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ENHANCING FORENSIC AUDIO:
WHAT WORKS, WHAT DOESN'T, AND WHY

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'Enhancing' has become a routine part of preparing indistinct covert recordings for admission as evidence in criminal trials. Typically, evaluation of its effectiveness is seen as a simple matter of listening to determine whether the enhancement sounds 'clearer' than the original. This seems like a straightforward approach, but it brushes over many important issues which can adversely affect the fairness of the trial. This article outlines findings from experiments, case studies and scientific literature to show how enhancing can affect perception in surprising and unpredictable ways, without listeners' conscious awareness. Discussion demonstrates that enhancing exacerbates, rather than mitigates, known risks of the jury being misled by an unreliable transcript. The conclusion indicates the direction in which to seek better procedures.

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I INTRODUCTION

The right to a fair trial is a cornerstone of a functioning democracy. Realistically, we must accept that it is not possible, in practice, to guarantee that every trial will be perfectly fair: there are simply too many contingencies that can influence any particular outcome. However, it is important to maintain confidence that, in principle, legal procedures, followed diligently, do promote fairness.

The present paper canvasses a threat to fairness that, rather than arising from contingencies, is baked into established legal procedures — specifically, procedures for the handling of indistinct covert recordings used as evidence in criminal trials. As they currently stand, even if followed perfectly, these procedures cannot guarantee a fair outcome.[1] This situation was the subject of a 2017 'call to action', in which a consortium of Australian linguistics organisations[2] called on the judiciary to review and reform legal

[1] Helen Fraser, 'Forensic Transcription: How Confident False Beliefs About Language and Speech Threaten the Right to a Fair Trial in Australia' (2018) 38(4) *Australian Journal of Linguistics* 586 ('How Confident False Beliefs').

[2] The Australian Linguistics Society (ALS), The Applied Linguistics Association of Australia (ALAA), The Australian Speech Science and Technology Association (ASSTA) and The Australian Institute of Interpreters and Translators (AusIT).

procedures for the handling of indistinct covert recordings in four interconnected areas: transcription, translation, speaker attribution and enhancing.[3]

In a recent consultation, a working party of judges acknowledged the validity of the linguists' concerns in all four areas. The present paper focuses only on one: enhancing, i.e. processing applied by audio engineers to indistinct covert recordings with the intention of making their content clearer and thus easier for the court to understand.

The paper starts with a brief, informal review of current procedures for admission and use of enhanced audio. It then outlines a number of problems with those procedures, as seen from the perspective of linguistic science (including a brief consideration of how an enhancement interacts with a transcript). Finally, it indicates a direction for reform.

II CURRENT PROCEDURES: LEGAL PERSPECTIVE AND LINGUISTICS PERSPECTIVE

Under Section 48 of the *Evidence Act 1995* (Cth), a forensic audio recording is considered to be a 'document' for the purposes of a trial, and an enhanced version of the audio may be admitted as a 'copy' of the 'document'. Of course, it is understood that an enhancement is not an identical copy: enhancing, by definition, alters the original, albeit with the intention of improving its clarity. Since any alteration carries the risk, however minimal, that it might mislead, it is expected that the defence[4] will check carefully to ensure the copy is faithful to the original. Should this checking raise any doubt about the effect of the enhancing, they can call for a report detailing the processes that were applied, or hire an expert to review the enhancement. Any dispute not resolvable between the parties can be considered at a voir dire, where the judge, as well as hearing opposing arguments, may listen personally in order to compare the enhancement(s) against the original. If a serious anomaly is noted, the judge can exclude the enhancement. However, the normal expectation is that evaluation of forensic audio should be left as a matter for the jury, with appropriate judicial instruction.

[3] Helen Fraser, 'Thirty Years Is Long Enough: It's Time to Create a Process That Ensures Covert Recordings Used as Evidence in Court Are Interpreted Reliably and Fairly' (2018) 27(3) *Journal of Judicial Administration* 95 ('Thirty Years').

[4] Since enhanced audio is presented by the prosecution in the vast majority of cases, that is assumed as the default for present discussion. Naturally, similar considerations apply in cases where the audio is presented by the defence.

These concepts have been well established in law at least since *Eastman v R*,[5] and tested in Court of Appeal rulings.[6] For this reason, the effectiveness of enhancing is rarely disputed, and police and prosecution practice is built around the expectation, usually justified, that admission will be minimally challenged.

However, while the procedures outlined above were developed in good faith, and have become uncontroversial in law, they are problematic from a linguistics perspective.[7] They embody several false beliefs about the nature of speech; as well as the factors that influence the perception of speech in general, and of indistinct recorded speech in particular,[8] in ways that can be expected to affect the fairness of trials.[9]

The next section briefly reviews some of these false beliefs. Since they involve concepts that, though thoroughly refuted in relevant branches of the language sciences, remain widely accepted outside those specific domains, some of the points are likely to appear counterintuitive to readers more familiar with legal practice than with phonetic science.

III SOME FALSE BELIEFS ABOUT ENHANCING FORENSIC AUDIO

A *Enhancing is Not a Science But an Art*

Audio engineering is the profession tasked with producing high quality sound for live and recorded events, as well as for the broadcast and creative industries, and other applications. Its techniques are grounded in the science of acoustics, which individual practitioners master to varying levels of expertise.

Enhancing is a branch of audio engineering used in postproduction — processing previously recorded audio in order to create specific effects required for the purpose (typically movie soundtracks, advertisements or music recordings). As with enhancement

[5] (1997) 76 FCR 9.
[6] See, eg, *R v Giovannone* (2002) 140 A Crim R 1.
[7] Helen Fraser, '"Enhancing" Forensic Audio: False Beliefs and their Effect in Criminal Trials' (2020) 52 *Australian Journal of Forensic Sciences* 165-177 ('False Beliefs').
[8] Helen Fraser, '"Enhancing" Forensic Audio: What if All That Really Gets Enhanced Is the Credibility of a Misleading Transcript?' (2020) 52 *Australian Journal of Forensic Sciences* 465-476 ('What if All That Really Gets Enhanced').
[9] Helen Fraser, 'Enhancing and Priming at a Voir Dire: Can We Be Sure the Judge Reached the Right Conclusion?' (2019) *Australian Journal of Forensic Sciences* ('Enhancing and Priming').

of visual images, audio enhancing is acknowledged to be more of an art than a science, involving subjective judgement at all stages.[10]

Most commonly, enhancing is applied to input that is already of high quality ('enhance' means to take something good and make it better). However, related techniques can be used to restore degraded audio (e.g. old vinyl records or radio broadcasts) in order to make it easier or more pleasant to listen to.

As with restoration of old photographs, there are limits on what can be achieved (sometimes summarised with the aphorism 'garbage in, garbage out'). However, impressive results can be produced. These impressive results suggested the possibility of using enhancing techniques to improve the quality of indistinct forensic recordings, and forensic enhancement has now become a branch of audio engineering in its own right.[11]

However, while forensic applications may seem similar to general audio restoration, there are significant differences. Most obviously, the quality of the input to forensic enhancing processes is typically far worse than the most degraded audio an engineer would normally attempt to restore.

A more important, though less obvious, difference is that, in the forensic context, 'ground truth' (definitive, indisputable knowledge) regarding the content of the audio is not available. This means the engineer does not have a clear criterion against which to evaluate the effectiveness of the processes being applied.

From a legal perspective, this may not seem to be a problem, since it is not the engineer who is ultimately responsible for evaluating the content of audio admitted in a trial, but the jury. However, from a linguistics perspective, the lack of a scientific basis for determining the efficacy of enhancing techniques is crucial, as explained in the following sections.[12]

B *Enhancing Does Not 'Reveal' Words 'Masked' by Noise*

The experience of listening to indistinct audio is often one of being 'nearly' able to hear what is said, hindered only by what seems to be a veil of noise masking the words. The

[10] Simon Langford, *Digital Audio Editing: Correcting and Enhancing Audio in Pro Tools, Logic Pro, Cubase, and Studio One* (Focal Press, 2013).
[11] Robert C Maher, *Principles of Forensic Audio Analysis* (Springer, 2018).
[12] Note that these sections summarise material presented in greater detail in Fraser, 'False Beliefs' (n 7); Fraser, 'What if All That Gets Enhanced' (n 8); Fraser, 'Enhancing and Priming' (n 9).

concept that audio engineers have the ability to remove this 'veil' and reveal the words behind is promoted by movies and cop shows — even by some forensic audio practitioners. However, the examples they provide are usually constructed for the effect. The capabilities with real forensic audio are far more limited.[13]

Certainly, engineers can reduce noise. Modern enhancing software offers settings designed to filter out many different kinds of noise. However, applying these settings requires not just skill but subjective judgement — and even then they only work well when the noise is easily separable from the speech signal.[14] The problem is that recordings in which the noise is easily separable from the speech signal, while they may sound unpleasant, are usually not particularly difficult to understand.

What makes speech recordings 'indistinct' is when the signal and the noise are convolved by the recording process in ways that listeners' ears cannot resolve. The real problem with this type of audio is not too much 'noise', but too little 'signal' (useful perceptual information). Unfortunately, while this is the situation in which the legal process relies most heavily on enhancing techniques, it is also the one where the objective effectiveness of the techniques is typically lower than expected.

In fact, readers may be surprised to learn there is no research-based evidence supporting the capability of any general engineering techniques to make an objective improvement to the intelligibility of indistinct audio.[15] The surprise may be reduced, however, by reflecting that the demand for such techniques is so high that, had they been developed, they would be used profitably for a wide range of everyday purposes. For one small example, elderly television viewers have long wished broadcasters of gritty urban dramas would provide the option of an enhanced soundtrack that makes the dialogue easier to follow. Unfortunately, a BBC study,[16] commissioned to find techniques that could achieve this, concluded it was impossible: the best recommendation was for viewers to use subtitles.

[13] While individual practitioners may assert their enhancing makes audio clearer, at official levels the difficulty of validating the effectiveness of forensic enhancement techniques is well understood — see also Anna Bartle et al, 'An Approach to Audio Enhancement Validation' (Conference Paper, The International Association of Forensic Phonetics and Acoustics Conference, 2018); Forensic Science Regulator, *Draft Guidance: Digital Forensics Method Validation August* (UK Forensic Science Regulator, 2014).
[14] Maher (n 11).
[15] Philipos C Loizou, *Speech Enhancement Theory and Practice* (Taylor & Francis Group, 2007).
[16] Mike Armstrong, 'Audio Processing and Speech Intelligibility: A Literature Review' (White Paper WHP190, British Broadcasting Corporation Research & Development, 2011) 1.

Indeed, responsible audio engineers acknowledge freely that they cannot improve the objective intelligibility of indistinct forensic audio. While they may agree to do what they can to improve 'listenability', they are often at pains to caution clients against inflated expectations. The problem is that clients readily misunderstand this advice. Specifically, they may think of 'listenability' as a step on the path to intelligibility, where in fact listenability and intelligibility are quite different dimensions.

This was demonstrated by a recent experiment[17] using audio from a real trial, enhanced by a well-credentialed audio engineer. The enhancement was admitted by the judge on the grounds that he found, after reviewing it personally, that it had made the covert recording easier to listen to, and thus could potentially assist the jury in discerning its contents. The experiment enabled participants to play a short section of the audio as often as they wished, then write down what they heard. Results showed that the enhancement was actually no more intelligible than the original, which was so poor that participants were able to transcribe at most a few random words, and, importantly, no two participants heard the same words.

From a legal perspective, the limited capabilities of enhancing may not seem to be a problem: even if the processes do not actively help, the procedures outlined in Section II are intended to ensure that the jury is no worse off with the enhancement than with the original. However, from a linguistics perspective, this view is problematic. It assumes that enhancing either assists or has no effect, which is incorrect. As explained next, enhancing may appear to assist when it is actually misleading.

C *Enhancing Can Make Indistinct Audio Sound More Clearly Like Something it is Not*

Not all indistinct audio is actually uninterpretable. In many cases, repeated listening allows words to be discerned, albeit 'through a veil of noise', with greater or lesser confidence. The problem is the difficulty of determining whether the words are discerned accurately.

The issues are easier to explain in relation to the more familiar domain of visual evidence, where it is gradually coming to be more seriously recognised by the criminal justice

[17] Fraser, 'False Beliefs' (n 7).

system.[18] The UK Forensic Science Regulator[19] offers the instructive example of a car number plate depicted in a blurry photograph. Characters on the number plate, though far from clear, can be discerned with a certain degree of confidence. Surprisingly, however, a high quality photograph of the same number plate shows the confidently-discerned characters are nothing like the real thing. In retrospect, after the real characters have been seen, the relationship between the reality and the confident but erroneous perception can be worked out. However, no one could possibly discern the real characters spontaneously.[20]

The problem highlighted by the Forensic Science Regulator's number plate example is that the inaccuracy of the discerned characters can only be discovered because, in this particular example, ground truth regarding the real number plate happens to be known. In a trial, of course, ground truth is typically not available. This means that, if the number plate image had been admitted as evidence in a trial, the jury could never have got to the correct interpretation. More importantly, they could never have realised how wrong their perception of the blurry characters was, and would have had no reason to doubt their confident but inaccurate perception.

It is known that indistinct audio can create problems similar to those just discussed in relation to indistinct visual evidence.[21] For present purposes, the question of interest is the effect of enhancing in this situation.

To address this question, it is useful to start by returning to the number plate example. It is clear that no image enhancement technique (applied without knowledge of ground truth) could possibly reveal the characters of the real number plate. But that does not mean enhancing would have no effect at all. By making the (erroneously perceived) characters seem 'clearer', enhancing would give viewers even more confidence in their inaccurate perception than they had with the original.

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[18] Gary Edmond et al, 'Law's Looking Glass: Expert Identification Evidence Derived from Photographic and Video Images' (2009) 20(3) *Current Issues in Criminal Justice* 337.
[19] Forensic Science Regulator, *Forensic Image Comparison and Interpretation Evidence: Guidance for Prosecutors and Investigators* (UK Forensic Science Regulator, 2016).
[20] Useful multimedia demonstrations of these and following points are offered by Helen Fraser, 'Don't Believe Your Ears: 'Enhancing' Forensic Audio can Mislead Juries in Criminal Trials' *The Conversation* (Web Page, 2019) <https://theconversation.com/dont-believe-your-ears-enhancing-forensic-audio-can-mislead-juries-in-criminal-trials-113844> ('Don't Believe Your Ears').
[21] Clifford S Fishman, 'Recordings, Transcripts, and Translations as Evidence' (2006) 81(3) *Washington Law Review* 473.

This is exactly what can happen with indistinct audio, as shown by another recent experiment.[22] The 'fish experiment' used a section of indistinct audio for which (as for the number plates) ground truth happens to be known. Participants were randomly assigned to listen to either the original or the enhanced version.

Those listening to the enhanced version were more likely to hear words. That initially suggests that the enhancing had improved the audio quality. However, participants listening to the enhanced version all reported hearing different words, and none came close to the true content. This indicates that the enhancing actually produced a worse result than the original (the original, by evoking more 'unintelligible' responses, gave listeners a more realistic impression of actual audio quality than the enhancement, which helped listeners to hear words that weren't there).

These results highlight that the word 'clearer', in the context of indistinct audio, has two meanings. Enhancing the 'fish' audio made it 'clearer' in the subjective or aesthetic sense that it sounded less noisy and more 'listenable'. However, it did not thereby make it 'clearer' in the objective sense of giving listeners a more veridical impression of its real content. To the contrary, it increased listeners' confidence in unreliable perception.

Importantly, as with the visual example of the number plate, this mismatch could never have been discovered except that the experiment used audio for which ground truth was known. And again, in trials, by definition, ground truth is rarely, if ever, known with certainty.

This is why the lack of methods for scientific validation of the objective effect of an enhancement (see Section III A) is a major problem: there is no way to evaluate whether words apparently 'revealed' by the enhancing are really there. It is up to the jury to reach their own conclusion, with their only criterion being their own listening confidence. We have already seen that listener confidence can be thoroughly unreliable and misleading, but the situation is actually far worse than discussed so far.

[22] Fraser, 'False Beliefs' (n 7).

D *Enhancing Exacerbates, Rather Than Mitigates, the Risk of Listeners Being Misled by an Unreliable Transcript*

The discussion until now has concentrated on the effect of enhancement on the perception of those listening to indistinct forensic audio 'cold' (with no contextual knowledge and no transcript). This gives a useful baseline for understanding the subjective and objective effects of enhancing — but it is not how forensic audio is presented in court.

In court, listeners almost always have a transcript to assist their perception. We digress briefly, then, to consider the use of transcripts in court, and their effect on perception,[23] before returning to the effect of enhancement when used in conjunction with a transcript.

The law recognises there is always a risk that a transcript might be inaccurate to some extent (especially when, as is often the case, it is produced by detectives investigating the crime). To mitigate this risk, the jury is instructed not simply to accept the transcript on face value, but to listen to the audio carefully and reach their own opinion as to its contents, using the transcript only as an aid (the 'aide memoire' instruction[24] — see *R v Cassar*).[25]

Unfortunately, the aide memoire instruction is unrealistic. To understand the reason, it is necessary to appreciate the extraordinarily powerful influence of a transcript on perception.[26]

Legal procedures are based on the concept that a transcript can assist perception. In fact, with very indistinct audio a transcript can create perception, without listeners' conscious awareness of its effect.[27] Most importantly, the influence of an inaccurate transcript can be just as strong as that of an accurate transcript, sometimes stronger.[28]

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[23] For background, detailed explanation and references see Fraser, 'False Beliefs' (n 7).
[24] I A Wilson and K N Garner, 'Evidence of Tape Recordings' (1988) 4 *QUT Law Journal* 113.
[25] [1999] NSWSC 436, 7e.
[26] Peter French and Helen Fraser, 'Why "Ad Hoc Experts" Should Not Provide Transcripts of Indistinct Forensic Audio, and a Proposal for a Better Approach' (2018) 42(5) *Criminal Law Journal* 298.
[27] Readers who doubt this are urged to view the very short video on the front page of forensictranscription.com.au.
[28] A quick and entertaining introduction with many references is given by Kate Burridge, 'The Dark Side of Mondegreens: How a Simple Mishearing Can Lead to Wrongful Conviction' *The Conversation* (Web Page, 2017) <http://theconversation.com/the-dark-side-of-mondegreens-how-a-simple-mishearing-can-lead-to-wrongful-conviction-78466>.

The power of a transcript, accurate or otherwise, to influence or 'prime' perception of forensic audio in these ways is well established, and extensively covered elsewhere.[29] The question to consider here is the effect of enhancing in situations where listeners have a transcript (as they typically do in court).

The answer is an extension of the effect discussed earlier, whereby techniques that make audio 'clearer', in the subjective sense that it seems less noisy and more 'listenable', can misleadingly give listeners the sense that the audio is 'clearer' in the sense of being more objectively intelligible. However, with a transcript, this effect is far greater than when the audio is heard 'cold' (as it was in the experiments described earlier).

It is fair to say that, while enhancing rarely, if ever, makes indistinct audio objectively clearer (as discussed above), it readily makes words portrayed in a transcript seem clearer. This can be useful if the transcript is reliably known, by reference to ground truth, to be accurate. However, as noted, that is rarely if ever the case in a trial. In a trial, making the audio subjectively 'clearer' can improve listeners' confidence in the transcript — whether or not the transcript is objectively reliable. In other words, what really gets enhanced is not the audio but the credibility of a potentially misleading transcript. This has been demonstrated by yet another experiment,[30] in which a manifestly inaccurate transcript was more likely to be accepted by participants listening to the enhancement than by those listening to the original.

The upshot is that, rather than 'garbage in, garbage out', the effect of enhancing indistinct audio heard under courtroom conditions can be 'garbage in, gospel out'.

E *Even Neutral, Responsible Listeners Cannot Reliably Evaluate the Effect of Enhancing by Observing Whether it Makes Words 'Sound Clearer'*

As we have seen, the law recognises that offering a transcript presents a risk of 'suggestibility' for careless or biased listeners, and legal procedures provide a strong system of safeguards to ensure the jury is not exposed to potentially prejudicial suggestions regarding the content of indistinct covert recordings. The problem (discussed

[29] Helen Fraser, '"Assisting" Listeners to Hear Words that aren't there: Dangers in Using Police Transcripts of Indistinct Covert Recordings' (2018) 50(2) *Australian Journal of Forensic Sciences* 129.
[30] Fraser, 'Don't Believe Your Ears' (n 20).

in detail elsewhere)[31] is that these safeguards rely heavily on careful listening by lawyers and judges acting as gatekeepers to protect juries from potential prejudicial 'assistance'. However, while these listeners are surely more careful and responsible than some others,[32] they are far from immune to being unwittingly misled by an inaccurate transcript.[33]

Again, the issue of present concern is how enhancing plays into this situation. Unfortunately, while providing an enhancement is intended to help, it actually hinders: evaluating an enhancement and a transcript together creates a dangerous circularity from which it is impossible to escape, even for a judge. A further experiment demonstrated this powerfully, using audio from a recent trial in which a judge listened personally in order to rule on a dispute over the effect of enhancing on an extremely indistinct covert recording.[34] The experiment showed that the judge's evaluation of the enhanced audio must have been far more influenced by the prosecution transcript than he was aware of — and posed the question: If a listener as neutral and responsible as a judge can be influenced in this way, is it fair to expect a jury to hear more reliably?

F *What 'Enhancing' Can and Cannot Do*

It is important to be clear about exactly what is and is not being argued in this paper. There is no claim that enhancing techniques can never be effective. The point is that current procedures do not allow reliable differentiation between effective and ineffective enhancement, and take insufficient account of factors known to affect the evaluation and perception of enhanced audio.

Neither is it suggested that forensic audio should never be processed with engineering techniques. Reformed legal procedures designed to ensure the reliable handling of indistinct covert recordings should certainly have a key role for audio engineers — but it should not be the role they currently have. The need is to develop procedures on the basis

[31] Helen Fraser, 'Forensic Transcription: The Case for Transcription as a Dedicated Area of Linguistic Science' in Malcolm Coulthard, Alison Johnson and Rui Sousa-Silva (eds), *The Routledge Handbook of Forensic Linguistics* (Routledge, in press).
[32] Andrew J Wistrich, Chris Guthrie and Jeffrey J Rachlinski, 'Can Judges Ignore Inadmissible Information? The Difficulty of Deliberately Disregarding' (2005) 153 *University of Pennsylvania Law Review* 1251.
[33] Helen Fraser, 'How Interpretation of Indistinct Covert Recordings can Lead to Wrongful Conviction: A Case Study and Recommendations for Reform' in Ron Levy et al (eds), *New Directions for Law in Australia: Essays in Contemporary Law Reform* (ANU Press, 2017) 191.
[34] Fraser, 'Enhancing and Priming' (n 9).

of a realistic understanding of the capabilities of engineers to improve the quality of indistinct audio, and of listeners to evaluate the improvement objectively.

IV REASONS FOR FALSE BELIEFS

In order to develop such a realistic understanding, it is helpful to consider why current procedures, designed in good faith, have come to embody an unrealistic understanding of the capabilities of enhancing techniques. One suggestion is that the reason stems from the view, embodied in Section 48(c) of the *Evidence Act*,[35] that a recording should be treated like a document (see Section II above). It is easy to see how, from a legal perspective, 'an article or thing by which words are recorded in such a way as to be capable of being reproduced as sound' might be thought of as being similar to a printed document. However, for a variety of reasons,[36] it is a false analogy.

From a linguistics perspective, a recording is not at all like a document.[37] A transcript is a document, composed of discrete letters and words, but a recording is something quite different. That is because, contrary to popular belief, even clear speech is not a sequence of discrete words, but a continuous stream of sound.[38] The process of getting from a recording to a transcript is far more complex than usually recognised.[39]

Technically, then, what is 'recorded in such a way as to be capable of being reproduced as sound' is not 'words' but a representation (analogue or digital) capable of being reproduced as a continuous stream of sound, which, in turn, is potentially capable, under appropriate conditions, of being understood by competent listeners as a sequence of words, and, as a further step, of being transcribed into a written document.

This distinction may seem like nit picking but it has some significance. In particular, it affects expectations about the capabilities of enhancing. The (incorrect) assumption that an indistinct recording is like a printed document whose letters have become smudged or obscured creates the expectation that 'enhancing' might restore all or some of the 'sounds' — which might, albeit with some difficulty, then be rendered into words by listeners,

[35] *Evidence Act 1995* (Cth).
[36] Fraser, 'How Confident False Beliefs' (n 1).
[37] David R Olson, *The World on Paper: The Conceptual and Cognitive Implications of Writing and Reading* (CUP, 1994).
[38] Peter Ladefoged and Sandra F Disner, *Vowels and Consonants: An Introduction to the Sounds of Language* (Wiley-Blackwell, 3rd ed, 2012).
[39] Barry Heselwood, *Phonetic Transcription in Theory and Practice* (Edinburgh University Press, 2013).

much as letters on a printed page can be 'sounded out' by readers. In fact, however, nothing remotely like this is possible, as has been indicated in a small way in the preceding sections.

These limitations on the concept of a recording being a kind of document have had an effect on the development of legal procedures for admission of enhanced recordings.[40] They have also influenced legal decision-making in other ways. One example can be seen in the response to an application to review a conviction.[41] The application included expert opinion, supported by scientific analysis and experimental results, that a transcript, provided to the jury to assist them in understanding crucial words allegedly contained in an indistinct covert recording, was factually wrong. The judge reviewing the application rejected this opinion, but noted that he could have been persuaded if 'enhanced listening technology' had been used to show that the transcript given to the jury was incorrectly transcribed. Perhaps if he had understood that there is no technology capable of achieving this he might have interpreted the expert opinion differently, and reached a different decision about the application.

V CONCLUSION

Ensuring the right to a fair trial requires legal procedures that take account of established scientific findings to ensure that juries understand evidence accurately, fairly and in accordance with justice. The present article has reviewed one area where that is not currently the case, namely admission and use of enhanced versions of indistinct covert recordings.

This is one of several areas where current procedures, developed in good faith but with insufficient understanding of the nature of speech and speech perception, cannot guarantee that indistinct forensic audio will not mislead a jury. Given the power of covert recordings, as evidence that juries appear to perceive directly, 'with their own ears', this has a serious potential to compromise justice.[42]

[40] Fraser, 'False Beliefs' (n 7).
[41] Fraser, 'How Confident False Beliefs' (n 1).
[42] J B Gould et al, *Predicting Erroneous Convictions: a Social Science Approach to Miscarriages of Justice* (National Institute of Justice, 2012).

The recent call to action by Australian linguistics organisations has started the process of reform. Clearly, this will be a challenging task. One of the key planks of the call to action[43] is that success cannot be achieved by law, law enforcement or linguistics working alone, but requires a broad-based project fostering collaborative research and development. Following the favourable outcome from the recent judicial consultation (see Section I) such a project is now underway. The linguists involved are ready to welcome interest and support from law and law enforcement personnel.

[43] Fraser, 'Thirty Years' (n 3).

REFERENCE LIST

A *Articles/Books/Reports*

Armstrong, Mike, 'Audio Processing and Speech Intelligibility: A Literature Review' (White Paper WHP190, British Broadcasting Corporation Research & Development, 2011)

Bartle, Anna et al, 'An Approach to Audio Enhancement Validation' (Conference Paper, The International Association of Forensic Phonetics and Acoustics Conference, 2018)

Edmond, Gary et al, 'Law's Looking Glass: Expert Identification Evidence Derived From Photographic and Video Images' (2009) 20(3) *Current Issues in Criminal Justice* 337

Fishman, Clifford, 'Recordings, Transcripts, and Translations as Evidence' (2006) 81(3) *Washington Law Review* 473

Forensic Science Regulator, *Draft Guidance: Digital Forensics Method Validation August* (UK Forensic Science Regulator, 2014)

Forensic Science Regulator, *Forensic Image Comparison and Interpretation Evidence: Guidance for Prosecutors and Investigators* (UK Forensic Science Regulator, 2016)

Fraser, Helen, '"Assisting" Listeners to Hear Words That Aren't There: Dangers in Using Police Transcripts of Indistinct Covert Recordings' (2018) 50(2) *Australian Journal of Forensic Sciences* 129

Fraser, Helen, '"Enhancing" Forensic Audio: False Beliefs and Their Effect in Criminal Trials' (2020) 52 *Australian Journal of Forensic Sciences* 165-177

Fraser, Helen, '"Enhancing" Forensic Audio: What if All That Really Gets Enhanced Is the Credibility of a Misleading Transcript?' (2020) 52 *Australian Journal of Forensic Sciences* 465-476

Fraser, Helen, 'Enhancing and Priming at a Voir Dire: Can We Be Sure the Judge Reached the Right Conclusion?' (2019) *Australian Journal of Forensic Sciences*

Fraser, Helen, 'Forensic Transcription: How Confident False Beliefs About Language and Speech Threaten the Right to a Fair Trial in Australia' (2018) 38(4) *Australian Journal of Linguistics* 586

Fraser, Helen, 'Forensic Transcription: The Case for Transcription as a Dedicated Area of Linguistic Science' in Malcolm Coulthard, Alison Johnson and Rui Sousa-Silva (eds), *The Routledge Handbook of Forensic Linguistics* (Routledge, in press)

Fraser, Helen, 'How Interpretation of Indistinct Covert Recordings Can Lead to Wrongful Conviction: A Case Study and Recommendations for Reform' in Ron Levy et al (eds), *New directions for law in Australia: Essays in contemporary law reform* (ANU Press, 2017)

Fraser, Helen, 'Thirty Years Is Long Enough: It's Time to Create a Process That Ensures Covert Recordings Used as Evidence in Court Are Interpreted Reliably and Fairly' (2018) 27(3) *Journal of Judicial Administration* 95

French, Peter and Helen Fraser, 'Why "Ad Hoc Experts" Should Not Provide Transcripts of Indistinct Forensic Audio, and a Proposal for a Better Approach' (2018) 42(5) *Criminal Law Journal* 298

Gould, J B et al, *Predicting Erroneous Convictions: a Social Science Approach to Miscarriages of Justice* (National Institute of Justice, 2012)

Heselwood, Barry, *Phonetic Transcription in Theory and Practice* (Edinburgh University Press, 2013)

Ladefoged, Peter and Sandra F Disner, *Vowels and Consonants: An Introduction to the Sounds of Language* (Wiley-Blackwell, 3rd ed, 2012)

Langford, Simon, *Digital Audio Editing: Correcting and Enhancing Audio in Pro Tools, Logic Pro, Cubase, and Studio One* (Focal Press, 2013)

Loizou, Philipos, *Speech Enhancement Theory and Practice* (Taylor & Francis Group, 2007)

Maher, Robert, *Principles of Forensic Audio Analysis* (Springer, 2018)

Olsen, David, *The World on Paper: The Conceptual and Cognitive Implications of Writing and Reading* (CUP, 1994)

Wilson, I A and K N Garner, 'Evidence of Tape Recordings' (1988) 4 *QUT Law Journal* 113

Wistrich, Andrew, Chris Guthrie and Jeffrey J Rachlinski, 'Can Judges Ignore Inadmissible Information? The Difficulty of Deliberately Disregarding' (2005) 153 *University of Pennsylvania Law Review* 1251

B *Cases*

Eastman v R (1997) 76 FCR 9

R v Cassar [1999] NSWSC 436

R v Giovannone (2002) 140 A Crim R 1

C *Legislation*

Evidence Act 1995 (Cth)

D *Other*

Burridge, Kate, 'The Dark Side of Mondegreens: How a Simple Mishearing Can Lead to Wrongful Conviction' [2017] *The Conversation* (Web Page) <http://theconversation.com/the-dark-side-of-mondegreens-how-a-simple-mishearing-can-lead-to-wrongful-conviction-78466>

Fraser, Helen, 'Don't Believe Your Ears: 'Enhancing' Forensic Audio Can Mislead Juries in Criminal Trials' [2019] *The Conversation* (Web Page) <https://theconversation.com/dont-believe-your-ears-enhancing-forensic-audio-can-mislead-juries-in-criminal-trials-113844>