell and Myles 1998, among others) have defended that there is no difference in the acquisition of an L2 or L3 and that all the languages that come after the native language are second languages. Others such as Hufeisen and Marx (2004) defend that TLA should not be considered equal to SLA and not a subtopic of it (Solís, 2015). The assumption of "no difference" relies on the fact that most of TLA research was primarily based on SLA studies, therefore, SLA theories and approaches were applied to TLA as a starting point. TLA is however a rapidly emerging research area. Most current research on TLA focuses on various aspects related to the effect of second language (L2) experience on L3 perception, difference between acquisition of L2 and L3, similarities among L1, L2 and L3 influence of L2 phonological perception, relationship between L1, L2 and L3. These researches have shown that the child language learners, like adult language learners, are indeed affected by their L1. If a child has not finished learning their L1 phonology, their cognitive learning mechanisms are still in the active process of organizing grammatical constructs. The early L2 learner may be in a qualitatively better position than an adult to treat L2 input as evidence to drive grammatical learning, speeding up their acquisition (Tessier & Duncan, 2013). In the area of TLA, vocabulary is one of the most focused areas. The effects of the listener's native language on the perceptual system included L1-based biases and tendencies clearly observed in the perception of non-native segments and syllables. Many of the studies have done on lexical cross-linguistic influence and transfer within psycholinguistic and sociolinguistic fields. It is argued that in the acquisition of L3 both L1 and L2 play significant role. L3 phonology is also a focused area in research of TLA. The cross-linguistic similarity task manifest that multilingual speakers absorb L3 sounds to L1 and L2 (means that L3 is influenced by L1 and L2). L3 can thus be influenced by L1 and also can influence the L1 (L1↔L3), and the cross-linguistic influence can also take place between the L1, L2 and L3 (L1↔L2↔L3) (Cenoz et al., 2001). It is believed that the L1 and L2 always serve as the L3 initial state. If a linguistic property is shared in the L1 and the L3, then acquisition will be facilitated (i.e. positive or facilitative transfer); however, if the L1 and L3 do not align (coordinate), then acquisition will be hindered (i.e. negative or non-facilitative transfer). For example, Vowels are much different from consonants because of their higher acoustic intensity and are distinct from each other in mostly the first three formant frequencies. The acoustic difference of vowel and consonant defines how they are perceived. For testing categorical discrimination or perpetual distance of different languages, one can use AX discrimination task (determines whether the two stimuli in a trial are same or different), cross linguistic similarity task, Natural referent vowel (NRV) framework, Perceptual assimilation model (PAM) and many more. The results of AX discrimination task of Kronrod's study reveal that L3 learners, especially beginners, differentiate similar sibilant pairs of L3 (Kronrod, 2016). NRV focuses specifically on the acoustic and articulatory properties of vowels and support the development of vowel perception by attracting an infant's attention and proving a stable perceptual form for the language learner. It provides development of native vowel perception. PAM, one of the most widely accepted theories of speech perception, claims that the child recognizes and learns to hear high-level articulatory gestures that discriminate sound contrasts in L1 and learner perceptually assimilate non-native phonemes into his/her own phonemic inventory. As per Tyler et al (2014), the principles which are guiding NRV, focus specifically on the acoustic and articulatory properties of vowels, on the other side PAM predictions were not intended to be specific to either consonants or vowels.

Several scholars suggest that L3 phonological acquisition is shaped by L2. 'L2 Status' or 'foreign language effect' has been explained by greater cognitive similarity between non-native languages (L2 and L3) in terms of the methods of learning, setting, the degree of meta-linguistic knowledge and awareness. There is one possible source of transfer in the case of L2 acquisition, and it is the first experience learning an additional language. L3 acquisition is slightly different: the speaker has experience acquiring an additional language, but this is the first experience in which there are multiple possible sources of transfer. Previous research also reports some cases which define the assimilation of L3 productions with both the L1 and L2. The learners may detect features of non-native sounds that are much consistent with native phonological categories. Perceivers may indentify and discriminate possible pairs of sounds, of non-native phonemes, in terms of acoustic similarities or dissimilarities to native phonemes and contrasts. If contrastive non-native phones/phonemes assimilate to the native contrasts, then it might be easy to discriminate but conversely, if contrastive non-native phones/phonemes do not assimilate to the native contrasts, then they may be difficult to discriminate. The relationship between identification discrimination has been interpreted as consequences of categorical perception, which is also reflected as an increased sensitivity to stimulus differences at the boundaries (Aaltonen et al., 1997). Kuhl (1991) provided the very first evidence, which suggests, that discrimination is affected not only by physical factors but also by stimulus typicality (Aaltonen et al., 1997). Learners of third language associate specific features of both L1 and L2 with features of L3, more strongly at the initial stage of phonological perception and production. We can say that the perception and production skills of L3 are influenced by both L1 and L2.

Categorical effects in speech perception are typically studied through behavioral identification and discrimination tasks, which provide data on listener's ability of classifying the sounds (identification) and differentiating sounds along with acoustic continuum (discrimination) (Kronrod, 2016). Categorical perception provides an opportunity to test the ability of learner to resolve the basic units of L3. Since many beginners L3 learners seem more likely to perceive unfamiliar phones in terms of acoustic similarities, as interpreted in Kogan (2020), or dissimilarities to native phonemes and contrasts. This contrast will also be examined through a psycholinguistic test and interpreted using the extended Kuhl (2000) model for perceptual magnet in categorical perception. There is an influence of experience of L2 on L3 perception and influence of L2 phonological perception. The experience of learning L2 provides learners of third language with an increase in ability to discriminate among non-native speech sounds.

According to Onishi (2016), L3 learners have an advantage in phonological perception after learned an L2. He studied the acquisition of L3 Japanese with help of L1 Korean and L2 English in terms of perception. The results Onishi presents is that the better the Korean learners performed during the English identification task, the better they distinguish voicing in stops at word-initial position in Japanese. The better the learners perform in L2, the better they performed in their L3, but limited to few contrasts of L3 acquisition that is somehow influenced by speaker's both the L1 as well as L2. The better the participants performed in L2, the better they performed in their L3 but limited in few contrast L3 acquisition (somehow influenced by speaker's both L1 and L2) (Onishi, 2016).

The study of Wrembel et al. (2019) indicated that it seems to be easier for L3 beginners to perceive the subtle phonetic differences in new phonological contrasts (Liu & Lin, 2021). Wremble aimed at investigating the perceptual categorization of Polish L3 sounds by young multilinguals and in his 2019 study, Wremble extended the existing paradigms of a vowel cross-linguistic similarity task from L2 to L3 studies. In this paper of Wremble, we can found that he used a cross-linguistic similarity task to examine whether L3 vowels would be perceptually assimilated to the L1 (German) phonological categories or L2 (English) categories or both and also used the AX perceptual discrimination task to examine if learners perceive a Polish contrast between retroflex and palato-alveolar sibilants that does not occur in any of their other languages. Wremble's this study, provides first data and information for the potential extension of the PAM/PAM-L2 model to the context of L3 phonological acquisition and findings also indicate that multilinguals seem to be more likely to perceive subtle differences between highly similar speech sounds that would typically follow the single-category assimilation pattern and to develop separate L3 categories for them (Wremble et al., 2019).

Many of the researches pointed out that the acquisition of a true L2 and the L3 is not the same whereas others argued that acquisition of both the L2 and the L3 is same. So, it is a complex idea to be discussed and the rationale for distinguishing L3 acquisition from L2 is complex and varied. Specific experience is needed to facilitate perceptual ability in an L3, rather than broad linguistic experience. During L3 phonological acquisition competing L2 perceptual targets may function as attractors in the learner's target phonology (Kopečková, 2015). Kopečková's study suggests that the two groups of Polish L2 and L3 child learners of English are differed in their perception of similarities between the target vowel sounds (of English and Polish) and their L1 counterparts. In this study, the perceptual assimilation task (PAM) tested the children's judgment of cross-linguistic phonetic similarities in the form of eight English vowels and six Polish vowels. With their extended phonetic-phonological repertoires, L3 child learners seem to be in a better position to attune their perceptual processing of L3 speech (Kopečková, 2015). This study suggests that both the learning processes (of L2 and L3) build on the basic cognitive mechanism of perception and classification, which is modulated by many of the learner's linguistic and non-linguistic experiences.

After researching on differences in the perception of English vowel sounds by child L2 and L3 learners (Kopečková, 2015), she worked on the bilingual advantages in the L3 learning and investigated L3 phonological development in 19 German learners of Spanish who already known to English. The learners were tested on the basis of their developing ability of producing the Spanish /r/ and /ɾ/. The results showed the positive effect of bilingual experience of L3 speech learning and also revealed that active bilinguals produced more target sounds (Kopečková, 2016).

Amaro in her earlier study presented data that suggest differential influence on an L1 versus L2 by which a native-like L2 shows greater L3 influence than the L1 (Amaro & Wrembel, 2016). Amaro

(2016) compares the Spanish perception and production by L1 English/L2 Spanish and L1 Spanish/L2 English speakers and Sypiańska (2016) found L3 English effects on L1 Polish but not L2 Danish vowel production, although proficiency was not controlled for in this study (Amaro, 2017). As per Amaro (2017), if a learner/speaker is unable to recognize the similarities between L3 and L1/L2, then, perhaps they turn to default secondary strategy (using the L2 as an initial hypothesis for L3). While acquiring the L2, it is the first experience of learner of acquiring an additional language, whereas while TLA, learner has already an experience of acquiring of additional language, but this can be the first experience where there are multiple sources of transfer (of one language to the new additional).

Liu and Lin (2021) investigated, in their cross-linguistic study of L3 phonological acquisition, how students learning L3 (i.e. Japanese or Russian) perceived and produced word-initial stops in the respective target language and also investigated the link/relationship between perception and production. The results of this study revealed that the phonetic similarity in different stop categories of the L1, L2 and L3 created the confusion for learner in perception. In this study, they used the identification task (i.e. perception task) and the reading task (i.e. production task) for their research, where identification task analyzed how accurately L3 learners and native speakers could perceive voiceless and voiced stops of Japanese or Russian and reading task analyzed the voice onset time (VOT) (duration of time period between release of a closure and the onset of voicing) distribution of voiced and voiceless stops in L2 (English) of learner. In this study, the results from the perception test showed that learners were more accurate in perceiving voiced stops in L3 Japanese and L3 Russian than in perceiving voiceless stops. Additional results from the L3 reading task showed that the VOTs of the voiceless stops produced by both groups of L3 learners were mainly positive (Liu & Lin, 2021). It also showed the results that L3 beginners had a high accuracy in perceiving L3 voiced stops but the production is somehow difficult for them. Also the study found a positive relationship between the perception and production of voiceless stops in the initial stage of L3 acquisition, however there was no correlation between the perception and production of voiced stops (Liu & Lin, 2021). Most of the researches has focused on the perception and production and discrimination of non-native consonant contrasts and the very little was focused (during last decades) whether the perception of non-native vowel contrasts follow the same or different principles as non-native consonant contrasts.

Tyler et al. (2014) tried to evaluate whether similar or different principles are the basis of perception of non-native vowel contrasts. The acoustic differences between vowels and consonants seem to be escorted by differences in how they are perceived. This project of Tyler et al. (2014) examined American English monolingual's perceptions of six cross-language vowel contrasts. The researchers' primary purpose was, in particular, to evaluate the predictions from both the PAM and NRV models. The results of this study revealed high levels of inter-individual variability in the assimilation patterns for non-native vowels. Most of the vowel contrasts were assimilated as TC (two-category assimilation), UC (uncategorized-categorized assimilation), or UU (uncategorized-uncategorized assimilation). The results of Tyler's (2014) indicate that TC, CG (category-goodness assimilation), SC (single-category assimilation), UU, and UC assimilation types can be obtained for non-native vowel contrasts, but these types varies among individuals for any given non-native vowel contrast. They conclude from their research that PAM principles do extend beyond non-native consonants, non-native vowels and that NRV predictions were upheld for SC assimilation type.

Sypiańska (2016) tried to analyze all the languages in linguistic repertoire of two groups of speakers: L1 Polish, L2 Danish (bilingual speakers) and L1 Polish, L2 Danish and L3 English (multilingual speakers), with respect to the acoustic properties of some selected front vowels (L1 Polish /ɛ/, L2 Danish /ɛ/, /e/, /æ/ and L3 English /ɛ/). Sypiańska exerted combined cross-linguistic influence on L3 phonological acquisition and analysis focus of this work is vowel quality which is based on the measurements of F1 and F2 at vowel midpoint. This finds out the effects of L3 English on L1 Polish but not on the L2 Danish. According to this study, the existence of a global language system was evidenced by the quality of the L1 vowels of a bilingual group which was different from the same L1 of a multilingual group, likely because the latter also had a third component language (Sypiańska, 2016).

List of Abbreviations:

L1 – First language
L2 – Second language
L3 – Third language
SLA – Second language acquisition
TLA – Third language acquisition
PAM – Perceptual assimilation model
NRV – Natural referent vowel
LEAP-Q - Language Experience and Proficiency Questionnaire

1.1. Bias in the Language Learning

Language is a socially transmitted system; therefore, the biases of language learners impact on its structure. While perceiving speech, listeners are biased by different factors such as cognitive limitations (memory and attention), and native limitations (their native language). Learners, as earlier said, may detect features of non-native sounds that are much consistent with their native phonological categories (can be acoustic or articulatory similarities) and we can observe the bias. L2 learners are L1 perceivers to begin with, bringing their native-language experience and biases into the perception of L2 sounds and structures. Languages bias their speakers towards focusing on events in certain ways. By the time adulthood is reached, listeners usually will have adapted well to the phonotactic constraints of their native language, and are likely to demonstrate their L1 perceptual biases when hearing nonnative sequences. The effects of the listener's native language on the perceptual system included L1-based biases and tendencies clearly observed in the perception of non-native segments and syllables (AlMahmoud, 2011). Martin (2017) focuses on two factors: processing bias during word recognition, and learning bias during the transmission process. In this research, Martin tested French participants on their ability to recognize mispronounced words and found that manner and place features were more important than the voicing feature. He found that listeners were biased both by bottom up acoustic perception and top-down lexical knowledge. Also, in perception and production, there was evidence of a learning bias, showing how even a small bias favoring one pattern over the other could influence the linguistic typology over time. Listeners are biased by language-specific knowledge in addition to baseline constraints on hearing. Listeners can be biased, somehow, as per statistical patterns in their native language because, to begin with, their learned biases in phonological patterns are learned language in statistical processes (Peña et al, 2002). Peña et al (2002) in their seminal study, assess the statistical and structural computations for learning words and grammar in an artificial language. They explored whether learners can segment a stream of speech by nonadjacent transition probabilities. They performed five experiments which contain familiarization stream included meaningless speech composed by trisyllabic items. They discovered that adults and infants can perform statistical computations, but they do not appear to use this ability for simple structural generalizations (Peña et al, 2002). Martin (2017) explores two sources of bias: acoustic perception and lexical knowledge. These sources combined during the time of word recognition to bias listeners to pay attention to important features. These biases shape linguistic systems. The findings of this research are that both the manner (due to acoustic) and place (due to its status in lexicon) contrasts were important in word recognition. Phoneme inventories are biased favoring stop over fricative consonants (Nam, 2012). A similar bias is evident in acquisition. Nam (2012) tested English and French infants aged 4-5 months to determine whether they show a perceptual bias favoring stop manner.

It can be said that phonological learning is biased, such that not all patterns are equally learnable. Biases, on the basis of their effect, can be of two forms: structural bias (bias for simple patterns) and substantive bias (based on the substance of the features rather than abstract complexity) (O'Hara, 2018). Substantive bias in place of articulation inventories shows two kinds of biases: a) structural (patterns based on just syllable-position are better arrested than conjunctions of syllable-position and place of articulation) and b) anti-structural (patterns based on conjunctions of syllable-position and place of articulation are better arrested than those defined only with place of articulation. There are some anti-structural bias against patterns that are defined simply on the place of articulation scale such as its emergent with constraints defining the markedness hierarchies and no direct emergent from channel bias (substantive bias) (O'Hara, 2018).

The results of paper of White & Sundara (2014) are consistent with a learning bias favoring alternations between similar sounds over alternations between dissimilar sounds. Learners prefer patterns with an underlying phonetic motivation, sometimes called a substantive bias. Under some accounts, learners are biased against ‘‘unnatural’’ or ‘‘marked’’ patterns due to universal grammatical constraints on learning. However, infant studies looking for markedness biases have produced mixed results, with some providing support and others finding no effect. If infants have a bias to prefer alternations between similar sounds, then we expected generalization from dissimilar to similar sounds (bias condition), but not from similar to dissimilar sounds (control condition). The asymmetry in generalization (i.e., from less similar sounds to more similar sounds, but not *vice versa*) is coherent with the outline that learners are biased to prefer alternations between phonetically similar sounds (White & Sundara, 2014).

Torres and Canovas (2018) claim that the group of children, unlike adults with normal hearing, showed fronting bias in place of articulation errors, where Spanish listeners were biased for the sound of /ɵ/, while English listeners showed bias for the sound /f/. For voicing sounds, it is relatable that adult listeners with normal hearing are strongly biased towards devoicing Spanish stops. In case of manner of articulation, Moreno-Torres et al. (2018) found a relatively small amount of errors, and a slight bias towards stopping in the labials (p/f) and dentals (t/θ), but not for the velars (k/χ). The stopping bias in the labial and dental consonants might indicate a preference for unmarked consonants or that background noise energetically masks more effectively the turbulences of fricatives than the stop bursts. In the case of place of articulation, Moreno-Torres et al. (2018) did not find a fronting or backing bias. It might be seen as possible that a fronting bias appears in children with normal hearing. As per Torres and Canovas (2018), consonant confusions are mostly present in the case of place of articulation whereas manner errors are most uncommon. For voicing, the children with cochlear implants (are electronic devices that can help to provide a sense of sound to a person who is severely hard of hearing) showed a clear voicing bias, the children with normal hearing showed a balance between voicing and devoicing, and the adults with normal hearing showed a slight devoicing bias. For the place of articulation bias, they revealed that the existence of significant differences between the adults with normal hearing (backing bias) on the one hand, and the two groups of children (fronting bias) on the other. The fronting bias was somewhere stronger in the children with cochlear implants than in the children with normal hearing. Regarding the manner of articulation in these three groups, there was a balance between stopping and fricativization. These groups were identical with regards to manner of articulation, rather than for voicing or place of articulation (Torres & Canovas, 2018). For place of articulation, both groups of children showed a fronting bias as compared with the adults with normal hearing.

Polka and Bohn’s the Natural Referent Vowel (NRV) framework discussed about the acoustic-phonetic bias through which high-salience vowels are preferred over low-salience vowel. The acoustic-phonetic high-salience bias is present earlier to the onset of word recognition. This bias interacts with the language experience and therefore this bias is perpetuating for most non-native contrasts but somehow it is absent or weaker for native contrasts. It can be said that directional asymmetries (according to NRV framework) are driven by acoustic-phonetic high salience bias. Also in general, an acoustic-perceptual bias affects perception in young infancy and comes to interact with language experience in adulthood. According to Nam (2014), perceptual biases related to acoustic properties are revealed as perceptual asymmetries in stop-fricative perception. The investigation of Polka et al. (2005) was about vowel perception bias at three different age groups in three language groups. Monolingual infants showed the NRV bias by listening longer to the more peripheral vowels /u/ and /i/ than their respective less peripheral counterparts /y/ and /ɪ/ in all three age groups (Nam, 2014). By analyzing these three groups, they claim that the NRV bias may not be a low level auditory bias; rather it is a phonetic level bias that is shaped by differences in language experience. In the same way, we can say that place of articulation bias or manner of articulation bias is also shaped by different language experiences of listener/learner. In the perception of consonant manner contrast, there is a presence of perceptual bias grounded in acoustic property salience, and to address this presence, Nam (2014) theorize that not all consonant manners are equally acoustically salient. The finding of this research confirms that a stop bias is in place before infants can produce these stops or fricative sounds or recognize words, consistent with the notion that the bias is related to inherent salience differences between stops and fricatives. This bias is interacted with the language experience and bias is maintained for non-native contrast but somehow is absent or weaker in native contrast.

Biases are emerging from the various systems of speech production and perception underlies various types of sound change with corresponding phonological profiles. Children may come to language acquisition with bias to organize the linguistic knowledge in ways that turn out to differ from the organization used by their parents. According to the report of Garrett and Johnson (2013), some properties of bias factors in sound change are that the lack of randomness in perceptual variation; and bias is directional. With the movements of articulators there introduce variability in speech and it might introduce bias as well for sound change, is typically asymmetric. For changes grounded in perceptual parsing, this would mean that listeners sometimes introduce bias and this could happen in two ways: asymmetric misperception may be a bias factor, in some cases, and perceptual hypercorrection. They claim that symmetric misperception cannot generate asymmetric bias factors. Biases in speech production and perception provide the starting point in sound change, but they do not exhaust the processes of phonologization. It seems reasonable to assume that variants produced by phonetic bias factors are usually 'corrected', either by perceptual processes like compensation or by rejection of speech errors (Garrett & Johnson, 2013).

Several asymmetries can be founded in speech error corpora and in speech errors, alveolars are replaced by palatals more often than palatals are replaced by alveolars (Stemberger, 2019). Palatal bias is a term (by Stemberger) used to refer to asymmetries observed in the errors that are made in speech production. A bias is predicted for /s/ to be replaced by /š/ more often than the reverse; an anti-frequency effect predicts a bias away from alveolars towards the other places of articulation and there is a bias for alveolars to be replaced by labials more than the reverse.

Overall, there is a bias for alveolars to be replaced by labials, since labials contain the element [labial] contrasting with no place of articulation feature in alveolars (Stemberger, 2019). The lack of an asymmetry, however, masks two equal and opposite asymmetries: a bias towards velars for voiceless stops but towards labials for voiced stops. Both biases are for a less frequent segment to be replaced by a more frequent segment. The manner of articulation (MOA) information behaved entirely parallel to the place of articulation (POA) information, in the experiments described by Stemberger (2019). Stemberger (2019) has shown that there are some general biases: for alveolars to be replaced by labials and velars, for voiceless obstruents to be replaced by voiced ones, and for stops to be replaced by nasals and fricatives. Learners come to the language learning task with some biases that make certain linguistic systems easier to acquire than others, and as a consequence of cultural transmission these biases have effects on the types of languages we should expect to see in human populations. Understanding the cultural evolutionary consequences of particular learning biases is therefore central to understanding the link between language learning in individuals and language universals. The consequence of such biases will be a linguistic system which is well adapted for communication (Smith, 2010). Weak biases in learners can therefore have strong effects on the frequencies of competing linguistic variants in a language. So, language universals are not necessarily a direct reflection of strong biases in the language acquisition device, but may derive from weak bias in individual learners that have strong or even categorical effects (Smith, 2010).

1.2. Perception of L3 by Punjabi Speakers

Bilingual children do not differ greatly from monolingual children in terms of global phonological ability; however, they may differ significantly from monolingual children in specific linguistic areas such as Voice Onset Time (VOT), syllable structure, and rhythm (Kehoe & Havy, 2018). There is only one study, led by Sorenson Duncan and Paradis (2016), has included all three sets of factors together and examined their influence on the non-word repetition accuracy of bilingual children, aged 5-8. Kehoe and Havy (2018) intend to advance this study in several ways. First, we consider younger age ranges to gain insight into the early stages of phonological acquisition. Second, we consider spontaneous and imitated productions of real words. They examine the influence of language-internal, language-external, and lexical factors on the phonetic-phonological development of monolingual and bilingual children. Studies which have compared monolingual and bilingual children on global measures of phonological acquisition, such as percentage consonants correct (PCC), percent vowels correct (PVC), whole-word proximity, and size of the phonetic inventory do not find strong evidence that the speech of bilinguals differs from that of monolinguals. Bilinguals may do better than monolinguals, less well than monolinguals, or behave similarly to monolinguals. The failure to find consistent monolingual–bilingual differences on global measures such as PCC or PVC does not mean, however, that cross-linguistic interaction does not take place. A phonetic/phonological property that contains more elements and more structure is more complex than a phonetic/phonological property that contains fewer elements and less structure. Children acquiring a high-complexity (Hindi, Punjabi, or Urdu) coda language were more accurate in their production of coda consonants than children acquiring a low complexity (Cantonese or Mandarin) coda language (Kehoe & Havy, 2018).

It is believed that English is succeeded to achieve the status of lingua franca among the languages of world. One can also consider it as an emerging L2 or L3 language of Asia, especially in the subcontinents. One the ground of this, it would be right to claim that the population size of English speakers is larger than any native language (Farooq & Mahmood, 2017). The influence of native language (L1, e.g., Punjabi in our case) as well as of L2 (e.g., Hindi) on the acquisition of L3 (English in our case) has no doubt which ultimately produce number of local varieties of English language. The use of first language in acquiring the nonnative language can be seen as incidental influence and speakers are unaware of their lingual interference which initiated variations in L2/L3 proficiency. SLA/TLA is am organized process where phonological constraints of L1 could add some native language effects in L2/L3.

PAM predicts that discrimination performance on non-native contrasts will vary from poor to excellent depending on how the contrasting non-native phones are assimilated (categorized and goodness-rated) to native phonological categories. The perceiver may detect features of a nonnative phone that are perfectly consistent with a native phonological category (Best & Tyler, 2014). If the L2/L3 contrasts can assimilate to native phonemes they are classified as a two category (TC), Category goodness (CG) or Single category (SC) contrast depending on similarities and discrepancy between the L2/L3 contrasts and between the L3, L2 and L1 contrasts. As per PAM, in two-category (TC) assimilation members of the L2 contrast assimilate to two different native categories, that is, one member assimilates to one native category and the other one to another native category; in category goodness (CG) each member of the L2 contrast assimilates to the same one native category with one of the members being more deviant from the native sound than the other; and in single category (SC) both L2 phones assimilate to one phoneme in the native category and both are equally deviant from the native sound (Pilus, 2016).

In this study, I have investigated how Punjabi speakers perceive features of non-native language (English) that are consistent with native phonological category. Punjabi and English belong to two different sub-families of languages: English is one of the West Germanic languages, whereas Punjabi is a part of the Indo-Aryan family (Chohan & Gracia, 2019). An added facet is that Punjabi has three tones: high, mid, low (Karamat, 2001). Works on Punjabi phonology are few. Punjabi and Hindi are similar in terms of their phonologies but their script, way of writing alphabets and historical features are different from each other. Punjabi is a very rich linguistic variety loaded with a vast variety of sounds. These sounds may have different acoustic features like duration, nasalization. The tone is considered as a significant element in the Punjabi language. The study of Chohan & Gracia (2019) claims that even though English and Punjabi are from two different language families; yet they present phonetic similarity between them. Both of the languages may have less structural overlap. There are 24 consonant sounds in English and 32 consonant sounds in Punjabi. Among these 56 consonant sounds, 20 consonant sounds (like /p/ (p), /b/ (b), /ʃ/ (S), /ʤ/ (j), /m/ (m), /n/ (n) and others) are similarly used in both languages, which share the same place and manner of articulation. However, there are 14 consonant sounds (as /w/ is in English but not in Punjabi; /ɣ/ (Z) is in Punjabi but not in English) which are different in terms of manner and place of articulation of both (Punjabi and English) languages.

Karamat (2001) in her study on phonemic inventory of Punjabi said that Punjabi spoken in India (Eastern Punjab) is more influenced by Sanskrit, unlike Western Punjab (Pakistan) which is influenced by Persian and Arabic. Gurmukhi script is phonemically more directly linked to spoken Punjabi than Urdu script. According to Karamat, Punjabi system involves five distinctive tongue positions: labial, dental, retroflex, palatal, and velar. Also there are 10 vowels in the Punjabi vowel system: three short, seven long (four back and three front) vowels. Also Maxwell and Fletcher (2009) investigated the acoustic-phonetic characteristics of English vowels in L1 speakers of Punjabi and Hindi. Although they noted that both Punjabi and Hindi are Indo-Aryan languages, they were careful to document differences in the vowel inventories and superasegmental features of the two languages based on their phonological description of these languages. Even though very few differences were observed in English vowels produced by Punjabi and Hindi speakers, Punjabi speakers produced English diphthongs with more phonetic variations than Hindi speakers. Native language phonology may influence the perception and production of non-native language (Maxwell & Fletcher, 2009).

1.3. Research Approval:

The study was approved by the University's Human Research Ethics Committee.

2. Research Methodology:

Due to the pandemic and lockdown it was very difficult to conduct an experiment and asked the participants to perform the task under our supervision. So I had to find an appropriate experiment that can be performed online and provide the accurate data. I had decided to create an experiment in online mode. At first I created a LEAP-Q (Marian, Blumenfeld & Kaushanskya, 2007) via Google form and distributed among participants. This questionnaire includes participant's consent, demographic information (name, age, gender) and their linguistic background like how many languages do they speak; their first language, second language, language used with family and friends, order of language acquisition, dominant language, and fluency and so on. There was no gender bias in collecting data. The recorded randomized stimuli (114 of both experiments-1, 2) had access to all the participants. Instructions were given to the participants with Punjabi word list in a pdf form. Participants performed both listening task within the range of 1 hour to 1 hour and 15 minutes.

2.1. Participants (Population & Sample):

A total of 16 (8 females and 8 males) listeners participated in the two experiments described in this study. Out of these participants, one listener was of high school, nine were undergraduate and graduate students and six were post-graduate students. This age ranged from 18 to 26 (mean-21.875; standard deviation- 2.446085). In order to access participant's linguistic backgrounds, an online survey was conducted via Google form. Participants were given the Language Experience and Proficiency Questionnaire (LEAP-Q) adapted from Marian, Blumenfeld, & Kaushanskya (2007). Participants filled in the forms online in English. LEAP-Q has four main sections: personal information, linguistic background, and English language acquisition (Appendix 1).

According to LEAP-Q 15 participants speak 3 languages and one of them speaks 5 languages. 15 participants reported Punjabi as their first language (L1) and one reported Hindi as L1. Among all the participants, 9 participants reported English, 5 reported Hindi, 1 reported Punjabi and 1 reported both Hindi and English as their second language (L2). Most of the participants use Punjabi at home as well as with friends. But some of them claimed that they use Punjabi, Hindi and English as well for communicating with their friends. This questionnaire is done to look at the background of the participants as described above. But detailed analysis of this questionnaire is not the part of this study.

2.2. Stimuli:

The cross-language perceptual assimilation and category goodness experiment was based on 19 vowels, 11 monophthongs /iː/, /ɪ/, /ɛ/, /æ/, /ɑ/, /ɒ/, /ɔ/, ʊ/, /u/, /ʌ/, and /ɜ/, and 8 diphthongs /ɪə/, /eɪ/, /aɪ/, /ɔɪ/, /oʊ/, /aʊ/, /eə/, and /ʊə/ in the contexts bVd and hVba, taken from Rehman (2019). English minimal pairs were constructed in two contexts: bVd (19 vowels*1 speaker*3 repetitions =57) + hVba (19 vowels*1 speaker*3 repetitions =57). Here bVd were English words and hVba were nonsense words that are used for perceptual assimilation. These word sets were recorded in Audacity software as .wav files (with 48000 Hz). The following table lists the English words and nonsense words that were used for the cross-language assimilation and goodness rating task.

Table 3.1: test words in bVd and hVba context.

Test words in bVd context	Test words in hVba context
Bead	Heba
Bid	Hiba
Bed	Heba
Bad	Haba
Bard	Harba
Bod(y)	Hoba

Bawd	Horba
Budd(hist)	Hooba
Booed	Who'ba
Bud	Huba
Bird	Hurba
Bayed	Haba
Bide	Hiba
Boyd	Hoiba
Bode	Hoeba
Bowed	Howba
Bared	Hareba
Beard	Heerba
Boored	Hureba

These words were provided in wav file form along with the set of 24 Punjabi words (23 words + option of 'none') and instructions to focus on the first vowel sound of each word. Participants were asked to select the Punjabi word which may contain the similar vowel sound as of the stimuli (through Google Drive) and rate the Punjabi word's category goodness (perceived goodness) on a 11-point scale, from 0, "not Punjabi-like," to 10, "Punjabi-like."

Table 3.2: Punjabi vowels and response categories for the perceptual assimilation

Punjabi vowel	Punjabi response categories and glosses
/ə/	ਬਸ (bas, Bus) ਹਦ (hadd, Extent) ਸਖਤੀ (sakhti, Strictness)
/ɑ/	ਚਾਹ (chah, Tea) ਲਾਈਨ (line, Line) ਕਾਰਡ (card, Card)
/ɪ/	ਫਿਰ (fir, Then)
/i/	ਭੀੜ (bheed, Crowd) ਨਸੀਹਤ (nasihat, Exhortation)
/ʊ/	ਉਪ (up, Deputy) ਗੁਰੂ (guru, Teacher)
/u/	ਦੂਰ (door, Away) ਭੂਤ (bhoot, Ghost)
/e/	ਭੇੜ (bhed, Sheep) ਸ਼ਹਿਰ (shehar, City)
/ɛ/	ਤੈਅ (taeh, Decided) ਹੈਡ (head, Head)
/æ/	ਜੈਨ (jain, Jain religion)
/o/	ਘੋੜਾ (ghoda, Horse) ਭੋਗ (bhog, An occasion when Sikhs follow the path of Guru Granth Sahib) ਹੋਏ (hoye, Were)
/ɔ/	ਜੋੜ (jod, Joint) ਮੌਤ (maut, Death)
none	ਕੋਈ ਨਹੀਂ (koi nahi, None of the above)

2.3. Listening task:

In the language perceptual assimilation task, for each of the 19 English vowel 23 Punjabi words were provided to the participants to indentify the potential responses. These response alternatives were selected on the basis of Punjabi vowel sounds that are somewhat similar to English vowel sounds. Participants heard each stimuli with English vowels in bVd (Exp 1) and hVba (Exp 2) and were asked to judge to which Punjabi vowel it was most similar by selecting one of the 23 response alternatives or "none" if they thought the vowel they just heard did not match with any Punjabi vowel, as shown in Figure A.2.1 and Figure A.2.2 (for Experiment 1, bVd) and in Figure A.2.3 and Figure A.2.4 (for Experiment 2, hVba) (Appendix 2).

Following the participant's response, the participants then rated its goodness on scale of 0-10, "Punjabi-like" (10) and "not Punjabi-like" (0). The participants could replay the sound if they wished. In this experiment the stimuli were fully-randomized, such that tokens from different vowels, and repetitions were presented in random order. For experiment 1, participants completed a total of 3 judgments for each bVd stimulus on each vowel (3 repetitions of each word) for a total of 57 stimuli (1 talker * 3 repetitions * 19 vowels). Similarly, in Experiment 2, participants completed a total of 3 judgments for each hVba stimulus on each vowel (3 repetition of each word) for a total of 57 stimuli (1 talker * 3 repetitions * 19 vowels). Total testing time for each experiment ranged from 30 minutes to 40 minutes and both experiments.

3. Results and Discussion

3.1. Results:

The following tables represent the frequency and average rating of Punjabi vowel (from given Punjabi word list) that participants choose on the basis of similarity with English vowels (from given stimuli). One stimulus is repeated three times and 16 participants listen these sounds randomly (16 * 3) provide total 48 responses for one English vowel. Following frequency tables along with average rating of both listening experiments (bVd and hVba) give an idea about perceptual assimilation of English (L3) vowel by Punjabi (L1) speakers.

3.1.1. Experiment 1 (bVd):

Table 3.3: /i/

V	Freq	Avg. rating
/o/	1	8
/i/	32	6.9
/ɪ/	7	5.4
/ɑ/	2	6
/ɔ/	1	5
/i/	1	5
/ə/	1	6
None	3	0

For vowel /i/ (bead), out of 48 responses total 33 responses were chosen similar vowel sound of Punjabi. The average rating of the vowel /i/ is 6.9 given by listeners. Some of the participants (total 7 responses) select short vowel (/ɪ/) instead of long vowel (/i/), and 3 responses were for option "none" that they were unable to recognize the sound similarity with given words list.

Table 3.4: /ɪ/

V	Freq	Avg. rating
/ɑ/	1	5
/ə/	4	6.5
/ɛ/	4	5.5
/i/	20	6.15
/ɪ/	5	2.8
/u/	3	3.6
/e/	1	5
/u/	2	7.5
/i/	1	5
none	7	0

For vowel /ɪ/ (bid), only 5 responses with 2.8 average rating out of total 48 responses were chosen by Punjabi speakers. On the other side 21 responses were there for vowel /i/ with rating of 6.1. While listening to these stimulus participants were unable to recognize whether it is long vowel or short vowel, and 7 responses were for "none" shows their inability for finding similarity between vowel sounds of both languages.

Table 3.5: /ɛ/

V	Freq	Avg. rating
/i/	1	7
/ə/	3	6.6
/ə/	2	6.5
/ɛ/	24	7.1
/ɪ/	1	5
/ɔ/	1	7
/ə/	1	6
/ɛ/	4	6.7
/ɑ/	1	8
/o/	1	6
/e/	1	5
None	8	0

For the vowel sound /ɛ/ (bed), total 28 responses were chosen for similar vowel sound with average rating of 6.9 out of total 48 responses. 6 responses can be seen for /ə/ and 8 for "none" option.

Table 3.6: /æ/

V	Freq	Avg. rating
/ɪ/	1	4
/ɑ/	3	6
/ɛ/	25	6.5
/e/	2	7.5
/ə/	1	7
/ɛ/	6	5.1
/i/	1	6
/ɛ/	5	6
/i/	2	7
None	2	0

For English vowel sound /æ/ (bad), there is not any response for similar sound in Punjabi word list. But out of all responses, total 38 responses were chosen by participants with average rating of 5.9 or 6 for vowel sound /ɛ/. And others responses were for /ɪ/, /ɑ/, /e/, /ə/, /i/ and "none".

Table 3.7: /ɑ/

V	Freq	Avg. rating
/u/	1	9
/ə/	4	5.5
/ɛ/	4	6
/ɑ/	19	7.5
/ə/	5	7.8
/e/	1	7
/ʊ/	1	6
/ɑ/	3	6.6
/ɛ/	1	6
/o/	1	8
/ʊ/	1	6
/i/	1	6
None	6	0

For vowel /ɑ/ (bard), there were total 22 responses for same vowel with 7 average rating. 9 responses were for /ə/ and 6 were for "none". And several single responses were for sounds like /i/, /ʊ/, /o/, /ɛ/, /e/, /u/; but these sounds are not similar with the stimuli provided to participants for this specific vowel.

Table 3.8: /ɒ/

V	Freq	Avg. rating
/ɔ/	11	6
/ə/	6	5.1
/ʊ/	2	5
/ɔ/	8	6.8
/o/	14	7
/i/	2	6
/ʊ/	2	3
None	3	0

For English vowel sound /ɒ/ (body), there was not any response for same vowel but there were 19 responses for /ɔ/ with 6.4 average rating and 14 for /o/ with 7 rating. Instead of these some responses were for /ə/ (6), /ʊ/ (4), /i/ (2) and "none" (3). There is not any similar vowel sound in Punjabi but as per this listening task participants found some similarity while perceiving /ɔ/ and /o/.

Table 3.9: /ɔ/

V	Freq	Avg. rating
/o/	1	9
/ɔ/	24	6.9
/ə/	2	8
/u/	1	6
/ɑ/	1	5
/ɔ/	2	5.5
/i/	1	6
/ɛ/	1	5
/ə/	1	5
/i/	1	2
/o/	4	6.7
/æ/	1	4
/u/	1	7
/ə/	1	6
None	6	0

For /ɔ/ (bawd), total 26 responses were there for the same vowel sound in Punjabi language with 6.2 average rating. And 6 responses for "none" who were unable to identify the similarity and 5 for /o/, 4 for /ə/, 2 for /u/, 1 for /ɑ/, /ɛ/, /æ/ and 2 for /i/.

Table 3.10: /ʊ/

V	Freq	Avg. rating
/ʊ/	16	5.6
/ɑ/	2	6.5
/u/	11	5.9
/o/	5	5.6
/ɔ/	1	7

/e/	1	7
/ɔ/	2	7.5
/o/	1	7
/ə/	1	5
/u/	1	7
None	7	0

For the vowel sound /ʊ/ (budd-hist), there were 16 responses for same vowel with 5.6 average rating and 12 responses for /u/ with 6.4 average rating. For this stimulus, participant's responses were scattered among several responses such as 6 for /o/, 2 for /ɑ/, 3 for /ɔ/, 1 for both /e/, /ə/ and 7 for "none". Listeners were, as in /i/ and /ɪ/, confused between short and long vowel (/ʊ/ and /u/).

Table 3.11: /u/

V	Freq	Avg. rating
/ə/	1	5
/ʊ/	4	3
/ɛ/	1	6
/u/	14	6.3
/ʊ/	8	6.2
/u/	13	7
/ɔ/	2	5.5
/ɪ/	1	4
/o/	1	7
None	3	0

For /u/ (booed), out of 48 total 27 responses were there for the same vowel sound with the average rating of 6.6. And along with this, 12 responses were for /ʊ/ with 4.6 rating. Instead of these 3 for "none", 1 for all /ə/, /ɛ/, /ɪ/, /o/ and 2 for /ɔ/. In this stimulus also, there is a slight confusion in long (/u/) and sort (/ʊ/) vowel.

Table 3.12: /ʌ/

V	Freq	Avg. rating
/ɑ/	1	7
/ə/	16	5.3
/ɑ/	2	5
/ə/	7	6.5
/ɛ/	5	6.4
/ɑ/	4	7
/o/	1	7
/i/	1	6
/ʊ/	3	5
/e/	1	8
/i/	1	5
/ɑ/	1	6
None	5	0

For the stimulus /ʌ/ (bud), maximum responses (23) were for /ə/ with average rating of 5.9. along with this there were 8 responses for /ɑ/, 5 for /ɛ/, 3 for /ʊ/, 2 for /i/, 1 for both /e/, /o/ and 5 for "none". There was not any sound in responses that is similar to /ʌ/ but participants perceive /ə/ as similar sound with this.

Table 3.13: /ɜ/

V	Freq	Avg. rating
/ɑ/	19	9.5
/ɛ/	2	4.5
/æ/	2	4
/ɔ/	1	7
/i/	1	8
/ə/	1	6
/i/	3	5.6
/ɔ/	2	5.5
/ə/	3	6
/o/	1	5
/ɑ/	1	9
/ʊ/	1	4
None	11	0

For the sound /ɜ/ (bird), there is not any sound in Punjabi similar to this. But in this listening task 20 responses of /ɑ/ in total were found for this stimulus with 9.2 rating. 11 responses were for "none" option. And there were 4 responses for both /i/ and /ə/, 3 for /ɔ/, 2 for both /ɛ/ and /æ/ and 1 for both /o/ and /ʊ/.

Table 3.14: /eɪ/

V	Freq	Avg. rating
/e/	19	7.4
/ɛ/	7	5.4
/ɪ/	5	5.8
/i/	3	7
/æ/	1	5
/ɔ/	1	7
/o/	1	7
/ə/	2	6
/ɑ/	1	7
/ɔ/	2	6
None	6	0

For first vowel sound of /eɪ/ (bayed), total 19 responses were for /e/ with 7.4 rating and 5 for /ɪ/ with average rating of 5.8, 7 for /ɛ/ with 5.4 rating. Also there were 3 responses for /i/ and /ɔ/, 2 for /ə/, 1 for /ɑ/, /o/ and /æ/ and 6 for "none".

Table 3.15: /aɪ/

V	Freq	Avg. rating
/ɔ/	2	5.5
/ɑ/	34	6.6
/æ/	1	5
/o/	1	8
/e/	1	6
/ɛ/	1	5
/ɑ/	3	6.3
None	5	0

For first vowel (as per instructions) sound of /aɪ/ (bide), there were total 37 responses for /ɑ/ with 6.4 rating, out of 48 responses. And some of the responses were for /ɔ/ (2), /æ/ (1), /o/ (1), /e/ (1), /ɛ/ (1), and "none" (5).

Table 3.16: /ɔɪ/

V	Freq	Avg. rating
/o/	14	6.7
/ɪ/	4	5.7
/ɔ/	2	5.5
/u/	1	7
/e/	1	6
/ɑ/	2	6.5
/ʊ/	1	4
/ɑ/	1	8
/ɔ/	1	5
/ə/	2	4.5
/o/	1	8
/ə/	1	6
None	17	0

For first vowel of this stimulus, /ɔɪ/ (boyd), there were only 3 responses for /ɔ/ with 5.2 rating, but 15 responses for /o/ with 7.3 rating and 17 for "none". Instead of these there were some scatter responses for different vowels like /ɪ/, /u/, /ʊ/, /e/, /ɑ/, /ə/.

Table 3.17: /oʊ/

V	Freq	Avg. rating
/ɪ/	3	5
/ɔ/	7	7
/o/	4	6
/u/	3	5.6
/ɔ/	8	6.2
/o/	12	6.6

/ɑ/	2	3.5
/e/	1	6
/æ/	1	5
/ʊ/	1	7
/ɛ/	1	5
None	5	0

For the first vowel of this stimulus /oʊ/ (bode), total 16 responses were there for /o/ with 6.3 average rating and 15 for /ɔ/ with 6.6 rating. Along with these, there were responses of /ɪ/, /u/, /ɑ/, /e/, /æ/, /ʊ/, /ɛ/ and "none" as well.

Table 3.18: /aʊ/

V	Freq	Avg. rating
/ɛ/	3	6
/ɔ/	3	7.3
/u/	8	6.2
/ʊ/	1	3
/ɛ/	4	5
/ə/	2	5
/o/	1	6
/ə/	1	5
/o/	2	5.5
/i/	2	3
None	21	0

For /aʊ/ (bowed), maximum number of responses was found for "none" (i.e. 21), which showed the non-similarity of vowel sounds of both English and Punjabi. There were 8 responses for /u/, 7 for /ɛ/, 3 for /ɔ/, /ə/, /o/, 2 for /i/ and 1 for /ʊ/.

Table 3.19: /eə/

V	Freq	Avg. rating
/i/	4	7
/o/	2	7
/ɑ/	8	6.8
/i/	2	6.5
/e/	3	6.6
/o/	1	7
/ɑ/	2	6.5
/ɛ/	1	9
/o/	1	7
/ɪ/	1	5
/u/	1	8
None	22	0

For /eə/ (bared), total 22 responses were there for "none" and only 3 responses for /e/ with 6.6 average rating. Along with this there were 6 for /i/, 4 for /o/, and 10 for /ɑ/, 1 for /ɛ/, /ɪ/ and /u/.

Table 3.20: /ɪə/

V	Freq	Avg. rating
/i/	6	6
/ə/	1	8
/i/	27	6
/ɛ/	1	6
/ɑ/	2	5.5
/e/	1	4

/ə/	1	7
/e/	1	8
/u/	1	2
None	7	0

For the first vowel of /ɪə/ (beard), there was not any response for /ɪ/ but there were 33 responses for /i/ with average rating of 6 and 7 for "none". There were some scatter responses for /ə/ (2), /ɛ/ (1), /ɑ/ (2), /e/ (2) and /u/ (1).

Table 3.21: /ʊə/

V	Freq	Avg. rating
/i/	6	3
/u/	21	6.7
/ʊ/	1	5
/u/	9	7.5
/ʊ/	4	6
/e/	1	7
/ə/	2	5.5
None	4	0

For /ʊə/ (boored), for first vowel, there were only 5 responses for /ʊ/ with average rating of 5.5 but there were 30 responses for /u/ with 7.1 rating. Also there were 6 responses for /i/, 2 for /ə/, 1 for /e/ and 4 for "none". Here also participant's confusion between long vowel and short vowel can be seen.

3.1.2. Experiment 2 (hVba):

The stimuli of this experiment included non-sense words that have similar vowel sounds as stimuli of first experiment. In this listening task participants were more confused while perceiving the sounds and identifying the similarity between both English and Punjabi. Even the use of option "none" was frequently used in this listening task.

Table 3.22: /i/

V	Freq	Avg. rating
/e/	4	7
/ə/	4	8
/ɛ/	4	6.2
/i/	7	7.7
/ɪ/	3	5.3
/i/	3	5.6
/ɑ/	1	6
/ɔ/	1	8
/o/	1	7
/æ/	1	3
/ʊ/	1	8
/o/	1	6
/ə/	1	5
/ɛ/	1	5
None	15	0

For /i/ (heba) of listening task 2 (hVba), there were only 10 responses for the same vowel with average rating of 6.6 and 15 responses were for "none". In addition to this, responses were scattered among several vowel sounds like 4 for /e/, 5 for both /ə/ and /ɛ/, 3 for /ɪ/, 2 for /o/ and 1 for /ʊ/, /æ/, /ɔ/ and /ɑ/.

Table 3.23: /ɪ/

V	Freq	Avg. rating
/ə/	6	4.6
/e/	2	6
/i/	3	7
/ɛ/	2	4.5
/i/	3	6.3
/ɪ/	8	5.5
/ɛ/	2	5
/ɑ/	1	4
/ɔ/	2	7
/o/	2	3.5
/e/	1	5
/o/	1	7
/u/	1	6
/ʊ/	1	5
None	13	0

For the vowel sound /ɪ/ (hiba), only 8 responses were there for same (/ɪ/) vowel sound with 5.5 rating and 13 responses were for "none". Instead of these there were several different vowels that can be found in responses such as /ə/ (6), /e/ (3), /i/ (6), /ɛ/ (4), /ɑ/ (1), /ɔ/ (2), /o/ (3), /u/ (1) and /ʊ/ (1).

Table 3.24: /ɛ/

V	Freq	Avg. rating
/æ/	4	6
/o/	3	5.6
/i/	5	3.8
/ɛ/	17	7.2
/o/	2	4
/u/	1	7
/o/	2	4.5
/ə/	1	4
/e/	2	6
/i/	2	5
None	9	0

For the sound /ɛ/ (heba), total 17 responses were found for the same sound (/ɛ/) with 7.2 rating and 9 for "none". Also with these there were 4 for /æ/, 7 for both /o/ and /i/, 2 for /e/ and 1 for both /u/ and /ə/. In this stimulus participants were still able to perceive and identify the similarity between vowel sounds.

Table 3.25: /æ/

V	Freq	Avg. rating
/o/	1	4
/ɛ/	11	5.1
/ɪ/	5	4.8
/i/	5	4.2
/ɛ/	9	6.8
/u/	2	7
/ɑ/	4	5.7
/ə/	3	4.3
/ɑ/	1	9

/e/	1	7
/o/	1	8
/æ/	1	7
/o/	1	7
None	3	0

As earlier it is discussed in the context of Experiment 1 that there is not any vowel in Punjabi similar to /æ/ (haba), but still participants were found its similarity with /ɛ/. In same manner, in this task also, they found similarity with same vowel sound. There were total 20 responses for /ɛ/ with average rating of 6 and only 3 responses were for "none". Instead of this, there were several different responses for this sound as /o/ and /ə/ had 3, /ɪ/, /ɑ/ and /i/ had 5, /u/ had 2 and /e/ and /æ/ had 1 response.

Table 3.26: /ɑ/

V	Freq	Avg. rating
/ɔ/	1	9
/ɛ/	3	4.3
/ɑ/	12	5.8
/ɑ/	6	7.8
/o/	4	5.2
/ə/	2	7.5
/o/	2	4.5
/ɔ/	1	6
/ɑ/	1	5
/ʊ/	1	6
/i/	1	5
None	14	0

For /ɑ/ (harba), total 19 responses, for the similar vowel sound, were there with rating of 6.2 and 14 responses for "none". Some responses were found for other different vowels such as 6 for /o/, 3 for /ɛ/, 2 for /ɔ/ and /ə/ and 1 for /ʊ/ and /i/.

Table 3.27: /ɒ/

V	Freq	Avg. rating
/i/	1	8
/ɔ/	3	6
/o/	15	6.3
/o/	7	6.2
/e/	2	6
/o/	4	6
/ɑ/	1	3
/ə/	1	7
/ʊ/	1	8
None	13	0

For the stimulus /ɒ/ (hoba), there was not any response, as earlier discussed in Experiment 1, for this vowel but there were common responses that were found in the given table. There were 13 responses for "none" and 25 (maximum) responses were for /o/with 6.1 rating. In Experiment 1, the most similar vowel that was perceived was /ɑ/ but in this experiment (Exp 2) there was only 1 response for this vowel (/ɒ/) sound, and 3 for /ɔ/, 2 for /e/, and 1 for /i/, /ə/ and /ʊ/.

Table 3.28: /ɔ/

V	Freq	Avg. rating
/ɑ/	3	4.3
/ɛ/	2	6
/ɔ/	6	4
/o/	3	7
/ɔ/	6	6.1
/o/	6	6.1
/u/	2	6
/o/	14	6.2
/e/	1	7
/u/	1	6
None	4	0

For /ɔ/ (horba), 12 responses were for /ɔ/ with 5 average rating and 23 for /o/ with 6.4 rating. Only 4 responses were there for "none" and others were for different vowels like 3 for /ɑ/ and /u/, 2 for /ɛ/, and 1 for /e/.

Table 3.29: /ʊ/

V	Freq	Avg. rating
/ɛ/	2	4
/ɔ/	4	5.5
/e/	4	4
/ə/	5	5
/o/	6	7.3
/ʊ/	7	6.5
/u/	4	7
/ɔ/	2	4
/i/	1	4
/ɑ/	1	9
/ʊ/	2	5
/æ/	1	5
/u/	1	6
None	8	0

For the vowel sound /ʊ/ (hooba), 9 responses were for the same sound with average rating of 5.7 and 8 for "none". Along with that other responses were for different vowels like 6 for /ɔ/ and /o/, 5 for /ə/ and /u/, 4 for /e/, 2 for /ɛ/ and 1 for /i/, /ɑ/ and /æ/.

Table 3.30: /u/

V	Freq	Avg. rating
/ə/	1	5
/o/	5	5.6
/u/	12	5.1
/o/	7	4.8
/ʊ/	1	7
/u/	3	7
/ʊ/	4	6.2
/i/	1	6
/o/	2	5.5
/ɑ/	1	6
/ɔ/	1	6
None	10	0

For /u/ (who'ba), out of 48 total 15 responses were there for the same sound of /u/ with average rating of 6 and 14 for /o/ with 5.3 rating. 5 responses were for /ʊ/ and 10 for "none". Also there were responses with frequency of 1 as well like /ə/, /i/, /ɑ/ and /ɔ/.

Table 3.31: /ʌ/

V	Freq	Avg. rating
/ɛ/	3	6.3
/u/	2	4.5
/o/	4	6
/ɑ/	7	6.1
/ə/	8	5.3
/o/	2	8
/ə/	3	5.6
/ɑ/	4	5
/ɪ/	1	8
/ɑ/	1	4
/i/	1	7
/ɛ/	1	7
/ʊ/	1	4
None	10	0

For the sound of /ʌ/ (huba), there is not any similar sound but participants chose /ɑ/ (12) with average rating of 5 and /ə/ (11) with rating of 5.4. Responses with "none" option were 10 and 6 for /o/, 4 for /ɛ/, 2 for /u/, and 1 for /ɪ/, /i/ and /ʊ/.

Table 3.32: /ɜ/

V	Freq	Avg. rating
/ɑ/	11	6
/o/	6	5.8
/æ/	4	4.7
/ə/	7	6
/ɔ/	4	6.7
/o/	1	7
/ɔ/	1	3
/o/	1	3
/ɛ/	1	3
/i/	1	9
/ɑ/	2	6
/ə/	2	5
/u/	1	7
/ɛ/	1	8
/ʊ/	1	4
None	4	0

For the English vowel sound /ɜ/ (hurba), there was not any similar vowel sound but like earlier experiment, in this also participants found its similarity with /ɑ/ (13 responses) with average rating of 6. There were only 4 responses for "none" and 7 for /o/, 9 for /ə/, 4 for /æ/, 5 for /ɔ/, 2 for /ɛ/ and 1 for /i/, /u/ and /ʊ/.

Table 3.33: /eɪ/

V	Freq	Avg. rating
/o/	5	5.6
/o/	2	6
/ɛ/	16	5.5
/u/	2	7

/ɑ/	1	7
/e/	7	5.2
/ɛ/	1	6
/ɔ/	1	6
/ɪ/	1	8
/e/	1	4
None	11	0

The first vowel of this stimulus (as per instructions) /eɪ/ (haba), there is not any similar vowel but participants identify /ɛ/ (17) with 5.7 rating and /e/ (8 responses) with 4.6 rating. There were total 11 responses for "none" and 7 for /o/, 2 for /u/, 1 for /ɑ/, /ɔ/ and /ɪ/.

Table 3.34: /aɪ/

V	Freq	Avg. rating
/ɑ/	9	5.3
/ɪ/	2	6
/ə/	2	6
/ɑ/	11	6
/ɛ/	3	7
/i/	3	4.6
/o/	6	4.3
/o/	1	4
/ʊ/	1	5
/e/	2	4.5
/u/	1	4
None	7	0

For /aɪ/ (hiba), out of 48 responses total 20 responses were for /ɑ/ with average rating of 5.6 and 7 for "none" and /o/. Along with this, there were 3 responses for /ɛ/ and /i/, 2 for /ɪ/, /e/ and /ə/, and 1 for /u/ and /ʊ/.

Table 3.35: /ɔɪ/

V	Freq	Avg. rating
/ə/	3	6.6
/o/	14	7.4
/ʊ/	1	4
/o/	3	5.6
/o/	6	4.6
/ɑ/	1	8
/ɛ/	1	4
/ɔ/	2	6.5
/ɔ/	1	6
/ɑ/	1	8
/ʊ/	1	8
/u/	1	1
/e/	1	7
None	12	0

For /ɔɪ/ (hoiba), similar to first vowel sound, there were only 3 responses (/ɔ/) with rating of 5.8 and 23 responses for /o/ with rating of 6.2. There were 12 responses for "none" and 3 for /ə/, 2 for /ʊ/ and /ɑ/, and 1 for /e/, /ɛ/ and /u/.

Table 3.36: /oʊ/

V	Freq	Avg. rating
/ɔ/	11	4.5
/ʊ/	1	9
/o/	9	6.1
/o/	5	6
/ʊ/	2	6
/o/	6	6.3
/ɛ/	1	5
/e/	1	7
/ɔ/	1	5
/æ/	1	4
/u/	2	6
None	8	0

For /oʊ/ (hoeba), similar to the first vowel sound /o/ had 20responses in total out of 48 with 6.1 average rating and 12 for /ɔ/ with 4.7 rating. There were 8 responses for “none” and 3 for /ʊ/, 2 for /u/, and 1 for /ɛ/, /e/ and /æ/.

Table 3.37: /aʊ/

V	Freq	Avg. rating
/ɛ/	1	4
/ɪ/	1	7
/ɑ/	1	2
/o/	8	4.5
/ɑ/	2	6
/ɑ/	4	6.2
/o/	4	6.7
/ʊ/	4	5
/o/	2	5.5
/ʊ/	2	4.5
/ɔ/	2	6.5
/u/	1	6
/ɔ/	5	6.4
/u/	1	6
None	10	0

For first vowel of /aʊ/ (howba), there were total 7 responses (/ɑ/) with 4.8 rating and 14 responses for /o/ with 5.5 rating. There were 10 responses for “none” and 7 for /ɔ/, 6 for /ʊ/, 2 for /u/ and 1 for /ɛ/, /ɪ/.

Table 3.38: /eə/

V	Freq	Avg. rating
/o/	6	3.8
/ɑ/	1	1
/ɛ/	6	5.5
/ɑ/	5	6.4
/ɪ/	1	2
/e/	2	6.5
/æ/	1	9
/o/	1	7
/e/	3	6.3
/ʊ/	1	5
/i/	1	7

/ɔ/	1	7
/ə/	1	4
None	18	0

For /eə/ (hareba), similar to first vowel there were only responses with 6.4 average rating and 18 responses for “none”. Instead of this, there were 7 responses for /o/, 6 for /ɑ/ and /ɛ/ and 1 for /ɪ/, /æ/, /ʊ/, /i/, /ɔ/ and /ə/.

Table 3.39: /ɪə/

V	Freq	Avg. rating
/ɛ/	5	6.6
/o/	1	6
/e/	6	5.8
/ɑ/	2	5
/i/	5	5.6
/i/	3	7.3
/ɪ/	4	4.5
/ɔ/	2	5.5
/ɑ/	2	6
/ʊ/	1	6
/o/	1	6
/ə/	1	3
None	15	0

For the first English vowel of /ɪə/ (heerba), there were only 4 responses for /ɪ/ with average rating of 4 and 7 for /i/ with 6.4 rating (confusion between long and short vowel sound). There were 15 responses for “none” and 5 for /ɛ/, 6 for /e/, 4 for /ɑ/, 2 for /o/ and /ɔ/ and 1 for /ʊ/, /ə/.

Table 3.40: /ʊə/

V	Freq	Avg. rating
/e/	2	8
/i/	2	8.5
/ʊ/	6	4.3
/ʊ/	10	5.2
/u/	8	6.8
/i/	2	5.5
/o/	1	7
/æ/	1	5
/ɛ/	1	8
/u/	3	6
/o/	2	8
/ɪ/	1	4
None	9	0

For /ʊə/ (hureba), similar to first vowel sound there were 16 responses for /ʊ/ with 5 average rating and 11 for /u/ with 6.4 rating. There were 9 responses for “none” and 4 for /i/, 3 for /o/, 2 for /e/, and 1 for /æ/, /ɛ/, and /ɪ/.

3.2. Discussion:

While acquiring the second language it is learner's first time experience to deal with new language apart from the native language but while acquiring the third language he/she has already an experience to deal with new language. So this time they are more attentive while perceiving, identifying and producing the new language and L3 learners have an advantage in phonological perception after learned an L2. The term L3 is used to define the non-native language which a learner acquires after his/her second language (L2). There are several researches that claim that acquisition of L2 and L3 are similar but some of them claim that acquisition of both L2 and L3 are different. But the debate is still going on. Some researchers believe that it is L1 that influence the acquisition of L2 or L3. And somewhere it can be said that L2 or L3 also influence the L1 of learners. While acquiring the new language learners try to find the similarities and dissimilarities between native and non-native language. The assumption of "no difference" relies on the fact that most of TLA research was primarily based on SLA studies.

Learners may detect features of non-native sounds that are much consistent with native phonological categories or sounds (it can be similar on the basis on acoustics or articulation); so in this process one can find the bias in learner's perception or identification. They identify and discriminate possible pairs of sounds in terms of acoustic similarities or dissimilarities to native contrasts. While perceiving or discriminating the speech sounds, learners can be bias by different factors like cognitive (memory); native limitations (her/his own native language). Processing bias during word recognition and learning bias during transmission can be considered as two factors of bias. It is general that if non-native sounds or contrasts are somehow similar to the native ones then it might be easy for learner to discriminate and it can be said that this can be the reason of bias during word recognition. Learners try to associate specific features of L3 with L1 and L2; this is why perception and production skills of L3 are much influenced by L1 and L2.

It is believed that the better the learners performed in L2, the better they perform in L3. There are some studies that the learning process of both L2 and L3 build on the basic cognitive mechanism of perception and classification. Learners prefer similar sounds over dissimilar sounds. Lin and Liu (2021) investigated that the phonetic similarity in different stop categories of L1, L2 and L3 created confusion for learners in perception. And the studies of bias reveals that consonant confusions are mostly present in case of articulation whereas manner errors are most uncommon. Vowels are much different from consonants because of their higher acoustic intensity and are distinct from each other in the first three formant frequencies. The acoustic difference of vowel and consonant defines how they are perceived.

From the results of the data collection and its analysis, it can be seen that the stimulus of experiment 1, that were English words, is much identifiable and perceived by participants rather than the experiment 2, that were non-sense words. Both experiments had 19 words each and repeated 3 times and same 16 participants performed both experiments. In bVd experiment, for vowel sound /i/, /ɛ/, /ɑ/, /ɔ/, /ʊ/, /u/ and first vowel sounds of /eɪ/, /aɪ/, /ɔɪ/, /oʊ/ participants were able to identify the similar vowel sounds in Punjabi. But there were some vowel that had not any similar response like /ɒ/, /ʌ/, /ɜ/, but participants found some other similar vowel sounds like /ɔ/, /ə/, /ɑ/ and also participant's confusion between long vowel and short vowel found in the analysis as they select /i/ instead of /ɪ/ and /u/ instead of /ʊ/ or vice versa. Even they all were instructed to focus on first vowel sound but they were unable to identify the exact vowel sound from the diphthongs and select the option of "none" as in /aʊ/ and /eə/. In experiment 2, where non-sense word were provided in stimulus, confused the participants even though they had similar vowel sounds as experiment 1 but unable to identify and discriminate. Perhaps this was the reason why they select "none" for most of the responses and also the responses were found scattered among several different vowel sounds. In the hVba experiment, for vowel /i/ and /ɪ/ there were fewer responses for similar sound but more for "none". Other vowel sounds like /ʊ/, /ʌ/, /ɜ/ got several different responses in scattered way. As per PAM (Perceptual Assimilation Model), we got single category assimilation, two-category assimilation, even some of the uncategorized-categorized assimilation evidences can be seen as well.

4. Conclusion:

In this study, I have mainly focused on the perceptual assimilation and goodness rating of English (L3) vowels by speakers of Punjabi (L1). This study is divided into three parts: Introduction and literature review on TLA, PAM, and NRV; literature review on biases in language learning, place and manner of articulation; and listening task with two experiments (bVd and hVba). This is followed by the results of the two experiments on perceptual assimilation and goodness rating of vowels. Each stimulus had 3 repetitions and all the participants encounter these in randomized form; so there are total 48 responses for a single stimulus. Even though vowels used in stimuli of both experiments were same but participants were unable to identify the similarity to some extent and it seemed that they were slightly perplexed while perceiving the sounds. They were confused in short vowels (/ʊ/, /ɪ/) and long vowels (/i/, /u/).

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- **Appendix 1 LEAP-Q (Mentioned after Appendix 2 – in the end)**
- **Appendix 2**

Figure A.2.1:

Dear participants, thanks for taking part in this listening experiment.

You have some words of English language in form of audio along with list of Punjabi words.

Listen carefully first vowel sound and select the Punjabi word which may contain the vowel sound you just heard.

Then choose a number (0-10) to rate how close this sound was to that in the Punjabi word.

You have to write this with you and after completing this session scan that file and send it by mail in pdf form.

e.g., if you think audio stim005 is similar to word 'ਦੂਰ' and you rate it 7 for its similarity then you have to write it in the following manner:

stim005 – ਦੂਰ – 7

Figure A.2.2:

ਪੰਜਾਬੀ ਸ਼ਬਦ ਸਮੂਹ

ਭੂਤ	ਜੈਨ	ਸ਼ਹਿਰ	ਮੌਤ
ਭੀੜ	ਦੂਰ	ਘੋੜਾ	ਸਖਤੀ
ਫਿਰ	ਨਸੀਹਤ	ਭੇੜ	ਚਾਹ
ਹੈਡ	ਭੋਗ	ਲਾਈਨ	ਤੈਅ
ਕਾਰਡ	ਉਪ	ਹੋਏ	ਗੁਰੂ
ਬਸ	ਹਦ	ਜੌੜ	ਕੋਈ ਨਹੀਂ

Figure A.2.3:

Dear participants, thanks for taking part in this listening experiment.

You have some words of English language in form of audio along with list of Punjabi words.

Listen carefully first vowel sound and select the Punjabi word which may contain the vowel sound you just heard.

Then choose a number (0-10) to rate how close this sound was to that in the Punjabi word.

You have to write this with you and after completing this session scan that file and send it by mail in pdf form.

e.g., if you think audio hstim007 is similar to word 'ਦੂਰ' and you rate it 7 for its similarity then you have to write it in the following manner:

hstim007 – ਦੂਰ – 7

Figure A.2.4:

ਪੰਜਾਬੀ ਸ਼ਬਦ ਸਮੂਹ

ਭੂਤ	ਜੈਨ	ਸ਼ਹਿਰ	ਮੌਤ
ਭੀੜ	ਦੂਰ	ਘੋੜਾ	ਸਖਤੀ
ਫਿਰ	ਨਸੀਹਤ	ਭੇੜ	ਚਾਹ
ਹੈਡ	ਭੋਗ	ਲਾਈਨ	ਤੈਅ
ਕਾਰਡ	ਉਪ	ਹੋਏ	ਗੁਰੂ
ਬਸ	ਹਦ	ਜੌੜ	ਕੋਈ ਨਹੀਂ

Northwestern Bilingualism & Psycholinguistics Research Laboratory

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Language Experience and Proficiency Questionnaire (LEAP-Q)

Last Name		First Name		Today's Date	
Age		Date of Birth		Male ☐	Female ☐

(1) Please list all the languages you know **in order of dominance**:

1	**2**	**3**	**4**	**5**

(2) Please list all the languages you know **in order of acquisition** (your native language first):

1	2	3	4	5

(3) Please list what percentage of the time you are *currently* and *on average* exposed to each language. (*Your percentages should add up to 100%*):

List language here:					
List percentage here:					

(4) When choosing to read a text available in all your languages, in what percentage of cases would you choose to read it in each of your languages? Assume that the original was written in another language, which is unknown to you.
(*Your percentages should add up to 100%*):

List language here					
List percentage here:					

(5) When choosing a language to speak with a person who is equally fluent in all your languages, what percentage of time would you choose to speak each language? Please report percent of total time.
(*Your percentages should add up to 100%*):

List language here					
List percentage here:					

(6) Please name the cultures with which you identify. On a scale from zero to ten, please rate the extent to which you identify with each culture. (Examples of possible cultures include US-American, Chinese, Jewish-Orthodox, etc):

List cultures here					
	(click here for scale	(click here for scale	(click here for scale	(click here for scale	(click here for scale

(7) How many years of formal education do you have? ________ ________________________________
Please check your highest education level (or the approximate US equivalent to a degree obtained in another country):

☐ Less than High School	☐ Some College	☐ Masters
☐ High School	☐ College	☐ Ph.D./M.D./J.D.
☐ Professional Training	☐ Some Graduate School	☐ Other:

(8) Date of immigration to the USA, if applicable ______ ________________________________
If you have ever immigrated to another country, please provide name of country and date of immigration here.

__________________ ____

(9) Have you ever had a vision problem ☐, hearing impairment ☐, language disability ☐, or learning disability ☐? (Check all applicable). If yes, please explain (including any corrections):

____________________________________ ____

Language:

This is my (please select from pull-down menu) language. All questions below refer to your knowledge of .

(1) Age when you…:

began acquiring :	*became fluent* in :	*began reading* in :	*became fluent reading* in :

(2) Please list the number of years and months you spent in each language environment:

	Years	Months
A country where is spoken		
A family where is spoken		
A school and/or working environment where is spoken		

(3) On a scale from zero to ten, please select your *level of* ***proficiency*** in speaking, understanding, and reading from the scroll-down menus:

Speaking	(click here for scale	Understanding spoken language	(click here for scale)	Reading	(click here for scale

(4) On a scale from zero to ten, please select how much the following factors contributed to you learning :

Interacting with friends	(click here for pull-down scale)	Language tapes/self instruction	(click here for pull-down scale)
Interacting with family	(click here for pull-down scale)	Watching TV	(click here for pull-down scale)
Reading	(click here for pull-down scale)	Listening to the radio	(click here for pull-down scale)

(5) Please rate to what extent you are currently exposed to in the following contexts:

Interacting with friends	(click here for pull-down scale)	Listening to radio/music	(click here for pull-down scale)
Interacting with family	(click here for pull-down scale)	Reading	(click here for pull-down scale)
Watching TV	(click here for pull-down scale)	Language-lab/self-instruction	(click here for pull-down scale)

(6) In your perception, how much of a foreign accent do you have in ?

(click here for pull-down scale)

(7) Please rate how frequently others identify you as a non-native speaker based on your accent in :

(click here for pull-down scale)

Language:

This is my (please select from pull-down menu) language. All questions below refer to your knowledge of .

(1) Age when you…:

began acquiring :	*became fluent* in :	*began reading* in :	*became fluent reading* in :

(2) Please list the number of years and months you spent in each language environment:

	Years	Months
A country where is spoken		
A family where is spoken		
A school and/or working environment where is spoken		

(3) On a scale from zero to ten please select your *level of* ***proficiency*** in speaking, understanding, and reading from the scroll-down menus:

Speaking	(click here for scale)	Understanding spoken language	(click here for scale)	Reading	(click here for scale

(4) On a scale from zero to ten, please select how much the following factors contributed to you learning :

Interacting with friends	(click here for pull-down scale)	Language tapes/self instruction	(click here for pull-down scale)
Interacting with family	(click here for pull-down scale)	Watching TV	(click here for pull-down scale)
Reading	(click here for pull-down scale)	Listening to the radio	(click here for pull-down scale)

(5) Please rate to what extent you are currently exposed to in the following contexts:

Interacting with friends	(click here for pull-down scale)	Listening to radio/music	(click here for pull-down scale)
Interacting with family	(click here for pull-down scale)	Reading	(click here for pull-down scale)
Watching TV	(click here for pull-down scale)	Language-lab/self-instruction	(click here for pull-down scale)

(6) In your perception, how much of a foreign accent do you have in?

(7) Please rate how frequently others identify you as a non-native speaker based on your <u>accent</u> in: