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DIFFERENT VOICING PATTERNS BETWEEN BRITISH ENGLISH AND KENYAN ENGLISH PLOSIVES

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This paper is about the VOT characteristics of the six English plosive consonants as they are realised in the non-ethnically marked Kenyan English pronunciation. This is compared with the General British (GB)[1] pronunciation. The data analysed in the paper was obtained from reading of the *Boy Who Cried Wolf* passage by a sample of 14 university lecturers, who served as speakers. Half of the sample was female and the other half male. The passage was phonemically transcribed using the *Phonetizer** software. The output of transcription was further cross-checked using the *Oxford Advanced Learner's Dictionary*. The pronunciation of four token words containing the six GB plosives occurring in syllable onset was analysed using *Praat* (a speech analysis software developed by Boersma & Weenink, 2016). Quantitative data on segment duration was analysed using the Statistical Package for Social Sciences (SPSS). The study found that the non-ethnically marked KenE pronunciation, unlike GB, typically does not aspirate voiceless plosives where they are expected to be aspirated, i.e. in initial stressed syllables, while it *fully* voices their voiced counterparts.

[1] Cruttenden (2014) has replaced "Received Pronunciation" with "General British". He justifies the replacement in the following way:

> Because of this narrow use by many of the name RP, and the frequent hostility to it, the name of the accent described in this book has been changed to General British (GB). But it has to be made clear that, compared with previous editions of this book, it is not a different accent that is being described, but an evolved and evolving version of the same accent under a different name. (p. 80).

The authors of the present paper will follow Cruttenden's (2014) choice.

1. INTRODUCTION

Voice-onset time (VOT) measurements have been used in numerous studies to distinguish plosives between different languages, varieties of the same language, and even among individual speakers (see, for example, Docherty, 1992; Cho & Ladefoged, 1999; Karia, 2014). The voicing duration pattern has been consistently used in VOT research to show "schematic parametric representation[s] of the three phases of plosive production" (Karia 2014, p. 28). Figure 1 below, illustrates the voicing pattern associated with the VOT phenomenon in languages.

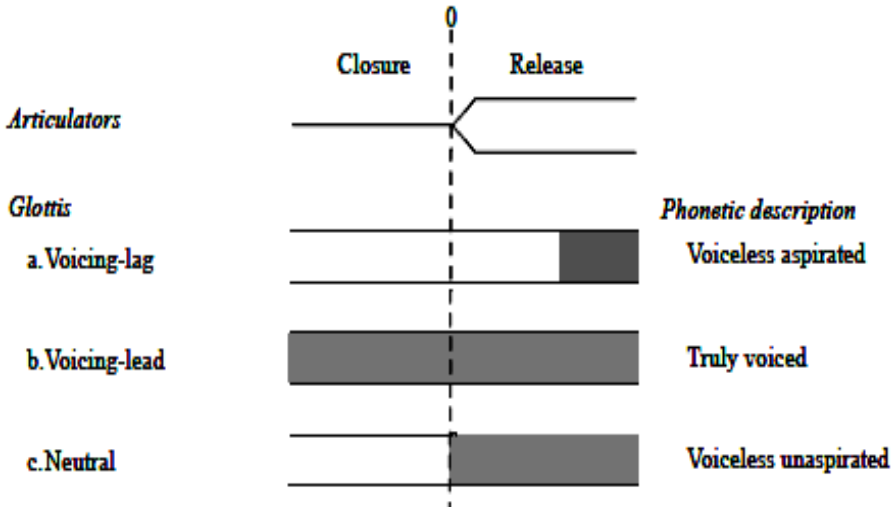


Figure 1: Voice Onset Time patterns in plosives (Source: Nasukawa 2010, p. 198)

As Figure 1 shows, three categories of VOT can be identified on the spectrograms of full plosives. Lisker & Abrahamson (1964), in their cross-language study of voicing, observe that "[…] it appears that the stop categories overall generally fall into three ranges – one from about -125 to -75 msec, one from zero +25 msec, and a third from about +60 to +100 msec" (p. 403). This observation is one good reference for the present study. Another one is Cruttenden (2014). He observes that "[…] there is a voiceless interval consisting of strongly expelled breath between the

release of the plosive and the onset of a following vowel, e.g. *pin, tin, kin* /pʰɪn, tʰɪn/, kʰɪn/" (p. 164). He further states that in GB "VOT values for aspirated stops are generally around 40-75 msecs […]" (p. 164). And yet another good one is Gut (2009), who provides the specific details of VOT differences between voiced and voiceless plosives in the following words:

> For English voiced plosives, the burst typically occurs between 20 ms before and after voicing begins. In other words, when producing [ba], [da] or [ga], speakers usually release the blockage of the airstream for the [b], [d] or [g] between 20 ms before and 20 ms after their vocal folds start vibrating for [a]. The corresponding VOT values are thus -20 ms to +20 ms. If voicing actually starts before the burst, the consonant is called **prevoiced.** For voiceless plosives in English, the typical VOT ranges between +40 and +80 ms. Aspirated plosives can have a VOT of up to + 120 ms, which means that there can be a 120 ms interval filled with friction between the release of the airstream obstruction and the vowel in words like *pat, tack* and *cap*. (p. 159).

The above quotation clearly sets the parameters for distinguishing between voiced and voiceless plosives and will thus serve as the reference guide for comparing the voicing patterns of plosives in KenE pronunciation and GB.

The phonology of Kenyan English has been mainly studied using perception-based approaches; see e.g. Schmied (2006) and Njoroge (2011). Few studies have used an acoustic-based approach: Hoffmann (2011), Karia (2014), and Itumo (2018). Hoffmann's (2011) study analysed only vowels, while the other two studied the consonants of KenE as well. Karia's (2014) study is important to the present one since it focused on the VOT phenomenon. Karia (2014) studied a group of ten Traumatic Brain Injury (TBI) patients whose VOT measures were contrasted with measures from another "*control group"* of ten speakers of KenE. As regards the VOT patterns of this latter group, Karia (2014) reports the following:

> […] the subjects of the control group produced voiceless plosives with short voicing lags (mean VOT for /pa/, /ta/, /ka/=15ms), and the voiced plosives with negative voicing lead (mean VOT for /ba/, /da/, /ga/= -

> 73 ms). This is because Kenyan English distinguishes between voiceless, non-aspirated stops and fully voiced stops. (p. 56)

The choice of speakers in Karia's (2014) control group was done through judgemental sampling to match the ethnic groups of the Traumatic Brain Injury (TBI) patients. They were matched "in terms of age, gender, first language/mother tongue and level of education" (Karia 2014, p. 37). The present study, which is based on Itumo (2018), uses data from a larger sample of 14 speakers (7 male and 7 female) who come from the three main indigenous language families in Kenya (Bantu, Cushitic and Nilotic) but whose pronunciation of English was judged by the researcher and three other "subject selectors"[2] to be non-ethnically marked. Since the present study focuses only on the speech of university lecturers, who are considered "educated", it will be interesting to know whether the VOT patterns of their speech are similar to those observed by Karia (2014).

2. METHODOLOGY

2.1 The speakers

The data in this study was obtained from fourteen lecturers from six Kenyan universities who were deemed to speak English with a non-ethnically marked accent; that is, one that did not betray their first language, which, in turn, would have revealed their ethnic affiliation. These speakers were drawn from the three language groups (i.e. Bantu, Cushitic and Nilotic) to which belong the main indigenous ethnic communities of Kenya. The sample was evenly distributed according to sex: 7 males and 7 females. Table 1 below shows the sample's ethnic distribution and sex and the codes used to label each of the speakers.

[2] These subject selectors were three lecturers of English and linguistics at three Kenyan universities: Kenyatta University, Egerton University and the Catholic University of Eastern Africa. They were were requested to separately determine whether the coded recorded data had overt ethnic markers and, if so, identify the ethnic group of the subject in question.

Table 1: Ethnic distribution of the speakers in the sample

	Major group	**Sub-group**	**Language**	**Gender**	**Speaker code**
1	BANTU	CENTRAL	Kikuyu	Female	FCB
2			Kamba	Male	MCB
3		WESTERN	Kisii	Female	FWB
4			Luhya	Male	MWB
5		EASTERN/ COASTAL	Ataveta	Female	FEB
6			Taita	Male	MEB
7	NILOTIC	HIGHLAND	Kipsigis	Female	FHN
8			Nandi	Male	MHN
9		PLAIN	Samburu	Female	FPN
10			Maasai	Male	MPN
11		LAKE/RIVER	Dholuo	Female	FLN
12			Dholuo	Male	MLN
13	CUSHITIC	CUSHITIC	Somali	Female	FC
14			Borana	Male	MC

As the table above shows, the subjects were drawn from thirteen ethnic languages. This was meant to make the study as representative as possible. To cater for variation due to possible sex-based, physiological differences[3] and gender-based differences[4], half of the sample was female and the other half was male. The speakers were labelled using initials drawn from each language family and subgroup that they belonged to. For example, FC stands for Female Cushitic, etc. Data from the two sexes was analysed separately to avoid amalgamation and, hence, consequent distortion.

[3] Men and women have different sizes of vocal tracts. On average, women's vocal tracts are approximately 15 cm long while those of men are about 17.5 cm long (Gussenhoven & Jacobs, 2013, p.25)

[4] Women's speech has been found by numerous socio-phonetic studies to be different from that of men (See, for example, Labov 2001)

2.2 Data collection procedure

The speakers' reading was recorded in quiet rooms behind closed doors using a high-definition Sony* mini-audio recorder. The speakers were asked to read the *Boy Who Cried Wolf*[5] passage (which is given in Appendix 1). Guided by Jongman, Wayland & Wong's (1998) procedure on recording, the microphone of the mini-recorder was placed at approximately 45 degrees and 15 cm away from the corner of the speaker's mouth to prevent turbulence from direct airflow. Four token words (see Table 2 below) were used for each of the plosives in syllable-initial position, where the plosives were followed by vowels. Word-final plosives and those occurring before other voiced consonants were not considered "since [they] often lack the burst of wide-band noise in their spectra which marks the instant of the release of the stop, and which is used as a reference point for measuring voice onset time" (Docherty 1992, p.16). Table 2 presents each of the four token words analysed for each of the six plosives; the target sounds are in bold type.

[5] The Wolf Passage has been designed for IPA phonemic analysis by David Deterding. Some linguists, among whom Deterding (2006) have used it as an alternative to the *North Wind and the Sun* (another text that has been used for phonetic research into different languages, but which has been found wanting as an analytic tool).

Table 2: The token words for the plosives under study

	Plosive	**Carrier words**
bilabial	p	***p**oor* x 2; *(some) com**p**any* x 2
	b	*(and) **b**egan*; *(the) **b**oy (so)*; (*of) **b**eing*; *(the) **b**oy (of)*
alveolar	t	*af**t**ernoon; moun**t**ain; **t**o (get); shou**t**ing*
	d	***d**ark;(few) **d**ays;(ran) **d**own;(usual) **d**iet*
velar	k	*(of) **c**oncern; (some) **c**ompany; loo**k**ing; chic**k**en*
	g	*(This) **g**ave;(to) **g**et;(a) **g**ood; be**g**an*

2.3 How to determine the voice onset time (VOT)

The voicing of the plosive segments is indicated by the presence of voicing striations, in the form of blue vertical lines in an oscillogram generated by the *Praat* software (Boersma & Weenink, 2016). (This software for acoustic analysis of speech sounds is available online at: http://www.fon.hum.uva.nl/praat/.) The moment when the blue striations begin on the oscillogram is marked as the onset of voicing.

2.4 Data analysis procedure

Quantitative data relating to duration measurements was recorded in milliseconds (ms). The data was computed using the Statistical Package for the Social Sciences (SPSS) and is reported in means and standard deviations (SDs) and analysis of variance (ANOVA). (For the means and SDs, see Appendix 2; for the ANOVA statistics, see appendices 3, 4, and 5.) For each pair of Kenyan English plosives, text grids for only one of the speakers are used by way of illustration. Each grid shows both the oscillogram and the spectrogram of the carrier word.

3. DATA PRESENTATION AND DISCUSSION

The presentation and discussion of the speakers' pronunciation data will follow the place of articulation of the six plosives: the bilabial, the alveolar, and the velar plosives.

3.1 The KenE bilabial plosives

The two bilabial plosives /p/ and /b/ were found to be characterized by two features in KenE: one, /p/ was generally unaspirated even in stressed syllables; two, /b/ was fully voiced. As regards segment duration, the mean occlusion duration for /p/ was 84 ms for the female speakers and 77 ms for the male speakers. The occlusion duration for /b/ was 83 for the female speakers and 70 ms for the male speakers (see Appendix 2). However, the differences in occlusion duration for the two bilabial plosives were not statistically significant (see Appendix 3). Regarding the bilabial plosive bursts, the female speakers recorded a mean burst duration of 34 ms for /p/ and of 29 ms for /b/. These scores are homogeneous for the two bilabial plosives as manifested by the standard deviation (SD) values of 13 and 21 for /p/ and /b/, respectively. Unlike their female counterparts, the male speakers did not record significant differences in their burst length (see Appendix 3). For the female speakers, the total mean duration was 117 ms for the voiceless bilabial plosive /p/ and 100 ms for its voiced counterpart, while for the male speakers the mean duration was 107 ms for /p/ and 96 ms for /b/.

Relating to VOT, the 28 examined word tokens for /p/ had a mean duration of 29 ms among both the female speakers and the male speakers. The voiced plosive /b/ on the other hand had a voicing lead of 82 ms among the female speakers and 34 ms among the male speakers. This means that

the onset of voicing was realized before the release burst. Figure 4 and Figure 5 are text grids of both /p/ and /b/ by a KenE speaker.

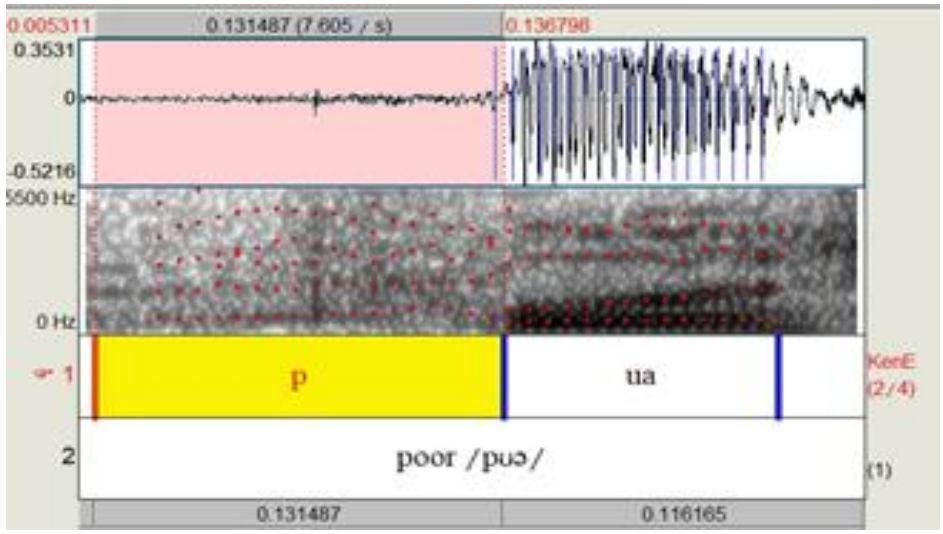
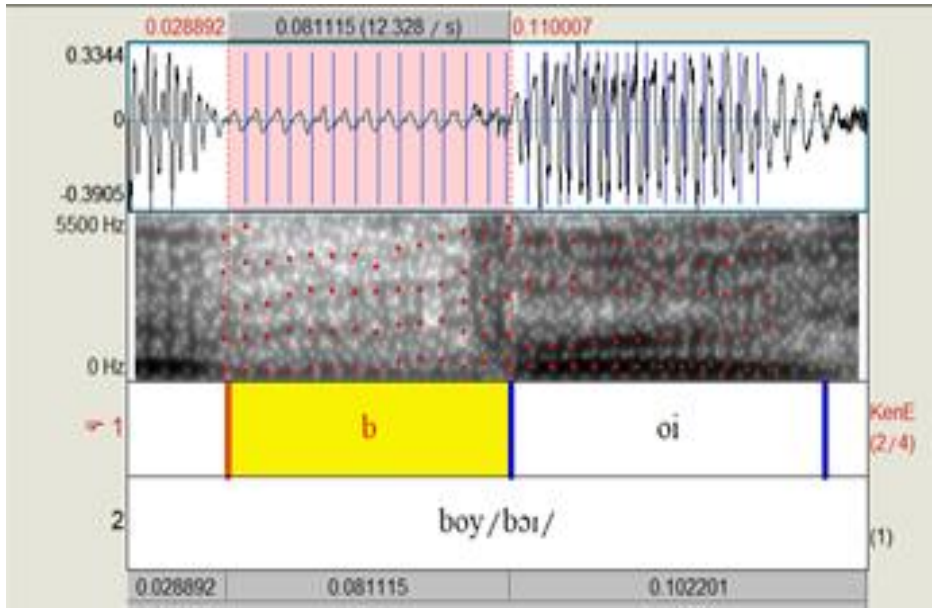


Figure 4: Oscillogram and spectrogram for /p/ by FWB

Figure 5: Oscillogram and spectrogram for /b/ by FWB



In the text grids above, the lack of voicing striations for /p/ clearly shows a “neutral” voiceless plosive. The sound /b/ in ‘boy’ is realized as a fully voiced plosive. As is evident in Appendix 3, the high significant values of ANOVA analysis shows that both /p/ and /b/ were clearly differentiated by VOT. Therefore, the realization of /p/ and /b/ in KenE is remarkably different from descriptions on RP as provided in Section 1 above.

3.2 The KenE alveolar plosives

There are two alveolar plosives in English. These are: /t/ and /d/. The occlusion duration for the voiceless plosive was 56 and 89 ms for the female and male speakers, respectively. The occlusion duration for the two plosives was significant for the female speakers. Men did not distinguish these two plosive in relation to occlusion. Women had a slightly longer burst of 42 ms for /t/ while men had burst duration of 29 ms. The burst duration for these two plosives is statistically significant. The total duration for the voiceless alveolar plosive was 98 ms among the female speakers and that of the male speakers was 118 ms. Its voiced counterpart had duration of 92 ms for both the female and 103 ms male speakers. The voiceless alveolar plosive had a VOT of 31 ms and 32 ms for the male speakers. The voiced plosive /d/ on the other hand had a voicing lead of 74 ms and 77 ms among the female and male speakers, respectively. From the data summarized in Appendix 1, it is evident that the voiceless sound is ‘neutral’ and its voiced counterpart is fully voiced. The VOT values for both /t/ and /d/ were highly significant across the sexes. Figure 6 and Figure 7 below contrast the extent of voicing of /t/ and /d/ by one of the speakers.

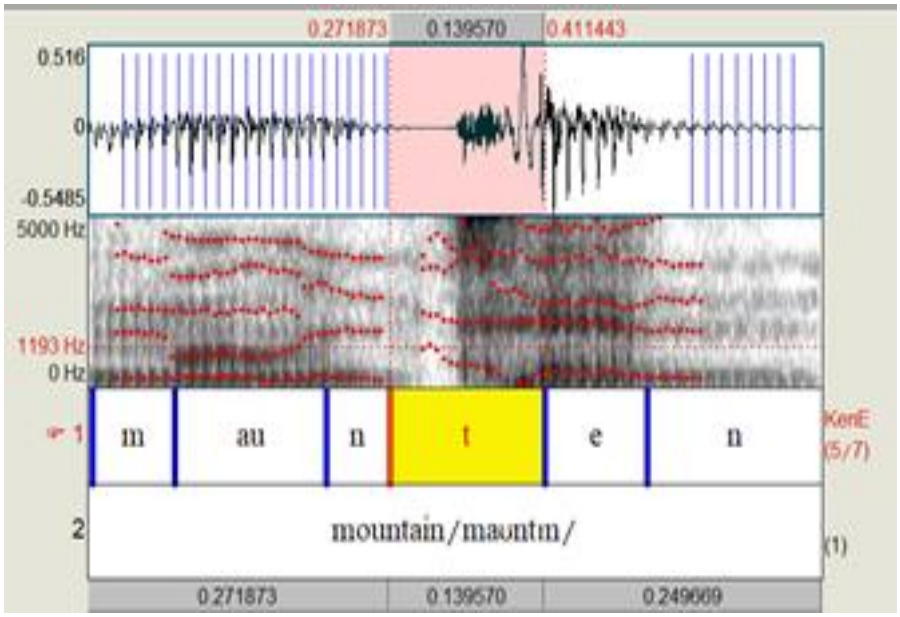


Figure 6: Oscillogram and spectrogram for /t/ by MCB

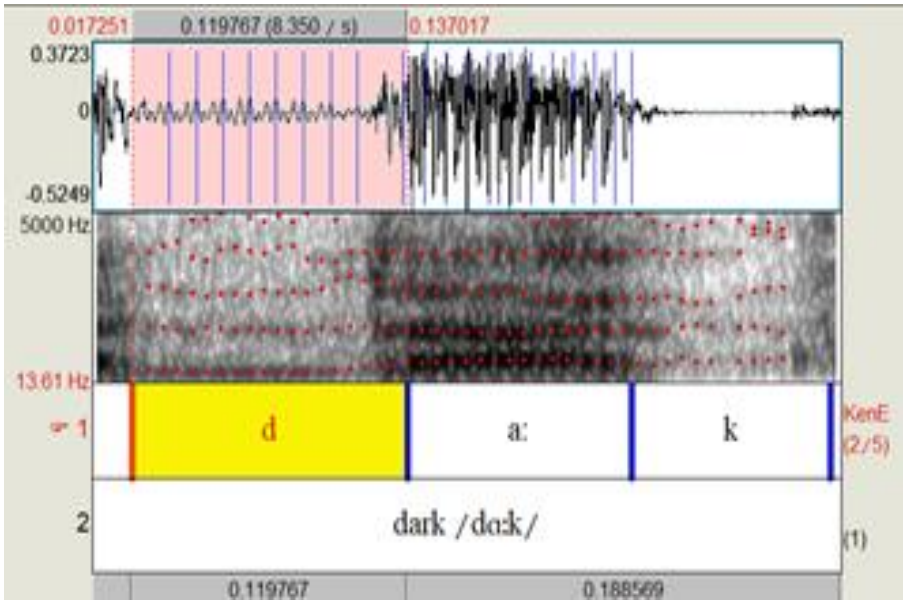


Figure 7: Oscillogram and spectrogram for /d/ by MCB

In the two figures above, oscillograms of the voiceless plosive /t/ have little voicing as indicated by blue striations. The voiced /d/, on the other

hand, has striations occupying the entire segment. Neither the voiceless nor the voiced sounds do show aspiration. It can therefore, be concluded that KenE alveolar plosives are distinguished, not by aspiration, as is the case for GB, but by voicing.

3.3 The KenE velar plosives

As in the cases of the bilabial and the alveolar plosives, 56 words for the two velar plosives, /k/ and /g/, were examined. The occlusion phase in the voiceless velar plosive had a mean of 84 ms for the female speakers and 56 ms for the male. The voiced velar plosive had a relatively shorter burst than its voiceless counterpart among both the male and female speakers. The ANOVA results showed that variation in occlusion length was significant among the male speakers. The burst for the voiceless plosive /k/ lasted 29 ms among female and 28 ms among the male speakers. The voiced plosive /g/ had a burst of 19 ms for the male and female and a close mean of 22 ms for the male speakers. The variation in burst length between the two plosives was significant for the female speakers but not for the male. Regarding the whole segment, /k/ had a duration of 113 ms and 97 ms among the female and male speakers, respectively. The voiced plosive /g/ had a total duration of 95 ms and 94 ms among the female and male speakers, respectively. The overall segment duration was not significant for both the female and the male speakers. As regards the VOT, /k/ had a duration of 26 ms for the female and 25 ms for the male speakers. Both groups had similar SD values, which shows great homogeneity between individual scores. A voicing lead duration of 75 ms and 56ms was obtained for the female and male speakers, respectively, which means that the voiced stop was fully voiced. The extent of voicing in the voiced plosive /g/ is evident in the striations in Figure 9. In contrast, there are no such striations for /k/ in Figure 8.

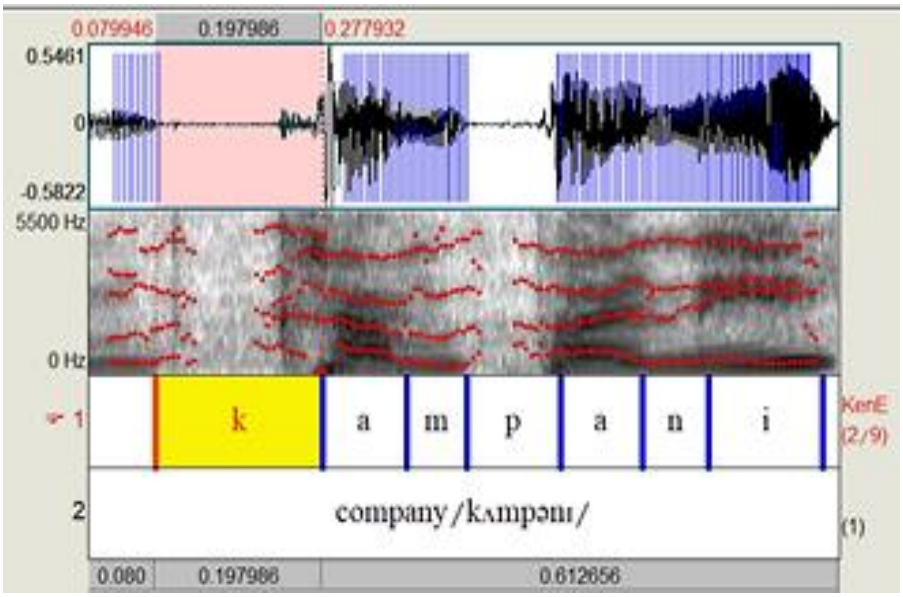


Figure 8: Oscillogram and spectrogram for /k/ by FC

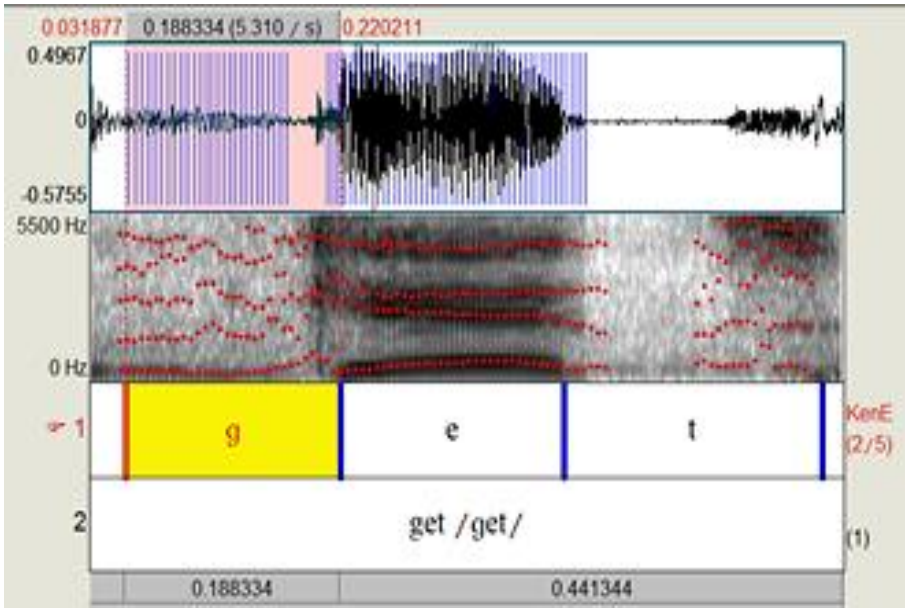


Figure 9: Oscillogram and spectrogram for /g/ by FC

In the two figures above, the closure phase of the plosives is indicated by little intensity. The voiced segment is clearly distinguishable from the voiceless segment since the latter has voicing striations, which occupy almost the entire plosive segment.

4. CONCLUSION

The present study sought to establish whether there existed VOT differences between the General British (GB) pronunciation and the non-ethnically marked KenE pronunciation of the six English plosives (/p, b, t, d, k, g /). Oral data on how these were pronounced was obtained from token words in the *Boy Who Cried Wolf* passage as read by fourteen university lecturers, who served as speakers. The focus was on how the plosives in question were pronounced in their syllable-initial positions. The speakers' reading was analysed using *Praat*.

Two key observations were made in the paper: first, the KenE voiceless plosives (/p, t, k/) were mostly neutral: their VOT duration ranged from 29 ms to 32 ms. For the purposes of comparison, it will be remembered from (Gut, 2009, p. 159) that the VOT duration for the GB voiceless plosives in English ranges between +40 and +80 msec. Second, their voiced counterparts (/b, d, g /) were observed to be fully voiced, with a voicing lead ranging from 30 ms to 80 ms compared to–"between 20 ms before and after voicing begins" reported for GB voiced plosives by Gut (2009, p. 159). The findings in this study confirm Karia's (2014) conclusion that "Kenyan English distinguishes between voiceless non-aspirated stops and fully voiced stops" (p. 56). Since some of Karia's (2014) subjects had a much lower level of education than those in the present study, it seems that *level of education* is not a determining factor in the voicing, or otherwise, of the plosive sounds of English. Other factors such as the influence of speakers' L1's during the acquisition of English as a second language may provide insights into the observed VOT patterns.

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APPENDIX 1: READING PASSAGE: *The Boy Who Cried Wolf*

There was once a poor shepherd boy who used to watch his flocks in the fields next to a dark forest near the foot of a mountain. One hot afternoon, he thought up a good plan to get some company for himself and also have a little fun. Raising his fist in the air, he ran down to the village shouting "Wolf, Wolf." As soon as they heard him, the villagers all rushed from their homes, full of concern for his safety, and two of his cousins even stayed with him for a short while. This gave the boy so much pleasure that a few days later he tried exactly the same trick again, and once more he was successful.

However, not long after, a wolf that had just escaped from the zoo was looking for a change from its usual diet of chicken and duck. So, overcoming its fear of being shot, it actually did come out from the forest and began to threaten the sheep. Racing down to the village, the boy of course cried out even louder than before. Unfortunately, as all the villagers were convinced that he was trying to fool them a third time, they told him, "Go away and don't bother us again." And so the wolf had a feast.

(Source: Deterding 2006)

Appendix 2: Means and SDs for the pronunciation of the 6 plosives by the 14 speakers

		Female speakers				Male speakers			
Plosive	**Statistic**	**Occlusion**	**Burst**	**Tot. Dur**	**VOT**	**Occlusion**	**Burst**	**Tot. Dur**	**VOT**
p	Mean	84	34	117	**29**	77	29	107	**29**
	N	28	28	28	28	28	28	28	28
	SD	37.64	13.11	43.96	10.08	26.79	20.89	34.73	8.13
b	Mean	83	17	100	**-82**	70	26	96	**-34**
	N	28	28	28	28	28	28	28	28
	SD	24.47	8.97	26.67	24.09	60.25	13.11	67.73	24.83
t	Mean	56	42	98	**31**	89	29	118	**32**
	N	28	28	28	28	28	28	28	28
	SD	20.26	13.43	20.79	13.25	25.67	19.95	41.67	15.00
d	Mean	88	16	104	**-74**	91	16	103	**-77**
	N	28	28	28	28	28	28	28	28
	SD	30.35	7.42	33.91	37.06	35.16	6.21	31.84	22.91
k	Mean	84	29	113	**26**	56	28	97	**25**
	N	28	28	28	28	28	28	28	28
	SD	56.53	12.08	62.00	12.54	19.52	15.00	70.81	10.72
g	Mean	76	19	95	**-75**	71	22	94	**-56**
	N	28	28	28	28	28	28	28	28
	SD	24.86	6.04	27.69	25.46	28.77	25.58	43.99	39.20

Appendix 3: ANOVA statistics for the KenE pronunciation of /p, b/

		Female speakers					Male speakers				
		Sum of Squares	df	Mean Square	F	Sig.	Sum of Squares	df	Mean Square	F	Sig.
Occlusion * Plosive	Between Groups	7.14	1	7.14	0.01	.933	714.29	1	714.29	0.33	.569
	Within Groups	54414.29	54	1007.67			117371.43	54	2173.54		
	Total	54421.43	55				118085.71	55			
Burst Length * Plosive	Between Groups	3778.57	1	3778.57	29.94	.000	114.29	1	114.29	0.38	.543
	Within Groups	6814.29	54	126.19			16428.57	54	304.23		
	Total	10592.86	55				16542.86	55			
Total Duration * Plosive		4114.29	1	4114.29	3.11	.083	1607.14	1	1607.14	0.55	.460
	Within Groups	71371.43	54	1321.69			156414.29	54	2896.56		
	Total	75485.71	55				158021.43	55			
VOT * Plosive	Between Groups	171607.14	1	171607.14	503.24	.000	55314.29	1	55314.29	162.08	.000
	Within Groups	18414.29	54	341.01			18428.57	54	341.27		
	Total	190021.43	55				73742.86	55			

Appendix 4: ANOVA statistics for the KenE pronunciation of /t, d/

		Female speakers					Male speakers				
		Sum of squares	df	Mean square	F	Sig.	Sum of squares	df	Mean square	F	Sig.
Occlusion* Plosive	Between groups	14464.29	1	14464.29	21.72	.000	28.57	1	28.57	0.03	0.86
	Within Groups	35957.14	54	665.87			51171.43	54	947.62		
	Total	50421.43	55				51200.00	55			
Burst Length* Plosive	Between Groups	9778.57	1	9778.57	83.06	.000	2064.29	1	2064.29	9.46	0.00
	Within Groups	6357.14	54	117.72			11785.71	54	218.25		
	Total	16135.71	55				13850.00	55			
Total Duration* Plosive		457.14	1	457.14	0.58	.450	3150.00	1	3150.00	2.29	0.14
	Within Groups	42714.29	54	791.01			74242.86	54	1374.87		
	Total	43171.43	55				77392.86	55			
VOT* Plosive	Between Groups	156457.14	1	156457.14	201.98	.000	167207.14	1	167207.14	446.04	0.00
	Within Groups	41828.57	54	774.60			20242.86	54	374.87		
	Total	198285.71	55				187450.00	55			

Appendix 5: ANOVA statistics for the KenE pronunciation of /k, g/

		Female Speakers					Male Speakers				
		Sum of Squares	df	Mean Square	F	Sig.	Sum of Squares	df	Mean Square	F	Sig.
Occlusion * Plosive	Between Groups	1028.57	1	1028.57	0.54	.466	3457.14	1	3457.14	5.72	.020
	Within Groups	102971.43	54	1906.88			32628.57	54	604.23		
	Total	104000.00	55				36085.71	55			
Burst Length * Plosive	Between Groups	1207.14	1	1207.14	13.23	.001	457.14	1	457.14	1.04	.312
	Within Groups	4928.57	54	91.27			23742.86	54	439.68		
	Total	6135.71	55				24200.00	55			
Total Duration * Plosive		4464.29	1	4464.29	1.94	.170	178.57	1	178.57	0.05	.822
	Within Groups	124471.43	54	2305.03			187614.29	54	3474.34		
	Total	128935.71	55				187792.86	55			
VOT * Plosive	Between Groups	144028.57	1	144028.57	357.71	.000	91207.14	1	91207.14	110.47	.000
	Within Groups	21742.86	54	402.65			44585.71	54	825.66		
	Total	165771.43	55				.187	55			

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