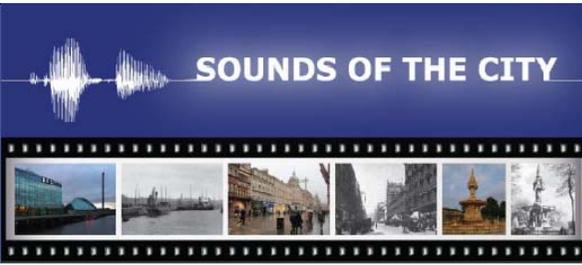# In the Aftermath of /u/ Leaving
Glaswegian Vowels through Real and Apparent Time

Brian José [1], Jane Stuart-Smith [1], Claire Timmins [2], Bernard Torsney [1]
[1] University of Glasgow   [2] University of Strathclyde

9th UK LVC Conference, University of Sheffield; 02 September 2013

SOUNDS OF THE CITY

The Leverhulme Trust

- **BACKGROUND AND INTRODUCTION**:
  ◦ Acoustic analyses of phonetic variation in Scotland's largest city: Glasgow
    – Interest in both change and stability
    – A real-time, cross-sectional (i.e., trend) study
      Working-class Glaswegian Vernacular English (GVE)
      Speakers to be balanced for age and sex
    – Diverse types of recordings
      Interviews : oral history, sociolinguistic
      Conversations among peers
      Documentaries: radio, TV, other
      etc & TBD (corpus development still ongoing)

Table 1: Targeted Structure of the Corpus (*still under construction*)		Age and Sex of Speakers					
		"Old" intended as 67-90 yr-olds		"Middle" intended as 40-55 yr-olds		"Young" intended as 10-17 yr-olds	
		M	F	M	F	M	F
Real-Time Period	1970s	**6**	**6**	6	6	**6**	**6**
	1980s	6	6	6	6	6	6
	1990s	6	6	6	6	6	6
	2000s	**6**	**6**	6	6	**6**	**6**

- **OUR CURRENT RESEARCH QUESTION**:
  ◦ What, if any, are the consequences of a front(ed) /u/ in GVE ?
    – /u/ has been considerably advanced in GVE for quite some time
      e.g., Macaulay 1977, McAllister 1963 [1938], Speitel & Johnston (1983)
    – Is the system with this front(ed) /u/ stable through real / apparent time?
    – Is it undergoing subsequent changes through real and/or apparent time?
    – The six bimoraic monophthongs of Scottish English (Scobbie et al 1999)
      FLEECE /i/, FACE /e/, BOOT /u/, CAT /a/, COT /O/, COAT /o/

- **METHODS**:
  ◦ A sub-sample of 31 speakers drawn from the 4 "corners" of Table 1
    – 7 "old" speakers recorded in the 1970s: 4M + 3F
    – 8 "young" speakers recorded in the 1970s: 4M + 4F
    – 8 "old" speakers recorded in the 2000s: 4M + 4F
    – 8 "young" speakers recorded in the 2000s: 4M + 4F
  ◦ Time-aligned transcriptions using Transcriber software (Barras et al 2001)
  ◦ Loaded and stored into the LaBB-CAT database (Fromont & Hay 2012)
    – Phonemic transcriptions via CELEX dictionary, as supplemented by user
    – Forced alignment of segmental boundaries with digital audio recordings
    – Automatic extraction of lexically stressed targeted vowels
      Approximately 21,500 tokens for these 31 speakers
      Slightly more than 100 tokens per speaker per vowel, on average
      min = 17, max = 362, stdev = 64
    – Automatic measurement of LPC formant tracks via Praat in LaBB-CAT
    – Measurement taken at 3 points within the vowel: 25% - 50% - 75%
      Sample reduced to 14,298 tokens (31 speakers)
      Just over 75 tokens per speaker per vowel, on average
      min = 8, max = 260, stdev = 50

- **METHODS, continued**:
  ◦ Data reduced from ~20,500 tokens to 14,298 tokens
    – Forced alignment: A wonderful tool, but...
      Sometimes good results
      Other times more troubling results
    – LPC formant tracking: A wonderful tool, but...
      Sometimes good results
      Other times more troubling results

  ◦ Removal of any tokens with a following /l/ or /r/ that slipped though during the data collection phase.

  ◦ Removal of unambiguous outliers (cf. Figure 1A)
    – Likely cause: formant tracking errors
    – Identification and current implementation:
      Values >1½ times the IQR above Q3 or below Q1; i.e., beyond the "whiskers" of a boxplot (cf. Figure 2) => Removal of that vowel token

  ◦ Removal of tokens with inconsistent formant values
    – Likely cause: sub-optimal forced alignments or formant tracking errors (or both)
    – Identification and current implementation:
      Ranges of formant values (measured at 25%, 50%, 75% into the vowel) >33% of the mean of those values => Removal of that vowel token

- **RESULTS AND DISCUSSION**:

Figure 5: Lobanov-normalized F1 x F2 Vowel Plots for All Speakers
Ellipses Show 68% Confidence Intervals (1 Standard Deviation)
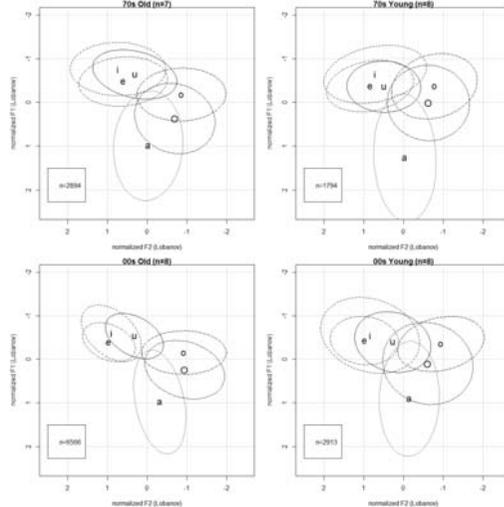
◦ Figures 1, 2, 3, 4 all show the effects of "cleaning" the data in these types of ways.
◦ As the analysis progresses, some further methods of "cleaning" the data may still be called for.

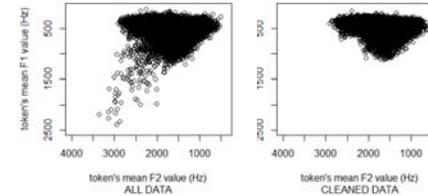Figure 1: Raw F1 x Raw F2 for All Speakers

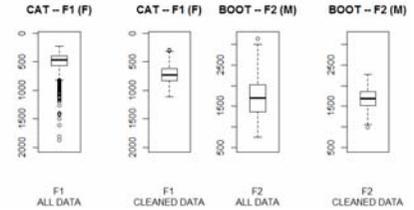Figure 2: Identification of Outliers and Effects of their Removal

Figure 3: Raw F1 ¼ of the way into the Vowel vs Raw F1 ¾ of the way into the Vowel
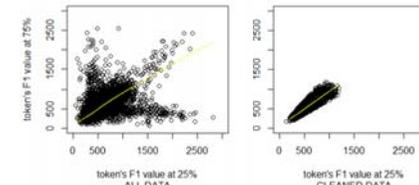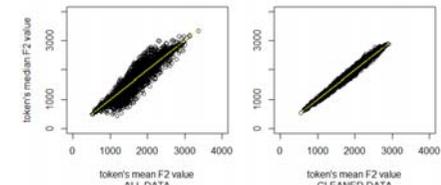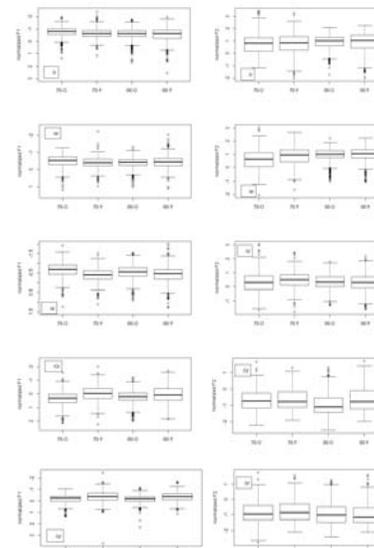
Figure 4: Mean Raw F2 vs Median Raw F2

Figure 6: Boxplots for Normalized F1 and F2

◦ Initial analysis using lmer in R (F1 and F2)
  – Fixed factors: vowel, group, (gender), context
  – Random factors: speaker, word

◦ Vowel height in apparent and real-time:
  – /i e u/ appear to be lowering
  – /o O/ appear to be raising

◦ Vowel front/backness in apparent and real-time:
  – /i e/ appear to be fronting
  – /u o O/ appear to be retracting

◦ These results confirm our first impressions for /u/ with respect to only /i a/. But we also see much more shifting in vowel qualities in GVE across the 20th century than has been assumed (e.g. Speitel and Johnston 1983).

- **NEXT STEPS**:
  ◦ Consider the role of sex/gender in these changes
  ◦ Expand the age/time dimension with cohorts from the 1980s and 1990s
  ◦ Consider shifts of the space itself, as well as for particular vowels within the space
  ◦ Consider additional vowels
    – e.g., KIT /I/, DRESS /E/; diphthongs

- **REFERENCES**:

  ° Barras, Claude; Geoffrois, Edouard; Wu, Zhibiao; Liberman, Mark (2001). Transcriber: Development and use of a tool for assisting speech corpora production. *Speech Communication* 33: 5-22.

  ° Fromont, Robert; Hay, Jennifer (2012). LaBB-CAT: An annotation store. *Proceedings of the Australasian Language Technology Association Workshop*: 113-117.

  ° Macaulay, Ronald (1977). *Language, Social Class and Education: A Glasgow Study*. Edinburgh: Edinburgh University Press.

  ° McAllister, Anne H. (1963). *A Year's Course in Speech Training*, 9th Ed. London: University of London Press. [First Edition, 1938]

  ° Scobbie, James M.; Turk, Alice E.; Hewlett, Nigel (1999). Morphemes, phonetics and lexical items: The case of the Scottish Vowel Length Rule. *Proceedings of the XIVth International Congress of Phonetic Sciences*: 1617-1620.

  ° Speitel, Hans; Johnston, Paul (1983). *A Sociolinguistic Investigation of Edinburgh Speech*. Final report to the ESRC (Grant No. 000230023).