Forensic Science Regulator

Overseeing Quality

Codes of Practice and Conduct

Appendix: Speech and Audio Forensic Services

FSR-C-134

Consultation Draft

This is a consultation draft and therefore should not be regarded or used as a standard. This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication, the consultation will run from 11 December 2015 to 29 January 2016. Comments should be sent to FSRConsultation1@homeoffice.gsi.gov.uk and should be submitted by 29 January 2016. This mailbox is not for general correspondence and is not routinely monitored so no acknowledgement will normally be sent. THIS DRAFT IS NOT CURRENT BEYOND 29 January 2016.

1. INTRODUCTION

1.1.1 The provider of digital forensic science (the provider) shall comply with the *Codes of Practice and Conduct* (the Codes) and be accredited to BS EN ISO/IEC 17025:2005 for any laboratory function as set out in the Codes.

1.1.2 Standards such as ISO/IEC 27037:2012 may be used as guidance if required. However, they are not equivalent and cannot be used as a substitute for the accreditation standard.

1.1.3 This appendix provides further explanation of some of the requirements of the Codes specifically pertaining to the provision of speech and audio analysis.

1.1.4 This appendix should be read alongside the Codes, the *Digital Forensic Services* appendix FSR-C-107,[1] BS EN ISO/IEC 17025:2005 and ILAC-G19, and will generally follow the heading titles used in the Codes with cross references to BS EN ISO/IEC 17025:2005 given in parentheses.

2. SCOPE

2.1.1 This appendix covers digital forensics work as it applies to speech and audio analysis.

3. IMPLEMENTATION

3.1.1 The Forensic Science Regulator requires accreditation to BS EN ISO/IEC 17025:2005 and the Codes by October 2017 as detailed in the Codes.

3.1.2 This appendix is available for incorporation into a provider's quality management system from the date of publication.

3.1.3 This is a draft published for consultation, when published in its final form it shall also be included in the provider's accreditation schedule as detailed in the Codes.

4. TECHNICAL RECORDS (BS EN ISO/IEC 17025:2005 REF 4.13.2)

4.1.1 Contemporaneous records must be made and retained for all types of speech and audio procedures and examinations.

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[1] Available from: https://www.gov.uk/government/collections/forensic-science-providers-codes-of-practice-and-conduct [Accessed 12/09/15].

4.1.2 A record must be made of the relevant characteristics of materials examined including, where applicable:

a. media type and any identifying features;
b. technical characteristics of recordings, e.g. tape speed, file format, number of channels, sample rate, bit rate;
c. the nature of any technical problems or impediments to analysis, e.g. noise, distortion, replay speed errors, signal dropouts or any potential integrity issues that the practitioner may become aware of.

4.1.3 A detailed record or audit trail must be kept of all subsequent actions performed on the material to the extent that an independent third party would be able to examine the notes and repeat the processes to achieve the same findings or end product.[2,3] Records are required regarding the following.

a. Digitisation from analogue sources or copying via digital interfaces, including interface, software and hardware used, levels and other settings.
b. Transfer of files and conversion of file types, including software and settings.
c. All processes such as filtering, speed adjustment, sample rate conversions, including software and settings.
d. Creation of new materials (e.g. enhanced or edited copies), including hardware, software and number of copies.
e. Where recordings are subject to editing, a record shall be retained of all edit points. Where the edited file is subject to analysis (e.g. for speaker comparison) all edit files must be retained in accordance with UK data retention legislation.

4.1.4 Where data files containing settings or audit trails can be saved electronically they must be retained as part of the case record, or in a secure location referred to in the case record.

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2 It is recognised that where a conclusion based on the findings is dependent on the analyst's interpretation, the conclusion of the third party may not be the same as that of the analyst.

3 For enhancement the records should be to a level that enables the recreation of auditory indistinguishable results. When adaptive filters are used this means that the approximate time(s) in the recording where the filter was trained must be noted.

4.1.5 Records must be kept of the timings within a recording at which measurements are taken and the methods and settings used. Observations of features relevant to the examination undertaken (e.g. signal discontinuities, segmental phonetic features) shall be sufficiently exemplified, with timings recorded. The practitioner should make notes of all analyses undertaken with details of results and findings.

5. CHECKING AND REVIEW (BS EN ISO/IEC 17025:2005 REF 5.9)

5.1.1 The provider shall have documented policies and procedures relating to the following.

a. The checking of case records, which may be carried out by the practitioners themselves or by other experienced practitioners (reviewers). The purpose of this is to ensure that the work carried out is appropriate, fully documented, in compliance with internal procedures and consistent with the description of it that appears in any ensuing report or statement. Checking of this kind shall be carried out on every case.

b. The review of critical findings,[4] which must be carried out by another competent practitioner in the same field (reviewer) who will examine the case records, digital copies of recordings, and any data files and spreadsheets relating to enhancement settings, etc.

c. In respect of audio enhancement, the reviewer shall check that suitable filters and dynamic processors have been selected and used appropriately and that the recording has not been over-processed.

d. In relation to forensic speaker comparison, in addition to checking each critical finding, the reviewer shall check that an appropriate range of analyses has been carried out satisfactorily, and that the results obtained are both replicable and consistent with the interpretation of the findings and the conclusions reached. This review shall be carried out in all cases.

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[4] Critical findings are defined in the Forensic Science Regulator's Codes (footnote 30) as *"observations or results that: have a significant impact on the conclusion reached, the interpretation, or an opinion provided; cannot be repeated or checked in the absence of the exhibit or sample; and/or could be interpreted differently".*

e. Checks shall also be carried out in cases where materials are rejected as unsuitable for analysis or where there is a significant divergence between samples. In these instances the extent of the checks should be commensurate with the exigencies of the materials and the examinations conducted.

f. Review by the practitioner of all work carried out by assistants.

6. ACCOMMODATION AND ENVIRONMENTAL CONDITIONS (BS EN ISO/IEC 17025:2005 REF 5.3)

6.1.1 Examinations and analysis should be conducted in an environment that is conducive to the detailed listening to speech and audio recordings, in particular by taking reasonable steps to minimise background noise levels and other potential sources of distraction/disruption.

6.1.2 When handling and storing magnetic recording media, care should be taken to avoid exposing them to strong magnetic fields, e.g. not placing them close to unshielded loudspeakers, or CRT VDUs.

6.1.3 Providers shall have procedures in place for the appropriate disposal of media containing confidential information, e.g. bulk erasure of magnetic media, destruction of CDs, wiping of hard drives and memory sticks.

7. MANAGING CONTAMINATION, ALTERATION AND LOSS OF AUDIO MATERIAL

7.1 General

7.1.1 Throughout the examination of forensic audio material there are potential risks of contamination, alteration and loss of audio material, which can be detrimental to the integrity of the recordings and any analysis results.

7.1.2 Contamination is the introduction of extraneous material to a recording or sample at the time of production or during examination at the laboratory. This must be avoided and controlled, as must any other undesirable changes or distortions to the material. The word ‘degradation’ is used collectively to describe any unwanted contamination, alteration, or loss of material.

7.2 Examples of Potential Degradations

7.2.1 The supplier shall be aware of potential degradations, including:

a. addition of noise from sources such as GSM telephones or mains electricity during the audio copying process;
b. addition of computer generated sounds, e.g. mouse clicks or alert tones;
c. aliases introduced when down-sampling if no anti-aliasing filter is used;
d. inclusion of speech from other individuals in edit files focused exclusively on a single speaker;
e. the selection of inappropriate replay and recording levels;
f. signal dropouts;
g. loss of high frequencies through the selection of inappropriate sampling rates;
h. incomplete transfer or accidental erasure;
i. conversion to compressed formats;
j. replay on poorly maintained or inappropriate equipment;
k. over-processing when attempting to reduce noise;
l. loss of high frequencies through non-optimal setting of the azimuth for analogue tape playback.

7.2.2 The production of open-field/acoustic copies, i.e. loudspeaker-to-microphone copies of forensic recordings, must be avoided unless no other transfer method is possible.

7.3 Integrity and Suitability of Submitted Materials

7.3.1 The provider shall take all reasonable steps to ensure that the material submitted by an instructing party is in an appropriate form and of the best available quality. This shall be, in order of preference, the original recording itself, a digital clone, or a copy made to the same standards as the practitioner would employ. Where the provenance of the material is in doubt, reasonable efforts shall be made to establish its origin and, if appropriate, obtain a better version. Where only a substandard copy, or a copy of unknown provenance is available, the practitioner must record all available information concerning:

a. how the recording/copy was made;

b. the effects this may have had on the integrity of the recording; and

c. the likely potential impact on the examination.

7.3.2 If the practitioner becomes aware of an issue with the integrity of a recording at any point in the course of their examination, this should be documented and reported to the customer.

7.3.3 For speaker comparison cases, the provider shall assess the recordings to ensure that they are adequate for the task. Adequacy cannot be specified by reference to a minimum duration or quality of sound as it involves an interaction of these factors with the distinctiveness of the voice in question. The elimination of suspects may be possible on otherwise limited samples where, e.g. there is a significant mismatch in accent.

7.3.4 The document *UKAS Policy on Deviating Samples* (TPS63) provides further information on how laboratories should treat samples that do not meet the required standards in relation to integrity, quality and other factors that may jeopardise the validity of the analysis results.

7.4 Avoiding Degradations in the Laboratory

7.4.1 The provider shall take the necessary steps to ensure that the original audio evidence is not compromised through the implementation of procedures for write protecting of media.

7.4.2 Steps must be taken to reduce and manage degradation of audio material at all stages of the examination by ensuring:

a. the use of appropriate and properly maintained equipment;
b. the adoption of appropriate validated and documented methods;
c. that staff are adequately trained to avoid introducing degradations;
d. that processed recordings are checked auditorily to determine whether speech intelligibility *may* have been reduced.

7.4.3 For enhancement work, regular peer review must be undertaken to ensure that practitioners are not over-processing recordings.

7.4.4 All material should be checked for degradation before proceeding with any analysis or dispatching it to the customer. If degradation is detected then

corrective actions must be taken to reduce or remove the problem. A record should be kept that degradation was detected and that steps were taken to obviate future occurrences. This could, e.g. require the re-routing of cables, the maintenance of equipment or a re-evaluation of the process followed.

7.4.5 In relation to the inclusion of speech from other individuals in edit files that are meant to include only a single speaker (see section 5), the nature of the recording will determine the extent to which some contamination is unavoidable, e.g. a short recording with lots of background speakers or overlapping speech. Certain analysis processes are more susceptible to the influence of contamination, e.g. long-term pitch measurements and automatic analysis, and steps should be taken to prepare edit files or demarcate speech in a way that is commensurate with the relevant task. All edit files and/or time markers should be retained as part of the case record (in accordance with UK data retention legislation).

8. TEST METHODS AND METHOD VALIDATION (BS EN ISO/IEC 17025:2005 REF 5.4)

8.1.1 The field of forensic speech and audio encompasses a variety of tasks. These range in complexity from simple technical procedures to complex, multi-stranded interpretive methods combining acoustic measurements and auditory judgements. The specific process, or combination of processes, adopted in any instance will be determined to a greater or lesser extent by the exigencies of the case, including the specific characteristics of the recordings.

8.1.2 Many of the tasks undertaken involve the interpretation of data and the provision of opinions. The document *UKAS Guidance on the Application of ISO/IEC 17025 Dealing with Expressions of Opinions and Interpretations* (LAB 13) provides information on how these factors can be incorporated within a laboratory's scope of accreditation.

8.1.3 The validation of non-analytic, technical procedures such as copying, digitisation or format conversion of recordings will require:

a. the testing of hardware and/or software;

b. assessment of the operating procedure for performing the task; and

c. the competency of the practitioner in following the procedure and evaluating its outcome.

8.1.4 Additionally, measurement-based methods, such as measuring formant frequencies, will require practitioners to be assessed on whether they can make consistent, reproducible, valid and reliable measurements that yield values within a range that compares closely with those that would be reported by other competent practitioners. Consistency between operators using the same process needs to be demonstrated and the validation should set acceptable variation between operators. Validation of the methods to make such measurements must also be carried out to demonstrate that the chosen methodology is fit for purpose.

8.1.5 Human-based interpretive methods will require the competency of the practitioner to be assessed via the independent confirmation of results, inter-laboratory comparisons, blind testing and testing of background knowledge associated with relevant subject-disciplines. Such testing must be sufficient to demonstrate that the methods to which they relate meet the necessary validation criteria. Laboratories may develop their own analyst testing programs and/or take part in relevant commercial or community operated testing programs.

9. EQUIPMENT (BS EN ISO/IEC 17025:2005 REF 5.5)

9.1.1 Professional or broadcast grade equipment (hardware and software) and interconnections shall be used unless professional equipment is not commercially available or there are technical reasons for using inferior equipment, e.g. it may in some cases be necessary to replay a recording using the equipment on which it was made.

9.1.2 Unless the practitioner is working with professional grade loudspeakers in an acoustically treated environment, headphones rather than loudspeakers shall be used for detailed analytic listening.

9.1.3 Where outdated or moribund technology needs to be used, all reasonable and practicable steps shall be taken to ensure that it is fit for purpose.

9.1.4 Where practitioners produce audio material, such as enhanced recordings, warnings should be provided in the accompanying report or statement that the use of inappropriate replay or reproduction equipment can result in significant degradation of quality.

10. REVIEW

10.1.1 When published, this document will be subject to review at regular intervals.

10.1.2 This version is a consultation draft so any comments please send them to FSRConsultation1@homeoffice.gsi.gov.uk as instructed on the front cover.

11. REFERENCES

BS EN ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories.* Available from: http://shop.bsigroup.com/

BS ISO/IEC 27037:2012 *Information technology -- Security techniques -- Guidelines for identification, collection, acquisition and preservation of digital evidence*. Available from: http://shop.bsigroup.com/

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