

Using angle calculations to demonstrate vowel shifts:

A diachronic investigation of the short vowel system in 20th-century RP (UK)

Anne Fabricius
Roskilde University

NWAV 36, Philadelphia, October 2007

Overview

- ◆ SHORT vowel system in RP
- ◆ Methods of the study
 - Normalization (Watt and Fabricius 2003)
 - Angle and distance calculations (Fabricius 2007)
- ◆ Data corpus

- ◆ Results
- ◆ Discussion

Introduction

- ◆ On examining change in vowel systems in real time
- ◆ Vowel configurations undergoing generational changes (eg NCS)
- ◆ Two complementary aspects to consider
 - Vowel qualities as absolute formant values
 - Vowel positions relative to each other in vowel space

The Puzzle of the Queen's data

- ◆ Harrington, Palethorpe and Watson 2000
- ◆ Reporting on the STRUT vowel (Λ) as 'backing' to be like SSBE(RP) values
- ◆ Contra other reports on RP with STRUT 'fronting' in the earlier part of the 20th century (cf Bauer 1985)

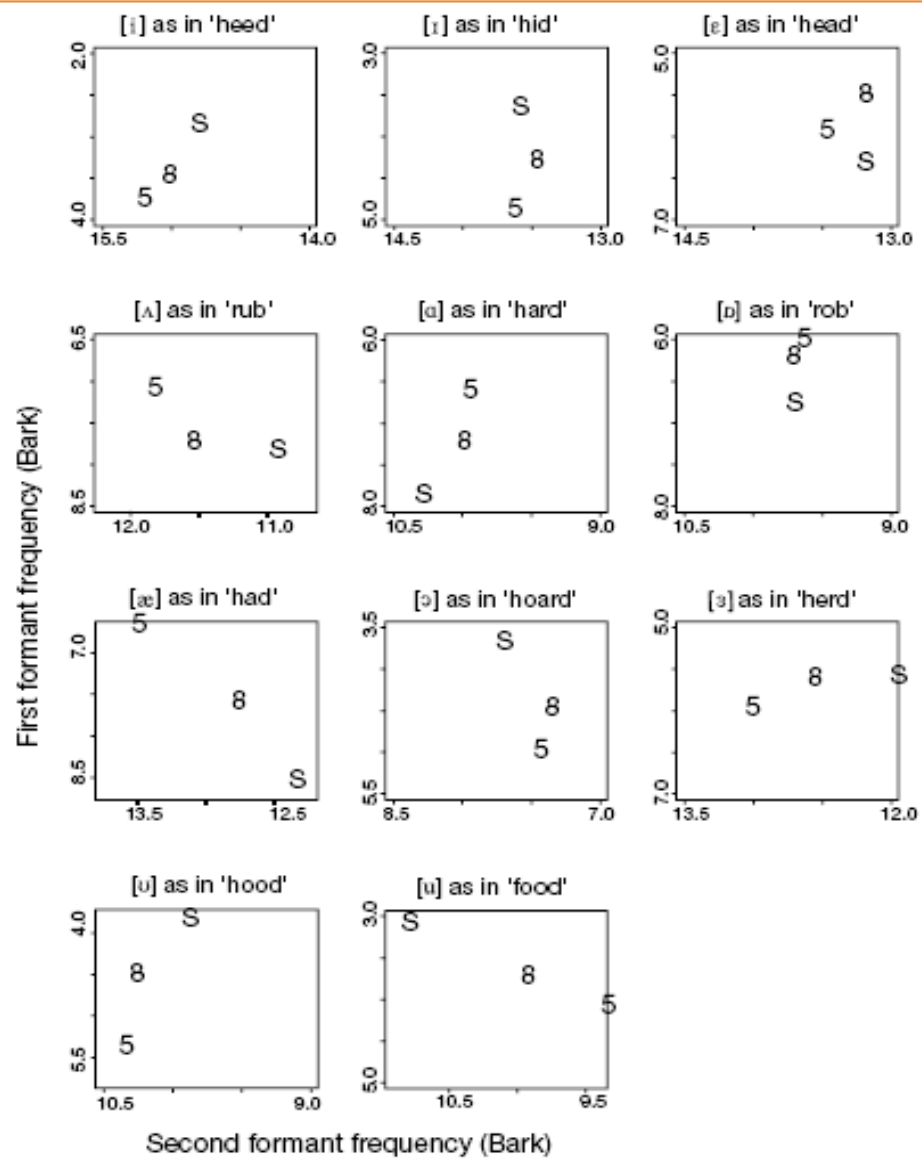


Figure 1 The three symbols '5', '8' and 'S' represent the average positions of different vowel types in the Christmas broadcasts of the 1950s and 1980s, and in standard southern British of the 1980s, respectively. The axes are the first two formant frequencies in Bark, a scale used to model the way listeners perceive vowels¹². Positions towards the top of each square correspond to less mouth opening; the left corresponds to sounds made by constricting the vocal tract nearer the lips rather than further back¹¹.

What is vowel change over time in the individual?

- ◆ an adjustment of vowel qualities in absolute terms?
- ◆ Or an adjustment of vowel qualities in relative terms, relative to each other?
- ◆ within an individual's lifespan, what is most likely?

Observed changes in the short vowel system of RP during the 20th century

- ◆ TRAP lowers and backs
- ◆ DRESS lowers
- ◆ KIT perhaps follows
- ◆ FOOT fronts and unrounds
- ◆ LOT seems to be stable
- ◆ STRUT ???

What has happened to STRUT?

- ◆ Difficult to investigate for several reasons
- ◆ How far 'back' was it originally?
- ◆ When did more fronted variants appear?
- ◆ What has happened since?
- ◆ Is it related to short front vowel lowering in some way?

British English Vowels: Jones 1909, 1932 (Received Pronunciation)

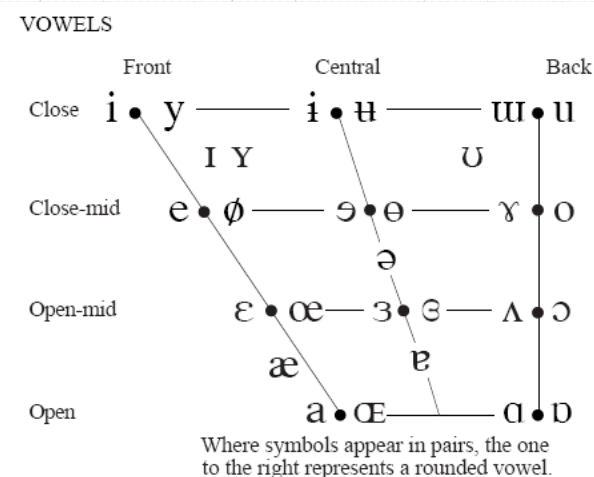
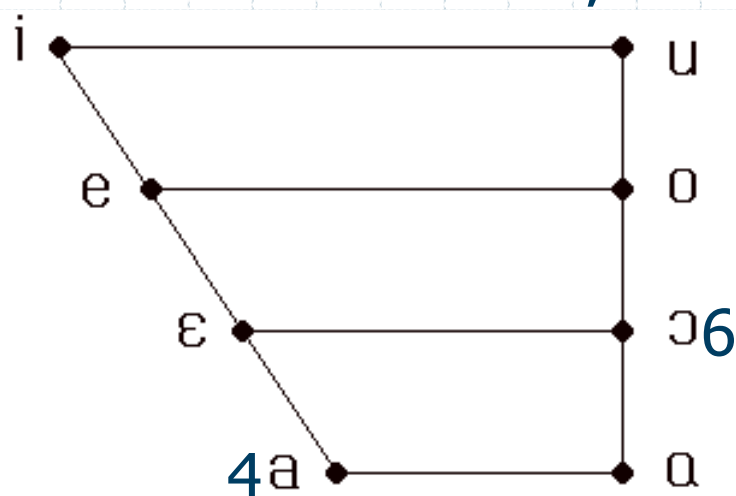
Front	Mixed	Back
i:, i		u:, u
e		o
ɛ	ə:, ə	ʌ
æ		ɔ:
ɑ	ɒ	ɔ

Front	Central	Back
i:		u:
i		u
e	ə:	o
ɛ	ə	ɔ:
æ	ʌ	ɔ
ɑ		ɒ

Gimson's "Pronunciation of English" 1962, 1970

Two different variants of RP:

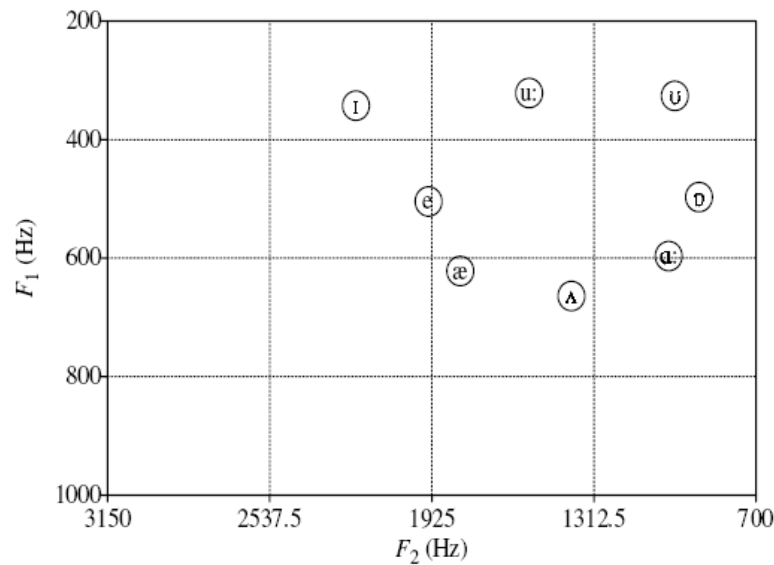
- ◆ General RP: STRUT centralised and higher than cardinal vowel
- ◆ Conservative RP: STRUT slightly in front of, but close to, cardinal vowel 6



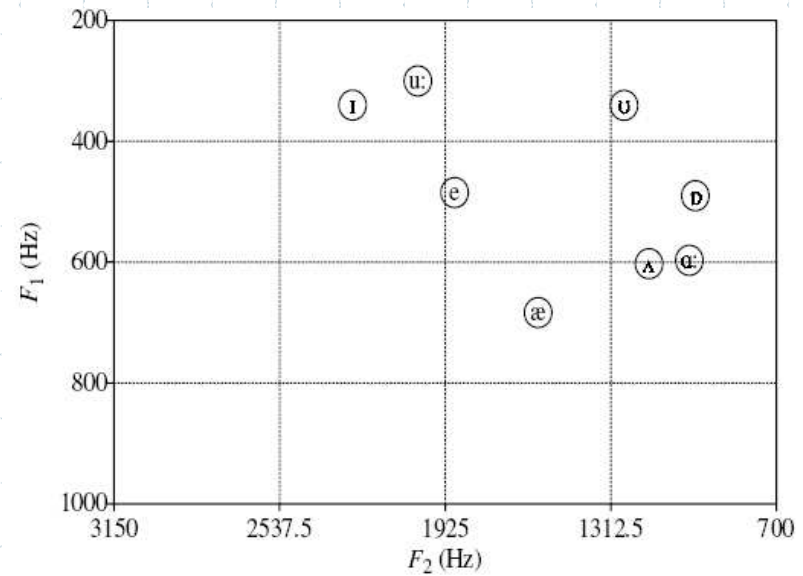
Other reports

- ◆ Wells (1982:281): the conservative U-RP variant is described as further back than the more general mainstream RP variant
- ◆ Bauer (1985): an acoustic study of Edinburgh University's collection of recordings of *Arthur the Rat*
- ◆ With speakers born 1900-1945
- ◆ However, all STRUT-tokens were vowels preceding nasal consonants (*run, young, coming*) which makes them less reliable as points of comparison with other vowels in other environments.
- ◆ Bauer's conclusion was that there was no clear trajectory for STRUT

Compare Torgersen, Kerswill *et al* studies of vowel configurations from working class speakers, Central London



Hackney elderly informants



Hackney young informants

Hawkins and Midgley 2005 (JIPA)

- ◆ An acoustic investigation of read speech
- ◆ 4 age-groups, males, Cambridge, UK
- ◆ All short and long monophthongs in carrier sentences
- ◆ Showed the well-known backing and lowering of TRAP and fronting of FOOT, but nothing definitive with respect to STRUT apart from the youngest generation having a vertical spread in F1) values
- ◆ No statistical analysis, small sample size

A paradox ...

- ◆ The expectation of the movement of STRUT over time: from a back vowel near cardinal 6 *forward towards* cardinal 4 (jf Jones, Gimson, Wells)
- ◆ The Queen speaks a conservative form of RP...
- ◆ Bauer (1985) investigated speakers around the Queen's generation and although expecting a forward movement, found none and concluded that the process was already complete early in the century
- ◆ Contra Harrington et al's description of QE2's Christmas broadcasts: from the 1950s to the 1980's: STRUT had moved *backwards* to SSBE values
- ◆ Hawkins and Midgley 2005 found no clear evidence for any STRUT movements

Fabricius (2007a and b)

- ◆ *Variation and change in the TRAP and STRUT vowels of RP: a real time comparison of five acoustic data sets (Journal of the International Phonetic Association)*
- ◆ *Vowel formants and angle measurements in diachronic sociophonetic studies: FOOT-fronting in RP (Proceedings of ICPHS Saarbrücken)*
- ◆ Comparison of four independent data sets plus measurements from my Ph.D. corpus (1997-8)
- ◆ Normalisation using a centroid-based technique: S-procedure (Watt and Fabricius 2003)
- ◆ Geometric angle and distance measurements enable comparisons

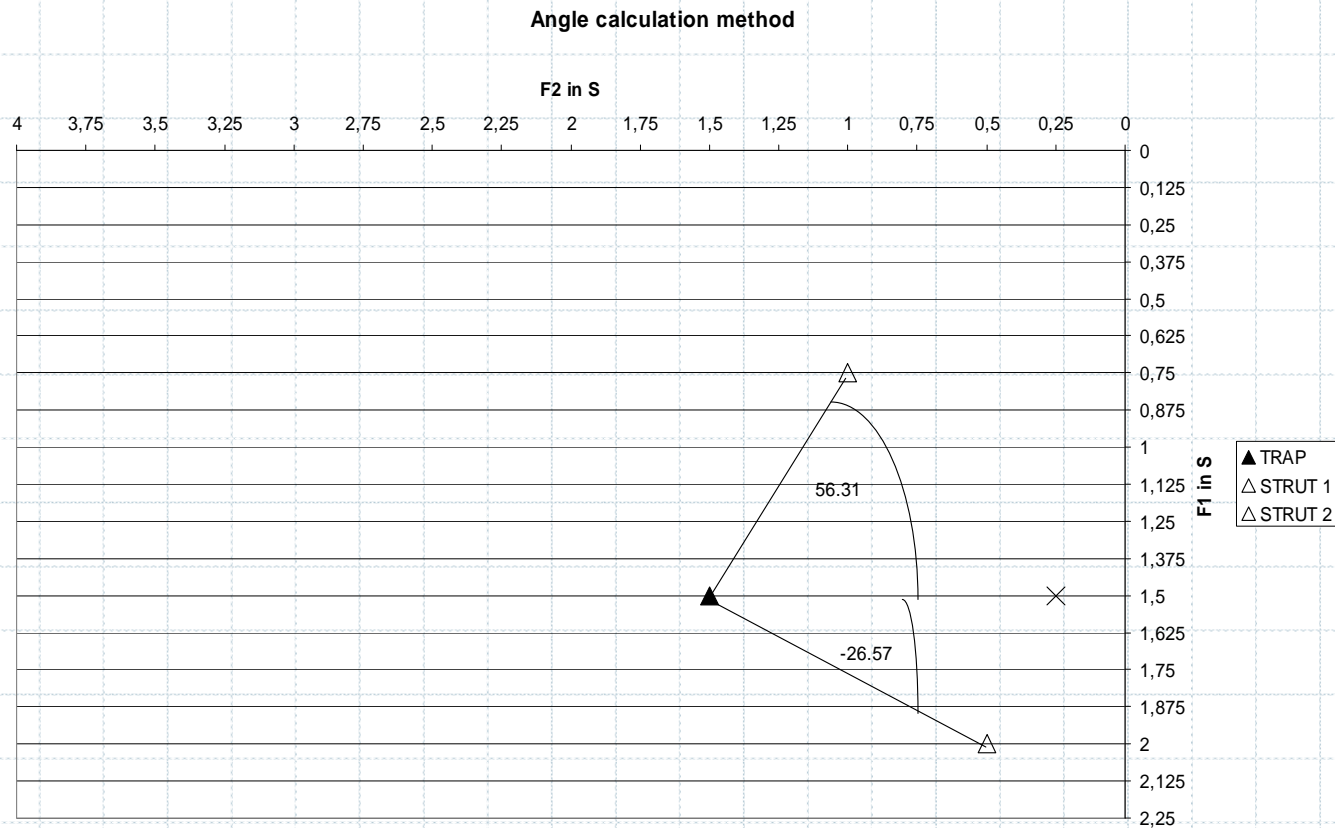
Data corpus details

- ◆ Source A Deterding (1997)
- ◆ Source B Wells (1962)
- ◆ Source C Hawkins and Midgley (2005)
- ◆ Source D Harrington *et al* (2000)
- ◆ Source E Sociolinguistic interview speech, four male speakers of modern RP, recorded in Cambridge, UK in 1997 and 1998 (data documented in Fabricius 2000)

The study

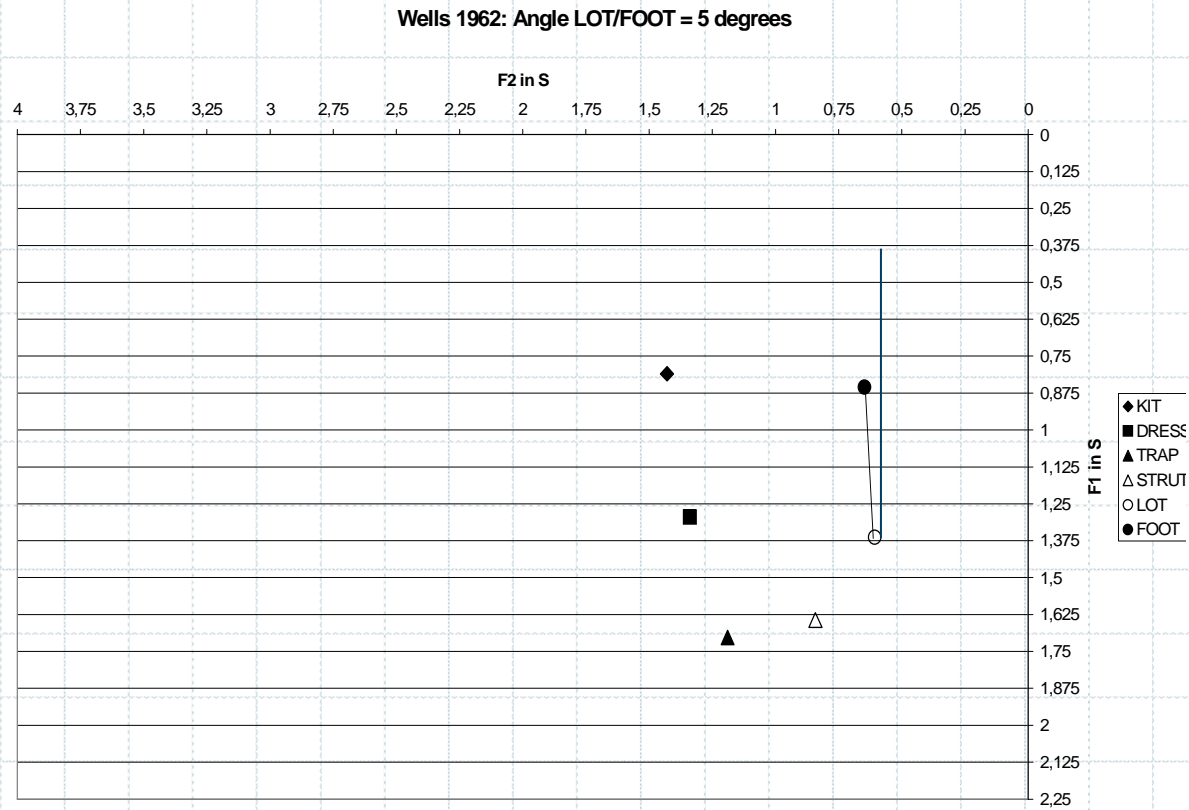
- ◆ Examines a range of data spanning from a speaker born in 1909, with a time span of around 70 years to the youngest born in 1980
- ◆ Normalises according to the S-centroid procedure (Watt and Fabricius 2003), enhancing visual comparison
- ◆ In addition, two geometrical measures to supplement the analysis of two-dimensional vowel plots
- ◆ Combines the advantage of replicable measures with the 'configurational' viewpoint of sociolinguistics (contra phonetics)

To find a precise geometric relationship between TRAP and STRUT



$$\tan \Theta = ((F1 \text{ trap} - F1 \text{ strut}) / (F2 \text{ trap} - F2 \text{ strut}))$$

To find a precise geometric relationship between LOT and FOOT

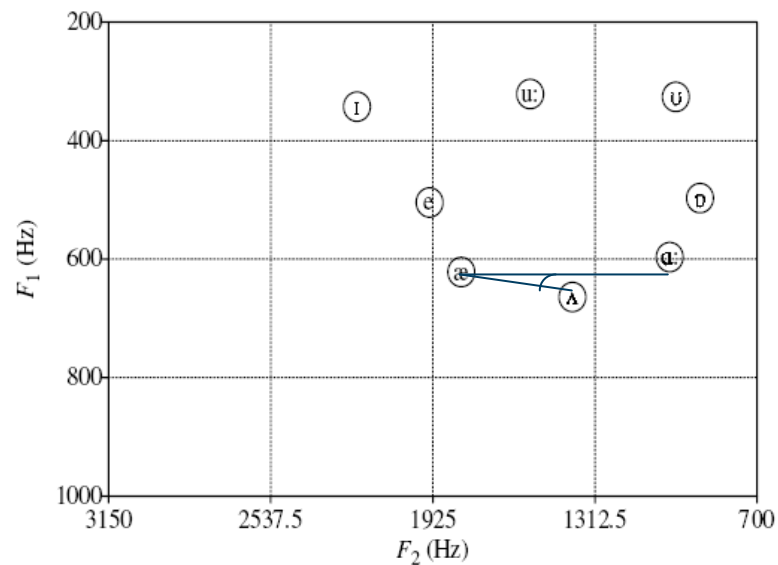


$$\text{TAN } \Theta = ((F2 \text{ FOOT} - F2 \text{ LOT}) / (F1 \text{ LOT} - F1 \text{ FOOT}))$$

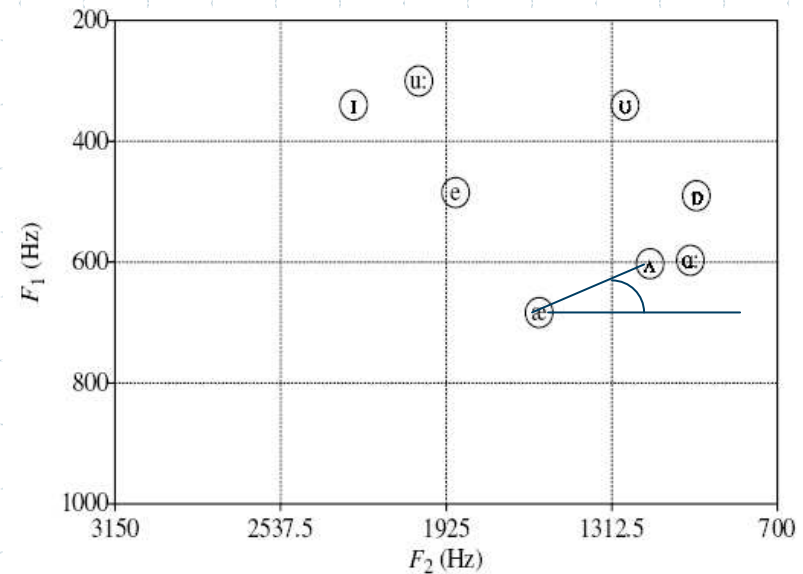
The angle calculation method

- ◆ By calculating the precise angle (relative to horizontal or to vertical as one chooses), one obtains a single value that represents the juxtaposition of the two vowels' average points in two-dimensional space,
- ◆ it is this value that may change through different generations

Torgersen, Kerswill et al's working class speakers, Central London again



Hackney elderly informants



Hackney young informants

...and Euclidean distance

- ◆ Euclidean distance can be used as an extra check on the actual separation between the two points (too little distance gives useless angles!)

$$ED(\text{TRAP}/\text{STRUT}) = \sqrt{((F1 \text{ TRAP} - F1 \text{ STRUT})^2 + (F2 \text{ TRAP} - F2 \text{ STRUT})^2)}$$

$$ED(\text{LOT}/\text{FOOT}) = \sqrt{((F1 \text{ LOT} - F1 \text{ FOOT})^2 + (F2 \text{ FOOT} - F2 \text{ LOT})^2)}$$

$$ED(xy) = \sqrt{((F1x - F1y)^2 + (F2x - F2y)^2)}$$

What does the method buy us?

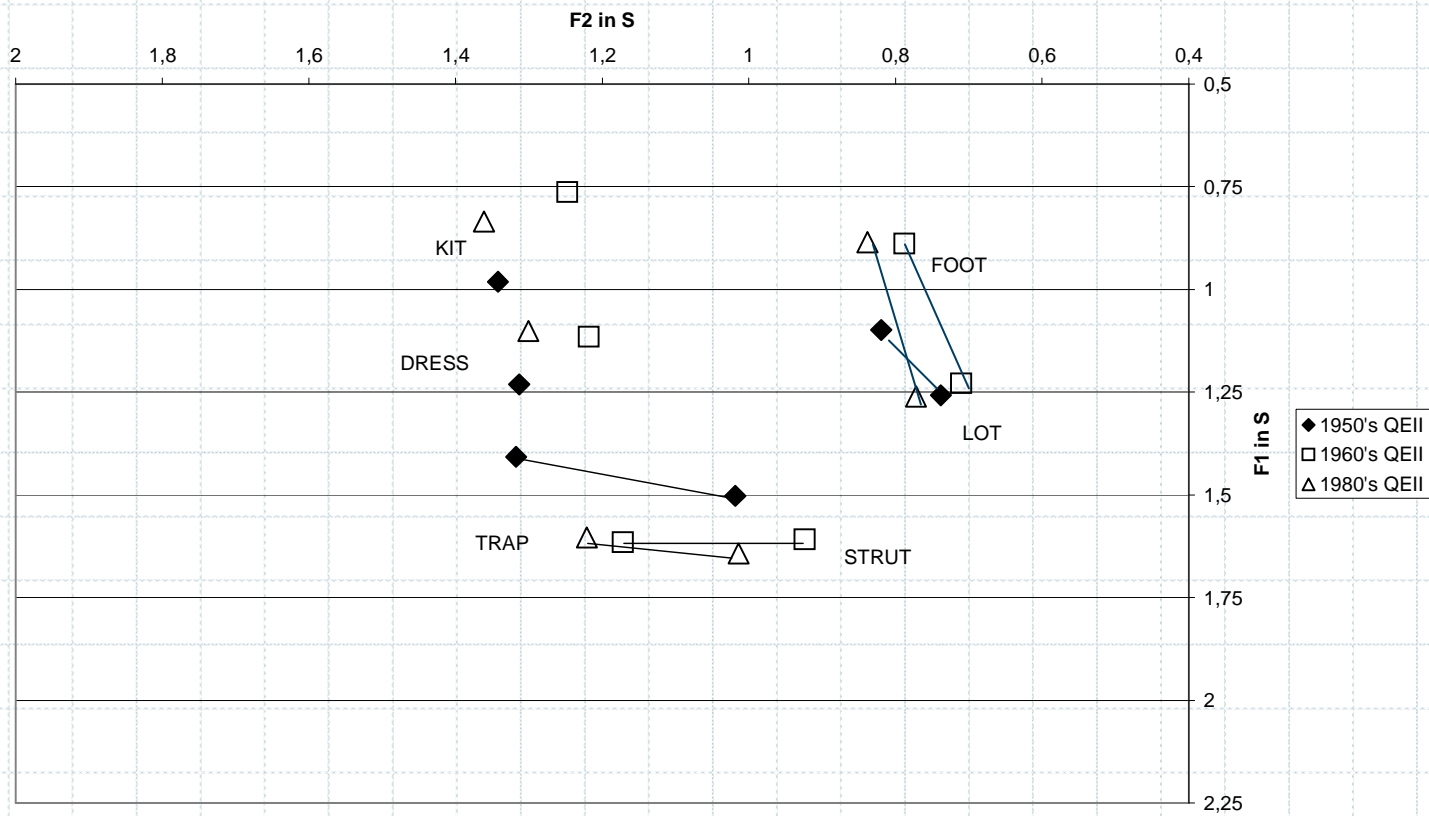
- ◆ Calculating an angle is an improvement on the usual phonetic comparison methods since it takes in two dimensions at once, not just one (stat. sigs in F1 or F2)
- ◆ We also gain on the quantitative sociolinguistic side since it gives a replicable number to compare and perform statistics on.
- ◆ It also potentially has forensic applications

Results

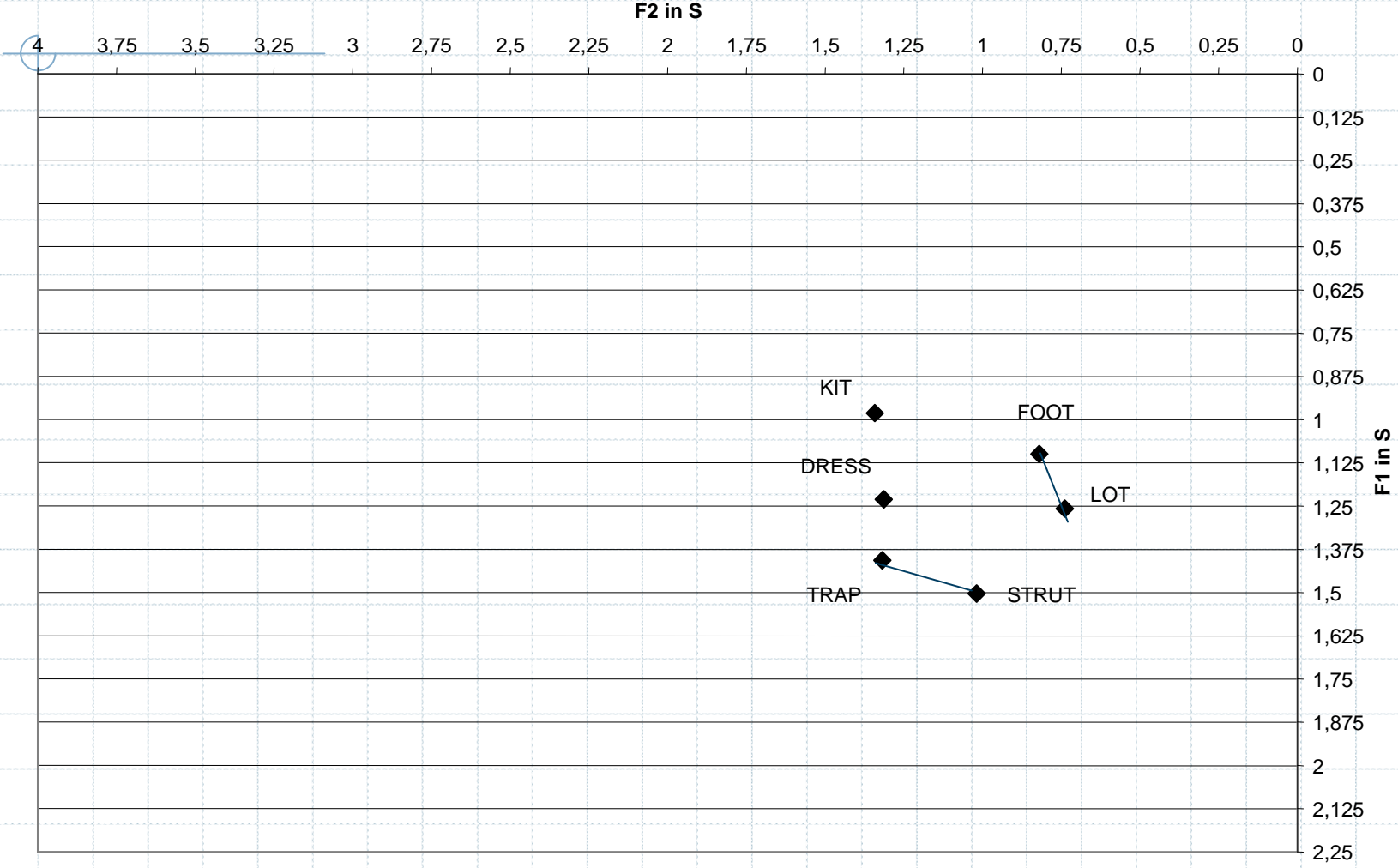
- ◆ See handout:
- ◆ Table with angle and distance measures for TRAP/STRUT and LOT/FOOT
- ◆ 3 main patterns for TRAP/STRUT
- ◆ Undeniably fronting of FOOT
- ◆ The TRAP/STRUT rotation
- ◆ STRUT's non-peripherality...

Dissolving the paradox...

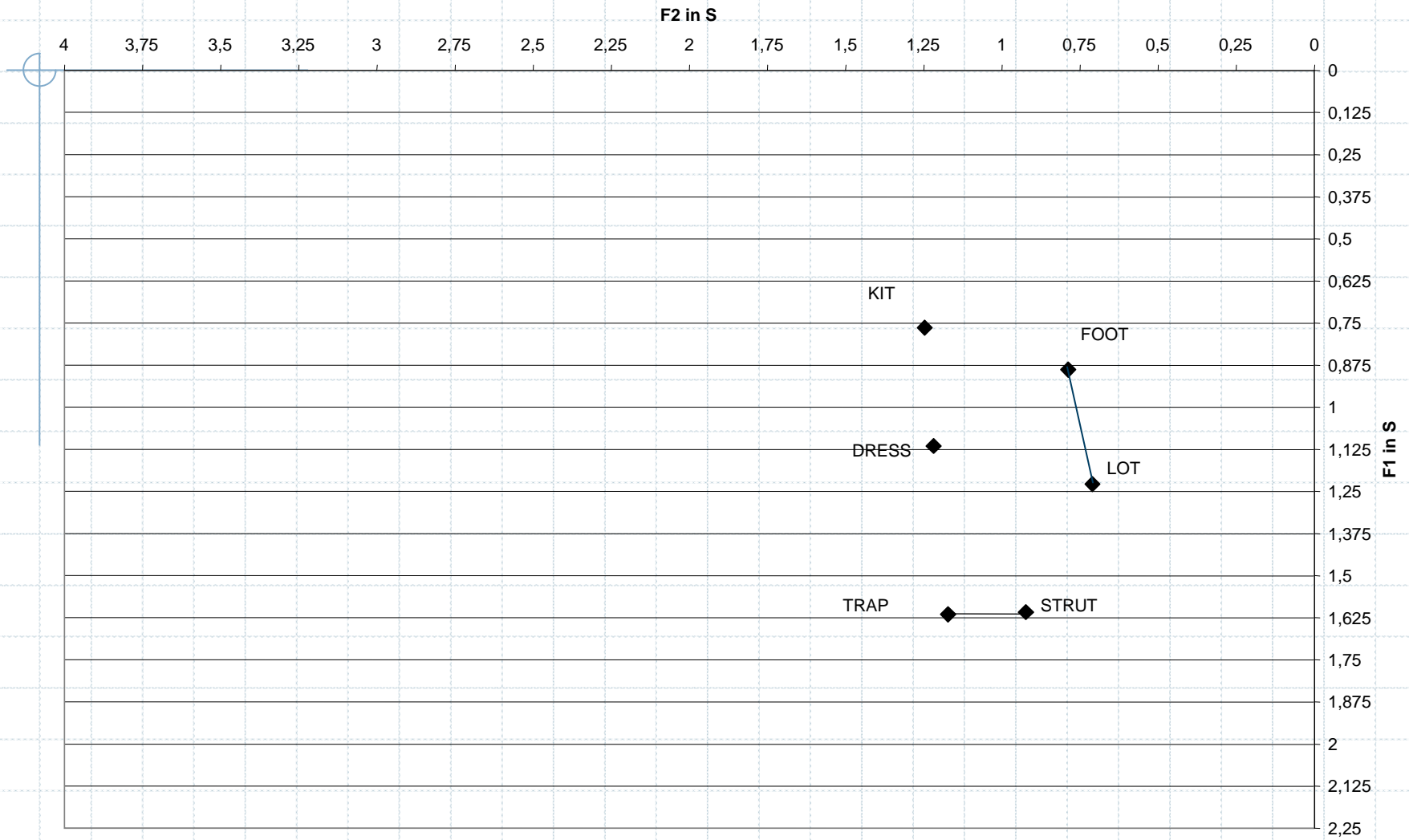
Queen Elizabeth's short vowels; based on Harrington et al (2000)



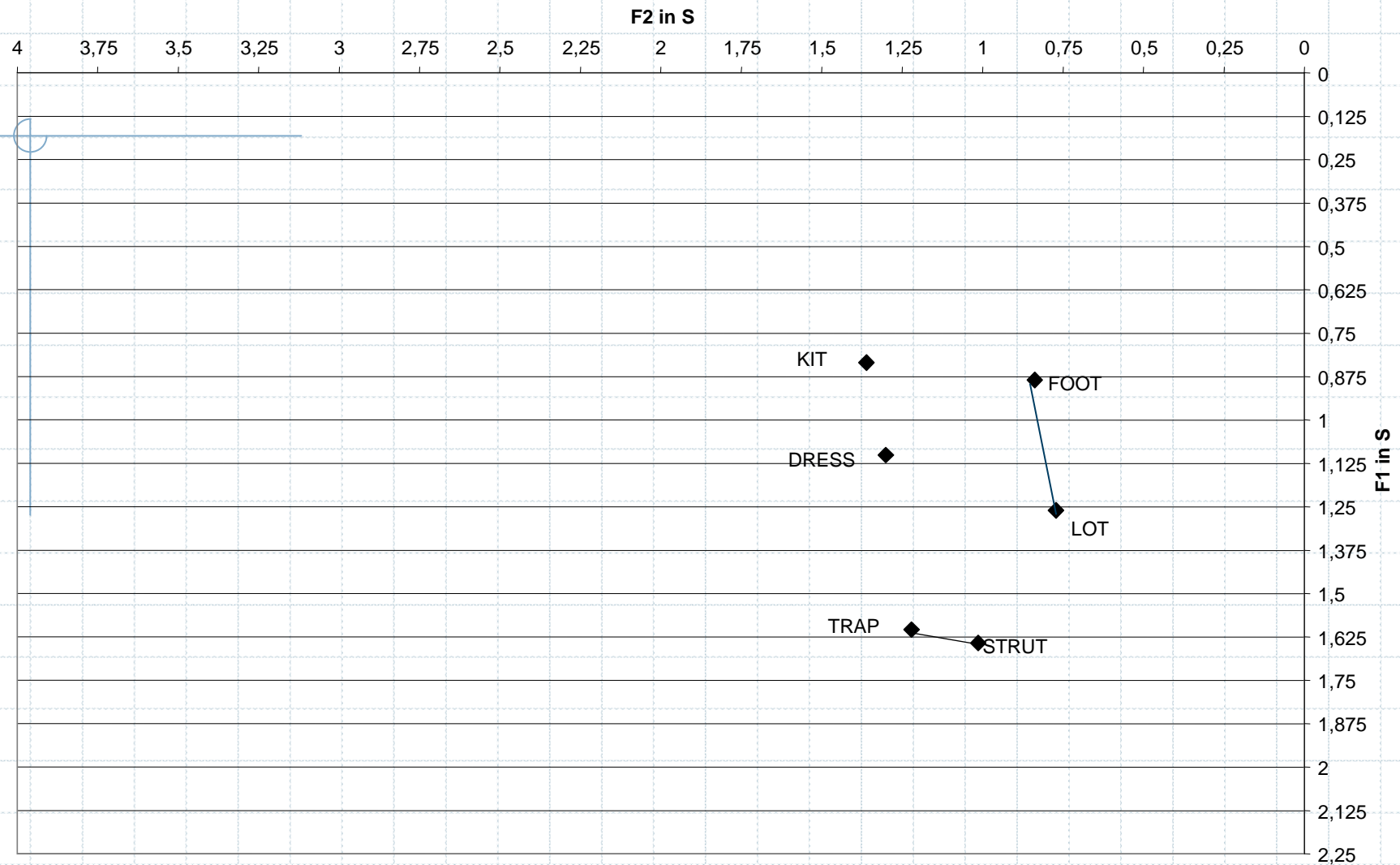
QEII 1950s: TRAP/STRUT –18, LOT/FOOT 27



QEII 1960s: TRAP/STRUT 2, LOT/FOOT 13



QEII 1980s: TRAP/STRUT -11 , LOT/FOOT 10



Vowel change in the individual post-adolescence

- ◆ can only be change in absolute terms?
- ◆ less likely to be in configurational terms – does it ever really happen in monodialectal situations? (no?)
- ◆ The two change processes must be kept conceptually distinct

References

- Bauer, L. (1985). Tracing phonetic change in the Received Pronunciation of British English. *Journal of Phonetics* 13, 61---81.
- Collins, B. & Mees, I.M. (1999). *The real Professor Higgins: the Life and Career of Daniel Jones*. Berlin, New York: Mouton de Gruyter.
- Cruttenden, A. (1994). *Gimson's Pronunciation of English, 5th edition*. London: Arnold. (6th edition) 2001.
- Deterding, D. (1997). The formants of monophthong vowels in Standard Southern British English pronunciation. *Journal of the International Phonetic Association* 27, 47–55.
- Fabricius, Anne H. (2000). *T-glottalling between stigma and prestige: a sociolinguistic study of modern RP*. Ph.D. thesis, Copenhagen Business School. Available online at:
<http://www.akira.ruc.dk/~fabri/Fabricius-2000-PhD-thesis.pdf> (Accessed 10 May 2007)
- Fabricius, Anne H. (2007a) Vowel formants and angle measurements in diachronic sociophonetic studies: FOOT-fronting in RP. In *Proceedings of ICPHS Saarbrücken*, August 2007.
- Fabricius, Anne H (2007b, in press) Variation and change in the TRAP and STRUT vowels of RP: a real time comparison of five acoustic data sets. *Journal of the International Phonetic Association*. 37,3: 293-320
- Gimson, A.C. (1962). *An Introduction to the Pronunciation of English, 1st ed*. London: Edward Arnold. (2nd edition) 1970. (3rd edition) 1980.
- Harrington, J., Palethorpe, S. & Watson, C.I. (2000). Monophthongal vowel changes in Received Pronunciation: an acoustic analysis of the Queen's Christmas broadcasts. *Journal of the International Phonetic Association* 30, 63–78.
- Hawkins, S. & Midgley, J. (2005). Formant frequencies of RP monophthongs in four age groups of speakers. *Journal of the International Phonetic Association* 35, 183–199.

References (cont'd)

- Jones, D. (1909). *The Pronunciation of English*. Cambridge: Cambridge University Press.
- Jones, D. (1918). *An Outline of English Phonetics, 1st edition*. Leipzig: Teubner. (3rd edition) 1932. (8th edition) 1956.
- Labov, W. (1994). *Principles of Linguistic Change. Volume 1: Internal Factors*. Cambridge, MA and Oxford, UK: Blackwell Publishers.
- Roach, P., Knowles, G., Varadi, T., & Arnfield, S. (1993). MARSEC: A machine-readable spoken English corpus. *Journal of the International Phonetic Association* 23, 47–54.
- Torgersen, E., Kerswill, P., Fox, S. & Cheshire, J. 2006. Endogenous Linguistic change in inner-London teenage speech as the generator of innovations: implications for models of innovation, levelling and diffusion. Paper presented at UCL, March 2006. http://www.lancs.ac.uk/fss/projects/linguistics/innovators/documents/UCL_poster_000.pdf
- Watt, D. & Fabricius, A.H. (2002). Evaluation of a technique for improving the mapping of multiple speakers' vowel spaces in the F1~F2 plane. *Leeds Working Papers in Linguistics* 9, 159–173.
- Wells, J.C. (1962). A study of the formants of the pure vowels of British English. Unpublished MA thesis, University of London.
- <http://www.phon.ucl.ac.uk/home/wells/formants/index.htm> (Accessed 31 August 2006)
- Wells, J. C. (1982). *Accents of English*. Volume 1: An Introduction, Volume 2: The British Isles; Volume 3: Beyond the British Isles. Cambridge: Cambridge University Press.



Thanks for your attention!