



Continuing Professional Development Forensic Speech and Audio Analysis

September 9-12 2018



UNIVERSITY
of York

Department of Language
and Linguistic Science

Contents

Course overview	3
Who is the course for?	4
Course aims	5
Course content	6-13
Attendee testimonials	14
Course costs	15
Contact us	16



Course overview

The Department of Language and Linguistic Science at the University of York is pleased to announce that our fourth CPD course in Forensic Speech and Audio Analysis will run from **September 9-12 2018**. The course allows participants to gain an understanding of both the theory and practice of forensic speech and audio analysis. In addition to being introduced to underlying concepts and principles, participants will gain hands-on experience of analysing real casework recordings.



The Department is recognised as a world centre for research in Forensic Speech Science and currently has UK research council funding of around £1.7 million for work in this field. For 9 years it has successfully run the world's only MSc degree programme in FSS and has a cohort of PhD students working in the area.

The CPD courses are taught by Departmental staff in conjunction with speech and audio experts from JP French Associates, the UK's longest-established and leading independent provider of forensic speech and audio services to law enforcement, prosecution and defence agencies. The firm has a record of casework unrivalled in the UK, having been involved in over 5000 cases internationally since the mid-1980s.

Who is the course for?

The course is designed for personnel from a range of professional backgrounds, including:

- police, government security and other investigative agency technical and scientific staff
- established forensic speech and audio scientists
- scientists currently working in related forensic specialisms



Course aims

The aims of the course are:

- to increase awareness and understanding of the procedures used in the various subfields of forensic speech and audio analysis
- to increase and enhance the skillsets of those already involved in those areas
- to prepare established practitioners for the impending government regulation of forensic speech and audio via ISO 17025 – staff delivering the courses formed a majority presence on the Home Office Forensic Regulator’s committee responsible for adapting the ISO to the specific needs of these fields. At present, this relates specifically to forensic speaker comparison and enhancement work. Compliance with the guidance provided by the Forensic Regulator and ISO 17025 will be addressed throughout the parts of the course dealing with those tasks



Course content

The course comprises a number of core components relating to forensic tasks.

Depending on client needs, however, we are prepared to give certain tasks extended treatment and reduce or remove others. Please contact the Course Information Officer (see p.15) to discuss any particular wishes or requirements.

Forensic speaker comparison

This major component of the course deals with procedures for the comparison of voices in evidential recordings with those of known suspects. Beginning from a consideration of speech production from both biological and social perspectives, the voice is considered as a hybrid - partly fixed but mainly behavioural - biometric. The problems this raises for the unique identification of speakers are addressed, and the course considers how the two major approaches to forensic speaker comparison in use across the world - namely, the auditory-phonetic cum acoustic method and the use of automatic speaker recognition (ASR) systems - each deal with them.



Participants gain first-hand experience of both approaches, which are explained and demonstrated in relation to real forensic recordings, some of which have featured in recent and high profile cases.

In respect of auditory-phonetic cum acoustic analysis, the most commonly used method of comparison employed by individual experts and laboratories internationally, participants are shown how the speech signal can be considered in terms of its individual component parts. This includes auditory and spectral analyses of consonant and vowel sounds, vowel resonance (formant) plotting and averaging, fundamental frequency (pitch) analysis, description of voice quality, analysis of speech prosody and intonation, and measurement of articulation rate.

The theoretical underpinnings of ASR comparison - mel frequency cepstral coefficient (MFCC) analysis and speaker modelling - are explained as a backcloth to practical sessions involving ASR software. Through a recently formed partnership between the University of York and the world-leading speech technology company Nuance Communications, course participants gain hands-on experience of cutting edge ASR systems and the latest generation of software.



Speaker profiling

Speech scientists are not infrequently asked to analyse recordings during a progressing criminal investigation in order to provide information about a voice. This is normally done to assist the police in identifying the section of the population to which the criminal voice belongs. Typical cases involve masked robberies, where the faces of the robbers are not seen but their voices are picked up on the soundtrack of a CCTV system, and the production of pornographic videos of children, where the cameraman remains off-scene but his voice can be heard directing the victims.



Central to the speaker profiling task is the concept of indexicality, the premise that the voice carries information about, or indexes, facts concerning its user. The course considers the range of questions speech scientists might realistically address in undertaking speaker profiling. These include regional background, ethnic minority and foreign language influences, presence of speech disorder or voice pathology, and intoxication. Consideration is given to the problems of estimating speaker age, but some matters, such as the overall physical characteristics of a speaker, height and body mass - as well as most psychological states - are viewed as lying beyond reliable assessment.

Analytic techniques - acoustic and sociophonetic - associated with speaker profiling are explained and demonstrated through real forensic recordings.

Transcription and questioned content analysis

Investigators' increased use of intrusive audio surveillance and covert recording in premises and vehicles has brought with it problems as well as benefits. Not least among the problems is that of speech intelligibility. While this is to some degree amenable to improvement using speech enhancement software (see below), one may nevertheless be left with a recording that is less than ideal in quality. The course considers the part to be played by the speech scientist in 'decoding' difficult recordings. The act of perceiving what was said is explained by reference to studies in cognitive phonetics and the problems of 'priming' and cognitive bias more generally are addressed. The uses of spectrographic analysis and other acoustic techniques in determining the content of limited, 'localised' areas of recordings (individual words or utterances) are introduced via forensic recordings from past cases.



Sound processing and enhancement of recordings

Participants are introduced to a range of speech intelligibility and 'listenability' problems arising from different kinds of noise contamination and detrimental acoustic environments (e.g. reverberant recording spaces, occluded and distant microphones). The approach put forward is to analyse the recording acoustically in order to determine the energy-frequency characteristics of both the speech signal and the noise and thereby establish which type of sound filter or dynamic processor might be most effective and what the appropriate settings may be.

Participants are given experience of a range of different filters and processors and particular consideration is given to the ways in which each might have detriments as well as benefits to the speech. Detriments are demonstrated by reference to the energy-frequency characteristics of different classes of consonant sounds in particular. Practical experience of sound enhancement technology is provided.



Authenticity examinations of recordings

The greatest breakthrough in authenticity testing of recordings – examinations to establish whether editing or tampering has taken place – is undoubtedly electrical network frequency (ENF) analysis. The rate of alternation of the electrical mains current in the UK is nominally 50 Hz, but in practice the rate of alternation is subject to minor fluctuations on a moment-by-moment basis in accordance with changes in the demands placed upon the electricity supply. The pattern of fluctuation is the same for the whole of the UK mainland (and other land masses across the world) and unique to any particular period of time. Many recordings contain low level mains hum, inducted from nearby cables and appliances, and this may be amplified and extracted. JP French Associates is the only independent sector forensic laboratory to have been recording mains hum continuously for the past 10 years. Analysts are able to compare the mains hum extracted from an evidential recording against the database of recorded hum and thereby determine both when the recording was made and whether it is a ‘mosaic’ of sections taken from other recordings made at different dates and times.



The course explains methods for recording a database of hum, extracting hum for evidential recordings and for running comparisons. Practical demonstrations of the technique are provided and illustrated from previous criminal cases. In addition to ENF analysis, participants are introduced to other tests in the authentication battery. These include critical listening, acoustic examinations, and analysis of meta-data from digital sound files.

Analogue tape recordings occasionally still arise in legal cases and participants are introduced to the use of magnetic field visualisation - conducted via iron-garnet crystals with the aid of low-power microscopy - as a means of authenticating these. Demonstrations are provided of how this technology can also be used to identify the particular machine on which a tape has been recorded.

Expressing conclusions in reports

A major debate across all areas of forensic science over recent years has concerned the framework used to express conclusions. It is now generally recognised that the logically coherent framework is that of the Bayesian likelihood ratio (LR) accompanied by a statement drawn from a verbal support scale. The course provides an understanding of this approach and contrasts it with other ways of stating conclusions: categorical judgements and classical probability scales.



In speaker comparison work, in order to arrive at an LR it is necessary to compare the voice in a criminal recording not only with that of the suspect but also with a reference population of speakers. This allows one to assess not just the degree of similarity between the suspect and the criminal but also how typical or otherwise the patterns found in the criminal voice may be in the relevant speech community. Given that some, if not most, features forensic speech scientists currently analyse are accent-dependent, consideration is given to what this may mean for compiling databases of reference recordings for use in casework.

Consideration is also given to the problems – and solutions – associated with combining LRs established for the individual features compared (e.g. particular vowels or consonants) into an overall LR for the comparison as a whole.

Participants are provided with training in the calculation of LRs arising from analyses and comparisons of recordings.

Attendee testimonials

"A lot of entirely new information communicated very well by knowledgeable people."

"Fantastic! Covers most ground at a very digestible level."

"The staff on the course, expertise and personalities were outstanding."



"I would like to thank Prof. Peter French, Dom, Phil and Vince for making this course great fun. I learnt a lot from it. It has been my pleasure and honour to have attended this course and have been taught by such eminent and competent scholars."

"The course was perfectly balanced between theory and practice."

"I would definitely recommend the course to my colleagues."

Course costs

Details of the course costs are listed below. In addition to full course participation, the course fee includes three nights' hotel accommodation. We provide all lunches, a three-course workshop dinner, a welcome reception and a walking tour of York City Centre.

For more information, please contact the Course Information Officer (details on p.15).

Details	Cost
Three-day CPD course including hotel accommodation, lunches, workshop dinner, welcome reception and York City Centre walking tour	£1500 per person



Contact us

For more information about the CPD course,
contact the Course Information Officer:

James Tompkinson MSc
CPD Course Information Officer
Department of Language and Linguistic Science
University of York
York
YO10 5DD
UK

Email: linguistics-forensics@york.ac.uk

CPD teaching staff

Professor Peter French

Dr Philip Harrison

Dr Vincent Hughes

Dr Dominic Watt



UNIVERSITY
of York