

# Best boot forward?

## A real-time study of Scottish English /u/ over forty years

GULP



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### Background

/u/ is fronting towards /i/ in the acoustic vowel space in Standard Southern British English (Harrington et al. 2011), American English (Labov et al. 2006), New Zealand English (Maclagan et al 2009).

*What about Scottish English?* Auditorily, /u/ has been reported to be fronted, and/or central in the vowel space for a long time (McAllister 1938, Macaulay 1977, Johnston and Speitel 1983). Recent acoustic and articulatory analysis suggests that /u/ is front and low (Scobbie et al. forthcoming).

### Research outline

We start to tackle this question using the analysis of a real-time corpus of naturally-occurring spontaneous speech. We draw on recordings of Glaswegian vernacular speech made in 2003 (Stuart-Smith 2006) and 1972 (Macaulay 1977).

The recordings were made using different equipment and various scenarios. In order to gain an appreciation of shifts in vowel quality over time which are independent of factors to do with the recordings themselves, we consider the data using two LPC algorithms as implemented in Praat and EMU. We look at the relative placement of /u/ in the auditory space defined by formant frequencies of /i/, /a/, /u/ in Bark (cf. Harrington et al. 2011).

### Method

Tab.1: Structure of the whole corpus and data presented here (indicated by red)

Decade of recording	G1: young 10-15	G2: adult 40-55	G3: old 67-90
70s	4m, 4f <b>2m</b>	4m, 4f <b>2m</b>	2m, 2f
80s	(3m, 0f)	7m, 1f	6m, 6f
90s	> 6m, 6f	4m, 4f	4m, 4f
00s	> 6m, 6f <b>2m</b>	6m, 6f <b>2m</b>	> 6m, 6f

- only syllables bearing prominence (stress or accent)
- phonetic context coded (place and manner of articulation)
- lexical set noted (standard or Scots)
- syllables with /r/-offset were excluded

Tab.2: Total number of tokens in this study

Vowels	70s		00s	
	G1	G2	G1	G2
i	65	30	45	38
a	84	35	63	38
u	92	43	51	37

Tab.3: LPC settings and formant analysis using two algorithms

	Praat	EMU
Sampling rate	10 kHz	44kHz
Time steps	6.25 ms (25%)	5 ms (20%)
Window length	25 ms	25 ms
Pre-emphasis	50 Hz (+ 6dB/octave)	F1-frequency (+ 6dB/octave)
LPC order	10	10
Nominal formant	5 formants within 5000 Hz range	F1 (adult): 500 Hz F1 (young): 550 Hz
Temporal measure	dynamic as average of 25-75% track	static at vowel midpoint

### Preliminary results

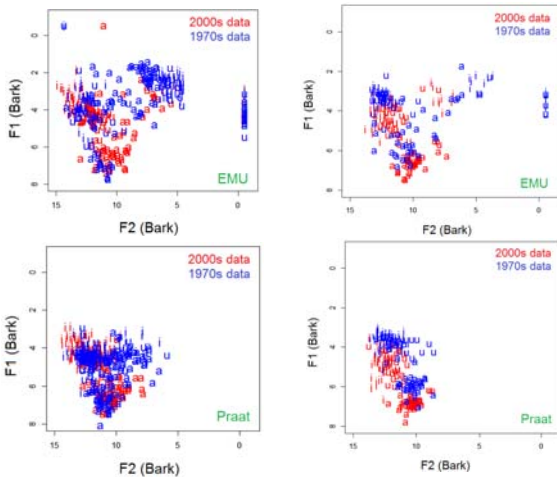


Fig. 1: F2/F1 formant plot of tokens measured for young speakers using EMU vs. Praat

Fig. 2: F2/F1 formant plot of tokens measured for adult speakers using EMU vs. Praat

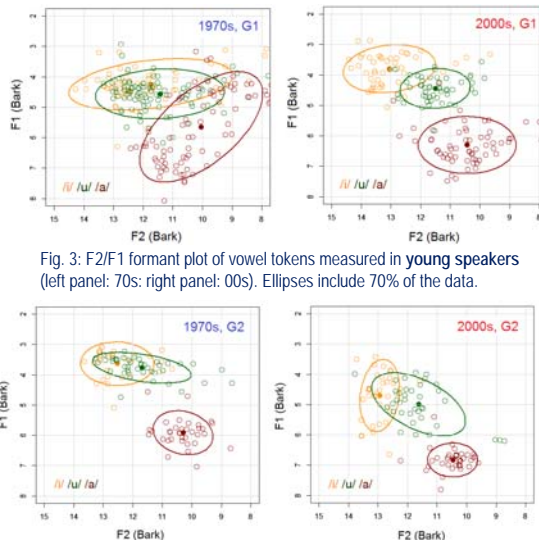


Fig. 3: F2/F1 formant plot of vowel tokens measured in young speakers (left panel: 70s; right panel: 00s). Ellipses include 70% of the data.

Fig. 4: F2/F1 formant plot of vowel tokens measured in adult speakers (left panel: 70s; right panel: 00s). Ellipses include 70% of the data.

$$d_u = \log E_{u/a} - \log E_{u/i}$$

(after Harrington et al. 2008)

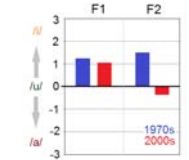


Fig. 5: Mean  $d_u$  between /u/ and /i/, /a/ in G1 speakers across two decades

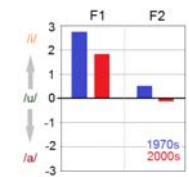


Fig. 6: Mean  $d_u$  between /u/ and /i/, /a/ in G2 speakers across two decades

### Summary

- Our preliminary results for both age groups in the 1970s are in line with the reports based on auditory analysis stating that /u/ in Scottish English vernacular was very front (Macafee 1983, Macaulay 1977).
- In apparent time for the 1970s, /u/ is lowering and fronting in younger speakers. In apparent time for 2000s, we see the same tendency for lowering in younger speakers. Both groups show a retracted vowel.
- In real-time, we find a slight lowering and stronger retraction of /u/ for both age groups. The retraction is more apparent in the younger group.

If these results are indicative of real-time change, the interesting point is that Scottish English is diverging from other accents of English in its trajectory for /u/.

### Discussion

Are we observing real-time change in /u/ in Scottish English vernacular?

- So far, we have analysed a very small part of the dataset.
- The data present challenges for measurement with respect to levels of background noise and recording quality. We are starting with the most difficult part of the dataset first in order to find solutions for dealing with technical issues.
- The recordings from the two decades are stylistically very different, interviews in the 1970s but very casual conversations between close friends in the 2000s. This is an additional factor constraining the variation across the two decades. However, we do not have a clear prediction as to its impact on the acoustic space.

**References** Harrington, Kleber, Reubold, (2008). Compensation for articulation. *JASA* 123; Harrington, Kleber, Reubold (2011) The contributions of the lips and the tongue to the diachronic fronting of high back vowels in Standard Southern British English, *JIPA*; Scobbie, Lawson, Stuart-Smith (forthcoming) The frontness of Scottish English /u/: a socially-stratified ultrasound tongue imaging study. *Italian Journal of Linguistics*. Labov, W., Ash, Sh., Boberg, Ch. (2006), *The Atlas of North American English: Phonetics, Phonology and Sound Change*. Macafee, C. (1983) *Glasgow*. Macaulay, R. (1977), *Language, Social Class and Education: A Glasgow Study*. Maclagan M., Watson C., Harlow R., King J, Keegan P. (2009), /u/ fronting and /t/ aspiration in Maori and New Zealand English. *Language Variation and Change*. Stuart-Smith (2007): The influence of the media. In: Llamas, C., Mullany, L. and Stockwell, P. (eds.)

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