Forensic Science Regulator

Overseeing Quality

Codes of Practice and Conduct

Appendix: Speech and Audio Forensic Services

FSR-C-134

Issue 2

Contents

1. Introduction

1.1.1 The provider of digital forensic science (the provider) shall comply with the Codes of Practice and Conduct for Forensic Science Providers and Practitioners in the Criminal Justice System (the Codes) [1] and be accredited to General requirements for the competence of testing and calibration laboratories BS EN ISO/IEC 17025:2017 [2] for any testing activity (referred to as ISO17025 from this point).

1.1.2 Standards such as ISO/IEC 27037:2012 [3] 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 [4], ISO17025 [2], Modules in a Forensic Science Process - ILAC-G19 [5], and Cognitive Bias Effects Relevant to Forensic Science Examinations FSR-G-217 [6]. It will generally follow the heading titles used in the Codes.

1.1.5 Although providers can be any size, this document will use the ILAC-G19 term ‘forensic unit’ (see Glossary).

2. Modification

2.1.1 This is the second issue of this document.

2.1.2 Significant changes to the text have been highlighted in grey.

2.1.3 The modifications made to create Issue 2 of this document were, in part, to ensure compliance with The Public Sector Bodies (Websites and Mobile Applications) (No. 2) Accessibility Regulations 2018. [1]

[1] To facilitate the operation of the Regulations the following significant changes to sections of the document are noted here. The following sections of the document have been amended 1.1.1, 1.1.4, 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 3.1.2, 5.1.1, 5.1.2, 5.1.3, 5.1.4, 6.1.1, 8.1.2, 8.2.1, 8.2.2, 8.3.1, 8.4.2, 8.4.3, 9.1.4, 9.1.5, 12, 13. The following footnotes have been amended: 1, 2.

2.1.4 The Regulator uses an identification system for all documents. In the normal sequence of documents this identifier is of the form 'FSR-#-###' where (a) the '#' indicates a letter to describe the type or document and (b) '###' indicates a numerical, or alphanumerical, code to identify the document. For example, the Codes are FSR-C-100. Combined with the issue number this ensures each document is uniquely identified.

2.1.5 In some cases, it may be necessary to publish a modified version of a document (e.g. a version in a different language). In such cases the modified version will have an additional letter at the end of the unique identifier. The identifier thus becoming FSR-#-####.

2.1.6 In all cases the normal document, bearing the identifier FSR-#-###, is to be taken as the definitive version of the document. In the event of any discrepancy between the normal version and a modified version the text of the normal version shall prevail.

3. Implementation

3.1.1 This appendix is available for incorporation into a forensic unit's quality management system from the date of publication.

3.1.2 This document was published on 22 September 2020.

4. Scope

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

5. Technical Records

5.1.1 Contemporaneous records shall be made and retained for all types of speech and audio procedures and examinations.

5.1.2 A record shall be made of the relevant characteristics of materials examined including, where applicable:

a. Media type and any identifying features;
b. Technical characteristics of recordings, for example, file format, encoding format, number of channels, sample rate, bit rate, and tape speed; and

c. The nature of any technical problems or impediments to analysis, for example, noise, distortion, replay speed errors, signal dropouts or any potential integrity issues that the practitioner may become aware of.

5.1.3 A detailed record or audit trail shall be kept of all actions performed on the material so that another competent practitioner can understand them and follow the process carried out. [2] 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 (for example, enhanced or edited copies), including hardware, and software.
e. Where recordings are subject to editing, a record shall be retained of all edit points. Where the edited file is subject to analysis (for example, for speaker comparison) all edit files shall be retained in accordance with UK data retention legislation.

5.1.4 Records shall 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 (for example, 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.

6. Checking and Review

6.1.1 The forensic unit 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 competent forensic

[2] For enhancement the records should be to a level that enables the recreation of auditorily indistinguishable or closely similar results.

practitioners (reviewers). The purpose of this is to ensure that the work carried out is:

i. Appropriate;
ii. Fully documented;
iii. In compliance with internal procedures; and
iv. 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,[3] which shall be carried out by another competent practitioner experienced in forensic science in the same field (the reviewer). The reviewer will examine the case records and digital copies of recordings. In addition to checking each critical finding, the reviewer shall check that an appropriate range of analyses has been carried out satisfactorily, and that results obtained are replicable. The reviewer shall not be aware of the initial practitioner's conclusion(s) drawn from the findings. Rather, reviewers will draw and record their own conclusion(s) before having knowledge of the practitioner's conclusion(s). It is recognised that where a conclusion based on the findings is dependent on interpretation, the conclusion of the reviewer may not be identical to that of the initial practitioner. However, the conclusion would normally be expected to be similar. Where there are significant differences between the conclusions of the initial practitioner and those of the reviewer that cannot be resolved through discussion this shall be disclosed and included in the report. This review shall be carried out in all cases.

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

d. Checks shall also be carried out in cases where materials are rejected as unsuitable for analysis or where there is a significant divergence between

[3] Critical findings are defined in the Forensic Science Regulator's Codes 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".

samples. In these instances, the extent of the checks should be commensurate with the exigencies of the materials and the examinations conducted.

e. The practitioner shall review all work carried out by assistants.

7. Accommodation and Environmental Conditions

7.1 Environment

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

7.2 Handling and Storage

7.2.1 When handling and storing magnetic recording media, care should be taken to avoid exposing them to strong magnetic fields, for example, not placing them close to unshielded loudspeakers, or cathode ray tube video display units.

7.3 Disposal

7.3.1 Forensic units shall have procedures in place for the appropriate disposal of media containing confidential information, for example, bulk erasure of magnetic media, destruction of compact discs, wiping of hard drives and memory sticks.

8. Managing Contamination, Alteration and Loss of Audio Material

8.1 General

8.1.1 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.

8.1.2 Contamination is the introduction of extraneous material to a recording or sample at the time of production or during examination at the laboratory. This shall be avoided and controlled, as shall 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.

8.2 Examples of Potential Degradations

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

a. Addition of noise from sources such as mobile phones or mains electricity during the audio copying process;
b. Addition of computer-generated sounds, for example, 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; and
l. Loss of high frequencies through non-optimal setting of the azimuth for analogue tape playback.

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

8.3 Integrity and Suitability of Submitted Materials

8.3.1 The forensic unit 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 should be the original recording itself or a digital clone of it, or another form of 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 shall 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.

8.3.2 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.

8.3.3 For speaker comparison cases, the forensic unit shall assess the recordings to ensure that they are adequate for the task. A record shall be made of the decision concerning adequacy. Adequacy cannot be specified by reference to a minimum duration or quality of sound as there are other factors involved. For example, a speech recording of relatively short duration or poor quality may be sufficient for a meaningful analysis if the voice in question turns out to be particularly distinctive. However, a recording in which there is no intelligible speech would be highly unlikely to be adequate for analysis.

8.3.4 The document UKAS Policy on Deviating Samples [7] provides further information on how forensic units 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.

8.4 Avoiding Degradations in the Laboratory

8.4.1 The forensic unit 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.

8.4.2 Steps shall 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; and
d. That processed recordings are checked auditorily to determine whether speech intelligibility may have been reduced.

8.4.3 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 shall 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, for example, require the re-routing of cables, the maintenance of equipment or a re-evaluation of the process followed.

8.4.4 In relation to the inclusion of speech from other individuals in edit files that are meant to include only a single speaker (see Section 6), the nature of the recording will determine the extent to which some contamination is unavoidable, for example, a short recording with lots of background speakers or overlapping speech. Certain analysis processes are more susceptible to the influence of contamination, for example, 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.

9. Test Methods and Method Validation

9.1.1 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.

9.1.2 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 [8] provides information on how these factors can be incorporated within the forensic unit's scope of accreditation.

9.1.3 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; and
b. Assessment of the operating procedure for performing the task.

9.1.4 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 shall also be carried out to demonstrate that the chosen methodology is fit for purpose.

9.1.5 Interpretive methods will require the competency of the practitioner to be assessed through the independent confirmation of results, inter-laboratory comparisons, blind testing using known 'ground truth' recordings and testing of background knowledge associated with relevant subject disciplines. Such testing shall be sufficient to demonstrate that the methods to which they relate meet the necessary validation criteria.

10. Equipment

10.1.1 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. For example, in some cases it may be necessary to replay a recording using the equipment on which it was made.

10.1.2 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.

10.1.3 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.

10.1.4 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.

11. Review

11.1.1 This document is subject to review at regular intervals.

11.1.2 If you have any comments please send them to the address or email set out on the Internet at URL: www.gov.uk/government/organisations/forensic-science-regulator.

12. References

[1] Forensic Science Regulator, Codes of Practice and Conduct for Forensic Science Providers and Practitioners in the Criminal Justice System. Birmingham: Forensic Science Regulator, Forensic Science Regulator.

[2] International Organization for Standardization, BS EN ISO/IEC 17025:2017General requirements for the competence of testing and calibration laboratories, British Standards Institution, 2017.

[3] International Organization for Standardization, BS ISO/IEC 27037:2012 Information technology – Security techniques – Guidelines for identification, collection, acquisition and preservation of digital evidence, British Standards Institution, 2012.

[4] Forensic Science Regulator, Digital Forensic Services appendix FSR-C-107, Forensic Science Regulator.

[5] International Laboratory Accreditation Cooperation, “Modules in a Forensic Science Process, ILAC G19:08/2014,” 2014. [Online]. Available: http://ilac.org/news/ilac-g19082014-published/. [Accessed 15 07 2020].

[6] Forensic Science Regulator, Cognitive Bias Effects Relevant to Forensic Science Examinations FSR-G-217, Forensic Science Regulator.

[7] United Kingdom Accreditation Service, “Policy on Deviating Samples (TPS63),” 2019. [Online]. Available: www.ukas.com/technical-services/publications/publications-relating-to-laboratories/. [Accessed 15 07 2020].

[8] United Kingdom Accreditation Service, “Guidance on the Application of ISO/IEC 17025 Dealing with Expressions of Opinions and Interpretations (LAB 13),” 2019. [Online]. Available: www.ukas.com/technical-services/publications/publications-relating-to-laboratories/. [Accessed 15 07 2020].

13. Glossary

Contamination

The undesirable introduction of extraneous material to a recording or sample at the time of production or during examination at the laboratory.

Contemporaneous records

An accurate technical record, made at the time, or as soon after the event (in this report this refers to any type of speech or audio procedure and examination) as practicable. It is a record of relevant evidence that was seen, heard or done by the maker of the record.

Critical findings

An outcome that meets one or more of the following criteria.

a. It has a significant impact on the conclusion reached and the interpretation and opinion provided.
b. Cannot be repeated or checked in the absence of the exhibit or sample.
c. Could be interpreted differently.

Forensic unit

A term used in ILAC-G19 to mean “a legal entity or a defined part of a legal entity that performs any part of the forensic science process”. It is interchangeable with provider. However, it is used in this document as these are small teams or sole practitioners that for accreditation purposes may be considered separate legal entities in larger organisations, providers and police forces.

Provider

The term is used to include all providers of forensic science, whether commercial, public sector or internal to the police service (for example, High Tech Crime Units). It can apply to sole traders, small and medium enterprises or even a unit in a larger organisation that delivers the service. See also forensic unit.

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