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RESEARCH PAPER

A Phonological Analysis of Closure and Consonant Duration of English and Pashto Stop Sounds

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ABSTRACT

The main objectives of the study is to investigating the acoustic properties of English and Pashto Stops. It investigates the L1 Pashto effect on the acquisition of English Stops and to find out whether the acquisition process of Pashto learners agrees to the speech learning model of Flege (1987). The data analyzed in the study has been collected through microphone and Laptop in the shape of recordings from the educated and uneducated two groups of Pashto speakers. The data is analyzed using the Praat software. The analysis focuses on the closure and complete consonant duration of stops. It proves that there are certain similarities and differences in the acoustics properties of English and Pashto stops. Moreover, it proves that the results partially agree to the speech learning model. The study recommends further research work on Pashto language in general and on the acoustic analysis of the Pashto language in particular.

Keywords: Acoustic Analysis, Closure-Consonant Duration, English-Pashto Stops, Pashto Phonology, Praat Analysis

Introduction

It is generally observed that L1 Pashto speakers produce English sounds through their L1 phonological competence. Although, these articulatory differences can easily be perceived by L1 English speakers but the acoustic difference cam not be perceived with scientific analysis. The researcher in the present study has used Praat software in order to highlight the difference in English and Pashto sounds. In this connection the researcher has delimited the present study to the analysis of stop sounds. The major aim of this study is to display the acoustic properties of English and Pashto stops produced by L1 Pashto speakers, L1 English speakers and L2 learners of English language. Thus the study does not only highlights the acoustic difference in the closure duration between L1 Pashto speakers and L1 English speakers but also presents the acoustic differences between the L2 learners of English language and L1 English speakers. In doing so, the study has highlighted the issues faced by L2 learners in producing English sounds acoustically. The researcher of the present study focuses on the pronunciation of English speech sounds i.e. stops in comparison with Pashto stop sounds. In this connection the researcher has based the analysis on the Speech Learning Model presented by Fledge (1987) where he says that there is no acoustic difference between identical sounds in two languages but there exists a crucial difference in the similar sounds between two languages in terms of acoustic properties. There are differences in terms of acoustic properties between the stop sounds of English and Pashto language due to the fact that there are similar stop sounds in Pashto and English language and this is the reason that the researcher has focused on the stop sounds of English and Pashto languages. The focus of the researcher is on the closure duration and complete consonant duration of stop sounds in both the languages. The researcher intends to compare these acoustic properties to bring out the differences and similarities of the plosive consonants of the two languages.

Literature Review

Acoustic phonetics deals with the acoustic properties of the speech sounds which include loudness, resonance, closure, voicing on time, pitch and the waves through which the speech sounds are transferred from the speaker to the listener. This study mainly focuses on the closure duration, burst, aspiration complete stop duration which are the different acoustic properties of stop sounds. (Chien et al. 2011),

The sound system of every language includes vowels and consonants speech sounds. This is a universal difference which applies to every variety of language spoken in the world. Consonants are those sounds, in the production of which the obstruction is made in the air passage in the mouth cavity. On the other hand, vowel sounds are articulated without obstruction in the vocal cavity. This is the only as well as the most significant difference between the two types of sounds.

Consonant are comparatively easy to learn than vowels but non-native speakers due to their mother tongue interference, face problems in the articulation of these sounds. Consonants are further distributed in different types such as stops, fricatives, affricate, nasal, lateral and semi-vowels etc.

A stop consonant (voiced or unvoiced) is produced when the air passage is completely blocked by the organs of speech inside the mouth cavity and then is released suddenly with a burst of air (Narayanan, 2009**).**

Pashto language has nine stop sounds as shown in the following figure. Two of them are bilabial, two dental, two Retroflex, two velar while one uvular.

Table 1
Pashto stop sounds

Place of Articulation	Bilabial	Dental	Retroflex	Velar	Uvular
Stops	p b	t̪ d̪	ʈ ɖ	k g	Q

Source: Rahman (2012)

Unlike Pashto, English has six stop sounds which are shown in the following table. Two are bilingual, two alveolar and two velar.

Table 2
English Stops

Place of Articulation	Bilabial	Alveolar	Velar
Plosives	p,b	t,d	k,g

Source: Roach (2004)

Moreover, the speakers of one language, for example, Pashto, often find the sounds of the second language difficult to learn such as English. Most of the time, these problems owe to the direct influence of the mother tongue (in this case Pashto language). This way, the resulted communication is impaired and the intended meaning is blocked due to some errors in the pronunciation. Among these, the stops of English language are more problematic, especially for Pashto native speakers. The L1 Pashto speakers are often reported to have problems in the pronunciation of English stops. These errors are needed to be analyzed and resolved through a proper channel in order to enable the language speakers for the correct pronunciation of English stops which is the main concern of this research study.

Phonetics is the study of speech sounds where acoustic phonetics is the study of the physical properties of speech sounds. (Lane, 2013) and it is the area where many L2 learners face peoblems. (Zhang & Yin, 2009).

Kent and Read (1992) discuss four different acoustic properties of stop sounds and these properties are voice onset time (VOT), closure duration, burst and vowel transition. VOT, closure duration and burst are the intrinsic cues of stop sounds and the neighboring vowel transitions are extrinsic cues of stop. The first to be discussed here is Closure duration.

Closure duration is the required duration for the state of being closed phonetically. It is to the maximum duration for closing the articulatory organs for the production of a stop sound. The present research is based on the comparative analysis of English and Pashto stop consonants; as a consequence, closure duration occupies the central place for the discussions and interpretations. (Abat et al. 2016)

Ladefoged (2001) states that there are differences in the stops because of the different acoustic properties: closure duration, voice onset time (VOT), the spectral characteristics of their release burst, and formant transitions of surrounding sonorant. Different studies have been conducted on the different acoustic properties of stops by many researchers.

Yahan et al. (2010) in their research closure duration in the chines speaker's production of English plosives, talk about the closure duration and VOT properties of the English plosives. Their research throws light on the importance of closure duration for stop consonants. They deem it as the "Production of stop consonants such as the voiceless /p, t, k/ and the voiced /b, d, g/ involves complete closure of certain articulators. The closure stops the airflow in the vocal tract and is followed by a release of a burst of air, Voice Onset Time (VOT) and the duration of such closure are two of the most important aspects of plosive production. The research is mainly focused on the closure duration and VOT of English stops. 'Yahan Fan, Hua Lin and Yu Chin (2010) have done their analysis with the help of Praat software. In the present research, the researcher also analyzes the closure duration and VOT of Pashto and English stops with the help of Praat analysis, therefore, Yahan Fan and her colleagues' research is the most helpful tool in this regard.

Ladefoged (2001) is a linguist who also discusses on the closure duration of English stops. He highlights the salient feature of the amplitude of stop consonants in regard to their closure duration. He further says Silent closure duration is an important cue to the perception of stop consonants manner and that is of phonetic distinction that rest on the perceived presence versus absence of the stop consonants. This research also investigates the importance of the closure duration and its amplitude.

Flege, et. all (1997) highlights the influence of speaker's first language (L1) in learning English as a second language (L2).They have concluded that the L1 influence is experience dependent. In the same way, Baker, et. (2002) conducted a study on English vowels spoken by L1 English and L1 English Korean Bilingual speakers. They concluded that the influence is very strong on the acquisition of English vowels by bilingual speakers and the in same L1 effect can be traced in the acquisition of consonants.

According to Vergum (2006) in learning the sounds of a second language, L2 learners usually shift their L1 sound system. In this case L2 learners mostly recognize L2 phonemes from their L1 phonetic categories. Children develop their mental categories for their native language from the immediate environment. As time passes children establish sounds phonetic categories in their minds for their native language sound system. These mental categories are concerned with the recognition of L2 sound system. It is a general opinion that in childhood, learning L2 phonological aspects is easy but in adulthood L2

learning becomes difficult and they face problems in attaining native like pronunciation of the target language (Gass & Selinker, 2001).

The Critical Period Hypothesis states that the second language learning becomes difficult after the age of puberty. This is termed as a very sensitive period in language learning. And after puberty, learning native like pronunciation of the target language becomes difficult (Gass & Selinker, 2001).

Flege's (1987) is of the view that speech learning process takes place throughout the life span. According to the Speech Learning Model (SLM) presented by Flege (1987) the sounds of the second language can be divided into three categories. These categories are similar, new and identical. identical sounds are those sounds which are exactly the same in L1 and L2 sound systems. New sounds are those L2 sounds which do not exist in L1 sound system. While similar sounds are those L2 sounds which bear close similarity to the L1 sounds but not exactly the same. Flege (1987) is of the view that learning identical and new sounds are easy than learning similar sounds. L2 learners create new mental categories for the new sounds in their minds with the passage of time, thus new sounds are learned easily. The identical sounds are the same in L1 and L2 that is why the same mental category is used to lean these sounds. Om the other hand in similar sound case the L2 learners usually merge the L1 phonetic category with L2 and hence these sounds are pronounced like L1 and not like L2. That is why learning and producing similar sounds is difficult.

In one of the studies by Flege (1995) the vowels of English exhibits slight differences in connection to L1 vowels in spite of strong accent in similar vowels / i: /, /u:/, and /ʌ/ (beat, boot, cut).

The studies conducted on the voiceless stops of English language by EFL learners whose language has no aspirated stops show that the VOT values of L2 English are longer than L1 of EFL learners and thus they are not able to learn native like pronunciation (Flege and Eefting 1987). Researches also show that the young learners in L2 environment learn stops more accurately than the adult learners (Flege 1995).

Hypothesis

The study hypothesized that L1 Pashto speakers face difficulties in producing English stops due to the concept of Similar-New sounds of Speech Learning Model by Flege (1987).

Methodology

Qualitative and quantitative both the approaches are adopted by the researcher in the current study. In the words of Silverman (1993) these two approaches are two schools of social science**.** He stats that qualitative method tends to test correlation between two variables while qualitative approach, in Silverman (1993) view, is mostly concerned with observation and description. The current study follows a mixed approach in which the researcher has analyzed the recordings taken from the selected participants qualitatively when the researcher compares the acoustic properties as well as quantitatively.

Population

L1 Pashto speakers and EFl Pashto learners using Yousafzai dialects living specifically in District Mardan, Sawabi and Peshawar are the target population of the study.

Sampling

This study follows purposive sampling techniques. It is one of the types of non-probability sampling technique in which the researcher selects the samples which follows certain characteristics. In the current study the researcher has selected samples according to a particular age span, gender and education. The sample comprises two groups. The age of the participants selected as samples is between 23 to 24 years for both the groups as well as only male speakers are selected as a sample for the study. Group one contains the educated L1 Pashto speakers learning English language at different institutes of Peshawar district. Their educational level is Master in English on the other hand group two contains uneducated L1 Pashto speakers of district Peshawar. The researcher has tried to select only those individuals as participants who are monolingual Pashto speakers. 25 speakers are selected in each category. The data of RP(received pronunciation) speakers has been taken from Leigh Lisker (1957).

Table 3
Categorization of the participants

Group "A"	Pashto L1 Speakers (Uneducated)
Group "B"	EFL Pashto Learners (Educated)

The researcher has provided total two stimuli lists to the participants containing stop sounds. One stimuli list contains Pashto stops in vowel consonant vowel (henceforth VCV) format which is designed for group A. while the other list includes English stops again in VCV format which is designed for EFL Pashto learners. The vowels before and after the consonant is the same /a/ sound in order to minimize the effect of the vowel on the stop sounds.

Pashto language has nine stop sounds as shown in the following table. Two of them are bilabial, two dental, tow alveopalatal, two velar while one uvular.

Table 4
Pashto Stimuli list

Place	VCV	VCV
Bilabial	/apa/	/aba/
Dental	/atta/	/adda/
Alveopalatal	/ata/	/ada/
Velar	/aka/	/aga/
Uvular	/aqa/	

Unlike Pashto English language has six stop sounds which are shown in the following figure. Two are bilingual, two alveolar and two velar. These stop sounds are given in the following table.

Table 5
English Stimuli list

Place	**VCV**	**VCV**
Bilabial	/apa/	/aba/
Alveopalatal	/ata/	/ada/
Velar	/aka/	/aga/

Each participant was made pronounce each word in VCV format of the stimuli list of Pashto two times which is 50 tokens for each word by 25 speakers. Total 450 tokens (50 each speaker multiplied by 9 words of the stimuli list) were collected from group A participants who are L1 Pashto speakers. On the other hand total 300 tokens (50 each speaker multiplied by 6 words of the stimuli list) were collected from the group B participants who are EFL Pashto learners. Total 450 + 300 = 750 tokens for each word of the stimuli list were recorded by using Praat software 4.4.13. The participant was asked to

pronounce the word again in case of mispronunciation. The words were recorded with the help of a microphone through Praat which had a frequency of 8000 Hrtz. An HP laptop and a microphone of high quality were used for recordings.

Instrument and Data Collection

The researcher has used Praat software for the analysis of the recordings. The major focus in the analysis was on the closure duration, stop duration and aspiration. The average value of every acoustic property is calculated in the Microsoft Excel program. An average value is taken out of each participant of group A's two tokens and this average value is then compared with the participant of group B average value pronouncing the same word of the stimuli lists. In total 25 average durations were taken from group A as well as group B respondents in terms of closure duration and stop duration.

Validity and Relaibility

The researcher has taken standard dieviation on all the average measureents recoded from the respondints in order to show how much the data is reliable and valid. Standard diviation shows how much a data is desperse, in other words it shows how much the data is diviant or near to the average mean. The researcher has calculated the average of all the 25 speakers in bothe the groups at closure duration level and stop duration level seperately. Thus the results of the standard diviation shows that the data is not more diviant from the average mean. As the data is recorded in miliseconds that is why there must be closness between the different durations recorded from the 50 different respondants. The low standard diviation in this case clearly shows the validty and reliability of the data. The following table shows the standard diviation measurments of group A speakers.

Table 6
The standard deviation of the average durations by group A speakers

Stop	Std. Deviation Closure Duration	Std. Deviation Sop Duration
/p/	.02764	.028802
/b/	.07368	.023415
/t/	.03491	.032627
/d/	.01268	.014462
/k/	.15228	.152619
/g/	.01422	.018522

The table clearly shows that the standard diviation at closure, VOT and stop duration is low. 25 respondents have pronounced each sound seperately and the durations are recorded in miliseconds. Thus it can be said that in such short durations high standard diviation would mean that the data is not valid and reliable. The following table shows the standard diviation calcculted on the data recorded from group B respondents.

Table 7
The standard deviation of the average durations by group B speakers

Stop	Std. Deviation Closure Duration	Std. Deviation Sop Duration
/p/	.02112	.024029
/b/	.01772	.019776
/t/	.02692	.032448
/d/	.01728	.020009
/k/	.04157	.047437
/g/	.01186	.014768

Group B standard diviation results also confirm that the data is not diviant from the average mean. This low standard diviation results in the cloumn of closure duration, VOT and stop duration exihibits the validity of the data.

Data analysis technique

The researcher has used Praat software for the analysis of the recordings. The average value of every acoustic property is calculated in the Microsoft Excelprogram. An average value is taken out of each participant of group A's two tokens and this average value is then compared with the participant of group B average value pronouncing the same word of the stimuli lists. In total 25 average durations were taken from group A as well as group B respondents in terms of closure duration and stop duration. The researcher has divided the analysis into two parts. In the first part the data is analyzed through descriptive statistics in order to identify different acoustic properties of stops pronounced by Pashto L1 speakers and Pashto EFL learners. In the second part of the analysis the researcher has focused on the hypothesis of the study and has used one sample t-test in SPSS. And then both the parts of analysis are concluded at the end in the light of research questions, research objectives and hypothesis.

Results and Results

Part 1

The researcher has divided the analysis into two parts. In the first part the data is analyzed through descriptive statistics in order to identify different acoustic properties of stops pronounced by Pashto L1 speakers and Pashto EFL learners. In the second part of the analysis the researcher has focused on the hypothesis of the study and has used one sample t-test in SPSS. And then both the parts of analysis are concluded at the end in the light of research questions, research objectives and hypothesis.

Comparison of the Acoustic properties of Group A, B and RP speakers

The main focus of this section in the analysis is on the comparison between the different values taken from group "A", "B" and RP **(Received Pronunciation)** speakers. The comparison is made through tables and figures. At first, the closure durations of group "A", "B" and RP speakers are compared with each other and then the stop durations of these groups are compared. The data of RP speakers is taken from Leigh Lisker (1957).

Table 8
Comparison of Average Closure Duration of Group "A", Group "B" and RP speakers

STOPS	RP	GROUP B	GROUP A
/p/	0.162	0.141	0.134
/b/	0.186	0.147	0.112
/t/	0.196	0.106	0.102
/d/	0.183	0.085	0.081
/k/	0.158	0.11	0.113
/g/	0.173	0.076	0.096

The table exhibits the comparison of the closure durations in the Pashto stops produced by group A speakers and English stops produced by group B speakers and the Native English speakers. The interesting feature of the table is that all the English stops produced by native English have longer closure duration than English stops produced by group B speakers and Pashto stops. Pashto stops have comparatively short duration even than the English stops by group b speakers who are Pashto L1 speakers. The only difference is found in Pashto stop /k/ and /g/ has longer closure than the English stop /k/ and /g/ by group B speakers. A trend of decrease is found in the stops produced by different speakers

except the velar stops. The decrease in closure duration is found in bilabial and alveolar stops from the stops of native English speakers to the English stops by group B speakers and then to the Pashto stops by group A speakers as English /p/ and /b/ by English have .162 and .186 respectively and group B English /p/ and /b/ have .141 and .147 while group A Pashto /p/ and /b/ have .134 and .112 m/sec durations. Same is the case with alveolar sounds /t/ and /d/. But in the case of velar sounds Pashto stops maximum closure next to English native stops and longer than the English stops by group B speakers. No stop bears the same average closure in these different stops produced by different sample groups as the Pashto stops are different from the English native stops and English group B stops and group B stops are different from English native stops and Pashto stops in terms of average closure duration.

Table 9
Comparison of Stop Duration of Group "A", Group "B" and RP speakers

Stops	RP	Group B	Group A
/p/	0.187	0.169	0.16
/b/	0.199	0.161	0.119
/t/	0.209	0.135	0.151
/d/	0.2	0.105	0.101
/k/	0.199	0.156	0.146
/g/	0.203	0.096	0.114

Table 9 presents the average stop duration of English and Pashto stops by different sample speakers. English stops by Native English speakers have longer duration than the English stops by group B speakers and Pashto stops by group A speakers. Group "B"speakers pronounced English stops longer than Pashto stops with the exception of /t/ and /g/ stops. /k/ and /g/ Pashto stops have longer duration than English stops by group B speakers although less than English stops by native speakers. Bilabial stops decrease its duration from English RP stops to group B and then to group A speakers. Same is the case with alveolar sounds. The average closure durations of English stops by L1 English speakers are longer than Pashto and English stops by L1 Pashto spaekers that is why English stops are longer than the other stops by group A and B speakers.

Part 2

Analysis of the Data according to the Predictions of SLM

According to prediction of speech learning model. According to Flege's (1995) speech learning model L2 learners face difficulties while learning and producing the similar sounds between L1 of the learners and L2, on the other hand L2 learners acquire identical sounds between L1 and L2 easily. Furthermore, if there are new sounds in L2, leaners acquire them easily as well. The speech learning model divides sounds into three main categories, new, identical and similar. New sounds are those sounds which exist in L2 sound system but not in L1 sound system. Flege (1987) is of the view that L2 learners create new phonetic categories for the new sounds of L2, thus these new sounds are easy to learn for L2 learners. In addition to new sounds of L2, identical sounds are also easy for L2 learners and identical sounds are those sounds which bears the phonetic features in L1 and L2. In simple words identical sounds are exactly the same between L1 and L2. On the other hand similar sounds which are difficult to produce and acquire for L2 learners, are those sounds which bears phonetic similarity in L1 and L2 but similar sounds are not exactly the same in L1and L2. Flege (1987) states in this connection that L2 learners merge similar sounds with each other in L1 and L2 and hence becomes difficult for L2 learners.

In the present study English serves as L2 while Pashto as L1. All the stop sounds of L2 English /p/, /b/, /t/, /d/, /k/ and /g/ exist in L1 Pashto; therefore, there is no as such new sound for L2 English learners to learn. Furthermore, both the languages English and

Pashto shares these stops, so these can be termed as similar sounds until it is found that which stops are identical in both the languages. To test the hypothesis of the study one sample t-test and paired t-test are used.

The hypothesis of the study was that L1 Pashto speakers face difficulties in learning and producing L2 English stops if the stops are similar while they learn easily those stops which are identical. T-test is used to confirm which sounds are similar or identical in Pashto and English stops. T-test gives a degree of signification between two variables or means. The value of significance is usually .05. this value of significance shows how much a closure duration or stop duration is significantly different between L1 Pashto stops, English stops by group b speakers and English stops by L1 English speakers. The average values of English stops by L1 English speakers are taken from Lisker (1957). .05 signification degree gives us 95% of similarity between two variables.

In the current study, the mean of closure and stop duration are taken as Alpha scale (P value) and this p value is compared with the mean values of closure and stop duration of Pashto stops by group A speakers and English stops by group B speakers. If the resulted p-value of closure and stop is greater than .05 the stops are said to be identical on the opposite if the p-value is less than .05, the stops are termed as similar. The following table shows the comparison between the Pashto stops produced by group A speakers and the stops by L1 English speakers. The average closure and complete stop duration of English stops by RP speakers are compared with the closure duration and complete stop duration of Pashto stops recorded from 25 group A speakers, who are L1 Pashto uneducated speakers. One sample t test is used for the following comparison between the different durations of English stops and Pashto stops produced by English native speakers and Pashto native speakers respectively.

Table 10
Comparison of Pashto Stops by Group "A" Speakers with English Stops by RP Speakers

Stops	Closure Duration		Stop Duration	
	T-Test	P-Value	T-Test	P-Value
/p/	5.116	.000	4.513	.000
/b/	11.120	.000	17.082	.000
/t/	9.557	.000	8.855	.000
/d/	38.627	.000	34.187	.000
/k/	1.489	.149	1.734	.096
/g/	27.224	.000	23.987	.000

Table 10 exhibits six stops in both English and Pashto languages. Although there are nine stops in Pashto language but English language has six stops that is why the comparison is made only between those stops which are available in both the languages. The purpose of this comparison is to show "new sound concept", "identical sound concept" and "similar sound concept". There is no "new sound" (stop) of Pashto language compared with English stops as Pashto /tt/, /dd/ and /q/ do not exist in English sound system. Looking at the table, it is easily concluded that only velar voiceless stop /k/ of Pashto language has greater degree of signification above,05, therefore /k/ stop is said to be identical in both languages in terms of closure duration. But the interesting point is that only one stop /k/ has more than .05 P value in terms of complete stop duration and only /k/ stop is identical in both the languages. /k/ stop is also identical in terms of closure duration as well as in terms of complete stop duration. Even in terms of as aspiration, there are differences. English voiceless stops are highly aspirated in the initial and middle position (Roach, 2004) while Pashto Voiceless stops are lightly aspirated in all positions.

Table 11
Results of the comparison of the stops in table 8

	Closure	Stop Duration	Overall
Similar	/p/, /b/, /t/, /d/, /k/, /g/	/p/, /b/, /t/, /d/, /g/	/p/, /b/, /t/, /d/, /g/
New	Nil	Nil	Nil
Identical	/k/	/k/	/k/

As the table shows overall all the stops /p/, /b/, /t/, /d/, /k/ and /g/ are similar. New stops are not found in English which do not exist in Pashto. /k/ stop is identical at closure and stop duration level in both the languages.

Table 12
Comparison of Group B Speakers with RP Speakers in the Production of English Stops

Stops	Closure Duration		Stop Duration	
	T-Test	P-Value	T-Test	P-Value
/p/	5.070	.000	3.73	.001
/b/	11.201	.000	9.55	.000
/t/	17.048	.000	11.402	.000
/d/	28.915	.000	23.731	.000
/k/	5.88	.000	4.532	.000
/g/	41.707	.000	36.255	.000

Table 12 exhibits the comparison of the closure duration and stop duration of English stops by group B speakers with English stops by RP speakers. The number of stops compared in both the cases is six. Three of these stops /p/, /t/, /k/ are voiceless and three /b/, /d/ and /g/ are voiced. The table presents that all the English stops by group b speakers have 0.00 p-value in closure duration column, thus it is clear that these stops are not identical with English stops by RP speakers. In the next column of stop duration all the stops have lesser values than .05 and they are said to be similar in both the languages. Still taking all the acoustic properties into consideration like stop duration and closure duration, it can be concluded that all the stops are similar in both the cases and no one is identical.

Table 13
Results of the comparison of the stops

	Closure	Stop Duration	Overall
Similar	/p/, /b/, /t/, /d/, /k/, /g/	/p/, /b/, /t/, /d/, /k/, /g/	/p/, /b/, /t/, /d/, /k/, /g/
New	Nil	Nil	Nil
Identical	Nil	Nil	Nil

As the table shows all the stops /p/, /b/, /t/, /d/, /k/ and /g/ are similar at closure duration and stop duration level. New stops are not found in English which do not exist in both the cases. At closure level, stop duration level and overall there is no identical stop in both the cases. It also shows that differences found in the Pashto stops by group A speakers and English stops by RP speakers as well as in English stops by group B and English stops by RP speakers. Group A with RP and group B with RP are compared and so for and there is no identical status between any stop in these cases. Still group A and B are not compared with each other. It might be possible that group A Pashto stops are identical with group B English stop therefore it is necessary to compare the stops by group A speakers with group B speakers. This type of comparison will provide a clear picture of the English stops by group B speakers who are L2 learners. The comparison makes it clear whether the English stops by group B speakers are identical with Pasto stops by group A speakers or with English by RP speakers. The following table shows the comparison between English stops by group B speakers and Pashto stops by group A speakers. A paired t-test test is conducted in which the recordings of both the groups are compared.

Table 14
Paired T-Test between Group A with Group B speakers

Stops	Closure Duration		Stop Duration	
	T-Test	P-Value	T-Test	P-Value
/P/-/P/	.994	.330	-1.139	.266
/b/-/b/	4.527	.000	-7.258	.000
/t/-/t/	2.60	.016	1.746	.094
/d/-/d/	.008	.0994	-.789	.438
/k/-/k/	.093	**.927**	-.356	**.725**
/g/-/g/	5.068	.000	4.705	.000

The table above shows that /p/, /d/ and /k/ stops at closure duration have greater p-value than .05 thus these stops are identical in group B stops and group. At stop duration level only one stop /k/ is identical between group A and group b speakers. In this case only /k/ sound is acquired by EFL Pashto learners as the same sound was identical between the productions Pashto EFL learners and native English speakers. The results are shown in the following table.

Table 15
Results of the Paired T-Test

	Closure	Stop Duration	Overall
Similar	/b/, /t/, /g/	p/, /b/, /t/, /d/, /g/	/p/, /b/, /t/, /d/, /k/, /g/
New	Nil	Nil	Nil
Identical	L1 like /p/, /d/,/k/	L1 like /p/, /t/, /d/, /k/ L2 like /k/	Nil

After the comparison of closure of English and Pashto stop by different sample groups and RP speakers, it is necessary to compare the overall stop duration. The following figure display the comparison of voiceless and voiced stops by group A, B and RP speakers. RP is represented through blue colure, group B through blue/orange colure and group A through green colure.

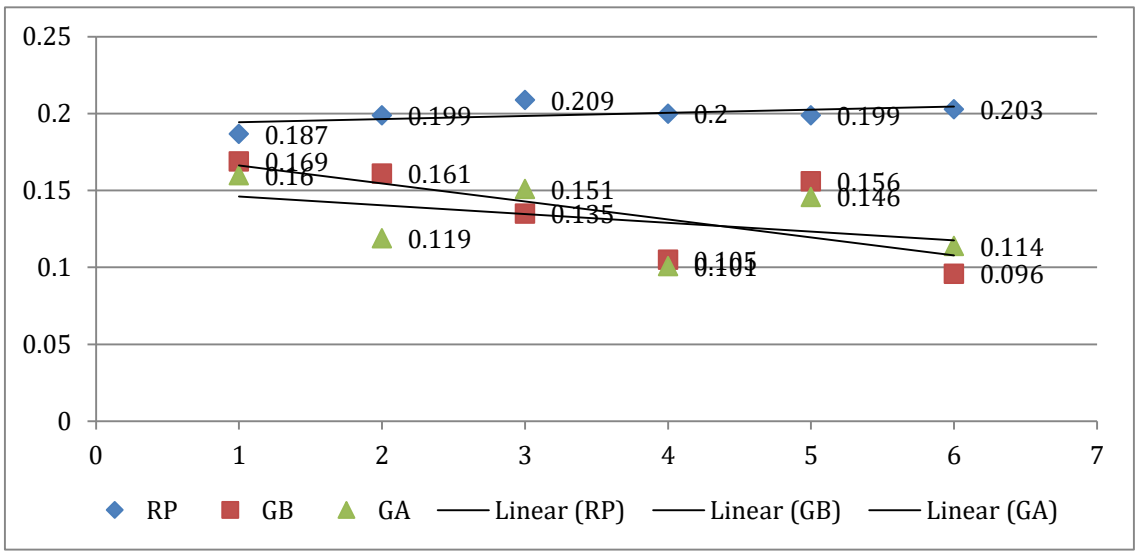

Figure 1 Comparison of stop duration of group "A", group "B" and RP

Figure 1 clearly shows that all the average duration of stops produced by different groups do not match at any level. Stops produced by RP speakers which are represented through blue color are on the top. Their duration is near to 2 m/sec and quite far away from the stops represented through red and green color. The trend line on the blue colors shows the stops of RP. Next to the RP stops the red color presents stops produced by group B speakers which are three are above .15 bar line and three are below the line. A trend line on the red color comes down from above .15 bar line to the point beneath .1 line. The blue color

presents stops produced by group a speakers which are between .15 and .1 bar lines. In these three colors no color is above each as their durations are different from each other which show there is no identical stop among the stops produced by group A, B and RP speakers.

Conclusion

The researchers have achieved the objectives of the study and the results are presented in the following table.

Table 16
Chart summarize the finding of above data if this data is in grph then remove the graph

Stops	Closure Duration	Stop Duration
/P/-/P/	L1 like	L1 Like
/b/-/b/	Different from L1 and L2	Different from L1 & L2
/t/-/t/	Different from L1 and L2	L1 Like
/d/-/d/	L1 like	L1 Like
/k/-/k/	L1 like	Acquired
/g/-/g/	Different from L1 and L2	Different from L1 & L2

The table 16 demonstrates the overall results of the comparisons mad in this chapter. The table shows that stops /p/ /d/ and /k/ produced by group B speakers are identical to Pashto stops by group A speakers in terms of closure duration and can be said an effect of L1. As group B speakers produced English stops which were not identical to English RP pronunciation and they were actually the L2 (English) learners. On the opposite these stop by L2 learners were identical to L1 Pashto Stops by group A speakers and thus can be concluded as L1 effect on l2 acquisition. Referring to the hypothesis of the study, it is evident now that the results of the current study agree to the prediction of SLM partially at closure level the only stop /k/ does not agree to the prediction of SLM and ultimately the results of the study do not agree completely to the SLM model. As at closure level stop /k/ was identical between L1 Pashto by group A speakers and L2 English by RP speakers but group B, the L2 learners did not acquire this sound while the SLM model says that identical sounds are easily acquired by L2 learners. Apart from this one sound the other stop at closure level were found similar between L1 and L2 and hence were not produced by L2 learners L1 English like.

Recommendations

The study recommends to invenstigate all the consonents sounds of Pashto language with the English consonant sounds in terms of Closure duration and Aspiration. Furthermore, another study may take Urdu language in adition to Pashto and English in terms of acoustic analysis.

References

Baker, W., Trofimovich, P., Mack, M., & Flege, J. E. (2002).The effect of perceived phonetic similarity on non-native sound learning by children and adults. Paper presented at the *Twenty-sixth Annual Boston University Conference on Language Development, Somerville, MA.*

Delattre, P. (1971). Pharyngeal features in the consonants of Arabic, German, Spanish, French, and American English. *Phonetica, 23*, 129-55.

Flege, J. E. (1987). The production of "new" and "similar" phones in a foreign language:A evidence for the effect of equivalence classification. *Journal of Phonetics, 1*, 47-65.

Flege, J. E. (1995). *Second-language speech learning: theory, finds, and problems* (4th ed., Vol.2). (W. Strange , Ed.) Timonium, U.S.A.: York Press.

Flege, J. E., Bohn, O., & Jang, S. (1997). Effect of experience on non-native speakers' production and perception of English vowels. *Journal of Phonetics, 4*(25), pp. 437-470.

Gass, S. M., &Selinker, L. (2001).*Second language acquisition: an introductory course*(2nded.). Mahwah, New Jersey: Lawrence Earlbaum Associates, Inc.

Habibi. Abdul Hai. (1994). ' *PataKhazana*'. University Book Agency Press. Peshawar.

Kent, Ray D. & Read, Charles (1992).The acoustic analysis of speech. *San Diego, CA: WhurrPublishing Group.*

Ladefoged, P. (2001). *A course in phonetics*. USA: Harcourt College Publishers.

Lane, L. (2013). *Focus on Pronunciation* .New York: Pearson educatio, Inc. Abat, Martina and Ettien Koffi. 2016. Social Network Analysis and L2 English Acoustic Vowel Space: A Case Study. *Linguistic Portfolios* 5: 34-47.

Lisker,L.(1957). Closure Duration and the Voiced-voiceless Distinction in English. International Review of Applied Linguistics,iii(33),42-43.

Narayanan, P. K. (2009, july). Closure duration analysis of incomplete stop consonantsdue to stop-stop interaction. *The Journal of the Acoustical society of America*, 2.

Rahman, G. (2012). 'English Problematic Consonants for Pashto Speakers'. *Academic A Research International.*

Roach, P. Ed third, reprinted (2004). '*English Phonetics & Phonology*'. Cambridge University press Cambridge.

Silverman (1993). *Interpreting qualitative data: methods for analyzing talk, text andinteraction*. London, Sage Publications.

Vergun, A. (2006). *A Longitudinal Study of The Acquisition of Amercian English Vowels*. A Ph.d Thesis submitted to Portland State University.

Yauan. F, Hua L. Yu C. (2010). 'Duration of closure in the Wu speakers' Production of English Stops'. *Journal of Phonetics, 1,* 263-271.

Zhang, F., & Yin, P. (2009, June). Asian Social Science.Retrieved September 24, 2017, from A Study of Pronunciation Problems of English Learners in China