PERCEPTUAL CONFUSION BETWEEN SOUTH AFRICAN AND BRITISH ENGLISH VOWELS

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ABSTRACT

South African English demonstrates a shift in the realizations of front vowels when compared to most British English accents. This study includes a perception experiment, where British English listeners are presented with tokens containing the vowels in question recorded by 4 SAE speakers. Then an acoustic analysis of the vowels is presented, which demonstrates the similarity between the British English set, and their SAE counterparts.

SOUTH AFRICAN ENGLISH

South African accents of English (SAE) demonstrate a shift in the realizations of front vowels to a generally closer or more central position than those found in most British English accents (see, for example, Wells [1]). This results in a set of vowels /æ, e/, and some contexts of /l/ that may potentially be confused by British English listeners with their set /e, ɪ, ə/, with /ə/ in monosyllables probably heard as /ʌ/. The question then arises as to what happens to /ʌ/; does this vowel also shift in SAE, and if so where to?

Normally context disambiguates any potential perceptual confusions between SAE and other accents; nevertheless, there are many possible homonymic clashes.

A further point to be considered is that SAE like many other English accents has a velarized variant of /l/ following vowels ([ɫ]: the 'dark-l'). As noted, for example, by Gimson [2], following dark-l has a tendency to centralize the preceding vowel. It is possible, therefore, that the short-vowel shift of SAE may be affected by this, in that centralization may have differential effects on perception.

The authors decided to design a perception experiment to test whether these short front vowels in SAE would indeed be perceived by British English listeners to be the shifted values when all contextual cues as to meaning are removed. This would also prove an opportunity to test the /ʌ/ vowel, and see whether it too would be perceived as shifted, and if so, to which vowel.

This experiment would then be follow-ed by an acoustic analysis of the SAE vowels, and a comparison of their formant values with those of British English.

PERCEPTION EXPERIMENT

Method

Four speakers were used in the perception experiment. Details of the speakers are given in Table 1.

Table 1. Details of the SAE Speakers.

	sex	age	area
speaker 1	M	20	Jo'burg
speaker 2	M	19	Durban/J'burg
speaker 3	M	20	Jo'burg
speaker 4	M	20	Durban

All the speakers were students at the University of the Witwatersrand, and were first language speakers of English.

The speakers were all recorded in good acoustic conditions on a DAT recorder by the first author. The material recorded consisted of a set of twenty different words embedded in the phrase "say the word ___ again". The words used are given in Table 3 below, and it can be seen that as well as the front vowels noted above, a wider range of vowels was included. This allowed investigation of whether other vowel confusions were present, as well as acting as distractors from the main set.

The subjects involved in the listening task were all first year Speech and Language Therapy students between the ages of 18-30, at two institutions in the UK. All had followed a course of one semester in phonetics and practical phonetics, but had not studied different accents of English. The details of the listeners are given in Table 2.

The perception task was undertaken by the last two authors at their institutions. An answer sheet was prepared (see Table 3), which listed for each token the target pronunciation, a first foil (in the case of the front vowels, the predicted changed version), and a second foil, more distant phonetically. Listeners had to mark which of the three words they heard in each instance. Targets and foils were randomized for each token. Separate answer sheets were used for each of the four speakers. Listeners were informed that the four speakers would not necessarily use the same targets, and that repetitions of targets by individual speakers was also possible.

There was a short gap between each token to force immediate responses from the listeners. All four speakers were presented in a continuous session, but no learning effect was seen in the results. Listeners were told to make a choice in each instance, and very few unmarked examples were found.

Table 2. Details of the Listeners.

	male	female	total
S. England/RP	2	10	12
Midlands	0	6	6
N. England	0	4	4
N. Ireland	0	13	13
S. African Eng	0	1	1

Table 3. Answer Sheet for the Perception Task. The Targets are in italics, and the First Foils are underlined.

1	hit	*heat*	heart
2	*hit*	hot	hut
3	putt	pat	*pit*
4	pal	*pill*	pull
5	*pool*	Paul	pull
6	pit	part	*pet*
7	still	*sell*	seal
8	soul	sell	*Sal*
9	pet	*pat*	port
10	pout	port	*pot*
11	*putt*	pat	peat
12	poot	part	*put*
13	pit	*peat*	part
14	pill	pall	*peal*
15	pod	*paired*	ped
16	*part*	port	put
17	pot	peat	*port*
18	beat	*boot*	but
19	*bird*	bead	bud
20	Paul	pull	*pearl*

Results

Results for all 36 listeners for all four speakers were calculated for each token in the experiment. While there was a certain amount of difference between the scores of the listeners (some of which appears to be attributable to their regional back-ground), and between the scores given to the four speakers, there was generally good agreement. It is hoped to explore what differences there were in greater depth elsewhere. In Table 4 below the total scores for all listeners for all speakers are given. The maximum possible score for any one token is 144; as noted above, a few instances of non-scoring occurred, and this, together with rounding percentages up or down, accounts for why the scores for some tokens do not reach 100%.

Table 4. Results for All Listeners and All Speakers in % out of 144 for each Token.

	%		
	Target	1st Foil	2nd Foil
1. heat	97%	3%	0%
2. hit	100%	0%	0%
3. pit	13%	88%	0%
4. pill	1%	98%	0%
5. pool	92%	8%	0%
6. pet	15%	85%	0%
7. sell	95%	2%	1%
8. Sal	35%	28%	37%
9. pat	7%	93%	0%
10. pot	90%	8%	2%
11. putt	59%	41%	0%
12. put	90%	10%	0%
13. peat	97%	3%	0%
14. peal	92%	8%	0%
15.paired	86%	14%	0%
16. part	58%	37%	3%
17. port	92%	7%	1%
18. boot	99%	1%	0%
19. bird	99%	1%	0%
20. pearl	84%	15%	1%

These results confirm that the major area of perceptual confusion for the British English listeners was with the short front vowels. For example 'pit' had an 88% score for its first foil ('putt'), 'pet' an 85% score for the main foil 'pit', and 'pat' a 93% score for the foil 'pet'. This confirms the predicted pattern of change. We were also interested in the behaviour of the central vowel /ʌ/, and if we examine the score for 'putt' we find that while on 59% of occasions it was

heard as 'putt', there was a considerable number of identifications (41%) as 'pat', which would suggest at least that these four vowels are shifting in a circular fashion. It would certainly appear important to include /ʌ/ in the acoustic study.

An exception to the trend just reported occurs with the token 'hit', where no instances of identification as 'hut' were recorded. This compares with 'pit' where, as just noted, only 13% identified the token as containing the /ɪ/ vowel. In South African English, however, /ɪ/ is noted as abetting raising, but blocking lowering of /ɪ/ [1]; this result confirms that characteristic, and a comparison of the acoustic aspects of the two allophones of this vowel is given below.

The effect of following dark-l on vowel identification is quite striking in these results. The token with the target high vowel, 'pill', was almost always heard as 'pull', while 'sell' was not heard as the raised equivalent 'sill', but was correctly heard as 'sell' in 95% of occasions. The low target vowel in 'Sal' caused the most confusion (and indeed showed quite an amount of variation between the four speakers). Both the second and third foils ('sell' and 'soul') scored well, though differentially between the speakers). The explanation for all these results clearly lies in the centralizing effect of following dark-l, as noted in the introduction. This effect will reinforce the movement of target /ɪ/ (and the increase in gravity lead to a perception of the rounded /ʊ/), but centralization of target /e/ does not bring it into conflict with any of the vowels in the foils. With target /æ/, the increased gravity with dark-l will lead listeners to expect a retracted but rounded vowel, thus causing the confusion seen in the results.

These results also show some con-fusion with several other target vowels, including 'paired', 'part', and 'pearl'. Some of the difficulty with these is possibly due to interference from the listeners accents (e.g. rhoticity in some cases), however they may reflect aspects of SAE as well. It is hoped to explore these results more fully elsewhere.

It is interesting to note that the one South African English listener did score higher on identifying target vowels, but was only marginally better than the average.

Table 5. Formant Values in Hz for the Test Words.

		F1	F2
'hit'	spkr 1	330	2175
	spkr 2	395	1656
	spkr 3	433	2047
	spkr 4	350	1798
	SBS	374	2165
'pit'	spkr 1	364	1498
	spkr 2	434	1494
	spkr 3	358	1672
	spkr 4	391	1601
	SBS	433	2056
'pill'	spkr 1	378	762
	spkr 2	399	798
	spkr 3	447	964
	spkr 4	492	886
	SBS	524	1296
'pet'	spkr 1	443	1671
	spkr 2	392	1891
	spkr 3	363	1979
	spkr 4	367	1844
	SBS	690	1996
'sell'	spkr 1	522	1383
	spkr 2	514	1322
	spkr 3	594	1351
	spkr 4	601	1201
	SBS	707	1735
'pat'	spkr 1	541	1960
	spkr 2	598	1721
	spkr 3	554	1809
	spkr 4	600	1565
	SBS	784	1615
'Sal'	spkr 1	663	1026
	spkr 2	564	1194
	spkr 3	602	1534
	spkr 4	581	1303
	SBS	783	1501
'putt'	spkr 1	568	1605
	spkr 2	571	1430
	spkr 3	581	1598
	spkr 4	614	1319
	SBS	795	1230
'put'	spkr 1	466	1240
	spkr 2	444	1414
	spkr 3	369	1576
	spkr 4	396	1236
	SBS	454	988
'pull'	SBS	486	695

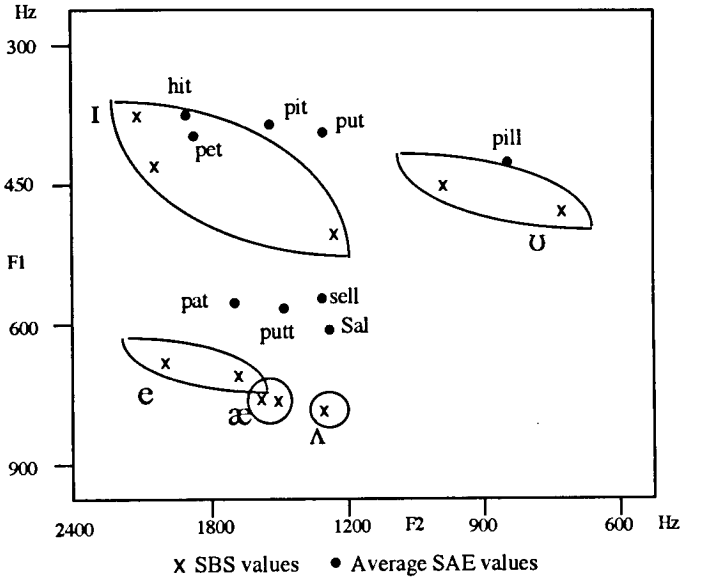

Figure 1. F1-F2 Plot for the SBS and SAE vowels.

ACOUSTIC STUDY

The acoustic study investigated the first two formants of the vowels in the following tokens: (2) 'hit', (3) 'pit', (4) 'pill', (6) 'pet', (7) 'sell', (9) 'pat', (8) 'Sal', (11) 'putt', (12) 'put', and for comparison the token 'pull' from the SBS speaker only.

The tokens were analysed on the Kay CSL™ 4300, software version 4.01, using the FFT function. Vowels were measured by placing the cursor on a central part of the vowel, avoiding formant transitions. In Table 5, the formant values for F1-F2 are given for the four SAE speakers, and for one SBS speaker (the second author), recorded reading the same list of words in the same conditions as the SAE speakers. Values from previous studies of SBS vowels [3] were similar to those reported here.

Figure 1 shows the average F1-F2 values for all four SAE speakers, compared to the SBS speaker. This clearly shows the reasons for some of the identifications, but suggests that other may well have been an artefact of the foils presented. It also suggests that switching from one identification to another may require further acoustic movement with some vowels as compared to others, as the difference between 'pit' and 'putt' demonstrates.

The figure also shows a general centralization of many vowels, not solely those with following dark-l. Nevertheless, the considerable raising of /æ/ and /e/ in 'pat' and 'pet' is clearly demonstrated, together with a centralization of /ɪ/ in 'pit'. The /ʌ/ in 'putt' fronts and raises only slightly, which may account for the ambiguous response to this vowel from the listeners. The other allophone of /ɪ/, that does not undergo centralization ('hit') is raised compared to SBS.

The authors hope to explore this whole topic more fully in further work, including the full set of monophthongs and diphthongs in SAE.

REFERENCES

[1] Wells, J. (1982), *Accents of English 3: Beyond the British Isles*, Cambridge: CUP.

[2] Gimson, A. (1989), *An Introduction to the Pronunciation of English*, 4th ed., London: Edward Arnold.

[3] Fry, D. (1979), *The Physics of Speech*, Cambridge: CUP.