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ON A SOUTH AFRICAN ENGLISH VOWEL SYSTEM

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1 Introduction

In practice, phonetic analyses are very often characterized by two features which could, potentially, limit their validity. The first of these features relates to the data used. Two aspects of this feature can be mentioned. First, linguists tend to describe speech sounds as they appear in words seen in isolation of their context. Labov (1971a, 1971b, 1972, 1975) and Labov, Yaeger and Steiner (1972:ch. 2, henceforth LYS) have clearly shown that, due to the large degree of self-monitoring present in situations like these, such data are easily slanted in the direction of the assumed prestige norms of pronunciation in the community and thus represent the (ultra-) formal standard rather than the knowledge underlying the vernacular of the community which is, presumably, what the linguist wants to investigate. What one needs, therefore, is data from free and spontaneous speech. The second aspect, which is closely related to the first, is the practice of linguists to rely (almost) solely on introspective data. In attempting to describe the vowel segments of a language, linguists often resort to articulating what *they* intuitively judge the vowel to be, and then set about describing its supposed features. As Labov has pointed out quite convincingly, some of the problems attending the use of such techniques are that the resulting data may be artefacts of the linguist's theoretical position, that the linguist's intuitions commonly reflect the prestige norms of the community, and that differences regarding the data may be difficult to resolve. So here too, what one needs is data from actual language use.

The second of the two limiting features in practical phonetic analyses is the (almost) exclusive use of impressionistic techniques. Though it is true, as Labov (in press:211) points out, that "(i)mpressionistic phonetic transcription continues to be the simplest, fastest and most flexible technique [for the measurement of vowels --- VNW]", such analyses are often conditioned by the expectations --- based on earlier phonetic de-

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scriptions --- of (especially semitrained) phoneticians. It is advisable, therefore, that attempts be made to obtain more objective and more reliable analyses, albeit only for purposes of control. Such analyses are provided by instrumental measurements.

Phonetic analyses and descriptions of South African English (henceforth SAE) vowels, as in (Lanham 1967 and 1978) and (Branford 1980) are generally impressionistic. These descriptions are, certainly, very useful, and accurate enough for the purposes they serve. However, as indicated above, it could serve a useful purpose to compare such descriptions with instrumental measurements of SAE vowels obtained from spontaneous speech. This is what the investigation reported on in this article, set out to do.[1)]

2 Data and the analytical procedure

In accordance with the principles mentioned above, and with the methods described in (LYS:ch. 2), the data used in the investigation were obtained from a tape recording of a conversational interview, lasting more than an hour, which a fellow visiting scholar, Hans Dua from the Central Institute of Indian Languages in Mysore, India had with the author. The speech style used during the interview was reasonably spontaneous. Several factors contributed to this: the interviewer and the author knew each other well and were both at home in an interview situation, and the interview took place in a location with which they were both fully acquainted. An open spool Nagra IV tape recorder with a Lavaliere microphone was used in a soundproof room, so that the quality of the recording was good.[2)] The method used for obtaining data will be described below.

The apparatus used for the instrumental analysis of the data forms part of the unique facilities available in Labov's linguistics laboratory. The vowel analysis facilities form an integrated system comprising

i. a sophisticated Tandberg 9000 tape recorder, connected to
ii. a PK box (named after its designer, Paul Kelley) which controls (via filters) the input to
iii. the RTA (i.e. the real time analyzer) which analyzes the input signals in terms of their frequencies and transmits these analyses via a special display control box to

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iv. the spectral display screen from which the investigator selects the spectra he wants to study, after which the selected spectra are sent for analysis and storage to

v. a PDP 11/10 mini-computer which is equipped with special vowel analysis programmes, such as the system for linear predictive coding (LPC) which measures formant values.

The procedure followed for the analysis was roughly as follows. First the vowel classes to be studied were determined. The 20 classes studied are presented below, in Tables 1, 2, and 3. Then, specific vowels were selected for measurement --- generally about 10 tokens per class. The selection of these tokens was done following the methods of LYS (p. 25), i.e. all fully stressed vowels (but none from weakly stressed words or function words) were chosen until about 10 tokens per class, or more in the case of vowels known to be interesting, had been obtained. 249 tokens were measured. Extra-heavy stress was marked. These vowels were then sent to the RTA which provided a display of the input signal in terms of spectra.

In the case of a satisfactory display, a set of spectra was selected which was then stored in a spectra file in the computer, along with all additional information deemed relevant. Relevant information included the vowel classification (for example, /ɪ/ is class 1), the duration of the token (in number of resonant spectra), the degree of stress on the token (tertiary to double stress), the speech style from which the token was drawn, the word in which the vowel appeared, the phonotactic, syllabic and morphological structure of the word concerned, and the counter number on the tape recorder at which the vowel token could be located. The information on the vowel's spectra was stored in terms of F1, F2, F3 (if available) and F Ø.[3)]

Print-outs of the information stored on each vowel were then obtained, and a spectrum for each vowel nucleus --- and one for the glides in the case of diphthongs, or a whole set in case a syllable was to be studied --- was selected. These were then stored in formant files. The selection of spectra was done in accordance with a specific set of criteria developed in the course of extensive vowel research by LYS (p. 29). The main consideration that played a role in the selection was the point of

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inflection, since the human ear is apparently especially sensitive to changes in direction. In the case of a steady state vowel the middle spectrum was selected. Care was taken not to select spectra at the beginning of the vowel because of the influence of prevocalic segments.

Lists of all the vowels were then available and could be printed along with their mean F1, F2 and F3 values and the standard deviation for each class. In addition, the computer could chart the stored vowel nuclei in a form which correlates with the conventional vowel chart used in articulatory phonetics. See Figure 1.

The formant values (F1, F2, sometimes F3 and FØ), along with other information obtained for each of the tokens --- see §3ff. --- were then analyzed. Vowel classes were sub-categorized (into allophones) with reference to (a) patterns in the formant values of the tokens in a class, and (b) the phonotactic distribution of the vowel. For example: /æ/ was classified into three sub-classes: $/æ/^1$ (mean F2 = 1066 Hz, followed by /l/), $/æ/^2$ (mean F2 = 1792 Hz, followed by a nasal) and $/æ/^3$ (mean F2 = 1497 Hz, elsewhere).

The rest of this report deals with the monophthongs and diphthongs in the vowel system studied. The aspects to be considered are

- i. the phonetic vowel chart of the system;
- ii. the allophones of some interesting vowels;
- iii. the state of the glides of some of the diphthongs; and
- iv. evidence of vowel shifting.

As a preface to the discussion, a computer print-out of 218 of the vowels studied is provided (Figure 1).[4)] The following points should be noted about this chart.

- i. The vowels are plotted in terms of their F1- and F2-values. Thus, the vowel symbolized as I has the values F1 = 477 hertz, F2 = 2688 hertz and is the [iy] of teams.
- ii. The F1-values are given from left to right and the F2-values from top to bottom.

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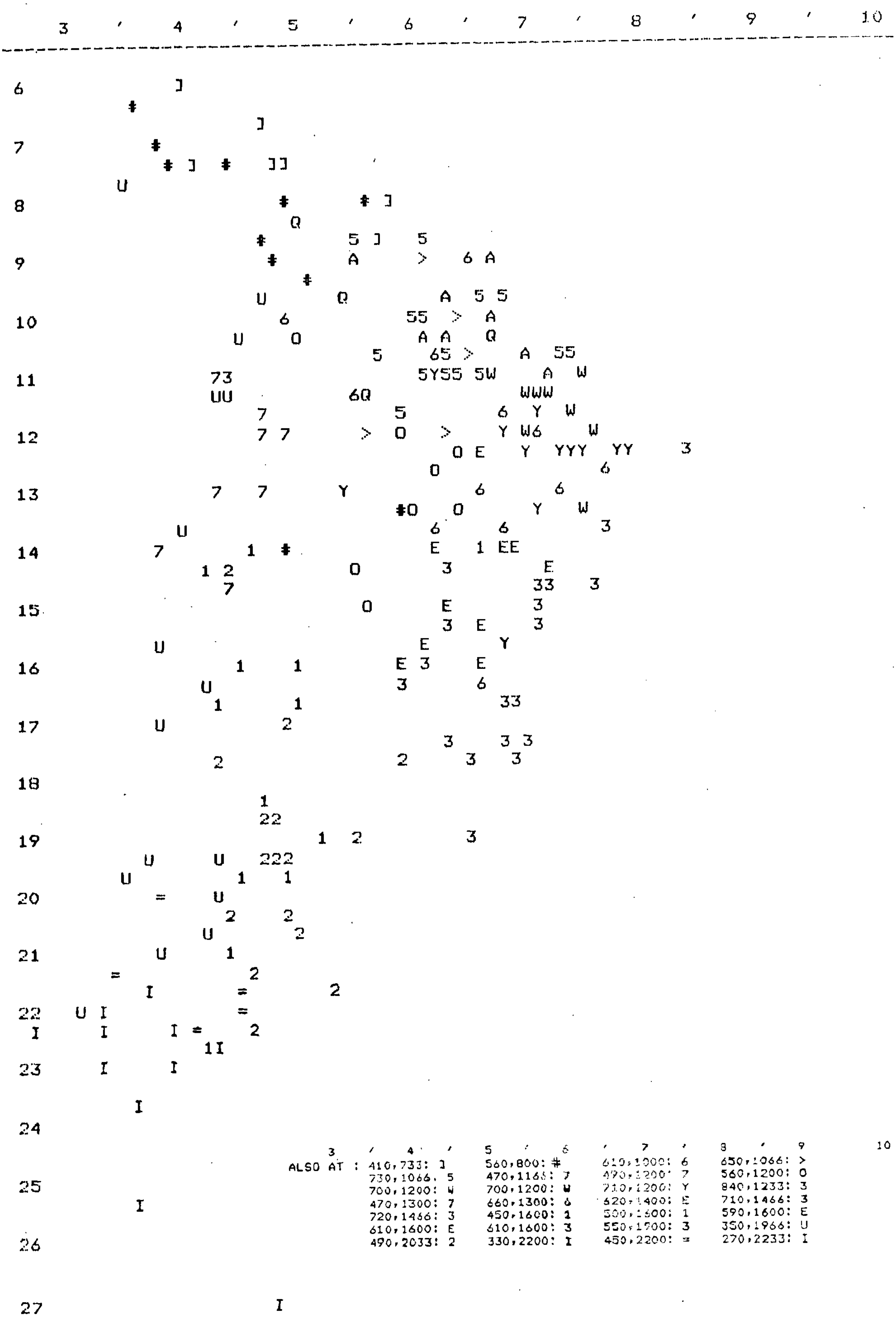

FIGURE 1

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iii. If Figure 1 is turned on its side so that the F1-values are on the righthand side and the F2-values at the top, the chart represents phonological space, and thus the traditional vowel chart. For example, the "high" front vowel [iy] (high F2-value, low F1-value) is then in the top lefthand corner and the "low" back vowel [ɒ] (represented by a 5) roughly in the bottom righthand corner of the chart.

iv. The F-values are given in kilohertz, thus "20" means 2000 Hz.

v. Occasionally two or more vowels have the same F-values. In these cases the overlapping vowels are given in a separate list. The list for Figure 1 appears in the bottom righthand corner of the chart.

vi. Each vowel class (and sometimes its allophones) is represented by a (numerical, alphabetical or other) symbol. The meanings of the symbols are given in (1) below.

(1)

1	-	ɪ	I	-	iy	U	-	uw
2	-	e	E	-	ey	=	-	ɨw
3	-	æ	Y	-	ay	#	-	ɔ
5	-	ɒ	Q	-	oy	A	-	ɑr
6	-	ʌ	W	-	aw	]	-	ɔr
7	-	ʊ	0	-	ow	>	-	ɑ

The most striking feature of this chart is the degree of variability: The vowel /e/, for example, varies from F1 = 444, F2 = 1433 (said) to F1 = 456, F2 = 2236 (head). Some of this variability is purely inherent, while the rest is distributionally predictable.

3 The lax vowels of SAE

The expected monophthongs are shown in (2).[5]

(2)

/ɪ/		/ʊ/
/e/	/ə/	/ʌ/
/æ/		/ɒ/

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The formant values of the relevant versions of these vowels are as follows.[6)]

TABLE 1:

		F1	F2	F3	AMP	FØ	DUR	WORD
/ɪ/	1.	492	906	0	1	121	8	UN(TIL)
		448	983	0	1	118	8	WILL
		N = 2	M(F1) = 470 SD = 22		M(F2) = 944 SD = 39		M(F3) = 0 SD = 0	
	2.	492	1953	2905	1	165	8	IF
		446	1961	0	2	94	3	IT
		421	2259	0	1	201	3	KICK
		523	1910	0	1	183	4	THINK
		437	2090	0	2	109	4	KIDS
		469	1823	2504	1	144	7	KID
		N = 6	M(F1) = 464 SD = 35		M(F2) = 1999 SD = 140		M(F3) = 2704 SD = 200	
	3.	664	1403	0	2	109	5	DID
		431	1661	2651	1	122	4	DID
		449	1615	0	1	214	6	SISTER
		496	1590	2669	11	251	5	THIS
		496	1596	2665	11	107	4	THIS
		461	1414	2671	2	119	5	THIS
		453	1584	2080	1	114	9	GIVE
		417	1428	2563	2	97	7	IS
		500	1666	2517	1	148	7	DID
		N = 9	M(F1) = 485 SD = 69		M(F2) = 1550 SD = 100		M(F3) = 2545 SD = 198	
/e/	1.	444	1433	0	1	109	9	SAID
		N = 1	M(F1) = 444 SD = 0		M(F2) = 1433 SD = 0		M(F3) = 0 SD = 0	
	2.	560	1115	2543	1	110	10	SELV-ES
		604	1008	2540	1	98	10	WELL
		N = 2	M(F1) = 582 SD = 22		M(F2) = 1061 SD = 54		M(F3) = 2541 SD = 1	

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TABLE 1 (cont.):

3.	498	2056	2673	1	101	5	THEN
	457	2119	0	2	107	8	YES
	476	1860	0	1	114	13	YES
	470	1851	0	1	108	6	LEGS
	456	2236	0	1	106	5	HEAD
	590	1781	0	1	153	7	FRIEND
	545	1908	2455	1	65	4	MET
	486	1940	0	1	128	4	WENT
	493	2049	2578	1	128	5	MET
	525	2165	2909	1	78	10	FRIEND-S
	434	1776	0	1	95	5	VE# RY
	484	1947	2478	1	141	4	STEA# DY
	485	1699	0	2	112	4	MET
	485	2039	2477	1	115	7	(A)GAIN
	435	2020	2546	1	109	6	DEATH
	466	1943	2449	1	112	7	BEND
	N = 16	M(F1) = 486		M(F2) = 1961		M(F3) = 2570	
		SD = 39		SD = 144		SD = 146	
/æ/ 1	629	1066	0	1	144	20	(NA)TAL
	N = 1	M(F1) = 629		M(F2) = 1066		M(F3) = 0	
		SD = 0		SD = 0		SD = 0	
/æ/ 2	695	1745	2951	11	158	17	MAN
	626	1731	0	1	143	8	STAND-ING
	689	1761	2771	1	102	13	AND
	554	1889	0	1	111	6	(BE)GAN
	650	1884	0	1	122	8	HAN-DLED
	683	1744	0	1	96	8	AND
	N = 6	M(F1) = 649		M(F2) = 1792		M(F3) = 2861	
		SD = 49		SD = 67		SD = 90	
/æ/ 3	686	1666	0	1	91	6	MATCH
	610	1604	2588	1	107	9	THAT
	651	1753	2570	1	109	10	BAD
	593	1637	0	1	107	9	HAD
	681	1653	2382	1	102	9	GRA# DUALLY
	835	1229	0	1	101	12	THAT
	N = 6	M(F1) = 666		M(F2) = 1592		M(F3) = 2532	
		SD = 76		SD = 155		SD = 87	

[Without the rather exceptional 6th token, <u>that</u>[2], the statistics are:

N = 6	M(F1) = 644	M(F2) = 1662	M(F3) = 2532
	SD = 37	SD = 50	SD = 87]

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TABLE 1 (cont.):

/æ/[4]

715	1476	2395	1	191	6	FACT
626	1543	2494	1	103	7	BACKS
771	1366	2347	1	169	4	CAR# RY
713	1547	2235	1	145	5	(AT)TACK-ED
706	1488	0	1	102	3	HAP# PEN
758	1455	2436	1	139	9	GRAB-BED
715	1476	2395	1	194	6	FACT
626	1421	0	1	134	8	(EX)ACT# LY
436	1085	2359	1	119	19	CAP# ITAL
712	1470	2156	1	131	6	BACK
706	1477	2184	1	135	6	BACK

N = 11 M(F1) = 680 M(F2) = 1437 M(F3) = 2333
SD = 88 SD = 121 SD = 110

[Without the rather deviant 9th token, capital, the statistics are:

N = 10 M(F1) = 704 M(F2) = 1471 M(F3) = 2330
SD = 45 SD = 50 SD = 116]

/ɒ/

627	1079	2639	1	106	5	BO# DY
638	1112	2442	1	134	6	GOT
548	882	2742	1	105	13	(IN)VOLV-ED
596	987	2446	1	66	4	STOP-PED
663	1110	2309	11	210	7	CROSS-SED
610	1011	2487	1	136	4	STOP
631	1090	2680	1	195	5	STOCK# Y
593	1156	0	1	127	4	STOP-PED
661	976	0	1	118	7	BLOCK
735	1066	0	1	169	6	POCK# ET
676	964	0	1	119	7	STRONG
572	1064	2255	1	115	5	CROSS
614	856	3087	1	117	5	DROP-PED
605	1090	2621	1	101	4	DOC# TOR
732	1072	0	1	164	8	ON

N = 15 M(F1) = 633 M(F2) = 1034 M(F3) = 2570
SD = 51 SD = 83 SD = 229

/ʌ/

1.

656	1620	0	1	177	5	YOUNG

N = 1 M(F1) = 656 M(F2) = 1620 M(F3) = 0
SD = 0 SD = 0 SD = 0

2.

653	903	0	1	127	8	ONE
615	1077	2016	1	129	5	ONE

N = 2 M(F1) = 634 M(F2) = 990 M(F3) = 2016
SD = 19 SD = 87 SD = 0

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TABLE 1 (cont.):

3.	617	1356	2242	1	117	6	RUG# BY
	545	1129	1920	1	151	6	SCRUM
	730	1303	0	1	116	4	FUNC# TION
	657	1304	2875	1	116	4	MON# EY
	680	1180	2346	1	133	8	RUN
	658	1286	0	1	200	7	TOUGH
	684	1373	2427	1	95	7	US
	769	1251	0	1	145	6	SOME
	613	1013	1283	1	113	5	MO# THER
	707	1192	0	1	113	4	SON
	486	992	2716	1	147	5	SOME
	N = 11	M(F1) =	649	M(F2) =	1216	M(F3) =	2258
		SD =	78	SD =	123	SD =	492
/ʊ/	375	1385	0	2	135	6	SHOULD
	434	1305	2067	2	116	3	FOOT
	490	1189	2469	11	182	3	LOOK
	472	1292	0	1	151	3	TOOK
	486	1185	0	11	269	3	TOOK
	426	1093	0	1	173	6	HOOD
	444	1482	0	1	236	3	TOOK
	471	1179	0	1	165	3	PUSH-ED
	472	1191	0	1	153	3	TOOK
	N = 9	M(F1) =	454	M(F2) =	1259	M(F3) =	2268
		SD =	33	SD =	109	SD =	201

The positions of these vowel classes, plotted by their mean formant values (with the shape of the ellipses indicating the distribution of the vowel(s)) are given in Figure 2. The individual words included in the chart represent sub-categories of the vowel classes, i.e. allophones.

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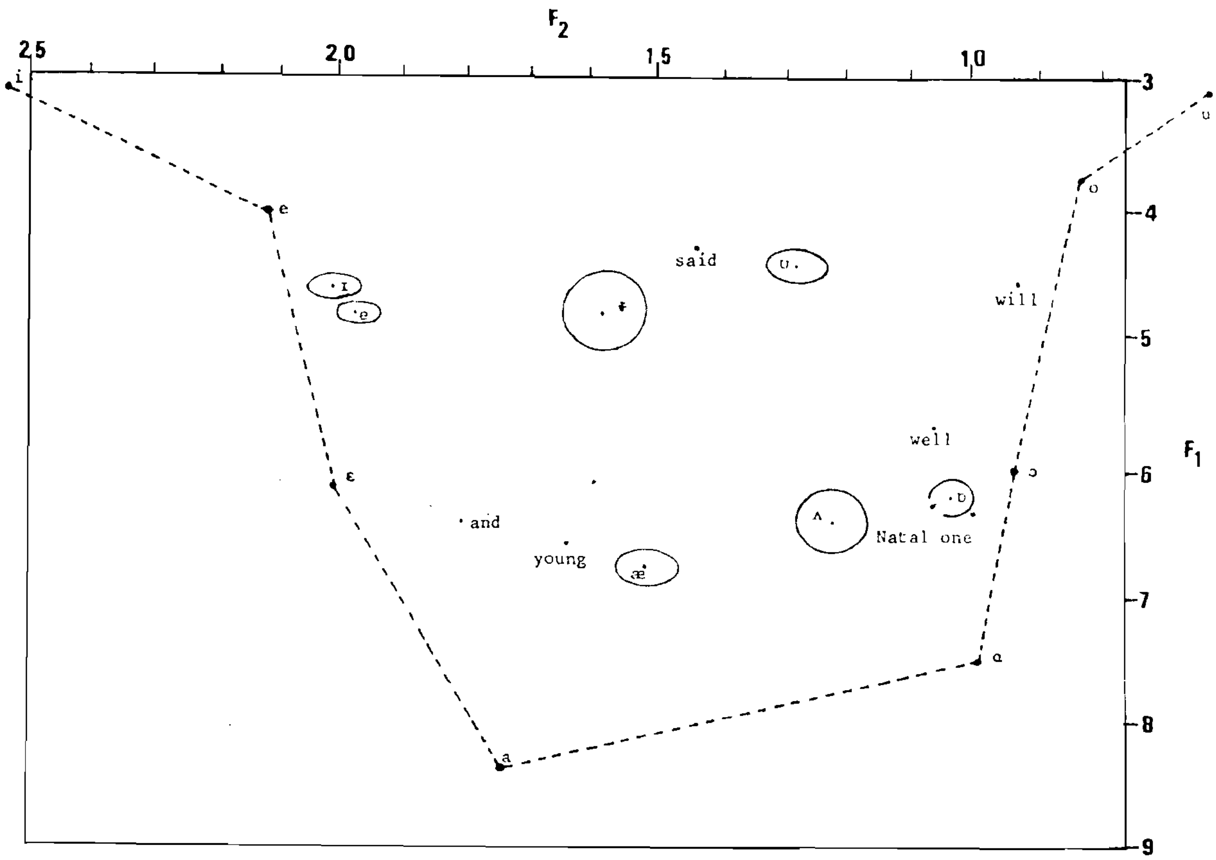

FIGURE 2: Lax SAE vowels in kilohertz. The dashed lines indicate the vowel positions of the cardinal vowels of Daniel Jones as per (Ladefoged 1967:88-89).[7]

The information provided in Table 1 allows us to make the following observations.

i. The /ɪ/ has at least two allophones: the retracted [ɪ̠] before word-final or dark /l/ and the /ɪ/ elsewhere. However, this latter sub-class poses some problems, since it may be divided into two further sub-classes: a central [ɨ] with a mean F2 of 1550 Hz, and a front [ɪ] with a mean F2 of 1999 Hz. Since this sub-categorization does not seem to be supported by clear phonotactic differences --- except that the front [ɪ] seems to be dominated by voiced fricatives and /s/, and the central [ɨ] by velars --- no decision can be made. More data are obviously required.

ii. With the exception of the rather deviant central said, /e/ seems to sub-categorize quite clearly into two allophones, viz. the sharply retracted [e] before dark /l/ and the [e] elsewhere.

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iii. /æ/ has 4 allophones, viz. a sharply retracted [æ] before dark /l/, a tensed [æ] before nasals, a slightly raised [æ] before $\begin{bmatrix}-\text{son}\\+\text{cor}\end{bmatrix}$, and the [æ] elsewhere.

iv. /ʌ/ has 2 allophones, viz. a retracted [ʌ] before nasals, and the [ʌ] elsewhere. The /ʌ/ in young is due to the preceding front glide.

v. No sub-classes seem distinguishable in the case of the remaining two vowels.

Looking at the chart (Figure 2) a number of striking features may be observed, the first of which is the relatively over-populated back area, especially if the diphthongs are also considered. Taking into account the restrictedness of the back space in the mouth, as well as the pressure to maintain functional oppositions in order to maximize communication and preserve the distinction between words --- see (Martinet 1952) --- it seems obvious that something must give among the back vowels. Vowel shifts and/or diphthongization seem inevitable.

The second striking feature of the chart in Figure 2 concerns the lowering of /ɪ/ (or raising of /e/). /ɪ/ and /e/ only differ 22 Hz for F1 (i.e. in height) and 38 Hz for F2 (i.e. horizontally). The "margin of error" thus seems to be very small. Figure 1 shows that these two phonemes (symbols 1 and 2) overlap quite considerably, with /e/ often further forward and even higher than /ɪ/. /ɪ/ and /e/ thus seem candidates for merging.

The third feature of interest in the chart is the occurrence of tensing before __N. LYS present a detailed discussion of vowel tensing and raising. Two aspects of their discussion are relevant to this report. Firstly, tensity is an abstract feature which functions in phonological rules at a reasonably high level of abstraction, e.g. to tense underlying lax /æ/ as in bad --- see (LYS:158). At a lower, more concrete level, it is (acoustically) realized by the feature peripherality. Peripherality refers to extreme position on the two-formant plot, i.e. peripheral vowels "approach the outer perimeter of phonological space" (LYS:106) and acoustically thus have low F1-values, and very high or very low F2-values

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compared to related vowels. However, LYS do not propose to "identify tenseness with peripherality, since there are obviously central vowels which are long and steady state monophthongs, with all (the) other properties of tenseness" (LYS:106).

Secondly, LYS differentiate the tensing and raising rules. According to them (p. 70) "Earlier treatments of the raising of short a have shown a single rule, converting [æ] into [ε:ə] , etc. This is certainly a simpler way of handling the situation, and would be preferable if there were not good reasons to differentiate the tensing and raising rules". LYS first apply tensing, then peripheral movement, then raising. They also distinguish various phonetic environments which differentially condition tensing in New York City English, viz. (hierarchically ordered) front nasals, voiceless fricatives and voiced stops.

The data on [æ] presented here support the latter findings. [æN] is tensed (undergoes peripheral movement) as compared to its related subcategories: began (F2 = 1889), and (F2 = 1761) and man (F2 = 1745) vs. match (F2 = 1666) vs. grabbed (F2 = 1455). The highish bad (F2 = 1753) and had (F2 = 1637) must obviously be explained.

4 The non-lax (or tense) SAE vowels

Lanham (1967:3-4) distinguishes the following long vowels in (conservative) SAE.

(3)	/iy/ - seek		/uw/ - boot
		/ɜ/ - turn	/ɔ/ - caught
			/ɑ/ - cart

The formant values of the versions of these vowels presented here are as follows.

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TABLE 2:

		F1	F2	F3	AMP	FØ	DUR	WORD
/iy/		327	2242	0	2	122	7	THREE
		355	2350	0	1	127	4	FIELD
		387	2235	2860	1	72	8	THREE
		328	2313	0	1	147	4	TEACH-ER
		477	2688	0	1	110	10	TEAMS
		388	2295	2977	11	105	20	WE
		357	2521	0	2	103	4	PEO# PLE
		374	2182	0	2	79	5	BEEN
		327	2212	0	1	127	5	TEACH
		273	2239	0	1	143	11	DEE
		432	2281	0	1	111	5	SEEK
		327	2212	0	1	127	5	TEACH
		N = 1	M(F1) = 355		M(F2) = 2308		M(F3) = 2918	
			SD = 55		SD = 138		SD = 59	
/ɜ/	1.	467	1516	2249	1	132	4	JERKING
		536	1632	0	2	101	8	HER
		510	1456	2626	11	237	10	FIRST
		464	1702	2350	1	87	6	CHURCH
		509	1604	2382	1	169	4	(AT)TORNEY
		N = 5	M(F1) = 497		M(F2) = 1582		M(F3) = 2401	
			SD = 28		SD = 87		SD = 138	
	2.	484	1315	2177	1	106	9	WERE
		434	1253	2285	2	107	5	GIRL
		579	1193	0	11	194	9	GIRL
		469	1410	2072	1	109	7	WORK-S
		472	1236	2031	1	184	8	WORK-ED
		N = 5	M(F1) = 488		M(F2) = 1281		M(F3) = 2141	
			SD = 49		SD = 75		SD = 99	
/ɑ/	1.	697	1078	0	1	117	9	(RE)GARD
		628	952	2776	1	130	8	MARK-EDLY
		672	906	0	1	123	12	MAR-BLES
		718	1089	0	1	115	13	HARD
		629	1018	2764	1	150	7	START-ED
		545	899	2479	1	110	7	PAR-TIES
		610	1024	0	1	116	15	CHARGE
		672	1014	0	1	96	5	CAR
		N = 8	M(F1) = 646		M(F2) = 997		M(F3) = 2673	
			SD = 52		SD = 67		SD = 137	
	2.	635	994	2741	1	136	6	PASS
		561	1195	0	1	106	8	WHAT
		648	1065	0	1	117	8	(AFRI)KAANS
		612	887	2575	1	107	12	ASK-ED
		631	1189	2251	1	160	11	AF# TER
		648	1065	0	1	117	8	(AFRI)KAANS
		N = 6	M(F1) = 622		M(F2) = 1065		M(F3) = 2522	
			SD = 30		SD = 107		SD = 203	

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TABLE 2 (cont.):

/ɔ/	1.	465	674	0	1	114	10	FORM-ED
		571	864	0	1	113	6	FOURTH
		578	811	0	1	176	16	(BE)FORE
		481	747	3149	1	104	11	YOUR
		395	585	2544	1	91	7	BORN
		488	726	3031	1	168	9	MOR-NING
		407	733	2555	1	197	5	SHORT

N = 7 M(F1) = 483 M(F2) = 734 M(F3) = 2819
SD = 66 SD = 84 SD = 273

	2.	562	801	0	1	144	13	SAW
		486	1389	2584	11	105	16	BROAD-ER
		587	1329	2504	1	78	9	DAU#GHTER
		356	629	2546	1	114	9	WALK-ED
		485	802	2657	1	198	12	TALL
		507	937	2607	1	155	4	THOUGHT
		474	860	2380	1	136	5	THOUGHT
		562	801	0	1	144	13	SAW
		435	735	2875	1	134	9	ALL
		386	717	2552	1	122	10	LAW
		379	699	2551	1	114	6	BOUGHT
		480	913	0	1	112	8	TAUGHT

N = 12 M(F1) = 474 M(F2) = 884 M(F3) = 2584
SD = 72 SD = 229 SD = 126

/uw/	1.	445	1039	0	1	128	11	SCHOOLS
		347	758	2555	1	97	10	SCHOOL
		469	975	0	1	114	8	SCHOOL

N = 3 M(F1) = 420 M(F2) = 924 M(F3) = 2555
SD = 53 SD = 120 SD = 0

	2.	398	1372	2161	1	131	5	LU=THER
		375	1581	0	1	214	7	TRUE
		438	1129	0	1	93	13	ROOM
		420	1633	0	2	197	5	TRUE
		433	1129	1602	1	105	19	MOVE-D

N = 5 M(F1) = 413 M(F2) = 1369 M(F3) = 1881
SD = 23 SD = 214 SD = 279

	3.	433	1988	0	1	190	5	SHOOT
		374	1917	0	1	131	8	TWO
		417	2051	0	2	59	5	DO
		425	1933	2156	1	246	5	TWO
		384	2085	0	1	130	5	DO
		349	1976	0	1	113	16	DO
		310	2194	0	1	122	5	JU# DO
		384	1704	2121	1	132	23	ZU# LU

N = 8 M(F1) = 384 M(F2) = 1981 M(F3) = 2138
SD = 39 SD = 134 SD = 17

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The information presented in Table 2 gives rise to a number of interesting observations. Firstly, whereas there seems to be no reason to distinguish more than one variant of /iy/, each of the other listed vowels has two or more allophones.

i. /ɜ/ is fronted after a segment which is either [+cor] or [+ant] .

ii. There seems to be a slight but possibly significant difference between /ɑ/ immediately followed by orthographic r, and /ɑ/ elsewhere. The evidence is, admittedly, slender, but it does bear looking into. If the distinction is found to hold, it will provide additional evidence for underlying /r/ in SAE.

iii. Similar grounds, and equally weak, exist for a distinction between [ɔr] and [ɔ] . The high SD for the F2 of /ɔ/[2] , viz. 229, further weakens the suggested analysis.

iv. The pattern in the variability of /uw/ is much clearer: three rather distinct targets exist in three rather distinct environments. First of all there is the retracted (and slightly lowered) [uw→↓] before a following /__l/, then there is the central [uw] following the liquids /m/ and /r/, and finally there is the sharply fronted [uw←] in the other positions.

Secondly, whereas both Lanham (1967:3) and Branford (1980:393) regard the /iy/ as a long vowel (thus not a diphthong, although Branford (pp. 393 and 398) adds that the /i:/ may involve a minor glide), it is, in the vowel system presented here, a diphthong. Of the twelve tokens in the data eight undergo forward movement, that is they glide forward, by an average of 200 Hz. In three of these cases the glide is also slightly higher than the vowel nucleus. The remaining four tokens remain stable with respect to both formant values.

The same is true, although to a lesser extent, of /uw/ . In this case, of course, the glide is backward. A clear majority of tokens have a glide target which is, on average, 314 Hz lower, i.e. "further back". Unfortunately, the number of spectra stored in the computer during the measurement stage is too small in many of these cases to allow confident observations. More data are therefore required before reliable deductions can be made.

A third feature of the vowel system presented here is that there is a considerable overlap between the long vowel /ɑ/ (pass, Afrikaans) and /ɒ/ (body, stopped, block). Their relative mean values are 622/1065 and

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633/1034. However, the greater length of /ɑ/ probably compensates for what Labov (in press:249) calls the "dimunition of the margin of security" between these two phonemes.

5 The glides of SAE

Lanham (1967:4) distinguishes the following diphthongs.

(4)	Fronting	Centralizing	Retracting
	–	/ɪə/ - clear; /uə/ - cruel	–
	/ey/ - day; /oy/ - boy	/eə/ - square	/ow/ - rope
	/ay/ - buy	–	/aw/ - out

The following diphthongs (two of which have already been discussed) should have been added.

(5) /iy/ - see   /iw/ - new; /uw/ - school

/oə/ - poor, sure

The formant values of the nuclei of these vowels as presented here are as follows.

TABLE 3:

		F1	F2	F3	AMP	FØ	DUR	WORD
/ey/	1.	663	1538	2355	1	123	7	PLAYED
		664	1610	0	1	117	11	GAME
		605	1608	2321	1	114	9	CASE
		593	1599	0	1	107	11	NAME
		610	1582	2506	1	114	10	PLACE
		625	1513	2241	1	125	13	EIGHT
		718	1433	2781	1	124	8	MAINLY
		593	1599	0	1	107	11	NAME

N = 8   M(F1) = 634   M(F2) = 1560   M(F3) = 2355
SD = 41   SD = 58   SD = 96

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TABLE 3 (cont.):

	2.	617	1403	2339	1	124	10	WAY
		679	1399	2465	1	100	15	MAY
		659	1230	2046	1	149	12	PLACES
		690	1401	0	1	133	9	MAJOR
		N = 4	M(F1) = 661		M(F2) = 1358		M(F3) = 2283	
			SD = 28		SD = 74		SD = 175	
/oy/		542	961	0	1	126	9	BOY-S
		666	1022	0	1	112	6	SPOILT
		496	838	0	1	101	11	BOY-S
		561	1130	0	11	275	6	POINT
		N = 4	M(F1) = 566		M(F2) = 987		M(F3) = 0	
			SD = 62		SD = 106		SD = 0	
/ay/	1.	680	1573	0	1	132	10	GUY
		744	1242	0	1	108	14	LIFE
		703	1227	2505	1	109	7	I
		714	1186	0	1	92	11	LIFE
		728	1233	0	1	143	13	I
		708	1179	0	1	158	13	I
		711	1318	0	1	157	9	HIGH
		679	1184	0	1	127	10	FIVE
		775	1240	0	1	133	10	FIVE
		542	1305	0	1	162	12	MY
		789	1227	0	1	137	9	PRI#MARY
		752	1238	2776	1	96	9	LIFE
		N = 12	M(F1) = 710		M(F2) = 1262		M(F3) = 2640	
			SD = 60		SD = 102		SD = 135	
	2.	619	1091	0	1	192	11	RIGHT
		N = 1	M(F1) = 619		M(F2) = 1091		M(F3) = 0	
			SD = 0		SD = 0		SD = 0	
/ɪə/	1.	476	1947	0	1	95	11	CAREER
		443	1809	0	1	108	14	BEERS
		446	1927	2893	1	125	12	BEER
		429	1929	2537	1	122	9	NEAR
		438	2088	0	2	60	6	REALLY
		495	1910	2763	11	191	15	IDEA
		N = 6	M(F1) = 454		M(F2) = 1935		M(F3) = 2731	
			SD = 23		SD = 82		SD = 147	
	2.	447	1786	0	1	111	8	YEAR
		480	1569	2269	1	103	11	YEAR
		445	1707	2362	1	91	9	YEAR-S
		472	1631	0	1	100	10	YEAR-S
		N = 4	M(F1) = 461		M(F2) = 1673		M(F3) = 2315	
			SD = 15		SD = 81		SD = 46	

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TABLE 3 (cont.):

/oə/		470	868	0	1	113	16	SURE
		479	904	2149	1	141	14	SURE

N = 2 M(F1) = 474 M(F2) = 886 M(F3) = 2149
SD = 5 SD = 18 SD = 0

/eə/		524	2011	0	1	113	13	SQUARE
		483	1986	0	1	93	12	SCARE-D
		491	2186	0	1	101	9	(AF)FAIR
		498	1835	0	1	70	8	SQUARE
		540	1845	0	1	130	18	THERE

N = 5 M(F1) = 507 M(F2) = 1972
SD = 21 SD = 128

/ɨ w/		448	2160	2600	1	117	11	KNEW
		454	2193	2760	1	117	7	KNEW
		453	2199	2765	1	73	7	KNEW
		405	2241	0	1	118	18	KNEW
		338	2145	0	1	111	8	FEW
		384	2004	0	1	107	6	VIEW

N = 6 M(F1) = 413 M(F2) = 2157 M(F3) = 2708
SD = 43 SD = 75 SD = 77

/ow/	1.	636	1322	2601	1	184	5	CHOK-ING
		620	1257	2215	1	122	9	COAST
		643	1226	2183	1	137	8	COAST
		561	1200	2325	1	125	9	BOTH
		598	1332	0	1	112	6	(DI)PLO# MA
		556	1510	0	1	107	9	SO
		547	1435	0	1	104	11	HOME
		591	1201	0	1	117	8	POST

N = 8 M(F1) = 594 M(F2) = 1310 M(F3) = 2331
SD = 35 SD = 106 SD = 165

	2.	497	1028	0	1	126	7	WHOL-LY

N = 1 M(F1) = 497 M(F2) = 1028 M(F3) = 0
SD = 0 SD = 0 SD = 0

/aw/		719	1142	2814	1	159	13	OURS
		702	1211	0	1	72	16	(A) ROUND
		695	1205	2556	1	101	8	COW# BOYS
		696	1213	3190	1	151	15	FOUND
		753	1349	0	1	117	11	TOWN
		741	1155	0	1	147	15	NOW
		748	1094	2711	1	108	19	HOW
		711	1139	2541	1	119	6	OUT-SIDE
		674	1086	2352	1	122	16	HOW
		697	1142	0	1	118	20	(A)ROUND
		763	1198	0	1	141	15	NOW

N = 11 M(F1) = 718 M(F2) = 1175 M(F3) = 2694
SD = 28 SD = 69 SD = 265

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Figure 3 indicates the phonetic distribution of the tense vowels and diphthongs of SAE in phonological space.

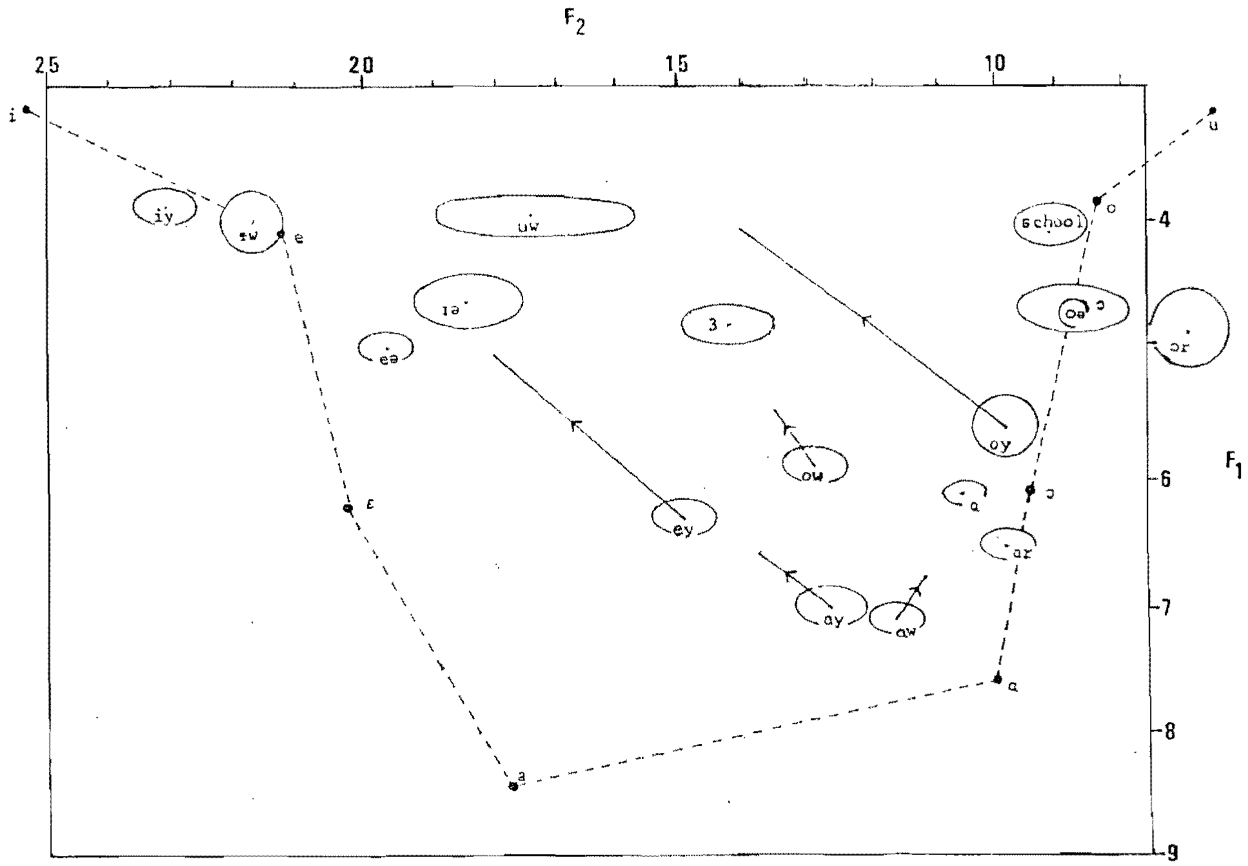

FIGURE 3: SAE vowel nuclei of non-lax vowels and diphthongs in kilohertz. Size and form of the ellipses indicate the approximate spread of the nuclei per vowel class. Arrows indicate glide movement (direction and approximate distance from the vowel nucleus) of selected diphthongs.

A number of interesting observations can be made on the basis of the information contained in Table 3 and Figure 3. Firstly, the formant values of some of the vowels, viz. /oy/, /eə/, /ɨw/, and /ɑw/ , are not distributed in any patterned way and no allophones can therefore be distinguished for them. Allophonic sub-classes can, however, be distinguished in the following cases.

i. /ey/ Though it is difficult to decide instrumentally when the variants of a phoneme group divide into different allophones, the recognition of /ey/^{1} and /ey/^{2} as allophones seems justified on the following grounds.

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(a) The difference in their mean F2 values is quite marked, viz. about 200 Hz.

(b) The lowest F2 of /ey/^{1} is 30 Hz higher than the highest F2 of an /ey/^{2}.

(c) The SD of the two proposed classes is small.

(d) /ey/^{1} and /ey/^{2} have different phonotactic distributions. /ey/^{2} occurs either word or syllable finally.

ii. /ay/ Though the evidence is extremely scant, the [ɑy↑→] of <u>right</u> most probably represents a separate allophone of /ay/. Apart from the difference in vowel length, which is not shown here but which is generally recognized, /ay/^{2} is higher and further back than any token of /ay/^{1}.

iii. /ɪə/ The most interesting fact concerning the /ɪə/ -class is the clear difference between /ɪə/^{1} and the <u>year</u> words. Lanham (1978:154) points out that the pronunciation of <u>year</u> is a shibboleth of Natal English, which is the variety of English acquired by the author. This observation is confirmed by the data. At mean F values of 461/1673, the vowel of <u>year</u> is decidedly a raised, central vowel. In fact, this vowel overlaps quite noticeably with the tokens of /3/^{1} that were measured, e.g. <u>church</u> and <u>first</u>.

iv. /oə/ /oə/ is interesting since the two tokens measured are phonetically [ɔ] . The same is probably true of <u>poor</u> and <u>Moor</u>. The merging between this vowel and /ɔ/^{2} is strikingly shown by the fact that their F values are almost equivalent, viz.

	MF1	MF2
/ɔ/^{2}	474	884
/oə/	474	886

v. /ow/ The division of /ow/ into two sub-classes is once again a manifestation of the strong retracting effect of a following dark /l/.

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Secondly, Figure 3 clearly shows up two further striking properties of the SAE vowel system. The first is the overpopulated back area which, in conjunction with the lax vowels, is sure to lead to vowel shifts and/or tensing and diphthongization. As pointed out above, one of the reasons for these probable shifts is the (unconscious) desire to maintain functional contrasts. The second is the tensity and height already present in the nuclei of /ɑ/ and especially /ɔ/. Although a glide sometimes seems to be present, no clear picture of diphthongization emerges from the data. The positions of the following nuclei are also noteworthy: the tensity of the so-called "central back glide /ɨw/, the centrality of /uw/ and /ow/, the backness of /ay/ and the centrality and lowness of /ey/.

A last aspect of the diphthongs which can be touched on briefly, is the status of the glide components involved. Lanham (1978:151-155) mentions that glide weakening is a feature of SAE dialects. Compare, for instance, the weakening of the /ey/ and /ow/ in General SAE, of the /aw/ and the /ay/ of Cape English, and the /ay/ of Natal English, and the fact that /eə/ is glideless in General SAE. More information is needed in order to comment fully on all these examples. However, it does seem that glidelessness is not generally characteristic of the glides presented here.[8)]

The glide in /ey/ is strongly present, being roughly 133 Hz higher, and 557 Hz in "front" of the vowel nucleus in the environments ___$ and ___# and 253 Hz in "front" in the environment ___[-son]. Relatively speaking there is some weakening before nasals, the glide being only 185 Hz in "front".[9)] Similarly, the glide of /aw/ is quite strongly present, being on average 108 Hz "higher" and 116 Hz further "back" than the nucleus. In the case of the inglide /eə/ there is very little information. The available information, however, points to a strong glide which is 500 Hz more "central" than the nucleus.

However, the data do seem to support Lanham's observations on /ay/ and /ow/ in General SAE. There is no clear pattern in the glide movement of /ay/: the glide's "forward" position varies between 19 Hz and 441 Hz. In the case of /ow/ the glide is sometimes back (by only 86 Hz) but more often "forward" (by 155 Hz).

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6 Vowel movements in SAE

The single most interesting aspect of vowel systems is their patterns of movement, i.e. the raising, lowering, fronting and backing within a single sub-system.[10)] Although phonological processes characteristically occur independently of each other since they are generally phonetically motivated, some vowel movements do seem to be linked. Push chains and pull chains --- see (Martinet 1952) --- are examples of this. It is generally agreed that chain shifts are brought about by phonological considerations such as the need to maintain structural relations, i.e. opposition. As soon as what Labov (in press:249) calls "the margin of security between two phonemes" is threatened, (e.g., because of over-crowding in phonological space) one of the two word classes is pushed away, and push chains result.

LYS report on investigations of the vowel movement in several languages at various stages of their history. They identified three principles of chain shifting: long or tense nuclei rise, short or lax nuclei fall, and back nuclei move forward. The four patterns of shifts distinguished by LYS are presented in Figure 4 below.

The four patterns presented in Figure 4 are discernible in the following cases.

Pattern 1 :	the Great Vowel Shift, a variation of which seems to be occurring in Philadelphia and New York City today.
Pattern 2 :	the English of Buffalo and Detroit.
Pattern 3 :	the English of London and Norwich in the U.K., and Atlanta in the U.S.A.
Pattern 4 :	the English of London and Norwich in the U.K., and the Southern U.S.A.

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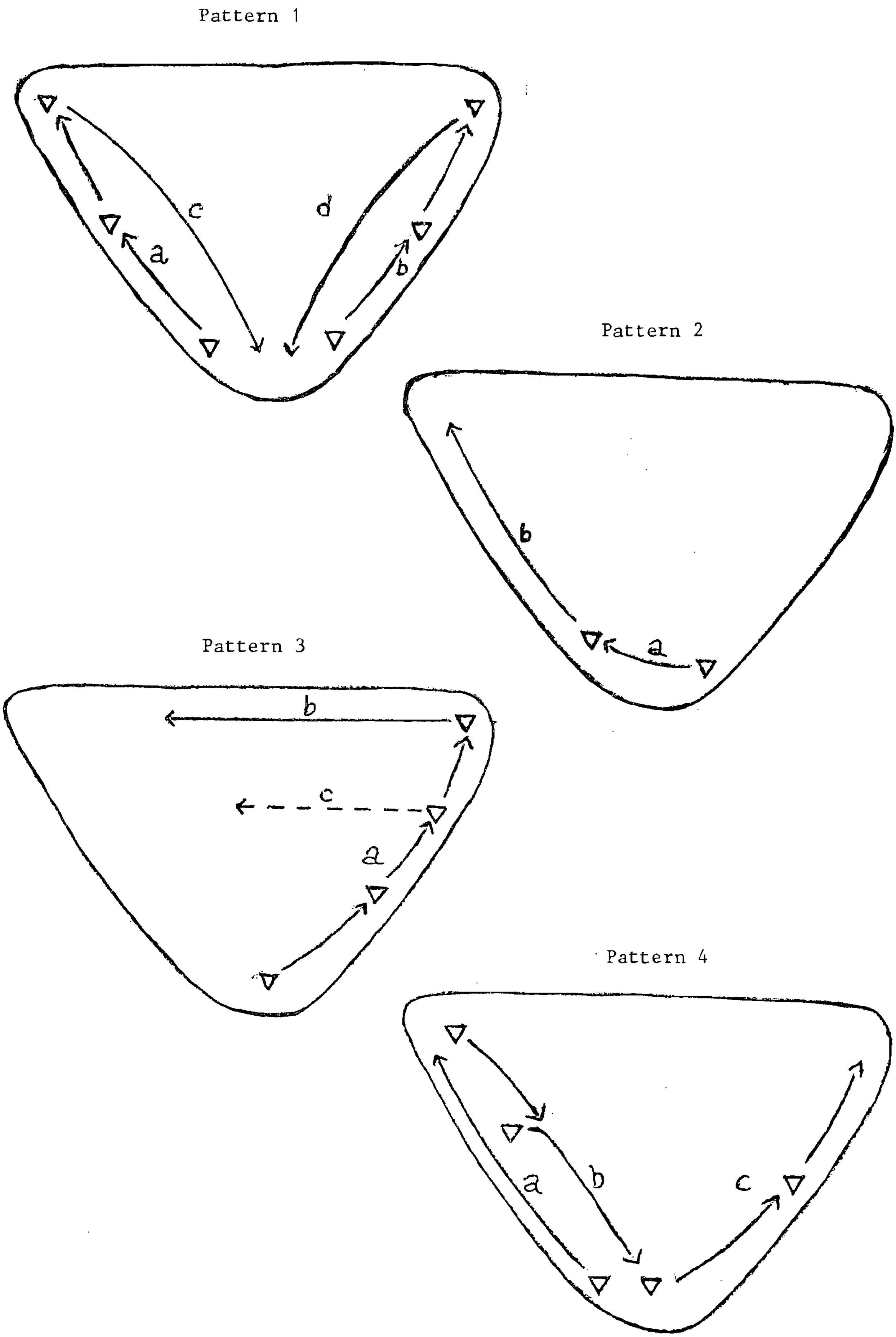

<u>FIGURE 4</u>: [LYS's Figure 4-1] Four patterns of chain shifting.

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Two examples of vowel systems exhibiting pattern 3 tendencies are shown in Figures 5 and 6 below.

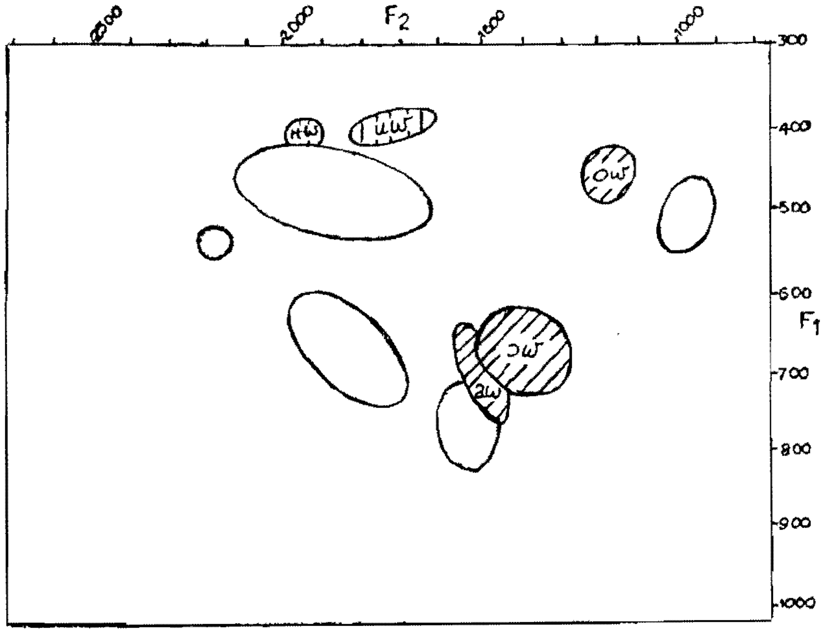

FIGURE 5 [LYS's Figure 4-13c.]: Pattern 3 chain shift in Norwich: Tony Tassie, 16.

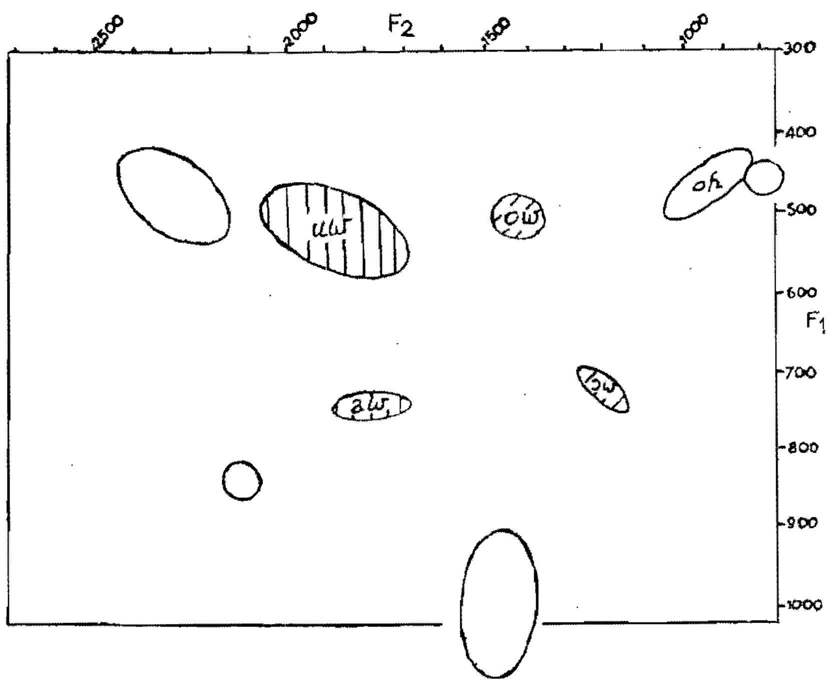

FIGURE 6 [LYS's Figure 4-13d.]: Pattern 3 chain shift in Norwich: David Branson, 14.

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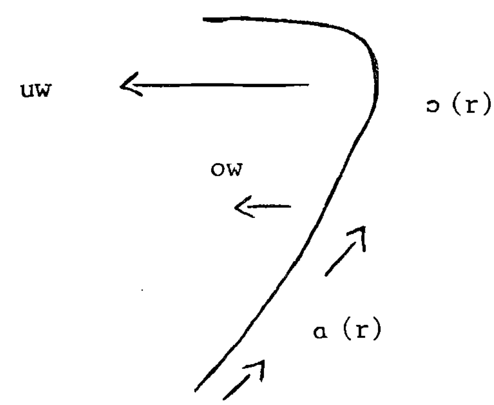
The system presented in this paper clearly shows evidence of vowel movement, as illustrated in (6).

(6)	/uw/	is strongly fronted.		
	/ow/	is beginning to move forward.		
	/ɔ/	and	/ɔr/	have moved up considerably.
	/ɑr/	and	/ɑ/	are also rising.
	/ɑr/	and	/ɔr/,	in addition, are quite tensed.

The vowel system in fact exhibits a pattern 3 shift, as shown in (7).

(7)



The system also contains a pattern 4 feature: /ey/ is lowered quite strongly. However, it does not exhibit the typical positional exchange between /iy/ and /ɪ/ which is quite typical of Southern U.S.A. dialects. The /iy/ is still higher and further forward.

The vowel movements observed in the system are obviously not necessarily evidence of ongoing changes in the SAE vowel system. Any claims to this effect would have to be based on data from several age groups, from different social classes, and from different styles. Rather, these movements probably derive from patterns of vowel shifting in the British dialects from which SAE originated. In this regard the similarity between the vowel system presented here and that of Tony Tassie and David Branson from Norwich --- see p. 25 above --- is probably significant.

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7 Conclusion

Although the observations reported on in this article are, I think, of interest, there are several ways in which they must be supplemented.

i. Studies must be undertaken of all the major varieties of SAE.

ii. Attention must explicitly be given to vowel shifting in apparent time.

iii. The social embeddedness of the vowel system of SAE must be examined, with special attention to the vowel norms of the working or lower classes.

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NOTES

1. The occasion for the investigation was a visit to the linguistics laboratory of the Department of Linguistics at the University of Pennsylvania during the 1980/1981 academic year. Appreciation is due to (a) the HSRC for making my visit to Bill Labov possible, (b) Bill Labov and his colleagues for their help during my stay, (c) Prof. L.W. Lanham, Director of the Institute for the Study of English in Africa at Rhodes University, for his comments on an earlier draft of this paper, and (d) Mrs. T. Botha, of the Department of Afrikaans, University of Pretoria, for her editorial assistance.

2. The quality of the recording can be ascertained from a copy in the author's possession.

3. The print-outs containing this information on the relevant vowels, are available from the author. It should perhaps be pointed out that the formant values obtained for the vowels are not to be regarded as "definitive" since F-values are co-determined by factors such as the speaker's vocal tract length.

4. The chart was an early one and therefore contains only 218 vowels.

5. The symbols and their values are from (Trager and Smith 1957).

6. Since only stressed vowels were studied /ə/ was not considered.

7. Ladefoged's measurements are in mel and they have consequently been converted into frequencies with a graph based on the mel-frequency scale --- see Ladefoged 1964[2] .

8. This may be due to the fact that the author is Afrikaans-speaking.

9. A feature of the /ey/ which does seem remarkable is the lowness of its nucleus.

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10. Movements across sub-systems, e.g. monophthongization and diphthongization, are not considered here.

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