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An Acoustic Analysis Of The Phonemic Shift Of The Voiceless Velar Fricative /X= خ/ Toward Aspirated Velar Stops /Kh= کھ

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Abstract

Languages of the world have different ranges of alphabets and their phonemic sounds. The Urdu language is considered phonologically very near to the Hindi language but despite this due to differences in the total number of alphabets and phoneme sounds some of the sounds of Urdu are not parts of the Hindi language and vice versa. One of them is the/x/ sound, which is not part of the Hindi sound inventory, due to the absence of the/x/ voiceless velar fricative sound Hindustani people use voiceless velar aspirated sound /kh/, in Urdu /Kh/ too presented as a voiceless velar aspirated sound and is used with different perspective and angle. It means in Urdu both sounds /x/ and /kh/ are part of the inventory while /x/ is missing in Hindi language. Both in Hindi and Urdu 15/15 as[1]pirated consonant stops are present. This paper intended to determine the impact of media on the phonological patterns of Pakistani students exposed to Indian Media. A comparative analysis has been done. For this purpose, four students, who were not exposed to Indian Media, government school students, were taken as participants and four selected students of Beacon House o-level were exposed to Indian media. Sound patterns have been analyzed using Paraat Software, which shows the stationary movement of the energy flow. Frequencies have been sorted out. Krashen's input and Swain's output hypothesis model have been utilized as theoretical perspectives. Students who were exposed to Indian Media, o-level students, become habitual to comprehensible input of Indian inventory so they started to speak the/kh/ sound even at the place of the/x/ sound while students of Government school use the plain /x/ sound as per Urdu rules because their comprehensible input in schools was plain /x/, and they use /kh/ at their proper places while o-level students do not have any idea of /x/ sound.

Keywords: *aspirated, fricative x/kh sound, Paraat, Phonological, frequencies, exposed, input/output, media, Hindi, Urdu, a consonant.*

Introduction

Paraat, open-source acoustic analysis software, is used to measure the duration of speech sounds and to identify which words have higher pitch, frequency and intensity (loudness) with the help of a spectrogram. Frequency is the number of cycles completed per second; measured in Hertz (Hz), when the cycle meets the axis for the second time, the second cycle is completed. In this paper, the frequency of acoustic sound, /x/ (an Urdu sound) has been measured to know the difference in phonological or phonemic sequence due to the impact of media, which governs these variations and shifts. Krashen's (1980) comprehensible input and Swine's (1985) output hypothesis model are being used as theoretical perspectives to get an idea about how

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Indian media is influencing the language of Pakistani students by bringing change in phenomenological orders.

Urdu اُردُو is written in a style derived from the Persian-Arabic alphabet. It is a right-to-left script and the shape assumed by a character in a word is context-sensitive, i.e. the shape of a character is different depending on whether its position is at the beginning, in the middle or at the end of a word (Khan & Adnan, 2018). A sentence illustrating Urdu is given below:

اردو پاکستان کی قومی زبان ہے۔

[ʊrd̪u pɑkɪstɑn ki qɔmi zubɑn hæ]

(Urdu is the National Language of Pakistan.)

After 1947, Urdu became the national language of Pakistan, Now in all major cities of Pakistan; people speak Urdu at home and work. Urdu is partially spoken and an official language of the State of Uttar Pradesh in India (Matthews, 2003). Urdu is actively used by 400 million people in India and Pakistan in their daily life at work and home and is more than partially understood in South Asian countries like India, Bangladesh and UAE. More than 220 million people in the Sub-continent regard Urdu as their mother tongue (Ghulam & Soomro, 2018). Outside the Subcontinent, large Urdu-speaking communities are found in the United States of America, United Kingdom, Mauritius, South Africa, Yemen, Uganda, Singapore, Nepal, New Zealand and Germany and have more than 60 million first language (L1) speakers in more than 20 countries all around the world (Iram, Khanum, Rubab, Bashir, & Javed, 2023).

The pronunciation of Urdu varies from region to region due to the different characteristics of their regions (Daud, Khan & Che, 2017). The word Urdu has a Turkish origin, meaning 'camp or army with its follower' (Saleem, Kabir, Riaz, Rafique, Khalid, & Shahid, 2002). It is popularly regarded as an offspring of Persian. It borrows words from different languages to expand its vocabulary. Major languages participating in the camp of Urdu are Persian, Arabic, Portuguese and English 'Saksena' (Farooq, 2015). It is a fact that no scientific speech processing research has been done so far, that can be the basis for improved applications and further research in Pakistan on the Urdu language. One of the primary reasons is the absence of any core material related to the phonetic inventory of Urdu (Ambreen & To, 2021). However, the spelling system for Urdu is much more consistent, each letter of Urdu corresponds to one sound, representing each letter by its basic sound can roughly be called phonemic transcription (Khan, 2023).

When linguists record words as a sequence of basic sounds in any language, the result is termed phonemic transcription. This is distinguished from phonetic transcription, which goes beyond to give more details of how it is pronounced (Reetz, Jongman, 2020). They added that there may exist some words that are not often pronounced the way they are supposed to be pronounced in any language. This results in phonetic and phonemic transcriptional contrasts. The environment in which these changes take place can be studied and phonological rules can be developed to explain these changes (Ernestus & Warner, 2011). In this paper, the phonemic shift has been analyzed in the language of the students who are exposed to Indian media with those students who are not exposed to Indian Media.

Hindi (हिन्दी), the national Hindi is a language with about 545 million speakers, 425 million of whom are native speakers, it seems to be phonologically similar to Urdu, but there is a difference in the alphabet (Hindi=52 letters, Urdu=36) and in its orthographic script and historical characteristics (Mehmood, Essam, Shafi & Malik, 2020). Most of the sounds are phonologically the same but some of the Urdu sounds are missing in Urdu and some Urdu sounds are missing in Hindi (Farooq & Mahmood, 2021). The absence of voiceless velar fricative خ in Hindi sound inventory lets the Hindi people use voiceless velar aspirated stop

instead of voiceless velar fricative خ i.e instead of خان they pronounce it / کھان/ / ख़ान/ [kʰɑːn]. Modifier 'h' is used with /k/ as /kh/ کھ which is one of the varieties of the / K/ sound. So, it does not have any direct relation with the/خ=x / sound. In Urdu, the language خ have specific distinctions but Hindi has no concept of خ and کھ phoneme is pronounced in any case.

x.xspf

In the Urdu inventory, there is a "Voiceless velar fricative" /خ / sound as in the word Khan (خان). The IPA symbol for this sound is /x= خ/. Unvoiced/voiceless means that the vocal cords don't vibrate while producing this sound. Velar implies that the region of production is the velum or the soft palat. Fricative means that this sound is produced by constricting the flow of air through a narrow channel, causing turbulence in this case, the narrow channel is formed by the back of the tongue and the velum. This sound is not part of the Hindi inventory.

ka.wav

The voiceless velar stop/plosive is a type of consonantal sound used in many spoken languages. The symbol in the International Phonetic Alphabet (IPA) that represents this sound is [k] ". The [k] sound is a very common sound cross-linguistically. Most languages have at least a plain [k], and some distinguish more than one variety. Most Indo-Aryan languages, such as Hindi, Urdu and Bengali, have a two-way contrast between plain [k] and aspirated /kh/. The sound in Urdu words (مکھی- makkhī) (کھٹّا- khaṭṭā) (مکھ- mukh) is one of the example of aspirated sounds.

Urdu inventory has almost 15 aspirated velar voiceless stops, In Urdu, aspirated consonants are represented by a combination of a simple consonant with Heh Doachashmee (ہ)[h], e.g. ک [k] + ہ [h] = کھ [kʰ], ب [b] + ہ [h] = بھ [bʰ], ل [l] + ہ [h] = لھ [lʰ], etc.

Fig1: Urdu Aspirated voiceless velar stops- phonemes

Hindi too has 15 aspirated consonants. In Hindi, out of 15 aspirated sounds 11 are represented by separate characters e.g. ख [kʰ], भ [bʰ], etc. and 4 consonants are represented by combining a simple consonant to be aspirated e.g. ह+ [h].

Hindi	Urdu	UIT	Hindi	Urdu	UIT
भ	ﺑﮭ [bʰ]	b_h	ड़	ﮍھ [ɽʰ]	r_h
फ	ﭘﮭ [pʰ]	p_h	ढ़	ﮌھ [ɽʰ]	r`_h
थ	ﺗﮭ [tʰ]	t_d_h	ख	ﮐﮭ [kʰ]	k_h
ठ	ﭨﮭ [ʈʰ]	t`_h	घ	ﮔﮭ [gʰ]	g_h
झ	ﺟﮭ [ʤʰ]	d_Z_h	ल्ह	ﻟﮭ [lʰ]	l_h
छ	ﭼﮭ [ʧʰ]	t_S_h	म्ह	ﻣﮭ [mʰ]	m_h
ध	ﺩﮬ [dʰ]	d_d_h	न्ह	ﻧﮭ [nʰ]	n_h
ढ	ﮈﮬ [ɖʰ]	d`_h			

Fig2: Urdu Aspirated voiceless velar stops- phonemes

Spectrogram

The concept of a spectrogram is very close to that of a spectrum (Altes, 1980). A spectrum describes the sound signal in terms of energy spread over its frequency and a spectrogram provides stationary information about frequency and energy, Speech is a continuous flow (Fulop, 2011). Phones are not discrete or distinct from each other, but they merge into one another, and spectrograms assess and visualize this continuity (Chappell, & Hansen, 2002).

In spectrograms, time is displayed on the horizontal axis, and frequency on the vertical axis. The amplitude of the frequency components (which in spectra is indicated on the y-axis) is expressed using the degree of blackness (more energy, more blackness). As formants are frequency regions with a high energy (due to the filter resonances), in the spectrogram they are displayed as dark bands and a yellow curve presents its movement 'usually from 0 to 5000 Hz' (Fulop & Fitz, 2006). They added on paraat software, the Oscillogram (upper panel) show the static motion of sound in the form of bands and the spectrogram is (lower panel) representation of sound bands in the form of formants and curved lines.

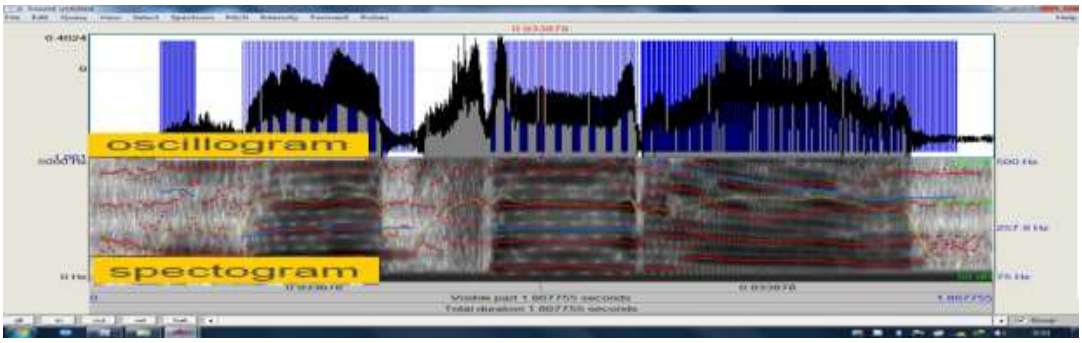


Fig3: Paraat showing Oscillogram and Spectrogram

Aims and Objectives

The objectives of the study are;

- To find the effects of Indian media on Pakistani student's language.
- To find the use of voiceless velar fricative ځ in the language of the Pakistani students exposed to media.

Research Question

Do the Pakistani students exposed to Indian media use voiceless velar aspirated stops /kh/instead of voiceless velar fricatives /x/

Hypothesis

Students exposed to Indian media use voiceless velar aspirated stops instead of voiceless velar fricatives

Theoretical Framework

Krashen's (1980) input and Swain's (1985) output hypothesis model was used as theoretical background

2-Literature Review

For most languages, their spelling or orthography is irregular and does not consistently represent sounds (Venezky, 1967).They violate the fundamental principle that each letter should represent one sound and each sound should be represented by one symbol. English is one of these languages since it uses twenty six letters to represent its forty basic sounds (Glushko, 2017).

As compared to Hindi and English in Urdu each letter has its separate sound but there are no standardized documents on the sounds of the Urdu language (Rao, Vaid, Srinivasan & Chen, 2011). Different studies at different levels have been published but none has been accepted as a standard. According to Kachru (1990), there are seven long oral vowels, and three short oral vowels, while Bokhari (2020) claims that there are seven long oral vowels, but seven short oral vowels. Kachru (1990) claims that the front low cardinal vowel [æ] exists as the front middle low vowel [ɛ] in Urdu. As a result, the back low cardinal vowel [σ] is shifted to the low centre, making it [a].

A substantial airflow to make the vocal cords vibrate a bit, despite their separation results in a breathy voice (Sataloff, 1992).This breathy quality can be added on top of ordinary speech i.e. vowels and consonants to make them plosive or aspirated (Napoli, 1996, p.32). He added English has many aspirated consonants but doesn't assign any unique character to them.

Fortunately, Urdu assigns a separate consonant to show aspiration. In Urdu,  [kh] following the letter represents aspiration generally, but it may represent a separate phoneme as well. There are believed to be as many as 15 aspirated consonants in Urdu (Khan, 1997). He added among them, only '10' aspirated consonants that are either stops or affricates, occur at multiple places in Urdu.

Aspirated stops are common in South Asian languages. Yallop and Fletcher (2007) have reported voiced aspirated plosives in Hindi and Gujrati. But aspirated approximations and fricatives are rare in the inventory of world languages. They also reported a voiceless aspirated fricative /S/ in Burmese. They also reported aspirated approximants /lH/ /wH/, and /jH/ in Marathi, a language spoken in South Asia (pp. 104). Urdu distinguishes between aspirated and non-aspirated consonants. Aspirated sounds are known as /m´hAprAn/ (heavy sounds) and non-aspirated as /´lpprAn/ 'light sounds' (Sharif, 2015).

Methodology

Speakers

To investigate the shift of fricative voiceless velar in Urdu, 10 native speakers of Urdu were recorded. Hence, the scope of this experiment was restricted to those Urdu speakers who were exposed to media and who were not exposed to media, out of ten students , the five belong to O- a level school system and were exposed to Indian media and the five of them belong to the

government school and were not exposed to Indian media. Selected speakers are natives of Gujranwala, Pakistan. They belong to the age group of 15 to 18 years.

Software

All the recordings were done and analyzed by using Paraat Speech Analyzer Software.

Type of Research

In this research quantitative research techniques have been used as all the recorded data is presented in numeral (frequencies) form and a graphical presentation has been given.

Features Analyzed

The F1/F2 intensity ratio of velar fricatives in all words was measured and analyzed.

Procedure

Recordings were taken through PRAAT v.4.1 from the speakers. PRAAT is a computer program that enables visualizing, playing, annotating, and analyzing sound objects in terms of their acoustic properties e.g. frequency, pitch, etc. Four Urdu words i.e. [khobsorat] (beautiful), [kharboza] (fruit-melon), [khargoosh] (an animal-rabbit), and [khak] (ash) were used. The speakers were asked to read the given words. In the utterances of the speakers, extrinsic consonant cues were observed and the mean of the frequencies were calculated.

Theoretical Background

Krashen's (1980) input and Swain's (1985) output hypothesis model were used as theoretical background, The input /output hypothesis gives a description of second language acquisition, how a second language is learned, if the input is comprehensible output will be more comprehensible and vice versa.

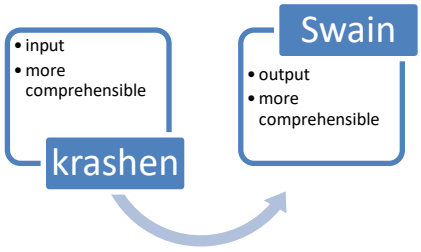


Fig: 4 a. Input /output hypothesis model

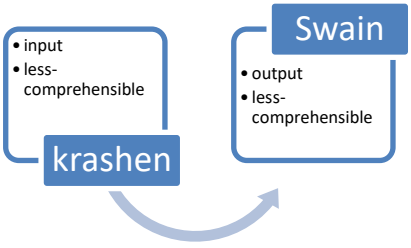


Fig: 4 b. Input /output hypothesis model

Data Presentation

Spectrogram of /خ /

F1

x= خ.wav

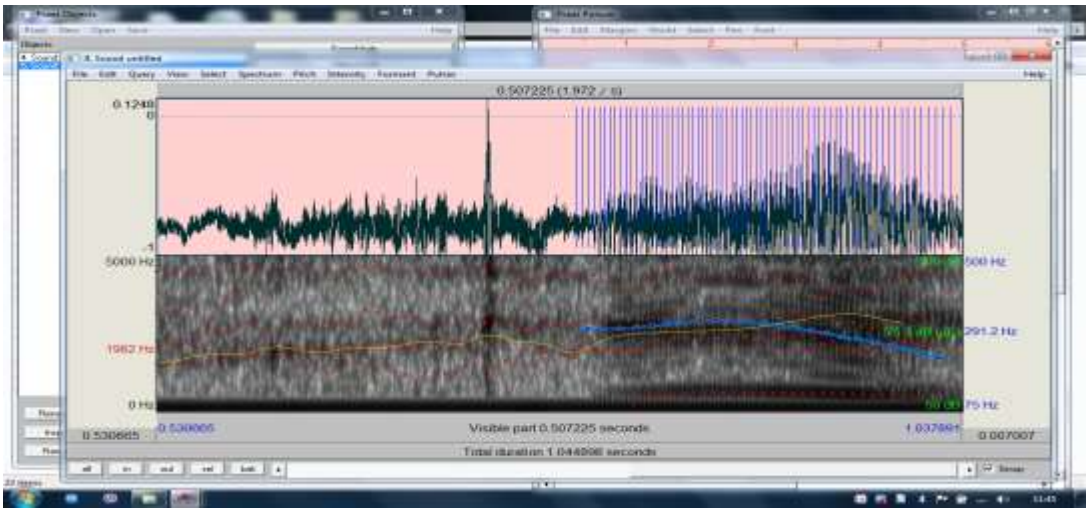


Fig5: The spectrogram of /خ / by Government school student

F2

kh.wav

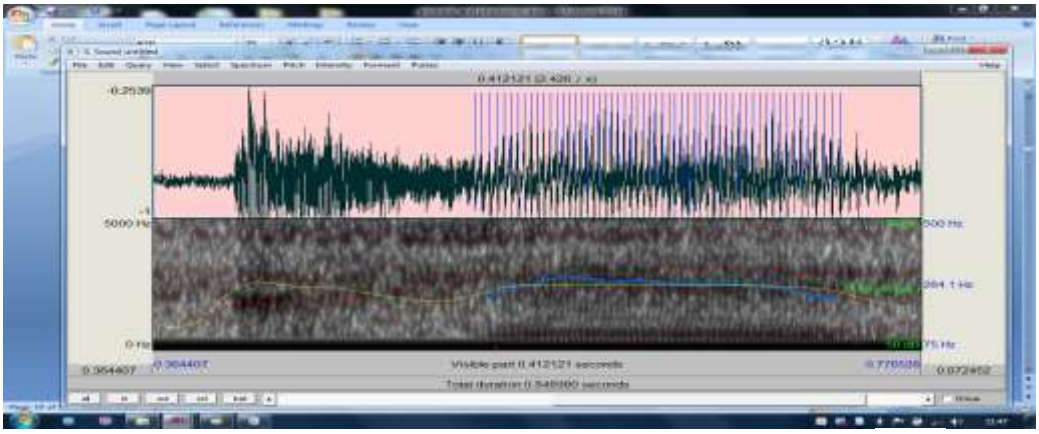


Fig6: The spectrogram of /خ / by O-Level school student **(**shifted toward / کھ /)

Spectrogram of [khobsorat]

F1

khobsorat.wav

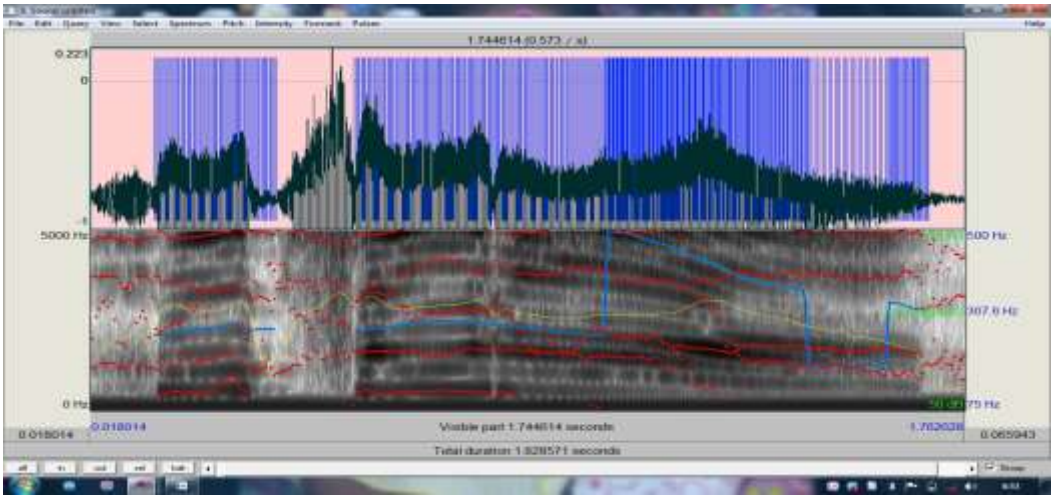


Fig 7: Frequency of the word (Khobsorat) on spectrogram by Government School student

F2

khubsurat.wav

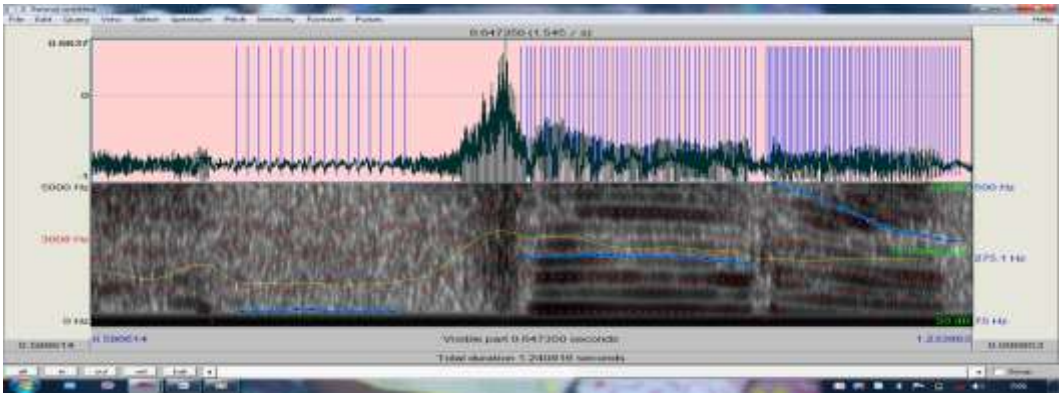


Fig 8: Frequency of the word (Khubsorat) on spectrogram by O level student (Shifted towards Khubsorat)

Spectrogram of [kharboza]

F1

kharboza.wav

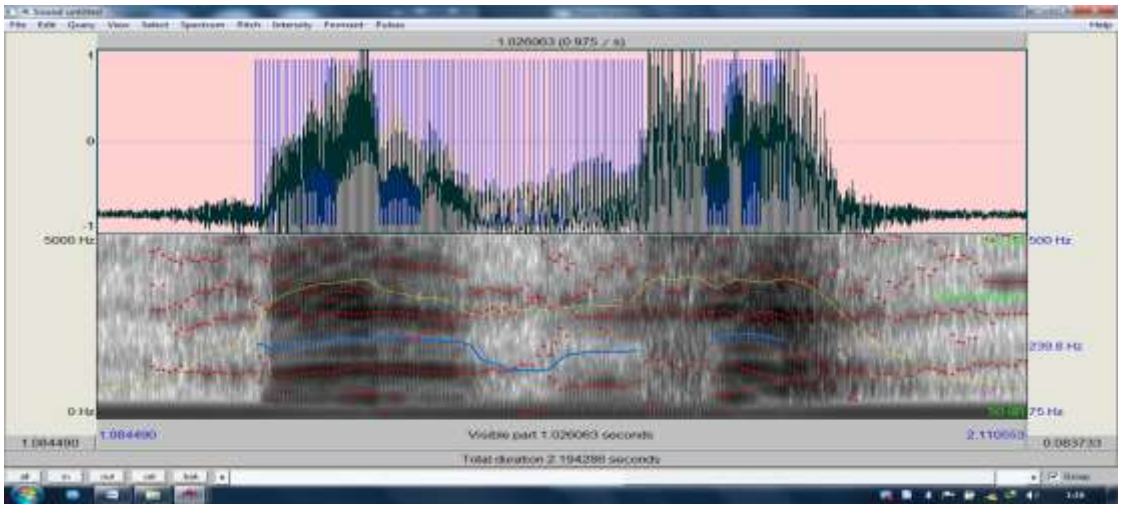


Fig 9: Frequency of the word (Kharboza) on spectrogram by Government School student.

F2

khurboja.wav

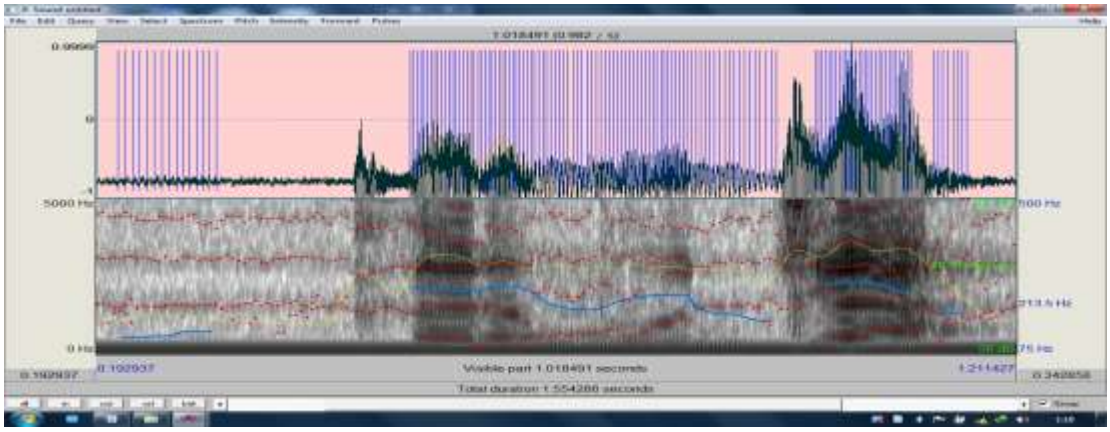


Fig 10: Frequency of the word (Kharboza) from O level student (shifted towards khuboja)

Spectrogram of [khurgosh]

F1:

khargoooosh.wav

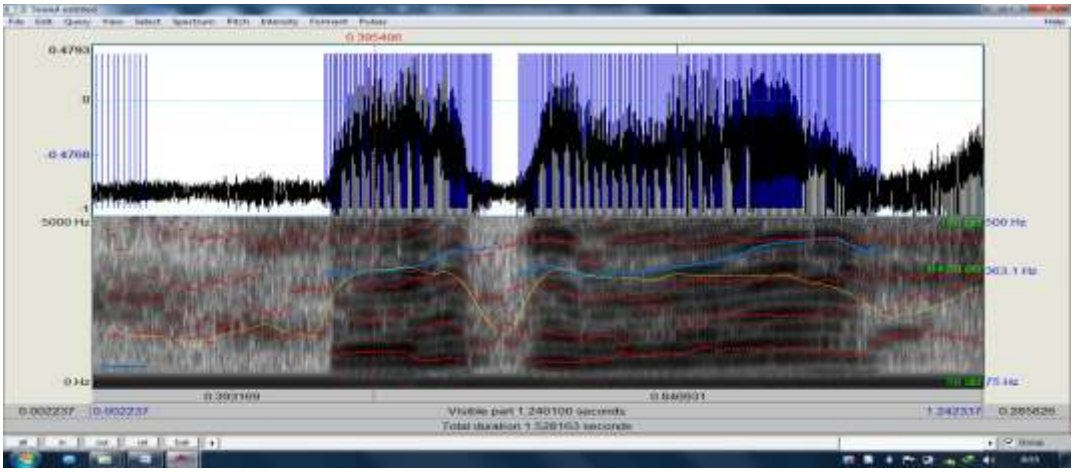


Fig 11: Frequency of the word (Khargosh) on spectrogram by Government School student

F2

KHARGOOSH.wav

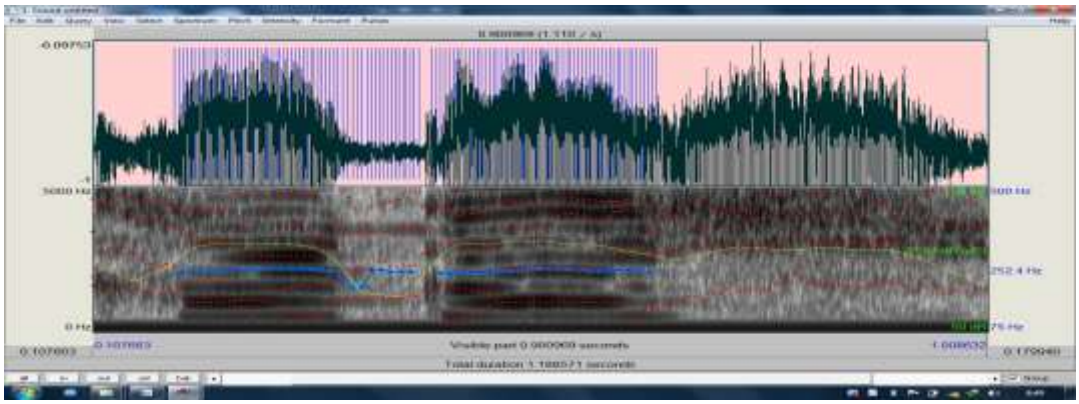


Fig 12: Frequency of the word (Khargosh) on spectrogram by the O-Level student (shifted towards khurgosh)

Spectrogram of [khak]

F1:

KHAAK.wav

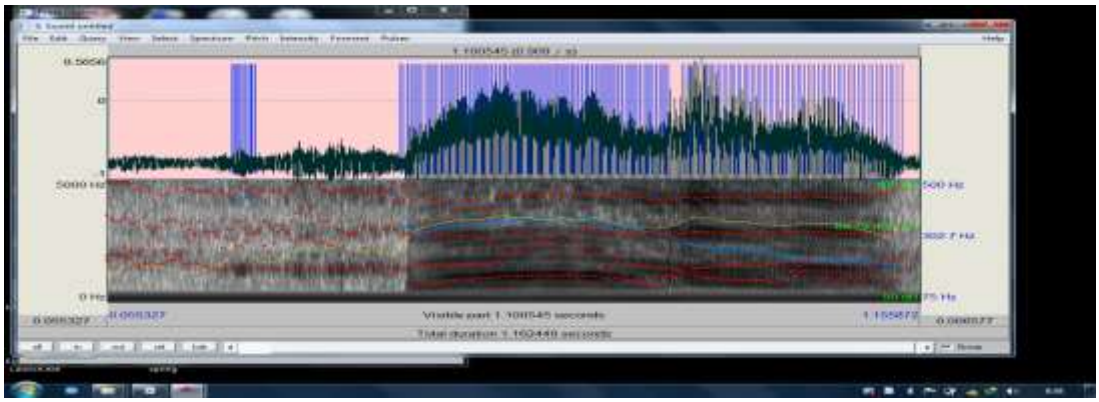


Fig 13: Frequency of the word (Khak) on spectrogram by Government School student

F2

khuk.wav

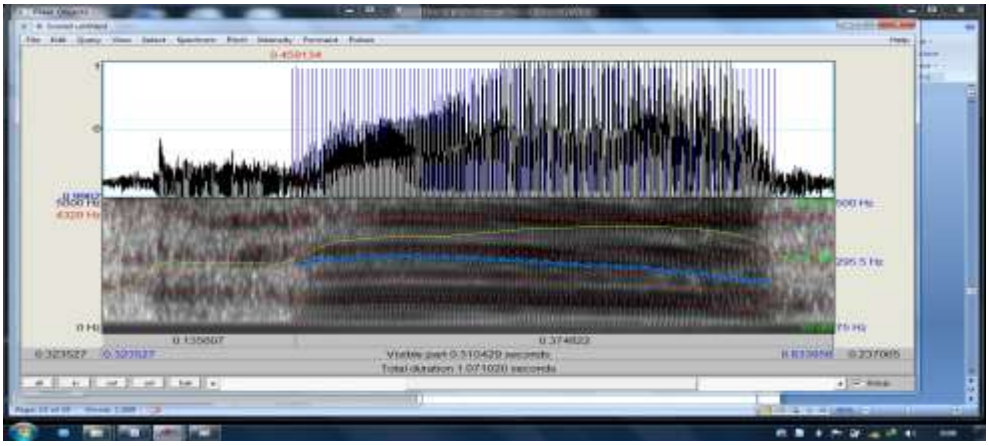
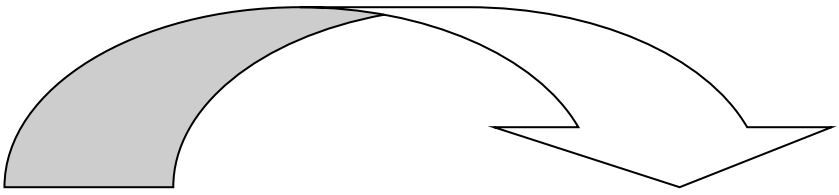


Fig 14: Frequency of the word (Khak) from O level student (shifted toward khuk)

Statistical presentation of frequencies measured on Paraat Spectrogram

Fig 15: Showing Paraat frequency F1 to F2, fricative velar plosive to aspirated velar plosive



#	اردو Plain /x / sound	Transliteration Government School students	Frequency= F1	Aspirated sounds,/ch/	Transliteration O-Level students	Frequency=F2
1	خ=X	X, kh	291	کھ	Kh	284

2	خوبصورت	Khobsorat	307	کھبصورت	Khubsorat	275
3	خربوزہ	Kharboza	239	کھربو جا	Kharboja	213
4	خرگوش	Khargoosh	363	کھرگوش	Khurgush	252
5	خاک	Khaak	302	کھاک	Khuk	295

Fig. 15: Showing Paraat frequency F1 to F2, fricative velar plosive to aspirated velar plosive.

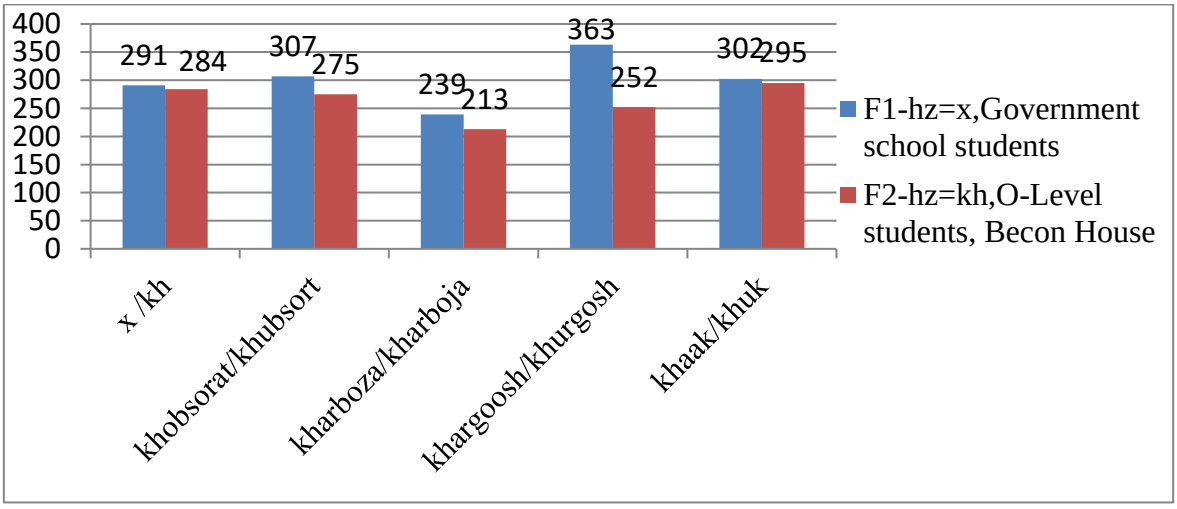


Fig 16: Showing graphical presentation of Frequencies of fricative /x/ which shifts towards aspirated sound /kh/.

5. Data Analysis

The F1 of the / خ / sound is 291 where whereas F2 is recorded as 284, The Frequency of / خ / is more as compared to the/ کھ /sound, as/ کھ /sound is spoken as a speedy puff of air as compared to the / خ /.so the frequency of sound waves of aspirated sound is less as compare to the fricative sound. More fricative sounds wave passes from a unit of time as compared to the aspirated waves.

The F1 of / خوبصورت / is 307 and F2/ کھبصورت / is 275 whereas F1 of / خربوزہ / is 239 with F2 213 for / کھربو جا /. F1 of / خرگوش / was recorded as 263 while the F2 for / کھرگوش / is 252. Similarly, F1 of/ خاک /is 302 and for / کھاک / it is 295.

This shows that the acoustic properties of the voiceless fricative velar are different from the aspirated velar stop.

6. Results and Discussion

In the Urdu alphabet inventory, both sounds خ and are present, Pakistani speakers can speak both sounds correct in their respective places but the sound خ is not the part of Hindi alphabet inventory so Hindu people are not able to speak خ instead of this they use aspirated sound whenever they have to speak 'kh' sound. These results of the data show that all the speakers who belong to government schools produced fricative velar stops with a long puff of air as frequency is higher while as compared to them the students exposed to Indian media spoke 'Kh' at the place K. According to Krashen's input comprehensible input, whatever is listed by the listener and understood depends on comprehensible input, if the input is comprehensible students will learn and absorb whatever is listened to them more properly but if the input is weak, results would be weak, and in line with input hypothesis Swain said if the input is comprehensible output would be comprehensible. It means students who become habitual to a foreign language that becomes part of their vocabulary daily used by them, they start using that in their routine. In the given research students who belong to rich community and has joined beacon house school system and habitual to watch Indian foreign TV channels, that language has become part of their daily routine language while students who were not exposed to Indian did not use rather they used the words which were being listened by them 'k', that is their comprehensible in input was pure Urdu language so was their output. This phonemic acculturation may be seen as positive, as students have the knowledge of the foreign language or may be taken as negative impact on the Urdu language as with the passage of O-level students will forget the original forms of the Urdu and would lead their national language towards language death.

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APPENDICES

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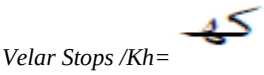
Urdu Phonemic Inventory

IPA	Letter	IPA	Letter	IPA	Letter	IPA	Letter	IPA	Letter	IPA	Letter
/b/	ب	/ɖ/	ڈ	/s/	ص	/g/	گ	/bʰ/	بھ	/ʈʰ/	ڑھ
/P/	پ	/ɖ/	ڈ	/z/	ض	/l/	ل	/pʰ/	پھ	/kʰ/	کھ
/ʈ/	ت	/z/	ذ	/t/	ط	/m/	م	/ʈʰ/	تھ	/gʰ/	گھ
/ʈ/	ٹ	/r/	ر	/z/	ظ	/n/	ن	/ʈʰ/	ٹھ	/lʰ/	لھ
/s/	ث	/ɽ/	ڑ	/ʔ/	ع	/v/	و	/ʤʰ/	جھ	/mʰ/	مھ
/ʤ/	ج	/z/	ز	/ɣ/	غ	/h/	ہ	/ʧʰ/	چھ	/nʰ/	نھ
/ʧ/	چ	/ʒ/	ژ	/f/	ف	/ɾ/	ۃ	/dʰ/	دھ	/ŋʰ/	نگھ
/h/	ح	/s/	س	/q/	ق	/ʰ/	ھ	/ɖʰ/	ڈھ		
/x/	خ	/ʃ/	ش	/k/	ک	/ʔ/	ء	/ rʰ/	رھ		

A. Showing Urdu Phonemic inventory.(in the given paper, x and kh are under observation)

Hindi Phonemic inventory

Velar Stops /Kh=

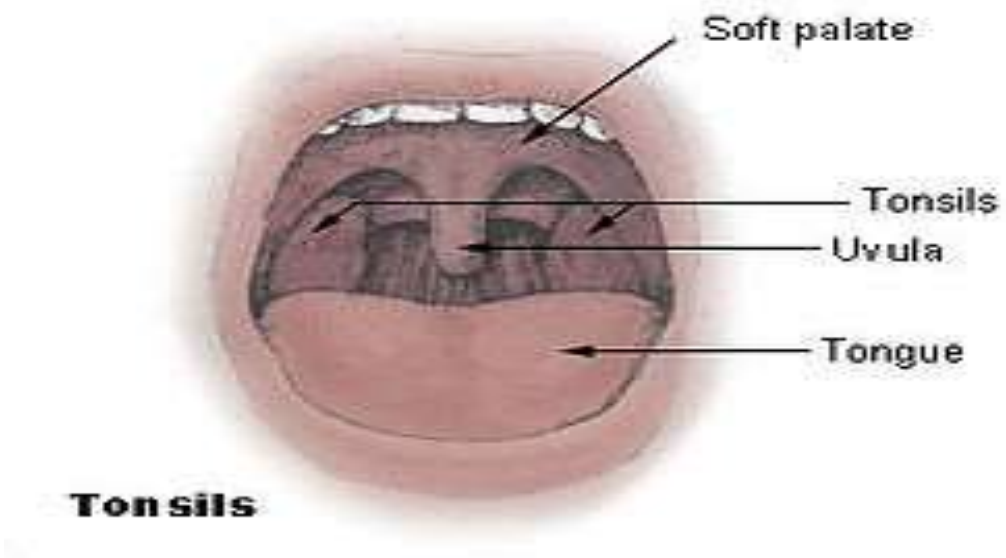


B. showing a phonemic inventory of the Hindi language.

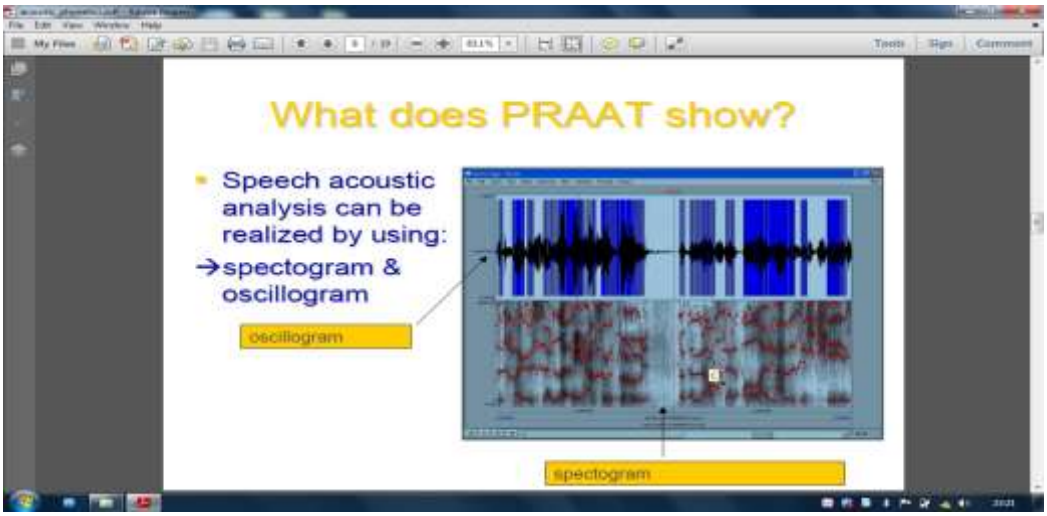
Varieties /k/

IPA	**Description**
K	plain k
k^h	aspirated k
k^j	palatalized k
k^w	labialized k
k̚	k with no audible release
k̬	voiced k
k’	ejective k

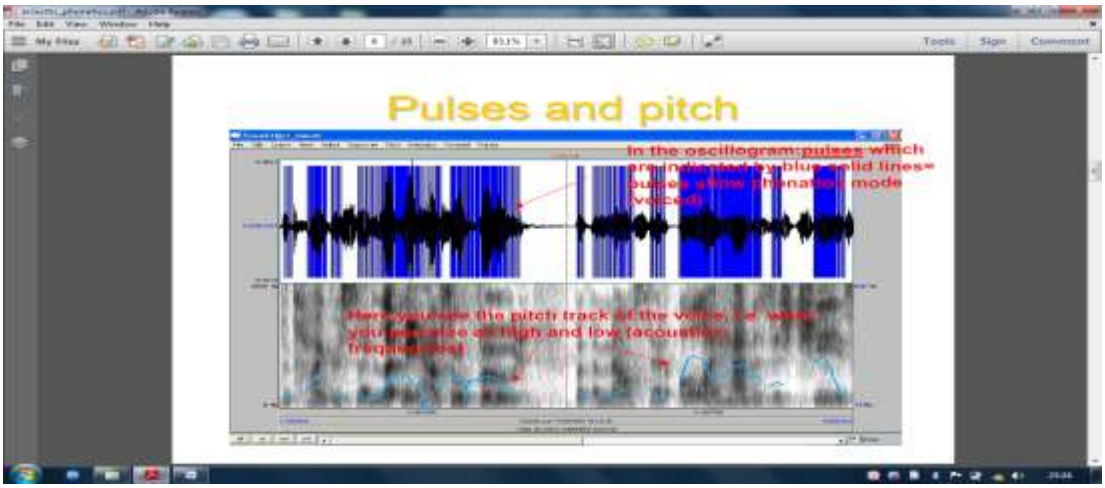
C. Showing different varieties of /K/



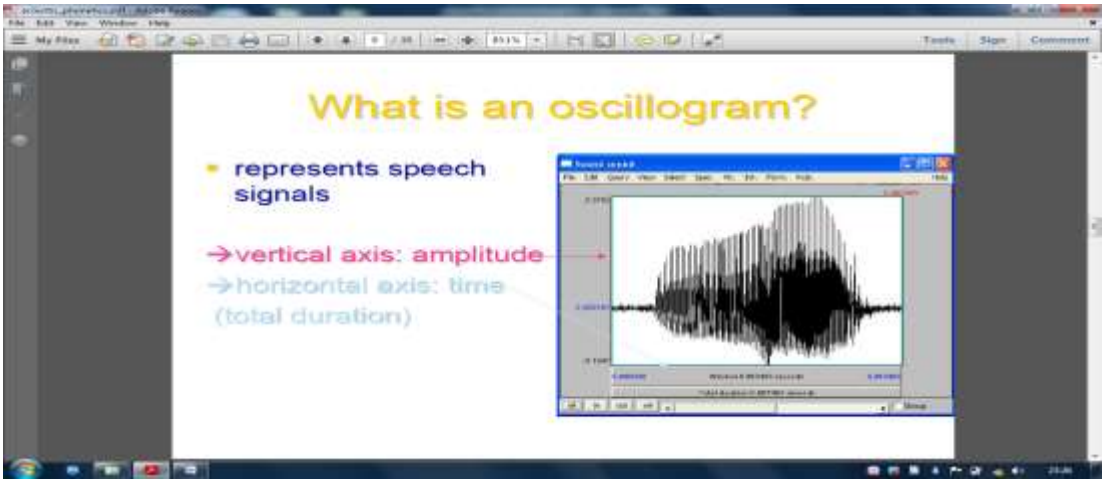
D. Positions of different Human Articulators which produce velar and aspirated sounds



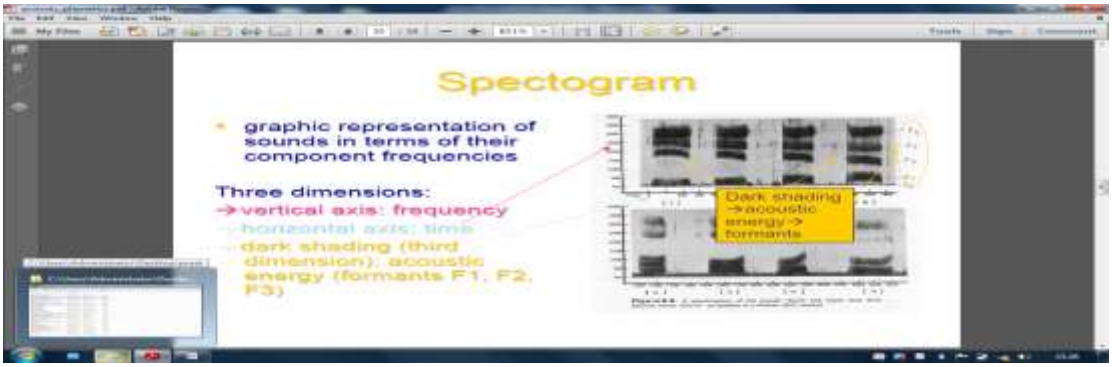
E. Paraat shows Oscillogram and spectrogram



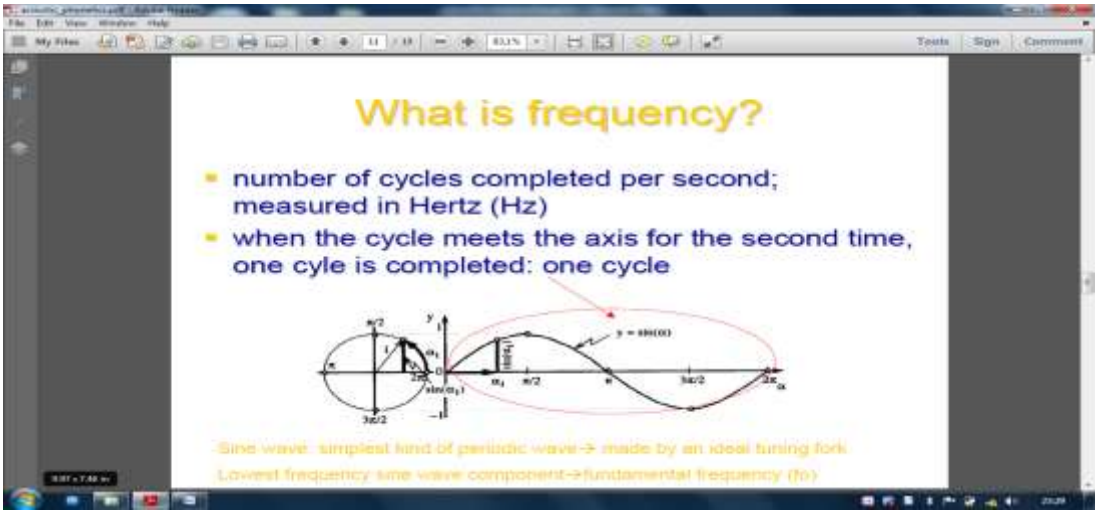
F. Paraat showing pulses and pitch



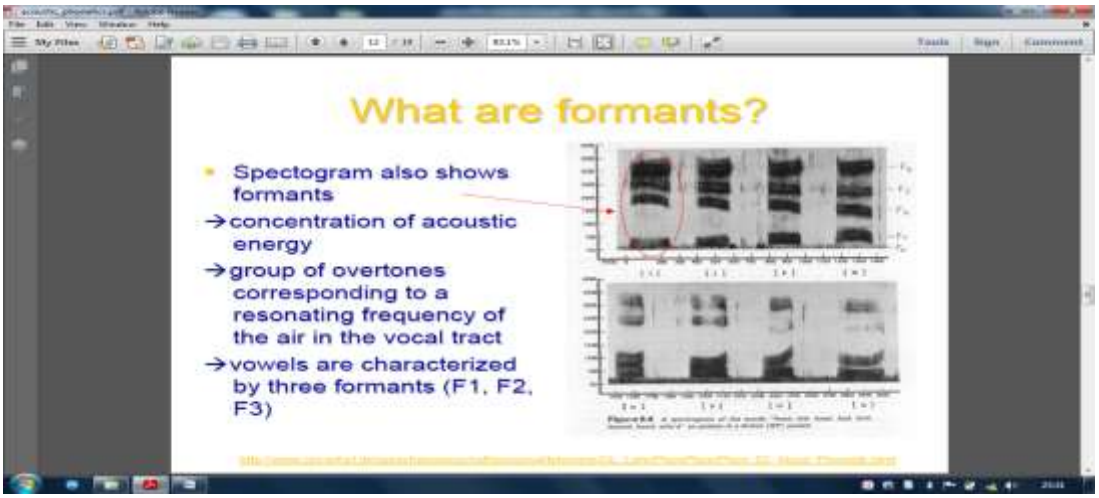
G. Paraat showing Oscillogram



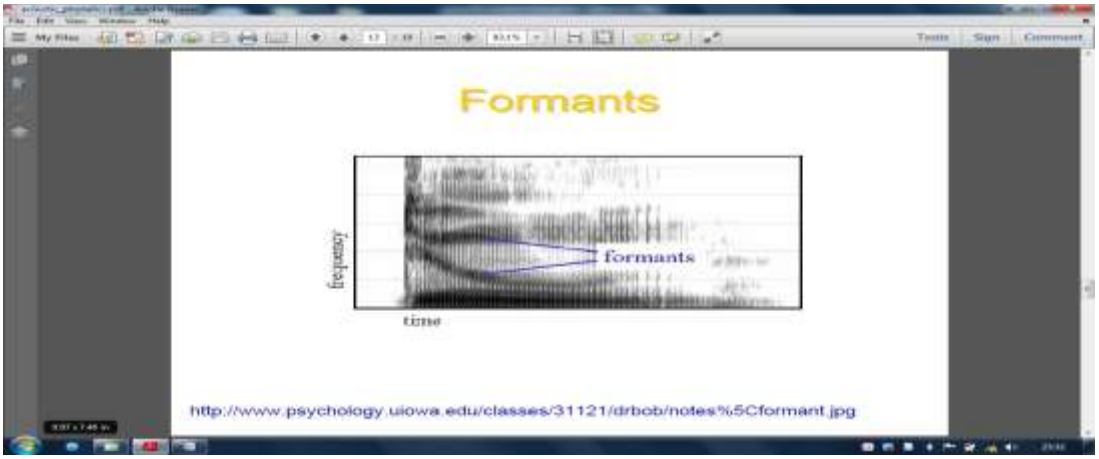
H. paraat showing spectrogram



I. Paraat showing frequency



J. Paraat showing formants



K. paraat showing formants