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An acoustic analysis of speech of London-based Baloch learners of English*

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Nasir Abbas Syed
Assistant Professor, Department of English Language & Linguistics, Lasbela University Uthal Balochistan, Pakistan
nasirabbassla@gmai.com

Dr. Gul Hasan Baloch
Pro Vice Chancellor
Lasbela University Uthal Balochistan, Pakistan

Abstract

According to feature model (FM) (Brown, 2000), a pair of new L2(Language 2) sounds can only be acquired if a feature which differentiates between the two new L2 sounds is active in the feature geometry of the L1 of learners. Conversely, the new L2 sounds may not be acquired in adult age if the feature which differentiates the two L2 sounds is not active in the L1 of the learners; according to the FM, a new L2 feature cannot be acquired in adult age. This study poses a challenge to the feature model. Balochi does not have aspiration contrast (Elfenbein, 1997). Thus, according to the FM, English aspiration contrast should not be acquired by adult Baloch learners of English. To test this prediction, an experiment was conducted with a group of L2 Baloch adult speakers of English living in London. All participants speak and listen to English by native speakers for more than 4 hours daily. In the experiment, the participants read a list of English words carrying English plosives, which were recorded. The VOTs for plosives were calculated using Praat (Boersma & Weenink, 2012). The results show that the participants

* The authors are immensely obliged to Dolat Khan for providing accommodation and arrangement of meetings with the Baloch community of London for data-collection in this study. We also acknowledge the contribution of the participants who voluntarily spared time from their busy life and provided specimens of their speech which made this research project a reality.
*Lasbela University Uthal, Balochistan.

had developed two separate VOT ranges for aspirated and unaspirated stops of English. This indicates acquisition of a new feature [spread glottis]. The acquisition of English aspiration contrast by the Baloch learners poses a challenge to the FM prediction that a new L2 feature cannot be acquired in adult age. The study also identifies other factors which play more effective role than the L1 in L2 acquisition.

Key words: Balochi, English, L1 (Language 1), L2 (Language 2), L2 acquisition, VOT (Voice Onset Time).

Introduction

The influence of L1 grammar on L2 acquisition particularly the acquisition of phonology is strongly established in the L2 literature (Lado, 1957). Most of the research on acquisition of L2 phonology in the last quarter of the previous century was directed towards perception as well as production of L2 sounds. Models of second language acquisition like perceptual assimilation model (Best, 1994, 1995), speech learning model (Flege, 1995), etc are mainly based on perception of L2 sounds and its relationship with production. Most of the latest models of second language acquisition agree that L1 interferes in acquisition of L2 phonology. One such model of second language acquisition is feature model (Brown, 1997, 1998, 2000) also called FM. The current study focuses on this model. The main research question is whether adult L2 learners can acquire a pair of new sounds which are differentiated by a feature that is not active in the L1 of learners? The FM also addresses this question.

One of the main objections raised against the feature model is that it is based on the experiments conducted by Brwon herself at her own with the speakers of only East Asian languages (Larson-Hall, 2004). Therefore, the current study is based on an experiment conducted with speakers of Indo-Aryan languages spoken in Pakistan and India. This provides a new context for testing the predictions of the FM.

1. Theoretical background

An important question which has been discussed in the L2 literature at large is why adult L2 learners cannot acquire quite native like competence in production of a second language despite spending decades on acquiring the L2. Such an example was observed in Iverson et al (2008) which reports on the failure of Sinhalese learners in acquiring English [v w] contrast despite living in London among native speakers of English for approximately 28 years. On the other hand, a child acquires L1 in maximum five-six years of

his/her early life. Does it mean that ability to learn a second language terminates at a specific age as the supporters of the critical period hypothesis (Lenneberg, 1967; Patkowski, 1990; Penfield & Roberts, 1959; Scovel, 1988) claim? According to Brown (1997, 1998, 2000), L1 grammar impedes the operation of the universal grammar ultimately resisting acquisition of an L2 contrast which the L1 grammar lacks. According to Flege (1995), it is not the critical period which matters much, rather it is the existence of an already acquired L1 which impedes the acquisition of an L2. Although Flege and Brown agree that L1 resists L2 acquisition in some cases but they have divergent interpretations for this. In the opinion of Flege, L2 learners develop an equivalence classification between similar L1 and L2 sounds as a result of which they cannot perceive the difference between an L2 and the corresponding L1 sound. Thus, they not only perceive both (L1 and L2) sounds as the same but also produce them as a single sound. This is because strong equivalence classification between two sounds leads to development of single phonetic category for the two sounds. On the other hand, Brown considers that it is the L1 phonological feature geometry which resists accurate perception of L2 sounds. Thus, the former considers phonetic perception and latter considers phonological features as a reason for failure of L2 acquisition.*

It is very rare to find an adult learner who speaks an L2 with such a native like accuracy that monolingual speakers of the L2 cannot identify him/her as a non-native speaker. Being aware of this, the researchers working on L2 acquisition accept that even those learners who are able develop new phonetic categories for L2 sounds, produce the L2 with accent to the extent that their speech can be easily identified by a layman native speaker as different from the speech of native speakers of the L2 (Flege, 1995).

There is a large body of literature on L2 acquisition. Most of the researchers agree that L1 interference is one of the major reasons of inaccurate L2 acquisition. However, according to the claim of Brown (1997,1998), no one before her identified the reason why and how L1 influences L2 acquisition. Brown argues that L1 feature geometry does not allow adult learners to accurately perceive any L2 contrast which does not exist in the L1. It is here that Brown differentiates the input and intake (1998, p.139). According to Brown, "although input is required for language acquisition, the specific intake will determine the developmental stages of the grammar." Input becomes intake when a learner detects a specific contrast in L2. And a learner

* It must be noted that there may be other factors which cause failure to acquire an L2. These factors may be lack of proper learning conditions, motivation and/or input, etc. In the current discussion we discuss the reasons of failure of L2 sounds in ideal learning environment.

can only perceive the new L2 contrast if it is based on a phonological feature which is already active in the L1 of the learner.

The argument of Brown is based on the idea that acquisition of L1 phonological system leads to the loss of general ability to discriminate phonetically different sounds (Werker & Tees, 1984). Conclusively, the feature model claims that new sounds which are differentiated on the basis of a phonological feature which is active in the L1 may be acquired but a sound pair which is differentiated on the basis of a phonological feature which is not active in the L1 cannot be acquired in L2, because L1 feature geometry only perceives a difference which is already active in the L1. Other differences are blocked.

Brown (1997, 1998, 2000) conducted several experiments with Chinese, Japanese and Korean learners of English. The experiments were done using different methods focusing on different sound pairs. Every time she reached the conclusion that the L2 learners could develop a new L2 contrast only if the relevant phonological feature was active in the L1 of the learners. If the relevant L1 feature was not active, the L2 learners could not acquire an L2 contrast. The Japanese learners could not acquire [l r] contrast because the feature [coronal] which differentiates [l] from [r] is not active Japanese; similarly, since the feature [distributed] which differentiates [s] from [θ] is not active in the phonological feature geometry of Chinese, Korean and Japanese languages, the [s θ] sound pair could not be acquired by these learners regardless of the varying input or other factors. On the other hands, the participants successfully acquired [p v] sounds, which although new, are contrasted on the basis of the feature [continuant] which is active in the L1 of the participants. In the acquisition of such sound pairs, the factors like time spent on learning or input, etc. was also found to be influential factors. On the basis of these experiments, Brown concludes that only these new sound pairs can be acquired by adult L2 learners which are contrasted on by a phonological feature already active in the L1 grammar.

2. Context of the study

Brown's model is based on her own research on only East Asian languages. The current study focuses on a new context. Balochi is a language spoken mainly in Pakistan, Iran and Afghanistan and other Middle Eastern countries. Balochi has voiced and voiceless phonemes but it does not have voiceless aspirated stops in its phonemic inventory. Thus, the feature [spread glottis] which differentiates unaspirated stops from the aspirated ones is not active in Balochi. According to the predictions of the FM, the adult Baloch learners of English may not be able to acquire English aspiration contrast

regardless of whatever input they receive. The current study aims to test this prediction.

Many Baloch families of Turbat have moved to London and go living there for years. This project focuses on the English speech of adult male Baloch speakers who started getting input from native speakers of English in London after their puberty. The group of participants is uniform in the sense that the learners all belong to one district of Balochistan i.e. Turbat. Therefore, influence of dialectal variation of the participants' mother tongue is strictly controlled. Besides, all participants of this study moved to England after they had passed the critical period of language acquisition. Therefore, any achievement in their speech will contribute towards the theoretical discussion of role of critical period and effects of post-puberty input received by L2 learners.

The current study is based on an acoustic analysis of aspirated [p^h t^h k^h] and unaspirated [p t k] allophones of English plosives. Major acoustic cue studied in this experiment was voice onset time. Voice onset time (VOT) is the time interval between the burst of a stop and the onset of vocal fold vibration for the following vowel (Docherty, 1992). It is calculated in milliseconds. If a stop is produced with aspiration, the VOT is bigger and if it is produced without aspiration, it is produced with relatively smaller VOT. Normally, 30-40 milliseconds is a cut off point between voiceless unaspirated and aspirated stops. Aspirated stops are in the range starting above the cut off point whereas VOTs of unaspirated stops remain under this cut off point. Previous research also shows that normally dorsal stops /k/ have bigger VOT than coronal /t/ or labial /p/ stop (Cho & Ladefoged, 1999; Docherty, 1992; Lisker & Abramson, 1967; Syed, 2013b, etc.). The following section provides details of the participants and research methods used for collection and analysis of data.

3. Research Methodology

Twelve participants who speak Balochi as mother tongue participated in this test. Balochi does not have aspiration contrast at phonemic level (Elfenbein, 1997). However, phonetic allophonic distribution in Balochi is very interesting. The speakers of Makrani Balochi have only unaspirated stops and those of Eastern Balochi have only phonetically aspirated stops in their L1 phonemic inventory. The participants of this study were all speakers of Makrani Balochi, living in London at the time of data collection. The detail of the participants is given in the following sub-section.

3.1. Participants

Twelve Balochi speakers participated in this experiment. All of them were living in the United Kingdom. Six of them were students and the remaining six were doing some jobs. The six student participants were also doing part time job as receptionists in hotels which provided them opportunity to interact with public and speak and listen to English spoken by native and non-native speakers. The details of the participants are given in Table 1.

Table 1: Detail of the participants

Factors	Data*
Age of Arrival in UK (years)	23.33(03.98)
Age in years	29.92(05.65)
LOR† in UK (months)	79.08(66.57)
Speaking English hours/day	04.92(02.78)
Listening English hours/day	05.92(02.15)

Table 1 shows that the average age of arrival of the participants in the United Kingdom is above 23 years which means they started listening to native English after they had passed the critical period of language acquisition. In an interview which was recorded before the main experiment, the participants were asked if they had regularly listened to native speech of English for more than a month before coming to the UK, which they replied in negative. In response to one of the questions, they informed that they had never gone to any other English speaking country before coming to the UK.

As Table 1 indicates, the mean length of residence of the participants in the UK is 79.08 months. However, standard deviations given in the parentheses show a large amount of variation among them. One of the participants had only four month stay at London. Except for one Balochi speaker, all other participants had been living in the UK for more than six months. According to Flege and Liu (2001), maximum of L2 learning occurs during early six years. Best and Tyler (2007, p. 21) and Flege and Fletcher (1992, p. 377) also agree to the idea that maximum of L2 learning occurs in early 6-12 months of learning. Thus, eleven out of twelve participants had learnt maximum of what they had to learn from their interaction with native speakers during their stay in the United Kingdom. The performance of only one participant may not change the results because his overall performance was not significantly different in the group. One of the questions asked from

* Standard deviations are given in parentheses.

† 'LOR' stands for length of residence.

the participants in the interview was how many hours the participants speak and listen to English with native speakers. According to the data given in Table 1, the participants speak and listen to English spoken by native speakers for approximately four to five hours.

The dialectal variation in the L1 of the participants was controlled to the possible extent. For this, the selection of the participants was purposive. Only those participants were selected who speak the same dialect of Balochi. The participants were all from District Kech of Balochistan Province in Pakistan who speak Western Balochi (Elfenbein, 1997). In this way, the group of participants are uniform in terms of their L1, linguistic, cultural and educational background, etc.

3.2. Data collection

Before data collection, the nature of experiment was explained to the participants without informing them about the main purpose of the experiment. A written permission was also obtained from the participants to record and use their voices for research purpose without showing their identity. Ethical approval for this study was also taken from University of Essex, Colchester, United Kingdom.

Before recording the speech of the participants, a semi-structured interview was conducted with the participants to get information about their linguistic background and other information required for the current experiment. The information detailed in the previous section was elicited in the interview. Afterwards, a written list of words was given to the participants and they were asked to produce the stimuli in natural normal speed. The productions were recorded using M-Audio digital recorder. The recordings were analysed acoustically using Praat software (Boersma & Weenink, 2012). The standard principles of acoustic analysis as suggested by phoneticians (Foulkes, Docherty, & Jones, 2010) were followed in taking measurements of VOTs. Audacity 1.3 Beta Unicode software was used to segment the target words (stimuli) from the recordings of sentences.

The list of stimuli carried the target words and some distracters. The target words started with plosives and with s+stop clusters. All the target words were immediately followed by the low vowel [a] which is considered most neutral in its effect on the VOT of the preceding consonants (Syed, 2011). That is why the low vowel [a] is preferred choice for researchers in experiments (e.g. Best, McRoberts, and Sithole (1988), Guion, Flege, Akahane-Yamada, and Pruitt (2000), etc based on perception tests). The list of the target words used as stimuli in this experiment is given in (1).

(1)

park, spark, tart, start, car, scar

These words were presented in the list along with the distracters in such a random sequence that each of the target words was written three times each as exclusive words and three times in carrier sentences. In this way we obtained six repetitions of each of the above words by each of the participants. In the following sections, results are presented and analysed.

4. Presentation of data

As discussed in the previous section, there were three repetitions for each of the target words list in (1). A statistical analysis shows that there is no significant difference between the average VOTs obtained in words and sentences. Therefore, the VOTs obtained in words and sentences were averaged. The mean VOTs are presented in Table 1. These VOTs are based 72 tokens for each of the sounds (3 repetitions *2 contexts (word & sentence) *12 participants).

Table 2: VOT for English plosives by Baloch speakers

Sound	Mean VOT (standard deviation)
[p^h]	31.89(15.88)
[p]	17.65(12.46)
[t^h]	41.33(13.84)
[t]	32.97(08.51)
[k^h]	62.38(11.62)
[k]	46.36(11.55)

A repeated measures analysis of variance RM ANOVA confirms that place of articulation contrast is highly significant in the VOTs ($F=57.747$, $p<.0001$). The aspiration contrast is also significant ($F=14.892$, $p=.003$). However, no significant interaction was noted between place and articulation and aspiration contrast ($F=2.607$, $p=.096$). For a detailed pair-wise comparison of aspirated and unaspirated stops, the mean VOTs were compared separately at each place of articulation. The results of the t-test applied on the data are given in Table 3.

Table 3: Aspiration contrast at various places of articulation

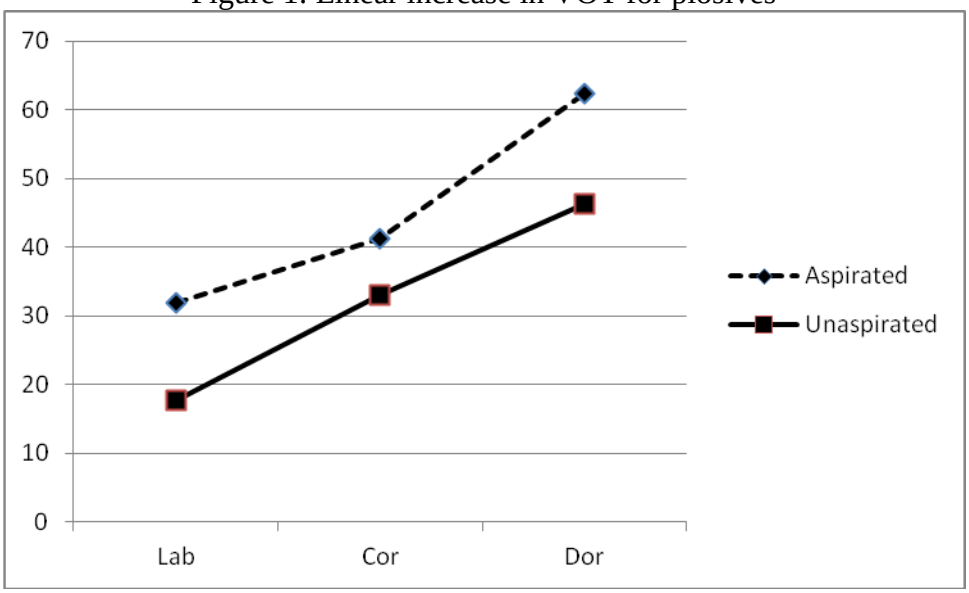
Place of articulation		T	Sig (two-tailed)
Labial	/p/	3.453	.005
Coronal	/t/	2.097	.060
Dorsal	/k/	4.480	.001

Table 3 shows that the aspiration contrast in VOTs of the participants is highly significant at labial and velar place of articulation whereas that on coronal place is marginally significant. These individual pair-wise comparisons finally confirm that the participants have acquired two separate ranges of voice onset time for aspirated and unaspirated allophones of English plosives.

Analysis and discussion

The data presented in Table 2 shows that there is a linear increase in the voice onset time for aspirated and unaspirated plosives of English produced by Baloch learners living in London. The VOTs of labial stops are the lowest and those of the dorsal stops are the highest with the VOTs for the coronal stops in between. Figure 1 reflects this picture.

Figure 1: Linear increase in VOT for plosives



These results are in line with the existing theories which predict a direct relationship between voice onset time and place of articulation. The phoneticians have already proved that the distance of point of articulation and vocal folds has inverse relationship with VOTs of stops, which means a bigger distance between the point of articulation and the vocal folds of speakers yields a shorter voice onset time and vice versa (Lisker & Abramson, 1964). Previous research has already established this relationship

(Cho & Ladefoged, 1999; Kent & Read, 2002; Lisker & Abramson, 1964 etc.). The current study provides some further evidence to this view.[*]

The main purpose of this study is to test the predictions of the feature model in the context of adult Baloch learners of English who live in London and get input from native speakers of English. The results of the t-test presented in Table 3 confirm that the participants of this study have developed two separate ranges of voice onset time for the aspirated and unaspirated allophones of English plosives. These two ranges are significantly different from each other at all three places of articulation.[†] These findings pose a possible challenge to the feature model. The model predicts that a new phonological feature is only acquired during the critical period of language acquisition when a child acquires mother tongue. For a second language acquisition, Brown predicts that a new sound contrast can only be acquired if the relevant feature which differentiates between the two sounds of a pair is already active in the L1 of learners. In the current context, the relevant feature which differentiates between aspirated and unaspirated English plosives is [spread glottis] (Clements & Hume, 1995). The aspirated sounds [p^h t^h k^h] are [+spread glottis] and the unaspirated stops [p t k] are [-spread glottis]. The feature [spread glottis] is not active in Balochi, since the speakers of Western Balochi do not have both aspirated and unaspirated phonemes in their L1. In this context, FM would predict that adult Baloch learners of English may not acquire the feature [spread glottis] in adult age. Previous studies have already demonstrated that Pakistani (Mahboob & Ahmar, 2004; Rahman, 1990, 1991) and Indian (Gargesh, 2004) learners of English do not develop separate VOT ranges for aspirated and unaspirated sounds of English. They rather produce these two sounds without aspiration. Baloch speakers of English living in Pakistan, like other Pakistani learners, do not maintain aspiration contrast in English as well as Urdu. It means, the participants of this study had not developed separate VOT ranges for these English sounds at the time of their arrival in the United Kingdom. As their own statements confirm, they started listening to English by native speech only after their arrival at London. Before their arrival at London when they were living in Pakistan, they had only access to Pakistani English which does not maintain aspiration contrast.

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[*]For parallel views on increase and decrease of VOT, see Lisker and Abramson (1967), Stevens, Keyser, and Kawasaki (1986), Hardcastle (1973), Suomi (1980) and Docherty (1992).

[†] Although the significant level in the comparison of aspirated and unaspirated allophones of coronal phoneme /t/ is bigger than .05 but it is very close to this level. Besides, some statisticians claim that the significant level for research in social sciences must be fixed at the p value of .1 instead of .05 .(Larson-Hall, 2010).

These factors confirm that London-based Baloch learners have acquired separate VOT ranges for aspirated and unaspirated allophones of English. These findings pose a big challenge to the feature model which claims that a new phonological feature cannot be acquired in adult age. The Baloch learners of English, as the findings of this study confirm, have acquired a new feature i.e. [spread glottis] in adult age. The findings of this study support the objection raised against the feature model by Larson-Hall (2004) that the claims of Brown's feature model get empirical support only from her own experiments conducted with speakers of only East Asian learners of English. We need to test these predictions on speakers of other languages of the world.

There may be two possible objections against the current findings. First, the VOT ranges of native English speakers may be different from those of the participants of this study. If we compare the VOT of stops produced by Baloch speakers with those of native speakers of English, we realize that the VOTs of the participants of this study are significantly different from the VOTs of the same sounds produced by native speakers of English.[*]The point of argument in this regard is that acquisition of a new sound never means quite native-like production; it rather means development of a separate phonetic category for that particular sound in the L2 phonemic inventory of learners (Flege, 1995). In the above data we found that the Baloch learners of English have developed separate categories for English aspirated stops which already do not exist in their L1.

The second possible objection to these findings is that Brown's predictions are about acquisition of new L2 *phonemes* but the current study focuses on *allophones* of English stops. This may be a valid objection. However, an important point to note is that allophones are also part of grammar of a language. The learners have to acquire those sounds which means they have to develop a separate category for those sounds and discriminate them from the closer sounds. To our understanding, the acquisition of allophones is rather more difficult than acquisition of phonemes. We hypothesize on the basis of these findings that the participants of this may also acquire aspiration contrast in at phonemic level. For example, in Urdu which national language of Pakistan aspiration contrast is phonemic. It is not irrelevant to point out here that all participants of this study had acquired Urdu in adult age.[†] A future project in this regard is to acoustically analyze the VOTs of Urdu stops (which are phonemes) produced by these participants to further confirm the findings of this study.

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[*] For a comparison, see voice onset time for allophones of English plosives in Docherty (1992) or Syed (2013a).

[†] Urdu being a national language of Pakistan is acquired by almost all educated Pakistanis.

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