Trying on a New BOOT:
Acoustic Analyses of Real-Time Change in Scottish English /u/

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I. Background, Purpose, Goals:

- Acoustic analyses of sound change through real and apparent time in Scotland's largest city, Glasgow
- A real-time cross-sectional (trend) study
  - Working-class Glaswegian vernacular speakers
  - Balanced for age and sex
- Data from a variety of sources
  - Sociolinguistic interviews
  - Oral history interviews
  - Conversations among peers
  - Radio / TV documentaries
  - etc & TBD

Table 1: Targeted Structure of the Corpus (*still under construction*)

		Age and Sex of speakers					
		Elderly [G3]		Adults [G2]		Teens [G1]	
		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

II. Current Focus:

- Our first foray into the data focuses on the /u/ (BOOT) vowel
- /u/ is fronted --or at least fronting-- in many varieties of English
  - in America (e.g., Feagin, 1986; Fought, 2002; Fridland, 2000; Labov et al, 2006)
  - in England (Harrington et al, 2011)
  - in New Zealand (Maclagan et al, 2009)
- In Scotland:
  - BOOT is a single lexical set consisting of both GOOSE /u/ and FOOT /U/
  - Reported to be a central-to-front vowel for quite some time (Macaulay, 1977; McAllister, 1938; Speitel & Johnston, 1983)
  - Contemporary accounts also describe lowering (Scobbie et al, forthcoming)
- Current sub-sample from shaded cells in Table 1

III. Methods and Preliminary Results, part 1:

- Primary research questions for the current analysis
  - Does real-time data from Glaswegian Vernacular support the reported frontness and a downward trajectory of BOOT in Scottish English? How best to find out?
- A sub-sample of 16 male speakers
  - 4 Grp2 [adult] males from the 1970s
  - 4 Grp2 [adult] males from the 2000s
  - 4 Grp1 [teen] males from the 1970s
  - 4 Grp1 [teen] males from the 2000s
- All prosodically prominent tokens of /i/, /u/, /a/ extracted (N = 1320)
  - Dynamic measurements of F1, F2, F3 from central portion of the vowel
  - Bark-transformed

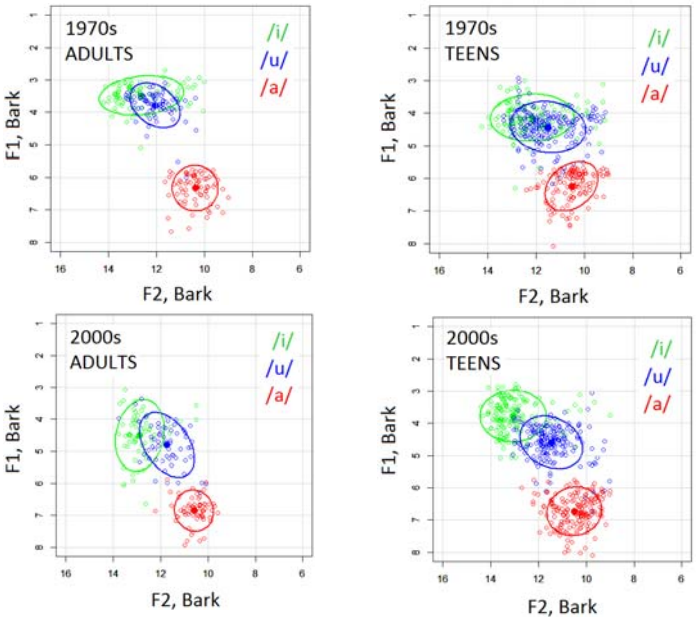

Figure 1: F1 x F2 Bark-transformed formant plots by age group and time period
Ellipses include 70% of the data; points mark centers of distributions.

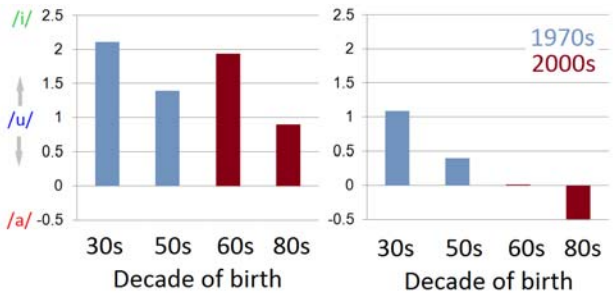

Figure 2: Position of /u/ relative to /i/ and /a/

Left Panel = F1 $d_u = \log E_{u/a} - \log E_{u/i}$ *Right Panel = F2*

(after Harrington et al 2008)

IV. Methods and Preliminary Results, part 2:

- Formant tracking can sometimes be difficult with noisy recordings like many of ours
- A promising alternative: 'cepstral' analysis, via discrete cosine transformation (DCT)
- DCT decomposes a signal into its component parts (as *cosine* waves)
  - DCT '*coefficients*' are indices of the global shape of the signal
  - Often effective at distinguishing one phonetic category --e.g., phoneme, allophone-- from another (Harrington 2010: 305).
- Gross summary of procedure (cf. Harrington 2010: 312-316):
  - FFT spectrum (Hz) => optional conversion to {Mel/Bark} => DCT 'cepstrum'

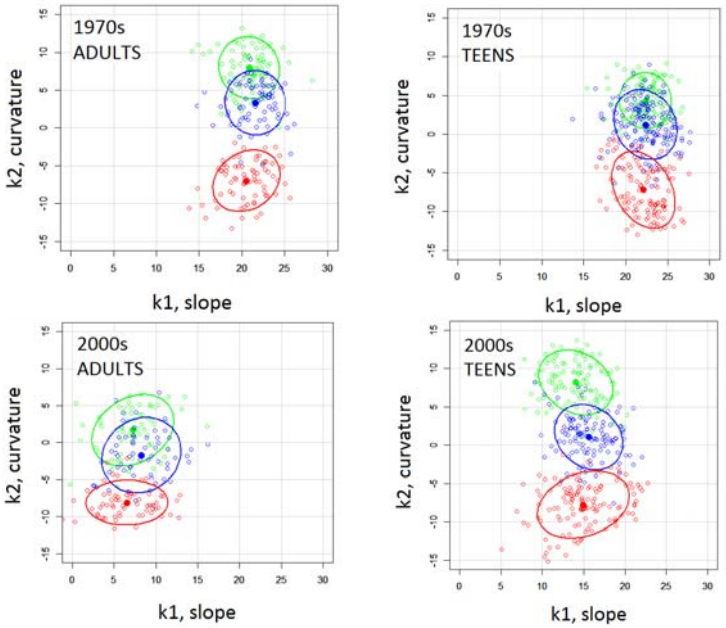

Figure 3: DCT coefficients slope *(k1) x* curvature *(k2) by age group and time period*
Ellipses show 95% confidence intervals, with vowel symbols at centers of distributions.

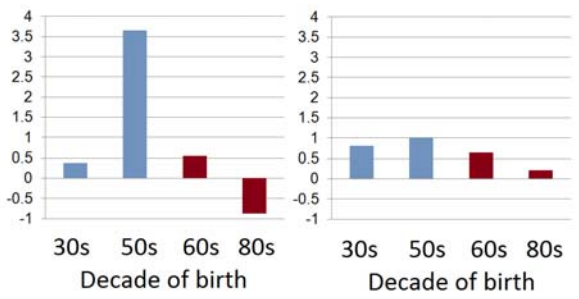

Figure 4: Position of /u/ relative to /i/ and /a/

Left Panel = k1 *Right Panel = k2*

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

(after Harrington et al 2008, applied to DCT k1 and k2)

V. Conclusions:

- Consistent with previous descriptions and auditory accounts, formant analyses reveal Scottish English BOOT in Glasgow to be considerably advanced in the vowel space, but seemingly retracting, as well as shifting downward through both real and apparent time.
- Similarly to classic formant analyses, preliminary *cepstral* (DCT) analyses effectively capture the relationships between the vowel categories and at least some of the diachronic development of those relationships.
- This is a first attempt to apply cepstral analysis to sociolinguistic research. In the future, we will explore additional coefficients and coefficient combinations in order to study variation and change in Glaswegian Vernacular English.
- The arguable advantages of cepstral analyses over formant analyses in some instances reveal them to be potentially promising New Ways of Analyzing (sociophonetic) Variation.

REFERENCES: See back side of handout.

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VI. References:

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