| Institution: University of York |
| Unit of Assessment: Linguistics |
| Title of case study: Forensic speaker comparison |
| 1. Summary of the impact |

Forensic speaker comparison is the analysis of recorded speech with evidential value in legal (usually criminal) cases. It is now routinely undertaken in the UK (ca. 600 cases annually) and increasingly elsewhere. It is vital that casework is underpinned by robust research, that reliable methods are applied, and that evidential results are framed appropriately. York is one of the world's largest research groups in forensic speech science, and in those academic disciplines (phonetics, sociolinguistics, sociophonetics) that provide the essential foundation for this applied field. The impacts of York research are felt through (i) enhancing understanding of variation in speech; (ii) applying research findings via collaboration in casework and research with J P French Associates (JPFA), one of the world's leading laboratories; (iii) providing doctoral research supervision for JPFA staff and professional training for other experts; (iv) providing expert evidence in legal cases in the UK and internationally; and (v) improving policy on expert evidence in the UK.

| 2. Underpinning research |

Note: research references are cited as [x]

The research foundation for York's impact in forensic speaker comparison is our long-standing reputation as a centre of excellence in phonetics, sociolinguistics, and the emerging interdisciplinary field of sociophonetics, in all of which York can claim to be a world leader. This is evidenced by a series of externally-funded projects (particularly on variation and change in British English, e.g. **[13]**), and investigation of fine phonetic detail and variation in speech production and perception. Key York staff are Paul Foulkes (Lecturer/Reader/Professor, 2000-present), Carmen Llamas (Lecturer/Senior Lecturer, 2007-present), and Dominic Watt (Lecturer/Senior Lecturer, 2007-present).

Our research yields new insights into the sources, loci and parameters of phonetic variation, the effect such variation has on listeners, and how this knowledge base can be drawn upon in forensic speaker comparison. York research establishes that structured variation in speech is caused by a far wider range of factors than is generally acknowledged in forensic phonetics, or in cognate fields such as speech/speaker recognition technology, revealing speech to be one of the most complex types of biometric information **[4, 6, 7, 9]**. This research enhances the foundation for reliable forensic speaker comparison: it provides an improved understanding of the distribution of phonetic features, the extent of variation found within speakers and populations, and the wide range of non-linguistic factors that affect speech and the acoustic signal. The outcome is a holistic perspective on linguistic variation and its probative value. The work supports and strengthens the phonetically-based approach to forensic speech analysis advocated in the UK over the last few decades, highlighting its advantages over the discredited method of 'voiceprinting', and demonstrating its complementarity with rapidly-developing methods from speech technology **[6, 8]**. The research base also enhances our understanding of ear-witnesses' testimony about voices and factors that affect memory and recall of voices **[3]**.

Several research projects have been conducted specifically to address issues in speaker comparison, including in connection with particular forensic cases. These include:

- establishing population distributions for numerous features of English dialects (Foulkes, Llamas, Watt; ESRC, IAFPA & Marie Curie grants; **[1, 4, 5, 9, 12-14]**).
- experimental work to investigate the effects of technical factors on acoustic signals, e.g. transmission of speech through mobile phone technology, revealing much more severe deleterious effects than in landline transmission (Foulkes; **[2]**).
- experimental work on garments worn over the mouth or face, such as surgical masks, balaclavas, or the niqaab, testing their effects on speech acoustics and intelligibility (Llamas & Watt; IAFPA & Marie Curie grants; **[10, 14]**).
- experimental work to understand factors that affect earwitnesses' ability to identify voices, including the type, technical quality, and duration of the speech sample, individual ability of listeners, and familiarity with the speaker (Foulkes; **[3]**).

| 3. References to the research |

Sources include peer-reviewed articles, solicited entries in major handbooks, books with major publishers, and ~£1m in grants, much of which was awarded through peer reviewed applications.

[4] was submitted to RAE 2008, where 95% of the York submission was assessed as 2* or above. **Bold** = York staff; <u>underline</u> = JPFA staff.

Publications (all can be supplied on request)

[1] Beal, J., Burbano-Elizondo, L. & **Llamas, C.** (2012) *Urban North-Eastern English*. EUP. (REF 2)

[2] Byrne, C. & **Foulkes, P.** (2004) The mobile phone effect on vowel formants. *International Journal of Speech, Language and the Law* 11: 83-102.

[3] **Foulkes, P.** & Barron, A. (2000) Telephone speaker recognition amongst members of close social network. *Forensic Linguistics* 7: 180-98.

[4] **Foulkes, P.** & Docherty, G. (2006) The social life of phonetics and phonology. *Journal of Phonetics* 34: 409-38.

[5] **Foulkes, P.** & Docherty, G. (2007) Phonological variation in England. In Britain, D. (ed.) *Language in the British Isles*. CUP, 52-74.

[6] **Foulkes, P.** & <u>French, P.</u> (2012) Forensic speaker comparison: the linguistic-acoustic perspective. In Solan & Tiersma (eds.) *Oxford Handbook of Language & Law*. OUP, 557-72.

[7] **Foulkes, P., Scobbie, J. & Watt, D.** (2010) Sociophonetics. In Hardcastle, Laver & Gibbon (eds). *Handbook of Phonetic Sciences* (2nd ed.). Blackwell, 703-54. (REF 2)

[8] <u>French, P.</u>, Nolan, F., **Foulkes, P.**, <u>Harrison, P.</u> & McDougall, K. (2010) The UK position statement on forensic speaker comparison. *International Journal of Speech, Language and the Law* 17: 143-52.

[9] Hughes, A., Trudgill, P. & **Watt, D.** (2012) *English Accents and Dialects* (5th ed.). Hodder.

[10] **Llamas, C.**, <u>Harrison, P.</u>, Donnelly, D. & **Watt, D.** (2009) Effects of different types of face coverings on speech acoustics and intelligibility. *York Papers in Linguistics* 9: 80-104.

[11] **Llamas, C.** & **Watt, D.** (eds.)(2010) *Language and Identities*. EUP. (REF 2)

Grants

[12] **Llamas,** <u>French</u> (2008-10) *Levelling & diffusion in the north east of England*. University of York. £10k.

[13] **Watt**, **Llamas** (2008-11) *Accent and identity on the Scottish-English border*. ESRC. £608k.

[14] **Foulkes**, <u>French</u>, <u>Harrison</u> et al (2010-14) *Bayesian biometrics for 2*. Marie Curie. £368k.

[15] **Foulkes**, <u>French</u>, <u>Harrison</u>, <u>Stevens</u> et al (2013-15) *Modelling features for forensic speaker comparison*. BA/Leverhulme. £10k.

4. Details of the impact

Note: research references are cited as [x], corroborative sources as {x}.

The main beneficiary of the impact is our collaborating laboratory, J P French Associates, the UK's largest lab for forensic speech and audio analysis and widely recognised as a world leader in the field. Our research also benefits other forensic speech analysts, and judicial systems in the UK and internationally. The impact of the research base is felt in several ways:

1. Professional support to J P French Associates (JPFA)

- Foulkes, Llamas and Watt act as consultants for JPFA, conducting casework and/or providing research-led insights to casework conducted by JPFA (especially via expert insight into Scottish and northern/midlands English dialects, variables for analysis, distribution of features and extent of expected variability of features). York staff were consulted in over 30 cases in 2008-13. **{8}**

- Methodologies developed in sociophonetics have been applied to forensic casework by JPFA and York staff. For example, formal quantification of sociolinguistic variables was integral to a 2009 case, establishing that an evidential recording was highly unlikely to have been produced by the suspect **[6**, p. 566**]**. Research on the acoustic effects of face coverings **[10]** was applied to an appeal case in 2013, in which audibility tests were reconstructed by the York group. The key issue was whether the speaker at the scene of the crime, wearing a motorcycle helmet, could have been heard or identified by witnesses. (Both cases are in progress in July 2013.)

- Our research with earwitnesses provides new insights into the factors that may affect witness recall of voices they have heard (e.g. whether the voice was shouting, disguised, or transmitted by telephone). This body of work confirms the view that earwitness testimony must be assessed with a detailed understanding of the specific context of each case, and enhances a court's ability to assess the reliability of the testimony. Work such as [3] is regularly cited in JPFA case

reports for UK and international cases, e.g. in R -v- Miah & ors (2009); DPP -v- Tighe & Tighe, (Ireland 2010); HMA -v- Gallagher (2010), R -v- Tongue (2012), R -v- Karsten (2013). **{8}**

- Voice quality analysis has rarely been included in speaker comparison reports, despite its clear potential as a diagnostic feature for analysis. In 2008 Watt and Foulkes assisted JPFA in developing a method, based on Laver's VPA protocol, to enable JPFA to undertake formal voice quality analysis for the first time. It has since been used in over 500 cases. **{8}**

- JPFA staff, benefitting from direct access to a thriving research culture through our collaboration, have greatly increased their own research output and involvement with wider academic communities (e.g. **[6,8,10,12,14,15]**, **{2,3,8}**, two staff engaged in Marie Curie FP7 grant (€3.2m) **[14]**, support to JPFA through University of York research funding **[11]**).

- Our collaboration has contributed towards the professional development of staff at JPFA. All five junior analysts are York Masters graduates, with four undertaking PhDs at York in 2008-13. They routinely apply research skills and insights acquired during their training to casework, drawing on our research outputs. Peter French summarises the impact as follows: "JPFA's unique relationship with the University of York has enabled the firm to be at the forefront of research in modelling individual speaker characteristics. This has provided us with a better understanding of the strengths and limitations of the various approaches to forensic speaker comparison and assisted with our developing new practical phonetic and acoustic measures for use in casework. The research and general input of members of the University has been invaluable to us and facilitated our rise to the position of the UK's largest and most prominent independent forensic speech and acoustics laboratory." **{8}**

2. Provision of expert testimony and opinion

- In 2008-13 Foulkes and Watt were lead or sole authors on expert reports in over 20 UK and international cases. Foulkes provided a written report and evidence in court in the high profile case of David Bain's retrial for the murder of five members of his family (New Zealand, 2008). The evidence played an integral role in a disputed section of a recording being excised prior to the jury hearing it. Bain has been described as a "unique case" in New Zealand legal history, "the first time that such detailed linguistic evidence... with such potential impact on such a significant trial has been successful in the New Zealand courts, the success lying in its having been heard in its entirety and its import accepted" **{4**, p. 154**}**. In 2013 Watt produced case reports for courts in Malaysia and Northern Ireland, having been identified as an appropriate expert on the strength of his research on speech by people wearing face coverings **[10]**. The Malaysian trial was for kidnap by a person whose face was masked, while the Northern Irish case concerned intelligibility of the voice of a robber wearing a scarf across his face. The Malaysian judge excluded the prosecution expert's evidence on the basis of Watt's report.

- Casework conducted by Foulkes and Watt routinely involves analysis of phonetic and linguistic features that they have analysed in detail in sociophonetic research **[4-7,9]**. For example, in 2010 Watt provided expert opinion in the perjury case of the former MSP Tommy Sheridan, drawing on his expertise in variation in Scottish English **[9,13]**, **{6}**.

3. Improving national and international practice in forensic speaker comparison

- Our research on mobile telephone transmission showed acoustic effects on vowel formants are far more serious than those in landline recordings **[2]**. Case analysis must therefore accommodate these factors, and appropriate steps be taken in acoustic analysis of case materials to cater for major differences in acoustic properties caused by the technical transmission (correcting first formant measurements or avoiding them altogether). This work is widely recognised and its findings applied routinely by analysts at many forensic agencies, including the US Secret Service **{1}**, BKA (German State forensic laboratory) **{5}**, NFI **{11}**, Royal Canadian Mounted Police **{9}**, as well as JPFA **{2}**.

- Phonetic insights on variation were integral to the development of a new framework for the expression of conclusions in 2007, in collaboration between York staff, JPFA, and colleagues at the University of Cambridge **[8]**. It was adopted as a common framework by almost all forensic phoneticians in the UK. This represents a marked change in the format used to present expert evidence. It offers a logical and legal advance on its predecessor, which incorrectly led analysts to offer definitive statements about speaker identity in a binary or probabilistic framework (effectively delivering a judgment of guilt, which is properly a matter for the trier of fact not the

expert witness). The UK framework has since been translated and adopted by practitioners in other countries including Germany, Spain, and Turkey. In Turkey, for example, the framework has been used in over 300 cases conducted since 2008 by the national forensic laboratory. **{10}**

- Since 2008 practising forensic analysts from Denmark, Norway, the Netherlands, and Spain have undertaken professional training at York, including via the MSc in Forensic Speech Science (either the full degree or key modules). The MSc provides a theoretical and practical grounding in forensic speech science, especially speaker comparison. It is squarely based on the research strengths of the York group, and on the working practices of JPFA. These analysts employ skills and insights from their training at York in their casework. For example, Jos Vermeulen MSc is now the sole registered speech expert at the Netherlands Forensic Institute (NFI; an agency of the Ministry of Security and Justice, and one of the world's leading forensic labs). All reports and witness testimony he produces are based in part on York research (e.g. **[2,3,6]**). Sociolinguistic research in particular has led to a "sharpening" of casework methods in the context of multilingual societies **[4,7,11]**. He describes the MSc as "the most relevant academic degree in the world" for the training of forensic practitioners in this field. **{11}**

- In 2012 the Royal Canadian Mounted Police appointed a York MSc/PhD graduate, Colleen Kavanagh, as a forensic speech expert. She is part of a unit which offers service to all of Canada. She applies research methods and insights from her training in her casework. Her appointment allowed the RCMP to include the phonetically-based UK practice **[6,8]** for some cases. This has led to an increase in the number of cases accepted by the lab (9 cases in 2013 as of 23/8/13, versus 1 to 6 cases in each of the previous seven years). In previous years, most requests were turned away because the recordings could not meet the RCMP's criteria. **{9}**

- In 2009-11 the UK Law Commission undertook a full review of the law on expert evidence, prompted by a call for reform from the House of Commons' Science and Technology Committee. This call reflected concern that expert opinion evidence was being admitted in criminal proceedings too readily and with insufficient scrutiny, and in light of concern over public confidence in the expert witness system. One aim of the review was to approach standardisation of the treatment of different forensic sciences. York led the UK group of forensic speech scientists in this review, holding a meeting of over 20 practitioners and interested academics in 2009. The response of the group was cited at length in the resulting guidelines on expert evidence. Based on our understanding of the complexities of speech, and the difficulties in applying linguistic analysis to forensic materials, we argued against a proposal to separate forensic practice into 'science-based' and 'experience-based'. Instead, we argued that most forensic analysis involves an application of scientific principles mediated by the analyst's experience. Our position was accepted as a general principle for forensic experts. **{7}**

5. Sources to corroborate the impact

{1} Chen, N., Shen, W., Campbell, J. & Schwartz, R. (2009) Large-scale analysis of formant frequency estimation variability in conversational telephone speech. *Proceedings of Interspeech* 2009, University of Brighton, pp. 2203-2206. [Schwartz is the forensic speech analyst at the US Secret Service; the research outlined acknowledges the findings of [2].]

{2} French, P. & Stevens, L. (2012) Forensic speech science. In M. Jones & R. Knight (eds.) *Bloomsbury Companion to Phonetics*. London: Continuum. [acknowledges the findings of [2].]

{3} Gold, E. & French, P. (2011) International practices in forensic speaker comparison. *International Journal of Speech, Language and the Law* 18: 293-307.

{4} Innes, B. (2011) R v David Bain – a unique case in New Zealand legal and linguistic history. *International Journal of Speech, Language and the Law* 18: 145-155.

{5} Jessen, M. (2008) Forensic phonetics. *Language & Linguistics Compass* 2: 671–711.

{6} 'Trial of the decade', report on Tommy Sheridan case. *News Of The World* 26 Dec. 2010.

{7} Law Commission (2011) *Expert Evidence in Criminal Proceedings in England and Wales*. London: The Stationery Office. (paragraph 3.46, pp. 37-38)

Personal testimony

{8} J P French Associates; **{9}** Royal Canadian Mounted Police; **{10}** Registered Forensic Expert, Justice Commission of Istanbul; **{11}** Forensic expert, Netherlands Forensic Institute.