Pashto Stops: VOT Duration and Effects on Vowel Length

Shahabullah[1], Muhammad Kamal Khan[2] and Aftab Hussain[3]

[1] Lecturer, Abbotabad University of Science and Technology, Abbotabad.

[2]Associate Professor, Department of English, Allama Iqbal Open University, Islamabad.

[3]PhD scholar at Department of English Language and Applied Linguistics, Allama Iqbal Open University Islamabad-Pakistan.

Corresponding author:

Muhammad Kamal Khan,

Associate Professor,

Allama Iqbal Open University, Islamabad.

kamal.khan@aiou.edu.pk

Abstract

This research study aimed to examine the voice onset time (VOT) duration for Pashto stops of the Yousafzai dialect and their impact on the subsequent vowel length. Following a descriptive approach, the study involved recording stops, including bilabials, dental, retroflex, velar, and uvular, from five Pashto speakers of the Yousafzai dialect aged 18-30 selected through convenient sampling. The recordings were made in a CVC pattern, focusing on the initial consonants. The study found that the retroflex /ʈ/ had the shortest VOT duration of 0.015 ms, while the dental /d̪/ had the longest VOT duration of -0.127 ms. The study also found that among voiceless stops in Pashto, the retroflex /ʈ/ had the shortest VOT duration of 0.015 ms, while the velar /k/ had the longest VOT duration of 0.054 ms. In voiced stops, the retroflex /ɖ/ had the shortest VOT duration of -0.104 ms, while the dental /d̪/ had the longest VOT duration of -0.127 ms. The study also revealed that vowel sounds were shorter after voiceless stops but longer after voiced stops. Overall, the findings of this study provide insight into the phonetics of Pashto stops in the Yousafzai dialect and how they impact vowel length. These results may have implications for language learners and researchers interested in Pashto phonology.

Keywords: Stops, VOT, Vowel Length, Pashto, Yousafzai dialect

[1] PhD scholar at Department of English Language and Applied Linguistics, Allama Iqbal Open University Islamabad-Pakistan.

[2] Associate Professor of English Language and Applied Linguistics, at Allama Iqbal Open University Islamabad-Pakistan. Corresponding author: kamal.khan@aiou.edu.pk

Introduction

All languages of the world have their phonemic inventories. These inventories have some sounds in common, while some sounds are language-specific. Stops are found in most languages of the world; however, there are some exceptions, i.e. colloquial Samoan lacks the coronal [t], whereas northern Iroquoian (North American Language) lacks bilabial [p] and [m] (Habib & Saeed, 2016). According to Lado's (1957) Contrastive Analysis Hypothesis (CAH), learners acquire similar features of L1 and L2 easily and face difficulties acquiring different features in L1 and L2. When acquired as L2, the English language is influenced by the learner's L1. English and Pashto both have oral stops. Both English and Pashto have common bilabial voiceless /p/, bilabial voiced /b/, velar voiceless /k/ and velar voiced /g/. In contrast, English has alveolar voiceless /t/ and alveolar voiced /d/, while Pashto has dental voiceless /t̪/, dental voiced /d̪/, retroflex voiceless /ʈ/, retroflex voiced /ɖ/ and uvular voiceless /q/ which are not found in English.

The sounds of L1 play a vital role in acquiring L2. This notion is presented by Brown (1998; 2000) in his Feature Model (FM), which predicts that problems in the acquisition of new L2 sounds originate in the feature geometry of L1. The current study is based on the acoustic features of Pashto (L1), and English (L2) stops produced by Pashto speakers of the Yousafzai dialect. In the features of sounds, Voice Onset Time (VOT) is the most important feature to identify them clearly (Lisker & Abramson, 1964). The present study concerns the VOT duration and its effects on the following vowel duration.

Focus language

The focus language of the present study is the Pashto language. Pashto is descended from the East Iranian group of languages. Ossetia and Yaghnobi are the other family members of the Pashto language.

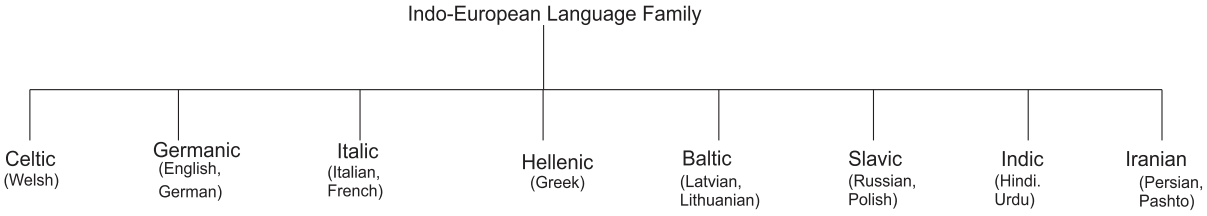


Figure 1 shows the Indo-European language family

Pashto (Pushto, Pakhto or Pukhto) is spoken in many countries across the globe but is a major language in Afghanistan and Pakistan. According to Iqbal and Rahman (2016), the total number of native speakers of Pashto globally is estimated to be around 50 million. It is the mother tongue of 52.3% of the overall population of Afghanistan. It is also one of the official languages of Afghanistan. In Pakistan, it is spoken in Balochistan and Khyber Pakhtunkhwa provinces. According to the 2017 census of Pakistan, Pashto has the second-highest native speakers (18.24%) after Punjabi (38.78%) in Pakistan. In Khyber Pakhtunkhwa, Pashto is the mother tongue of 70 – 80 % of the province's population (Rahman, 1995).

Figure 2 (adopted from 'A Reference Grammar of Pashto by Tegey and Robson, 1996) shows Pashto-speaking areas in Pakistan and Afghanistan.

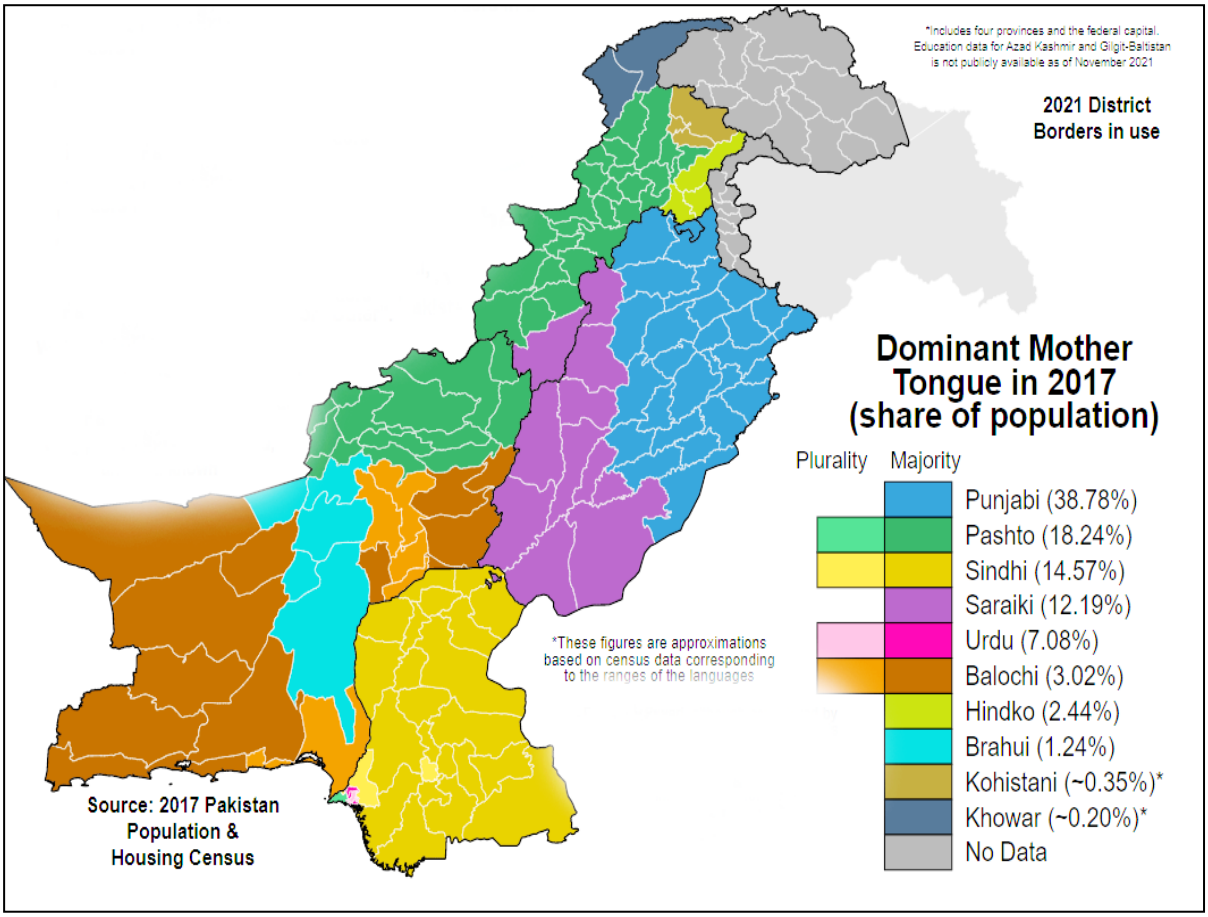


Figure 3 shows the linguistic map of Pakistan according to the 2017 Census of Pakistan

Pashto is written in Perso-Arabic script. Pashto has five main dialects, i.e. Qandahar dialect, Quetta dialect, Central dialect, Middle tribal dialect and Yousafzai dialect (Shahabullah, Rahman & Khan, 2020). The Yousafzai dialect of Pashto is the prestigious, standard and prominent dialect, among others. It is spoken in northern Khyber Pakhtunkhwa. The focus of the present study is the Yousafzai dialect of Pashto. Like other languages, Pashto also has its phonological system. There are 27 consonant and nine vowel sounds in the Yousafzai dialect of Pashto (Hallberg, 1992). The consonant chart of the Yousafzai dialect proposed by Hallberg (1992) is presented below.

Table 1 shows consonant sounds of the Yousafzai dialect of Pashto proposed by Hallberg (1992)

	Bilabial	Labiodental	Dental	Post alveolar	Retroflex	Velar	Uvular	glottal
Stops	p b		t d		ʈ ɖ	k g	q	
Fricatives		f	s z	ʃ		x ɣ		h
Affricates				ʧ ʤ				
Nasals	m		n		ɳ	ŋ		
Laterals			l					
Flaps			r		ɽ			
Semivowels	w			j				

Table 1 indicates nine stops, seven fricatives, two affricates, four nasals, a lateral /l/, two flaps and two semivowels in the Yousafzai dialect of Pashto. Hallberg (1992) proposed the consonant inventory of the Yousafzai dialect based on a standard list of 210 lexical words collected from Pashto speakers from various locations to represent the regional varieties. Ijaz (2003) conducted a study to verify the consonant inventory of the Yousafzai dialect of Pashto proposed by Hallberg (1992). She confirmed that there is no uvular stop /q/ and nasal velar /ŋ/ in the Yousafzai dialect of Pashto. Her study confirmed twenty-five consonant sounds in this dialect, excluding uvular stop /q/ and nasal velar /ŋ/.

Research Objectives

1. To measure the Voice Onset Time (VOT) of Pashto stops.
2. To see the influence of stops on the vowel length.

Research gap

Despite previous research on the phonemic inventory of Pashto sounds, a gap exists in the literature regarding the voice onset time (VOT) of Pashto stops. While some studies have analysed Pashto stops, such as Penzle (1955), Bell and Saka (1983), Hallberg (1992), Tegey

and Robson (1996), and Ijaz (2003), there is a need for a systematic investigation of the VOT duration and its effects on the vowel length of Pashto stops. Therefore, the present study aims to fill this gap by examining the VOT duration of Pashto stops and their effects on the following vowel length. This study will contribute to the existing literature on Pashto phonetics by comprehensively analysing the VOT duration of Pashto stops and its impact on vowel length. Additionally, this study will be significant for second language acquisition (SLA) as it will provide valuable insights into the challenges Pashto speakers may face when acquiring English stops, which differ significantly from Pashto stops regarding VOT duration.

Methodology

The present descriptive study examines the duration of voice onset time (VOT), vowel length, and voicing of Pashto stops. The study employs a quantitative research approach that is appropriate for the study. The target population for the study consists of all speakers of the Yousafzai dialect of Pashto. A representative sample of five participants was selected for the study using a convenient sampling procedure. The participants were all undergraduates between the ages of 18 and 30 years. They were chosen because they are likely to represent a good cross-section of the target population. The data was collected from these participants using a high-quality voice recorder named Zoom H5. The voice-recorded session was conducted in a soundproof room to ensure no external noises could affect the recordings. Five male speakers were recruited for the study and presented with a written list of minimal sets of words. The participants were physically and mentally fit and had no difficulty perceiving and articulating. The minimal set contained ten words, each with a target stop sound at the initial position followed by the same vowel sound. The researchers opted for the minimal set of words because it provides the same environment for all the stops and leaves no room for the adjacent sounds (vowels) to affect the target sounds.

The set of words used in the study included the following:

Table 2 shows the list of words selected for the recording and analysis of the present study

S. No.	Phoneme/stop	Word containing target stop	Meaning
1	/p/ پ	**/p** a l/	Grinding stone
2	/b/ ب	**/b** a l/	Another
3	/t/ ت	**/t** a l/	Forever
4	/d/ د	**/d** a l/	Butchered/cutting into pieces
5	/ʈ/ ټ	**/ʈ** a l/	Fraternity
6	/ɖ/ ډ	**/ɖ** a l/	Fats/type of oil
7	/k/ ک	**/k** o r/	Home
8	/g/ ګ	**/g** o r/	Grave
9	/k/ ک	**/kaar/**	Work
10	/q/ ق	**/qaar**/	Annoyed/angry

After the list of minimal sets was presented to the participants, they were instructed to pronounce each word at a normal pace. The researchers then recorded the participants' pronunciation using a high-quality voice recorder called Zoom H5. The voice recorded session was conducted in a soundproof room to ensure that no external noise could interfere with the recording. The five male speakers were physically and mentally fit and had no difficulty in perceiving and articulating the words.

Once the recordings were completed, they were analysed acoustically using computer-assisted speech analysis software called PRAAT. This software generated waveforms and digital spectrograms that allowed the researchers to analyse the VOT duration and voicing of the stops in each word. The collected data was analysed to determine the VOT duration, the time interval between the release of the stop closure and the onset of the following vowel, and the voicing of the stops, which refers to whether the vocal cords vibrate during the production of the sound.

The analysis results are presented in the following section of the study. By analysing the data, the researchers aimed to understand better the characteristics of Pashto stops,

specifically the VOT duration, vowel length, and voicing. This information could be useful for linguists and speech therapists who work with Pashto speakers. The study results are intended to apply to all speakers of the Yousafzai dialect of Pashto, as they constituted the population for the present study.

Analysis and Findings

Voiceless Stops

The data collected were analysed through PRAAT. Table 3 shows the average VOT values for the voiceless stops and the vowel length pronounced by the five selected participants of Pashto speakers of the Yousafzai dialect.

Table 3 shows the VOT for voiceless Pashto stops and the vowel length

Sound	**p**	**ṯ**	**ṭ**	**k**	**q**
VOT	0.021	0.030	0.015	0.054	0.050
Vowel Length	0.095	0.105	0.105	0.241	0.222

Table 2 contains only five voiceless stop sounds /**p, ṯ, ṭ, k, q**/. The words containing these target stops were analysed through PRAAT. Their VOT values are given in table 3 above. The spectrograms of the words containing the target sounds were taken respectively. Those spectrograms are shown in Figure 3, which shows the physical properties of individual sounds and clarifies their distinctive features. The table shows that the retroflex voiceless / **ṭ /** has the shortest VOT, whereas the velar voiceless / **k** / has the longest VOT value. The sounds / **p, ṯ, and ṭ /** were followed by similar vowel sounds /a/. The table shows variations in vowel length after / **p, ṯ, ṭ /**. The velar voiceless / k / was followed by the long vowel / ō /, and / q / was followed by the long vowel /a:/.

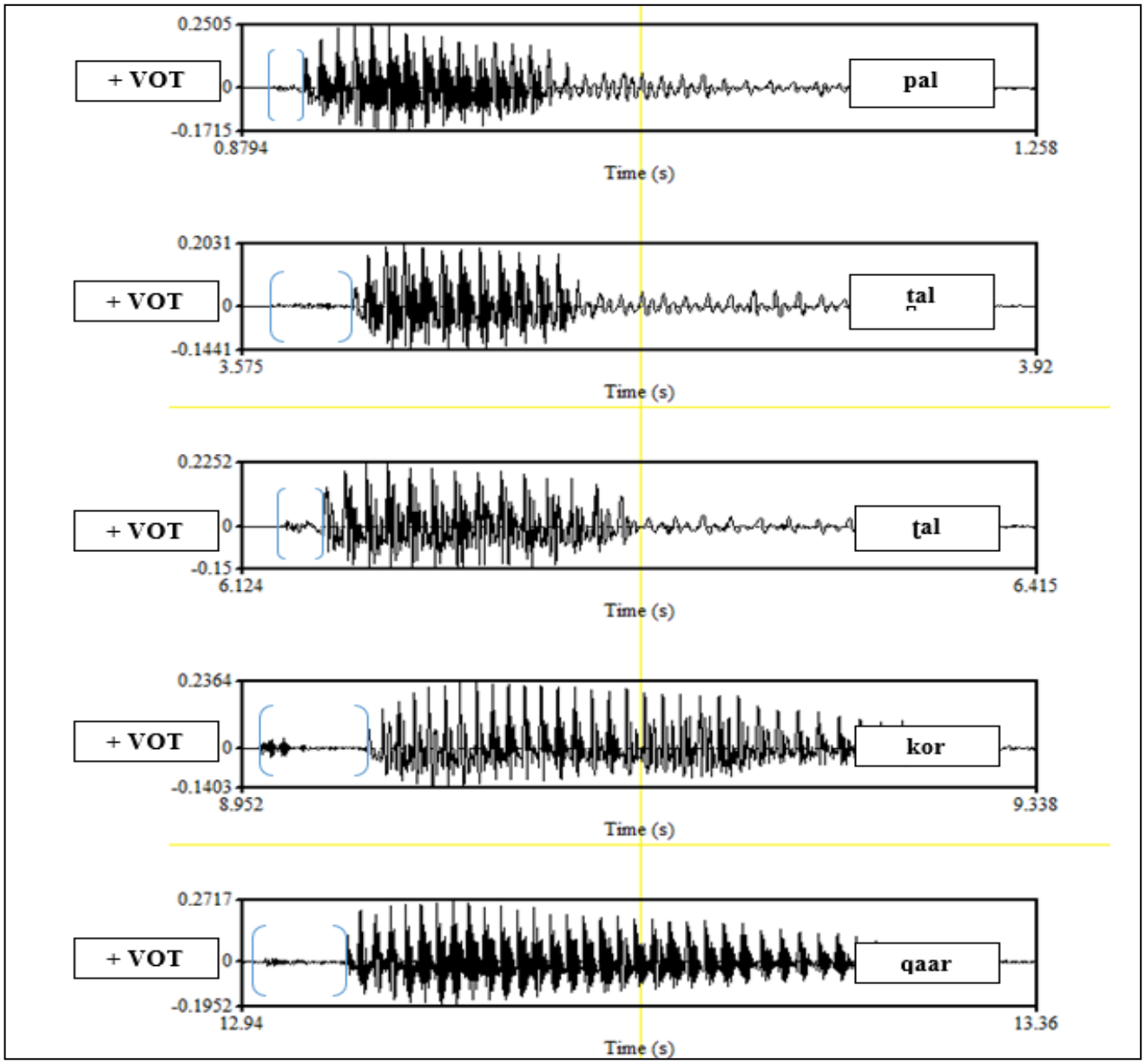


Figure 4 shows the Spectrograms of Five Voiceless Stops /p, ʈ, ʈ, k, q/ along with their VOTs

The spectrograms in Figure 4 show the VOT values of five voiceless stops. They all have positive VOTs and are marked with square brackets for more clarity. They have a range from 0.015 to 0.054. Among the five stops, /ʈ/ has the shortest VOT (0.015) and /k/ has the longest (0.054).

Voiced Stops

Pashto has four voiced stops /b, ɖ, ɖ, g/. All four stops were analysed through PRAAT for VOT values and vowel length. Their VOT values and vowel length, are given below in Table 4.

Table 4 shows VOT values for voiced Pashto stops and vowel length

Sound	**B**	**d̪**	**ɖ**	**g**
VOT	-0.111	-0.127	-0.104	-0.106
Vowel Length	0.110	0.110	0.109	0.242

Table 4 shows the VOT of voiced stop sounds and the length of the following vowels. Pashto voiced stops are /b, d̪, ɖ, g/. These sounds have negative VOTs, which are shown clearly. These VOT values were recorded after analysing the data through PRAAT. The duration of the following vowels was also recorded to confirm whether the stop affects the vowel length. Among the voiced stops, / ɖ / has the shortest VOT, while / d̪ / has the longest. The sounds /b, d̪, and ɖ/ were followed by the same vowel /a/. The table shows that the vowel length is similar after /b/ and /d̪/but a bit short after / ɖ /. The spectrograms for the voiced stops are given below in Figure 5.

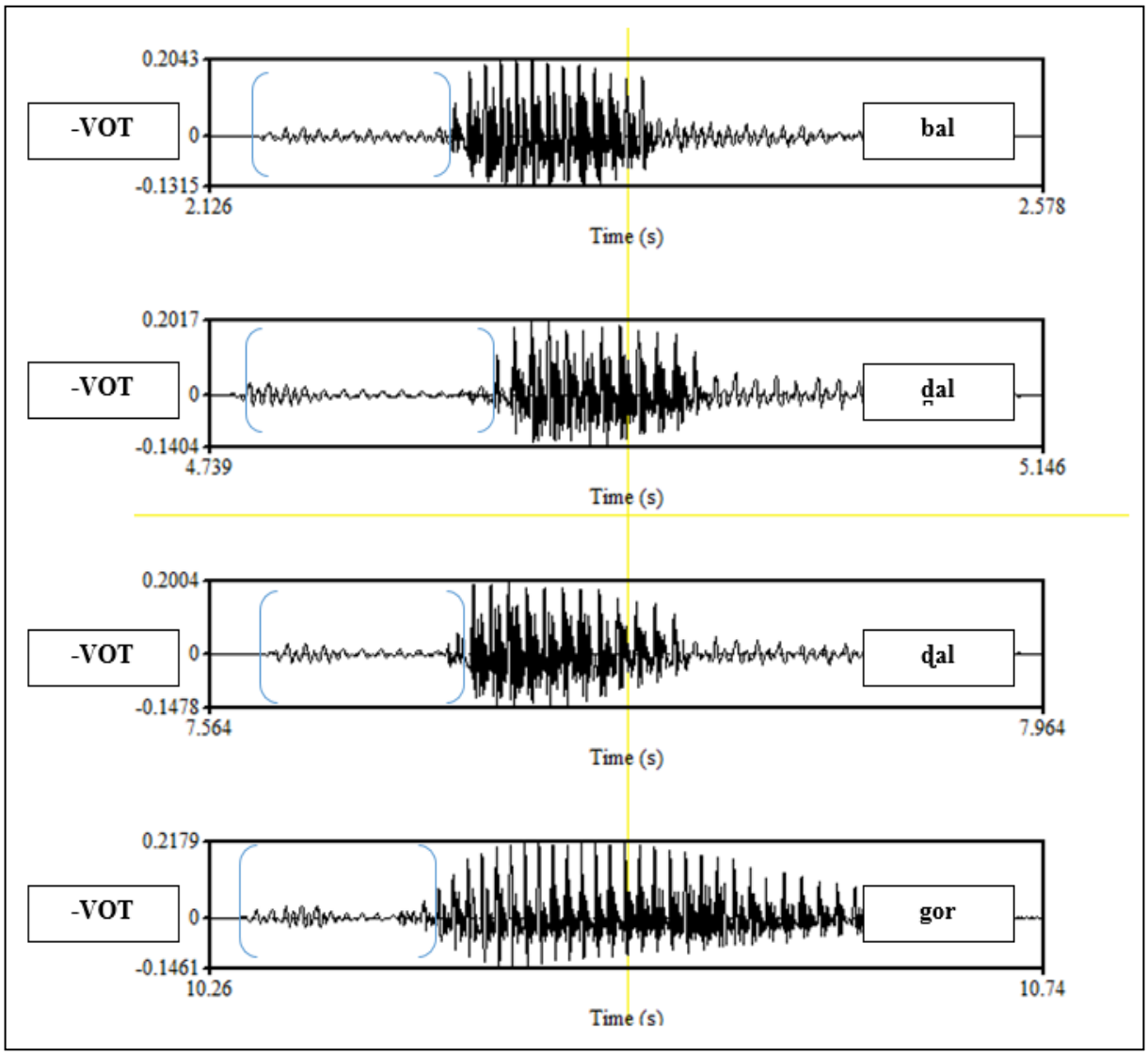


Figure 5 shows Spectrograms of Voiced Stops /b, ḍ, ḍ, g/

Figure 5 shows the physical representation of voiced stops and their VOT values. The durations of VOT are marked through square brackets. All four voiced stops have negative VOT. They range from -0.104 to -0.127. Among the four voiced stops, / **ḍ** / has the shortest VOT (-0.104) and / **ḍ** / has the longest (-0.127).

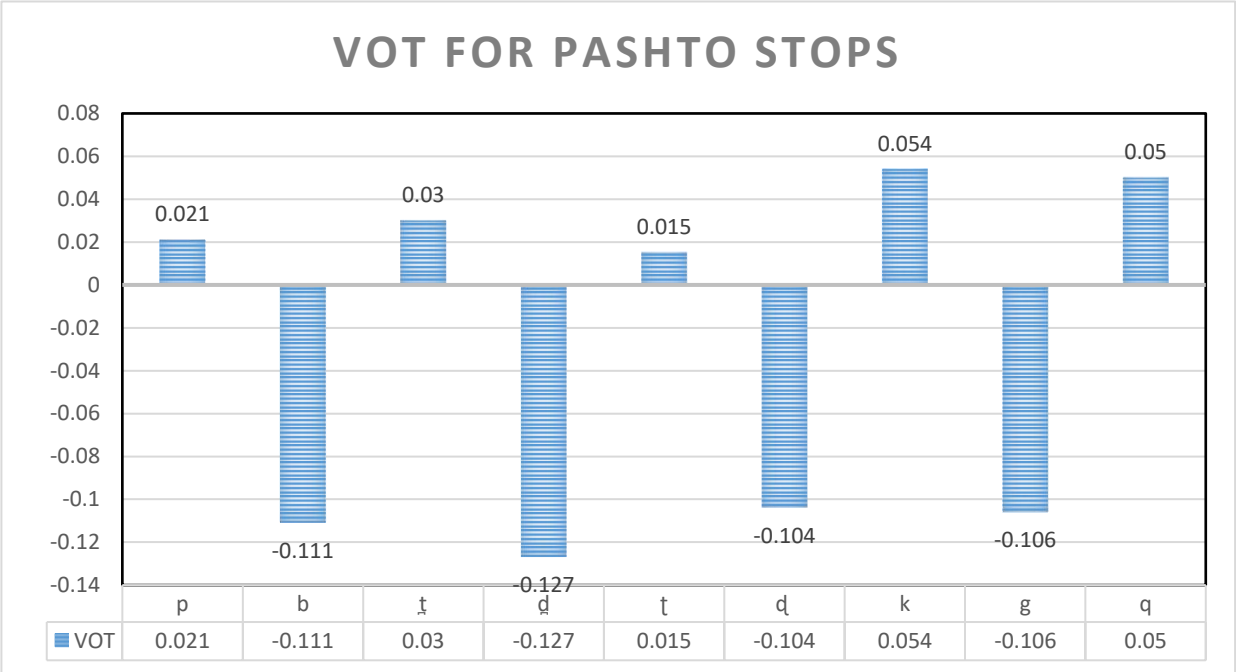
Voiced and Voiceless Stops

Table 5 below shows VOT values for both voiceless and voiced stops of Pashto for comparison. The table shows that / **ṭ** / has the shortest VOT while / **ḍ** / has the longest. The table also shows the vowel length. Both the bilabials, dental and retroflex, have similar vowel sounds after them. The vowel length is minimum after bilabial voiceless stop /p/, whereas it is maximum after bilabial voiced stop /b/ and dental voiced stop / **ḍ** /. The velar

stops /k/, /g/, and uvular stop /q/ have long vowels after them. The length of the vowel after velar stops /k/ and /g/ is almost the same.

Table 5 shows the VOT for Pashto stops and the vowel length

Sound	**p**	**B**	**ʈ**	**ɖ**	**ʈ**	**ɖ**	**k**	**g**	**q**
VOT	0.021	-0.111	0.030	-0.127	0.015	-0.104	0.054	-0.106	0.050
Vowel Length	0.095	0.110	0.105	0.110	0.105	0.109	0.241	0.242	0.222



Graph 1 represents all Voiced and Voiceless Stops of Pashto

Graph 1 above represents average VOT values of Pashto stops pronounced by Pashto speakers of the Yousafzai dialect. The Figure contains values below the average line and above the average line. All the values above the line are positive VOTs, and negative VOTs are below. In voiceless, the sound /ʈ/ has the shortest and /k/ has the longest VOT. In voice, /**ɖ**/ has the shortest and the /**ɖ**/ has the longest VOT. The dental voiced stop / **ɖ** / has the longest VOT, whereas the retroflex voiceless stop / **ʈ** / has the shortest VOT.

Conclusion

The present study focused on the VOT duration of Pashto stops and their effects on vowel length. The analysed data showed that among all the nine stops of Pashto, the retroflex voiceless /**ʈ**/ has the shortest VOT duration, while the dental voiced /**ɖ**/ has the longest VOT

duration. The result also revealed that the vowel sounds are shorter after voiceless stops and longer after voiced stops. The study also demonstrates no aspirated stops in the Yousafzai dialect of Pashto. The scope of the present study is limited to the VOT duration and vowel length of Pashto stops. Nevertheless, it can provide a base for further studies regarding the Pashto stops. Furthermore, the present study also provides a base for a comparative study of Pashto and English stops.

References

Bell, A. and Saka, M. M. (1983). Reversed Sonority in Pashto Initial Clusters. *Journal of Phonetics 11*. 259-75.

Brown, C. A. (1998). The role of the L1 grammar in the L2 acquisition of segmental structure. *Second Language Research, 14*(2), 136-193.

Brown, C. A. (2000). The interrelation between speech perception and phonological acquisition from infant to adult. In J. Archibald (Ed.), *Second language acquisition and linguistic theory* (pp. 4-63). Maldan Mass: Blackwell.

Habib, A., & Saeed, A. (2016). Acoustic Analysis of Pashto Plosives. *Science International (Lahore), 28*(4), 447-450.

Hallberg, G. D. (1992). Sociolinguistic Survey of Northern Pakistan Volume 4 Pashto, Waneci, Ormuri, Published by National Institute of Pakistan Studies, Quaid-i- Azam University Islamabad.

Ijaz, M. (2003). Phonemic Inventory of Pashto, Crulp Annual Students Report, 2002-2003.

Iqbal, M., & Rahman, G. (2016). A comparative study of Pashto and English consonants.

Lado, R. (1957). *Linguistics across Cultures: Applied Linguistics for Language Teachers*. Ann Arbor: University of Michigan Press.

Lisker, L., & Abramson, A. S. (1964). A cross-language study of voicing in initial stops: acoustical measurements. *Word, 20*(3), 384-422.

Penzle, H. (1955). A Grammar of Pashto: a descriptive study of the dialect of Khandahar, Afghanistan. *American Council of Learned Societies, Washington, D.C*.

Rahman, T. (1995). The Pashto language and identity-formation in Pakistan. *Contemporary South Asia*, *4*(2), 151-170.

Shahabullah., Rahman. G., & Khan. A. A. (2020). Syllabification of English Words by Pashto Speakers. *Global Language Review, 5*(1), 18-28.

Tegey, H. and Robson, B. (1996). *A Reference Grammar of Pashto*, Office of International Education (ED), Washington, DC.