

January 1977

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Recommended Citation

Timblin, Terry (1977) "Voiceprints: The Determination of Admissibility," *University of Dayton Law Review*. Vol. 2: No. 1, Article 8.

Available at: <https://ecommons.udayton.edu/udlr/vol2/iss1/8>

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VOICEPRINTS: THE DETERMINATION OF ADMISSIBILITY

One of the most crucial issues facing courts in recent years is the admissibility of novel scientific evidence. There is obviously a strong temptation to use a scientific process or machine that purports to provide unbiased information free from the many competency and credibility problems associated with testimonial evidence. One such process, called spectrographic analysis, is now being favorably received by the courts despite its substantial shortcomings. Spectrographic analysis—popularly known as “voice-prints”¹—is a technique for the identification of voices with the aid of a machine known as the sound spectrograph. The purpose of this comment is to examine the reliability of this technique to determine if the present state of the art justifies the reliance that has been placed upon it.

I. THE STANDARD OF ADMISSIBILITY

Before the question of the admissibility of any kind of scientific evidence can be resolved, it is necessary to determine what standards are applicable. The most definitive statement on this standard was formulated in the widely cited case of *Frye v. United States*.² There, the Court of Appeals for the District of Columbia stated:

Just when a scientific principle or discovery crosses the line between the experimental and demonstrative stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.³

The requirement of general acceptance of a scientific process within the particular field in which it belongs has become the predominant standard for admissibility of scientific evidence;⁴ thus the voiceprint technique will be analyzed in terms of that test.

1. The use of this term has been discouraged by both legal commentators and scientists in the accoustical field due to the association in the popular mind with fingerprinting, a method of identification bearing little similarity to spectrographic analysis either in its operation or degree of reliability. See text at 91, *infra*. However, because the term has gained nearly universal usage, it will be used throughout this comment.

2. 293 F. 1013 (D.C.Cir. 1923).

3. *Id.* at 1014.

4. C. McCORMICK, *McCORMICK'S HANDBOOK OF THE LAW OF EVIDENCE* § 203 (2nd ed. 1972).

II. THE SPECTROGRAPH

The theory of spectrographic identification is founded, first, on the proposition that every human voice is unique and that no significant change takes place in a person's voice over a period of time after physical maturity.⁵ Second, it is asserted that this uniqueness can be graphically depicted on paper by the use of a sound spectrograph.⁶

The human voice is produced by the expulsion of air from the lungs which when passed through the larynx causes the vocal cords to vibrate, creating sound energy. This energy is fashioned into speech by two vocal tract functions: the vocal cavities and the articulators. The first consists of the nasal, throat, and two oral cavities separated by the tongue. The articulators are the lips, teeth, tongue, soft palette, and jaw muscles. Because there is little likelihood that any two people have identical cavities and articulators, it is said that no two people can have the same voice characteristics.⁷

Granting the assumption that no voice can ever be like any other, it still became necessary to develop a device to demonstrate the difference. The apparatus chosen for this task was the sound spectrograph.⁸ This machine was developed by Bell Laboratories in 1941, and was used in an attempt to identify German radio operators during World War II.⁹ Following the war it was used mainly for speech research and therapy,¹⁰ as the principle thrust of the research was the identification of words.¹¹ In the early 1960's a Bell Laboratories engineer, Lawrence G. Kersta, again began experimenting with the spectrograph for the purpose of identifying voices.¹²

A good description of the operation of the spectrograph is provided by Hecker:

5. Kersta, *Speaker Recognition and Identification by Voiceprints*, 40 CONN. B.J. 586, 589-91 (1966).

6. *Id.* at 586.

7. *Id.* at 591.

8. For a more detailed description of the spectrograph and its operation see Kamine, *The Voiceprint Technique: Its Structure and Reliability*, 6 SAN DIEGO L. REV. 213 (1969); Case Comment, *Evidence: Admissibility of Spectrographic Voice Identification*, 56 MINN. L.REV. 1235 (1972).

9. Boren, *Voiceprint—Staging a Comeback*, 3 U. SAN. FERN. VAL. L. REV. 1, 4 (1974).

10. Bolt, Cooper, David, Denes, Picket and Stevens, *Speaker Identification by Speech Spectrograms: A Scientist's View of Its Reliability for Legal Purposes*, 47 J. ACOUSTICAL SOC'Y OF AM. 597, 605 (1970) (hereinafter referred to as First Bolt Study).

11. Jones, *Evidence vel non, The Non Sense of Voiceprint Identification*, 62 KY. L.J. 301, 304 (1973-74).

12. Kersta, *Voiceprint Identification*, 196 NATURE 1253 (1962); Kersta, *Speaker Recognition and Identification by Voiceprints*, 40 CONN. B. J. 586 (1966).

The sound spectrograph consists of four basic parts: (1) a magnetic recording device, (2) a variable electronic filter, (3) a drum which is coupled to the magnetic recording device and carries a sheet of special paper, [sensitive to] . . . (4) an electric stylus which marks the paper as the drum rotates. The magnetic recording device is first used to record a short sample of speech; the duration of the speech sample corresponds to the time required for one revolution of the drum [e.g., 2.4 seconds. The speech sample is then played back over and over again in order to analyze its spectral contents. For each revolution of the drum, the variable electronic filter passes only a certain band of frequencies, and the energy in this frequency band activates the electric stylus so that a straight line of varying darkness is produced across the paper. The darkness of the line at any point on the paper indicates how much energy is present in the speech signal at the specified time within the given frequency band. As the drum revolves, the pass-band of the variable electronic filter moves to increasingly higher frequencies, and the electric stylus moves parallel to the axis of the drum. Thus, a pattern of closely spaced lines is generated on the paper.¹³

The pattern on the paper is called a spectrogram, and is divided into two types: the "bar" and the "contour."¹⁴ The "bar" type is most commonly used for voice identification purposes.¹⁵ The three dimensions of a "bar" spectrogram are: time—measured on the horizontal axis; frequency—measured on the vertical axis; and amplitude (loudness)—measured by the darkness of the vertical bars. The series of bars which vary in length and in darkness form a visual pattern.

The identification process then is a matter of comparing the patterns produced from tapes of a known and an unknown voice. The spectrograph operator excerpts from each tape the same word or sound if such exists on both tapes. Since a criminal defendant, when giving an exemplar, is normally required to repeat verbatim whatever is on the unknown tape, there is no problem in obtaining the same words. Spectrograms of the cue word from each tape are then produced and compared for points of similarity. It is conceded by proponents of spectrographic evidence that the patterns produced by the same person saying the same word twice a few seconds

13. Comment, *supra* note 8, at 1239, quoting from M. HECKER, *SPEAKER RECOGNITION: AN INTERPRETIVE SURVEY OF THE LITERATURE* 12-13 (Am. Speech & Hearing Assn. Monograph No. 16, 1971).

14. For a comparison of the two types, see Comment, *The Evidentiary Value of Spectrographic Identification*, 63 J. CRIM. L.C. & P.S. 343, 344 & n.9 (1972).

15. Kamine, *supra* note 8, at 220-21 n.34.

apart will not look the same.¹⁶ However, it is countered that there is an even greater dissimilarity between the patterns of different voices saying the same word and that the relative similarity of the graphs produced by the same voice is sufficient to make a positive identification.¹⁷ In addition to comparing the spectrograms, the operator will listen to both tapes and compare them aurally. If the voice sounds the same to the operator and he finds a sufficient number of points of similarity on the spectrograph, he will then conclude that the same voice produced both tapes.

III. HISTORY OF THE DEVELOPMENT AND JUDICIAL CONSIDERATION OF THE TECHNIQUE

The development of spectrographic analysis for the purpose of voice identification has been dominated by the work of two men: Lawrence Kersta and Dr. Oscar Tosi, Professor of Audiology and Physics at Michigan State University.¹⁸ Kersta pioneered the technique, but Dr. Tosi's subsequent research was primarily responsible for the measure of acceptance that it has received from the courts.

A. *The Work of Kersta*

Kersta began experimenting with the spectrograph while he was still employed by Bell Laboratories. In 1966, he left Bell and formed Voiceprint Laboratories in Somerville, New Jersey where he began to manufacture spectrographs commercially. He conducted a study involving 16,000 voiceprints produced from the voices of 123 male Bell employees. He gave the evaluators, high school students, four prints from each of five separate speakers and asked them to match up the prints of each speaker. The students had better than 97% accuracy in these match-ups.¹⁹ With this study as a basis, Kersta claimed that spectrographic identification was foolproof.²⁰ This claim was ill-founded and his persistence in this opinion ultimately destroyed his credibility in both legal and scientific circles. First, the fact that Kersta never published the details of his experiments

16. Bricker, *The Voiceprint Technique: A Problem in Scientific Evidence*, 18 WAYNE L.R. 1365, 1368 (1972).

17. *Id.* at 1369.

18. Another ubiquitous character in this story is Lt. Ernest Nash of the Michigan State Police. Lt. Nash is a spectrograph operator, trained by Dr. Tosi, who has performed most of the actual production and comparison of voiceprints in the cases to be discussed. Of the reported cases, Lt. Nash has testified in fourteen, Dr. Tosi in eleven and Kersta in three. In *United States v. Franks*, 511 F.2d 25 (6th Cir. 1975), the expert was not named.

19. Cedarbaums, *Voiceprint Identification: A Scientific and Legal Dilemma*, 5 CRIM.L.BULL. 323, 329 (1969).

20. *Id.* at 329.

precluded duplication of his findings.²¹ Second, Kersta's credentials as a scientist were questionable.²² Third, the test employed only "closed" sample groups; *i.e.*, the students knew in advance that matches for a known sample existed within the sample group making the task merely one of putting together those that most looked alike.²³ Fourth, many observers felt that the sample group of Bell employees was so heterogeneous as to exaggerate the differences among the voices.²⁴ Finally, Kersta had an obvious financial interest as a manufacturer of the machines.

Kersta's claims of accuracy as well as the unsound scientific basis upon which the claims rested caused a great deal of skepticism in the acoustics field. The Acoustical Society of America, which is generally acknowledged to be the most authoritative organization in the United States in the field of sound spectrograph research,²⁵ has continuously expressed doubt as to the reliability of identification by voiceprints. In 1966 the Technical Committee on Speech Communication of the society passed a resolution discouraging the admission in court of voiceprint evidence and invited the Executive Council of the society to take appropriate action.²⁶ In addition, six members of the Committee conducted a study²⁷ which they published in 1970. The study concluded:

[T]he available results are inadequate to establish the reliability of voice identification by spectrograms. We believe this conclusion is shared by most scientists who are knowledgeable about speech; hence, many of them are deeply concerned about the use of spectrographic evidence in courts. . . .²⁸

B. *The Early Cases*

Before it became apparent that Kersta's assertions were rejected by virtually the entire acoustics field, he did achieve some early success. He qualified as an expert and testified in *People v. Straehle*,²⁹ the first known case in which spectrographic evidence was introduced. *Straehle* involved the prosecution of a police officer

21. Note, *Voiceprint Identification*, 61 GEO. L.J. 703, 710 (1973).

22. *Id.*

23. *Id.* Under forensic conditions an operator has no idea whether a match for the known tape is among the unknown samples or not.

24. *United States v. Raymond*, 337 F. Supp. 641, 643 (1972).

25. *Jones*, *supra* note 11, at 315.

26. *Id.* at 329.

27. Bolt, *supra* note 10.

28. *Id.* at 603.

29. 53 Misc. 2d 512, 279 N.Y.S.2d 115 (Westchester Co. Ct. 1967), *rev'd*, 30 App. Div. 2d 452, 294 N.Y.S.2d 42 (1968).

for perjury stemming from his denial that he tipped off a gambler about an impending raid. A recording of the warning had been made, and voiceprints taken from this tape—as well as prints produced from two exemplar tapes of the officer—were admitted into evidence by the trial court. The court held that it was for the jury to decide how much weight should be given to this evidence. A mistrial was subsequently declared and the indictment dismissed on other grounds foreclosing appellate review of this decision.

Kersta's testimony was again admitted in *United States v. Wright*,³⁰ a court-martial prosecution of an Air Force enlisted man for making obscene phone calls. Upon appeal of Wright's conviction, the United States Court of Military Appeals became the first appellate court to hold spectrographic evidence admissible. The precedential value of this case was, however, limited by a number of factors. First, the admissibility of the evidence was not based on the prevailing *Frye* rule, but rather on a provision of the Manual for Courts-Martial³¹ which does not require general acceptance in the relevant scientific field. In fact, the dissent in *Wright* pointed out that the majority opinion implicitly rejected the *Frye* standard.³² In addition, four witnesses aurally identified the voice on the recordings of the calls, and the wording of the opinion implies that the evidence was useful only for purposes of corroboration. And finally, the court noted that a tape of Wright's voice had been played in open court and considered by the members of the trial court in its decision: "Since voice identification by ear is fully acceptable to the courts, the court members could thus determine for themselves the margin of error, if any, in Mr. Kersta's expert opinions."³³ The court appeared to be more concerned about showing that the use of the voiceprint evidence was not prejudicial than in demonstrating its probative value.

The next two courts to consider the admissibility of voiceprints consigned the technique to temporary judicial oblivion. The case of *State v. Cary*,³⁴ which wound its way through the New Jersey courts

30. 17 U.S.C.M.A. 183, 37 C.M.R. 447 (1967).

31. A witness may testify as an expert and express his opinion if he "is skilled in some art, trade, profession or science or . . . has knowledge and experience in relation to matters which are not generally within the knowledge of men of common education and experience" U.S. DEP'T OF DEFENSE, MANUAL FOR COURTS-MARTIAL § 138(e).

32. 37 C.M.R. at 454.

33. *Id.* at 453.

34. 49 N.J. 343, 230 A.2d 384 (1967), *remanded* (for a showing that voiceprint technique and equipment were accurate enough to be admissible), 53 N.J. 256, 250 A.2d 15 (1969), *remanded* (for further expert testimony), 56 N.J. 16, 264 A.2d 209 (1970), *aff'g per curiam* on other grounds order of 99 N.J. Super. 323, 239 A.2d 680 (1968) (denying admissibility).

from 1967 until 1970, involved a prosecution for murder where the defendant had called a police station and made inculpatory statements. The call had been recorded and the prosecution moved the court to order the defendant to give a voice exemplar so that a voiceprint comparison could be made. The motion was granted and Cary appealed. The Supreme Court of New Jersey refused to uphold the order to give the exemplar, let alone to decide that voiceprint evidence would be admissible at trial. The court held that before a person's rights under the fourth amendment could be invaded for the purpose of conducting a scientific test, the product of the "search" must have the capacity to be admissible as evidence. The case was therefore remanded to the trial court for a hearing on the admissibility of spectrographic evidence.

At the hearing, Kersta again testified for the prosecution. However, this time the defense presented three expert witnesses whose credentials in the acoustics field were far more reputable than Kersta's. These included Dr. Tosi, Dr. Louis J. Gerstman,³⁵ and Dr. Peter Ladefoged.³⁶ The thrust of their testimony was that there had not yet been enough research conducted to either prove or disprove the reliability of the technique.³⁷ The court, noting that voiceprint identification was basically the theory and work of one man, accepted the conclusions of the defense experts and ruled the evidence inadmissible.³⁸

Eight months after the trial court's decision in *Cary*, the California Court of Appeals for the Second District, Division Two reached a similar conclusion in *People v. King*.³⁹ There, a CBS camera crew had recorded an interview with a young black male who admitted committing arson. The film was edited in such a manner that the man's identity could not be determined. The defendant was subsequently arrested on an unrelated charge, and a custodial search turned up a business card of a CBS cameraman who had filmed the interview. Suspecting a connection between the

35. Associate Professor of Psychology and Speech at the City University of New York, Dr. Gerstman was previously employed at Bell Laboratories.

36. Ladefoged and Vanderslice, *The Voiceprint Mystique*, 7 WORKING PAPERS IN PHONETICS 126 (1967). Dr. Ladefoged is a professor of phonetics at U.C.L.A.

37. Dr. Ladefoged also presented 39 letters from other experts, whose opinions he had sought on this issue, which were critical of the spectrographic method. Although hearsay, they were admitted to show that a controversy about the validity of such evidence existed in the speech and acoustical fields. 99 N.J. Super. at 332-33, 239 A.2d at 684.

38. This time the prosecution appealed to the New Jersey Supreme Court which remanded the case for further testimony. The prosecution could not produce any new evidence and the trial court's ruling was ultimately affirmed. 56 N.J. 16, 264 A.2d 209 (1970).

39. 266 Cal.App. 2d 437, 72 Cal.Rptr. 478 (1968).

defendant and the man in the film, the police surreptitiously obtained a voice exemplar. The tapes and voiceprints were examined by Kersta who concluded that King was the man being interviewed. The only evidence against King at his trial was the tapes, the film, and Kersta's testimony that the identity of all three recorded voices, as established by spectrographic analysis, was the same. Seven experts for the defense⁴⁰ disputed this testimony. King was convicted of arson and appealed.

The only issue before the court of appeals was the admissibility of the voiceprint evidence. After a review of the expert testimony the court held that it was error to admit the evidence and reversed the conviction. The court noted, as in *Cary*, that Kersta was alone in his claims of reliability; that the technique was obviously not generally accepted within the appropriate field; that Kersta had no medical or anatomical background to back up his theory of invariant speech; that he was an engineer and not an experimental scientist; and, that his work was not consistent with scientific method and was in fact more of a subjective art. The crux of the court's holding was that for the results of any test to be admissible in court, they must be verifiable by the scientific method. The voiceprint technique obviously failed under this standard. This ruling effectively ended Kersta's career as an expert witness, and no voiceprint cases reached the appellate level for the next three years.

C. *The Tosi Study*

The fallen standard was then picked up by Dr. Tosi. His testimony in *Cary* had stressed that his opposition was based on the insufficiency of research on the subject and not because he believed that identification by spectrographic analysis was impossible. He obtained a \$300,000 grant from the Law Enforcement Assistance Administration of the Department of Justice and conducted a study from 1968 until 1970. His results were published in 1971.⁴¹

The study attempted to meet the criticisms of Kersta's work. The subjects were two hundred fifty male Michigan State Univer-

40. Dr. Ladefoged; Dr. Gerstman; Dr. Frank Clarke, degree in sensory and physiological psychology; Dr. Peter Denes of Bell Laboratories; Dr. Joos, degree in philology; Dr. Victoria Fromkin, degree in linguistics; and Ralph Vanderslice, a graduate student in phonetics at U.C.L.A.

41. *Voice Identification Research*, A Report to the Law Enforcement Assistance Administration, United States Department of Justice, Department of Michigan State Police, East Lansing, Michigan (Grant No. NI 70-004, February 1971); Tosi, *et. al.*, *An Experiment on Voice Identification*, REPORT SHSLR 171, MICHIGAN STATE UNIVERSITY (July 1971). Tosi, Oyer, Lachbrook, Redroy, Nicol & Nash, *Experiment on Voice Identification*, 51 J. ACOUSTICAL Soc'y of AM. 2030 (1972).

sity students. In an attempt to assure homogeneity, only students who spoke with the "General American English" Midwest accent were used as subjects. Twenty-nine other students were trained as examiners. The examiners conducted thirty-five thousand identification trials within various formats. Some of the trials were with "closed" groups and some were with "open" groups; *i.e.*, the examiners were aware that a match for the known voice might or might not exist among the unknowns. The examiners were restricted to the use of spectrograms to make a decision, and could not actually listen to the voices. They had fifteen minutes during each trial to make a decision and they had to reach a definite conclusion—either identification or elimination—although they could express different degrees of certainty in their findings. The error rates for false identifications ranged from 0.5 per cent for the closed trials to 6 per cent for the open trials. While these results were to have a major impact on the courts, they did little initially to change the attitude of scientists in the speech and acoustics fields. The only expert to change his position was Dr. Ladefoged, and he did so only with significant reservations.⁴²

The same group that had been requested by the Acoustical Society of America to examine Kersta's work also conducted a study⁴³ of Dr. Tosi's experiments. The results were published in 1973. The Second Bolt Study acknowledged that Dr. Tosi's work was a step forward, but concluded that it still failed to demonstrate that a person's voice could reliably be identified by the voiceprint method. The most critical failings, according to the study, were that it did nothing to identify various characteristics of speech that make each voice unique nor to indicate what criteria were used in reaching a decision:

The present level of knowledge about personal voice characteristics, their recognition, and how they change under different conditions is still rudimentary. The recent work on speaker identification from spectrograms does not provide any new understanding as to which spectrographic features correlate most clearly or efficiently with the speaker's identity. . . . At the present time . . . the spectrographic identification of a voice by a trained observer appears to rely on a broad assessment of loosely defined points of similarity rather than on a carefully specified set of objectively defined spectrographic attributes. The Tosi experiments, in fact, show considerable disagree-

42. Jones, *supra* note 11, at 321-22.

43. Bolt, *Speaker Identification by Speech Spectrograms: Some Further Observations*,

54 J. ACOUSTICAL SOC'Y OF AM. 531 (1973) (hereinafter referred to as the Second Bolt Study).

ment among different panels of observers as to what constitutes a match when they are given the same matching task. . . . Further studies are needed to provide a better understanding of the decision process.⁴⁴

Other criticisms contained in the Second Bolt Study will be discussed in a later section.

D. *The Post-Tosi Study Cases*

Perhaps because of the delay of any kind of response by authorities within the speech and acoustics fields, Dr. Tosi was able to convince a large number of courts that voiceprints had now come of age. The first case to reach an appellate court was *State ex rel Trimble v. Hedman*⁴⁵ in which the Supreme Court of Minnesota held that spectrographic evidence was admissible to establish probable cause for an arrest. In *Trimble*, an emergency call, which was routinely recorded, was placed to the St. Paul Police Headquarters. Two officers were dispatched to the address given; one of them was shot to death by an unknown assailant. Since the police suspected that the defendant had made the call, they tape recorded her voice without her knowledge and forwarded, along with tapes of twelve other voices and the recording of the call, to Lt. Ernest Nash of the Michigan State Police, a spectrograph operator trained by Dr. Tosi. He concluded that the unknown voice was the defendant's. After she was arrested and indicted for murder, she petitioned for a writ of habeas corpus on the ground that there had been insufficient evidence for an arrest warrant. A hearing was held at which Lt. Nash and Dr. Tosi testified for the prosecution and Dr. Ladefoged (who had not yet changed his mind) testified for the defense. The application was denied and she appealed.

The Minnesota Supreme Court carefully noted at the beginning of the opinion that it was deciding only whether or not the identification by voiceprint was sufficient to justify the arrest warrant. The court reviewed Kersta's work and the early case law and noted Dr. Tosi's refinements, especially the use of open sample groups. It then pointed out that it has long been acceptable for witnesses to identify a person by aural recognition of his voice. If this were proper, the opinion reasoned, then comparison by other means; *i.e.*, voiceprints, was also permissible if the technique were established as reliable. In upholding the technique's reliability, the court leaned heavily on the testimony of Dr. Tosi and Lt. Nash as well as the admission by

44. *Id.* at 533.

45. 291 Minn. 442, 192 N.W.2d 432 (1971).

Dr. Ladefoged that voiceprints might aid the human ear in the comparison of voices. It was also pointed out that both the *Cary* and *King* opinions had left open the possibility of admitting spectrographic evidence if and when there was sufficient scientific evidence of its validity, and that these cases had preceded the Tosi Study. While the *Frye* rule was quoted in the opinion,⁴⁶ there was almost no discussion as to whether or not the technique had achieved acceptance in the scientific community.⁴⁷ The court basically adopted the *Wright* approach that it was for the trier of fact to decide how much weight to give the testimony of the opposing expert witnesses. In dicta, the court stated that spectrographic evidence should be admissible for purposes of corroboration and impeachment if a proper foundation is laid as to the qualifications of the expert.⁴⁸

The voiceprint cases which remain to be discussed were in many aspects similar to the *Trimble* case. Lt. Nash was the operator who actually made the identification in every case with one possible exception.⁴⁹ Dr. Tosi appeared as the principal expert witness in nine of the cases. The testimony of both was based solely on the conclusion of the Michigan State Study, since subsequent studies have failed to lend support to the reliability of the technique. Most of the courts that have admitted the evidence have relied on that study, and especially on its use of open sample groups.

The first federal court decision to consider the issue was *United States v. Raymond*,⁵⁰ in which the District Court for the District of Columbia held that voiceprints were admissible for any relevant purpose. In *Raymond*, a District of Columbia policeman had been ambushed while answering a false "officer in trouble" call, which had been recorded. Voice exemplars of Raymond and a codefendant were obtained and ultimately were compared spectrographically with the original tape. The prosecution moved to have the results of these tests admitted into evidence and the motion was granted. In upholding the admissibility of the voiceprints, the court focused on the use of open sample groups and relatively homogeneous voices in the Tosi Study. It noted the limitations under which the student

46. *Id.* at 452, 192 N.W.2d at 438.

47. The only reference made by the court to this issue was that, "Dr. Ladefoged agreed with Dr. Tosi's experiments '[a]s far as [he] has gone.'" *Id.* at 456, 192 N.W.2d at 440.

48. The court never received the opportunity to elaborate, as *Trimble* was acquitted at her trial; see Jones, *Danger—Voiceprints Ahead*, 11 AM.CRIM. L.R. 549, 560 (1973).

49. *United States v. Franks*, 511 F.2d 25 (6th Cir.), cert. denied, 422 U.S. 1042 (1975). In *People v. Kelly*, 49 Cal. App. 3d 214, 122 Cal. Rptr. 393 (1975), the actual spectrogram was made by a trainee under Nash's direction.

50. 337 F. Supp. 641 (D.D.C. 1972).

examiners worked; *i.e.*, the time limits, the requirement that they reach a decision regardless of their certainty, the limited number of samples of each voice available to them, and the fact that they could not listen to the tapes. The court then reasoned that a professional, not bound by those limitations, would achieve even better results. Thus, the court concluded that the spectrographs were sufficiently reliable to be admitted as evidence.

Although *Raymond* was to be widely cited as authority for admissibility, on appeal, the district court's decision was reversed on the voiceprint issue by the District of Columbia Court of Appeals.⁵¹ The critical error, according to the court of appeals, was the district court's concentration on the validity of Nash's conclusions instead of the issue of whether or not the technique was accepted in its field. In applying that standard, the court concluded that the Tosi Study had merely brought about an abatement of skepticism and not actual acceptance of the reliability of the voiceprint method.

All of the other federal courts that have been confronted with the spectrograph issue have ruled in favor of at least potential admissibility. In *United States v. Askins*,⁵² the District Court for the District of Maryland granted the prosecution's motion to obtain a voice exemplar of the defendant, but did not indicate whether spectrographic evidence would be admissible. The District Court of the Eastern District of Pennsylvania admitted voiceprint evidence to corroborate an aural voice identification at a parole revocation hearing in *United States v. Sample*.⁵³ The Sixth Circuit Court of Appeals, in *United States v. Franks*,⁵⁴ upheld an order to give an exemplar. In dicta, the court stated that the admissibility of the evidence was within the discretion of the trial judge, and noted the detailed examination of the expert witness to establish his credentials. There was no discussion of whether the technique was accepted in its field. A later Sixth Circuit case, *United States v. Jenkins*,⁵⁵ upheld the actual admission of voiceprint evidence on the authority of *Franks*. And finally, the Fourth Circuit Court of Appeals upheld a conviction partially obtained by spectrographic evidence, in *United States v. Baller*.⁵⁶ The test laid down by that court was whether the theory

51. *United States v. Addison*, 498 F.2d 741 (D.C. Cir. 1974). Despite this conclusion, the convictions of Raymond and Addison were affirmed as the remainder of the evidence against them was overwhelming.

52. 351 F. Supp. 408 (D.Md. 1972).

53. 378 F. Supp. 44 (E.D.Pa. 1974).

54. 511 F.2d 25 (6th Cir.), *cert. denied*, 422 U.S. 1042 (1975).

55. 525 F.2d 819 (6th Cir. 1975).

56. 519 F.2d 463 (4th Cir.), *cert. denied*, 423 U.S. 1019 (1975).

has been sufficiently proved to allow a jury to give the evidence whatever weight it sees fit. The Tosi Study was held to have met that test. The opinion stated that neither absolute certainty of result nor unanimity of scientific opinion was required.

As to state courts, California has seen the most litigation in this area. In *Hodo v. Superior Court, Riverside County*⁵⁷ the Court of Appeals for the Fourth District, Division Two became the first in the state to uphold admissibility. The opinion reviewed the previously discussed improvements,⁵⁸ and, as in *Raymond*, the court noted that a professional operator would not be working under the restraints encountered by Tosi examiners. The court then proceeded to formulate its own modified version of the *Frye* rule: It is not necessary that a scientific test be generally accepted by an entire field of learning, but only that it be accepted by *those who would be expected to be familiar with its use*.⁵⁹ Since only a handful of experts in the acoustics and related fields had actually conducted identification experiments with a sound spectrograph, Dr. Tosi, Kersta and Dr. Ladefoged were transformed into a majority, thus assuring the admissibility of voiceprints.

A similar analysis was conducted by the California Court of Appeals for the Fifth District in *People v. Law*,⁶⁰ except that the *Frye* rule was left intact. That court reversed a conviction based on voiceprint evidence, partly because a disguised voice was involved, and partly because the court took notice of criticism in the scientific field as well as by legal commentators. The opinion concluded that on these facts the evidence should not be admitted. In a subsequent case, *People v. Kelly*,⁶¹ the Court of Appeals for the Fourth District, Division One distinguished *Law* because it dealt with a disguised voice, and upheld the admission of spectrographic evidence.

Two Florida appeals court cases, *Worley v. State*⁶² and *Alea v. State*,⁶³ upheld admissibility for purposes of corroboration with little discussion as to the bases of the holdings. Both reserved the issue of whether the voiceprint method was reliable enough to be used as

57. 30 Cal. App. 3d 778, 106 Cal. Rptr. 547 (1973).

58. The court even took the unusual step of comparing the degrees earned and articles published by the two men. Kersta: Masters Degree in Physics and Electrical Engineering, 1 paper published in a scientific journal. Dr. Tosi: Doctorates in Audiology and Physics, 2 books and 35 articles published in scientific journals. *Id.* at 785-86, 106 Cal. Rptr. at 551.

59. This test was derived from another California case, *People v. Williams*, 164 Cal. App. 2d 858, 331 P.2d 251 (1958) dealing with the Nalline test for narcotics.

60. 40 Cal. App. 3d 69, 114 Cal. Rptr. 708 (1974).

61. 49 Cal. App. 3d 214, 122 Cal. Rptr. 393 (1975).

62. 263 So. 2d 613 (Fla. Ct. App. 1972).

63. 265 So. 2d 96 (Fla. Ct. App. 1972).

independent evidence.

The Supreme Court of New Jersey reversed its *Cary* holding in *State v. Andretta*⁶⁴ and ordered the defendant to submit a voice exemplar. It has yet to consider admissibility.

Two 1975 Massachusetts Supreme Judicial Court cases, *Commonwealth v. Lykus*⁶⁵ and *Commonwealth v. Vitello*,⁶⁶ upheld admissibility. The *Lykus* opinion adopted the *Hodo* approach of narrowing the field of experts to active practitioners in order to find scientific acceptance. *Vitello* was decided on the authority of *Lykus*.

And finally, the Ohio Court of Appeals for Cuyahoga County, in *State v. Olderman*,⁶⁷ affirmed a conviction for contempt of court for refusal to submit a voice exemplar. The holding was based primarily on prior case law and no opinion was expressed on whether or not such evidence would be admissible at trial.

IV. EVALUATION OF THE RELIABILITY OF SPECTROGRAPHIC ANALYSIS

It would be foolish to state flatly that it will never be possible for a machine to produce a picture of a voice which accurately depicts components that are invariant for a given speaker, nor can the theory that no two persons share the same voice components be dismissed. However, it is safe to say that such a machine is yet to be invented and that the theory is yet to be proved. Experts attach some scientific validity to spectrographic analysis. The sound spectrograph is conceded to accurately measure the frequency and amplitude of a voice over a fixed period of time. And, the results obtained in the Tosi Study are also conceded to be valid as far as they go. However, the fact that the machine measures what it purports to measure does nothing to prove that each human voice is totally unique or that no two people could have indistinguishable voices. None of the proponents of voiceprint admissibility have ever conducted any research to prove this and the theory of invariant speech remains a naked assertion.⁶⁸

The two most important reasons for contending that the voiceprint method is unreliable are highlighted in the Second Bolt Study. First, no one had yet been able to identify exactly which component or combination of components of a person's voice is the invariable factor that makes it unique. Second, no universal systematic set of criteria to be used in making a decision as to the identity of a

64. 61 N.J. 544, 296 A.2d 644 (1972).

65. 327 N.E.2d 671 (Mass. 1975).

66. 327 N.E.2d 819 (Mass. 1975).

67. 44 Ohio App. 2d 130, 336 N.E.2d 442 (1975).

68. *Voiceprint Identification*, *supra* note 21, at 708-09.

speaker has been developed. These difficulties substantially preclude any sort of scientific verification of the conclusions of a spectrograph operator.

Thus, spectrographic analysis remains an art, not a science. Its subjectivity is increased by the fact that the conclusions of the operator are partially based on his listening to the tapes in question. Therefore, the accuracy of an identification or elimination depends greatly on the skill and ethics of the operator, qualities not easily amenable to verification or cross-examination.

The visual portion of the analysis is also a subjective process. As previously noted, the same person saying the same word at different times will not produce an identical spectrogram. Since no meaningful identification of intraspeaker spectrograms exists, the operator is forced to look for individual "points of similarity," as yet undefined, within the spectrograms rather than comparing the overall patterns. Even the number of points of similarity required to constitute a match has varied, although Kersta has stated that there should be at least sixteen.⁶⁹ For purposes of finding a match, only points of similarity are considered and differences between samples are ignored.⁷⁰ This might be a valid technique if the operator was required to find the requisite number of points within a single comparison. However, the current practice permits the operator to use as many samples as he wishes in order to find the necessary points.⁷¹ In other words, *if the operator finds one point of similarity in each of sixteen comparisons he has achieved a match.*⁷² Without a limitation on the number of samples used, any two voices in the world could ultimately be declared identical.

There are other factors favoring false identification. Part of the similarity between spectrograms of a given cue word stems from the fact that the same word is being spoken and not that the same voice is speaking it.⁷³ The context in which a word is spoken, *i.e.*, whether it is spoken alone or as part of a larger phrase, is a crucial factor.⁷⁴ The spectrograms of a person speaking the same word in different contexts will vary greatly. In the Tosi Study the error rate doubled when words in context were used.⁷⁵ Since most voice identification cases involve recorded phone calls, the quality of the equipment is

69. Kamine, *supra* note 8, at 216.

70. *Id.*

71. *Id.* at 216-17.

72. *Id.*

73. *Voiceprint Identification*, *supra* note 21, at 709.

74. Kamine, *supra* note 8, at 215.

75. Second Bolt Study, at 532.

important. A human voice has a frequency range of from 80 to 8000 cycles, but a telephone can only handle frequencies up to 3500 cycles.⁷⁶ Thus, spectrograms produced from phone recordings are incomplete and possibly even less reliable than those produced from direct recordings. The time element is also important. Most voice exemplars are recorded at a considerably later time than the unknown voice.⁷⁷ The error rate in the Tosi Study again doubled when the recordings were made non-contemporaneously.⁷⁸

The conditions under which the Tosi Study was conducted were very artificial and partially responsible for the high accuracy rate reported. The Second Bolt Study concluded:

The results of the MSU Study have done much to determine *under laboratory conditions* the accuracies of identification that can be achieved under a number of conditions that would be present in practice. . . . We feel that the results of the MSU experiments fail to define adequately the reliability of the method. We continue to believe that the error rate in the practice of voice identification is not known at this time. The conclusions reached in our earlier paper have not changed.⁷⁹

What the Tosi Study did not test is also important. There were no experiments with female voices. Nor has any significant research been conducted on mimicked or disguised voices to determine if the spectrographic qualities of a voice can be altered by these means.⁸⁰ There has been no research into the phenomenon of confusability.⁸¹ Dr. Ladefoged has stated that even Dr. Tosi's sample group, derived from a large college campus population, may have been too heterogeneous. He raised the possibility that if tests were to run on long-time residents of a close-knit neighborhood, the shared speech characteristics growing out of their close association could make their voices spectrographically indistinguishable.⁸² Other factors that various experts wish to see explored before they can accept the technique as valid are the effects of background noise, disease, differing psychological states, foreign objects in the mouth, and missing teeth.

76. *Voiceprint Identification*, *supra* note 21, at 711.

77. The time spread was over five years. *State v. Andretta*, 61 N.J. 544, 552, 296 A.2d 644, 648 (1972).

78. Second Bolt Study, at 532.

79. *Id.* at 531 (emphasis added).

80. *Id.* at 522-23.

81. Jones, *supra* note 11, at 321-22.

82. *Id.*

While the Michigan State Study has received most of the attention by the courts, there have been other experiments in spectrographic voice identification with different results. Dr. Barry Hazen of the State University of New York at Buffalo conducted an identification study⁸³ using conversational speech in which he found error rates as high as 83.33 per cent. He concluded that “. . . [A]ccurate identification of speakers by visual comparison of spectrograms is not possible.”⁸⁴ Dr. Frank Clarke, an expert for the defense in *Wright* and *King* has conducted research showing a 60 per cent accuracy rate.⁸⁵ Two other researchers, Martin Young and Richard Campbell⁸⁶ have attained a 78.4 per cent accuracy rate for words in isolation and a 37.3 per cent rate for words in context.⁸⁷

In addition to most scientific authorities, a majority of the legal commentators who have dealt with this issue in depth have concluded that spectrographic evidence is not sufficiently reliable to be admissible.⁸⁸ And finally, the Federal Bureau of Investigation, an agency that certainly has a great interest in the development of an objective voice identification technique has had this to say:

[W]e feel that the comparison of voiceprints is useful as an investigative guide but has not been proven sufficiently well authenticated to serve as a reliable basis for expert testimony as to identity, at this time.⁸⁹

V. JUDICIAL ACCEPTANCE

While the voiceprint method has more than its share of problems, the fact remains that it has achieved considerable judicial recognition. There are several reasons for this. Probably the most important is the wide-spread confusion as to the scientific field to

83. Hazen, *The Effects of Differing Phonetic Context on Spectrographic Speaker Identification*, 54 J. ACOUSTICAL SOC'Y OF AM. 650 (1973).

84. Thomas, *Voiceprint—Myth or Miracle (The Eyes Have It)*, 3 U. SAN. FERN. VAL. L. REV. 15, 21 (1974).

85. *Voiceprint Identification*, *supra* note 21, at 711.

86. M. Young and R. Campbell, *Effects of Context on Talker Identification*, 42 J. ACOUSTICAL SOC'Y OF AM. 650 (1973).

87. *Voiceprint Identification*, *supra* note 21, at 711.

88. Kamine, *supra* note 8; Case Comment, *supra* note 8; Comment, *supra* note 14; Cedarbaums, *supra* note 19; Jones, *supra* note 11; *Voiceprint Identification*, *supra* note 21; Jones, *supra* note 48; Thomas, *supra* note 84. *The Voiceprint Dilemma: Should Voices Be Seen and Not Heard*, 35 MD. L. REV. 267 (1975-76); Comment, *The Status of Voiceprints as Admissible Evidence*, 24 SYR. L. REV. 1261 (1973). *Contra*: Boren, *supra* note 9; Bricker, *supra* note 16; Comment, *The Admissibility of Voiceprint Evidence*, 14 S. DAK. L. REV. 129 (1969). Greene, *Voiceprint Identification: The Case in Favor of Admissibility*, 13 AM. CRIM. L. REV. 171 (1975).

89. Comment, *supra* note 14, at 335 n.113.

which the technique belongs. Accoustics, of course, is the field with the most logical nexus to voiceprints. However, there are several other disciplines which relate to the subject. These include anatomy, linguistics, physiology, phonetics, physics, audiology, and psychology. The fact that such a wide range of expertise is required in order to do any meaningful research in the area of voice identification, and the fact that none of the active practitioners have such a broad background should tend to discredit their claims of reliability in the eyes of the courts. Unfortunately, the confusion has had, if anything, the opposite effect. Since no single scientific field can be said to be authoritative on the subject, some courts (*e.g.*, *Hodo* and *Lykus*) have seized the opportunity to decide for themselves which field they will look to for general acceptance and have opted for those actively and regularly involved in using the spectrograph for voice identification.

Dr. Tosi, Kersta and Lt. Nash have been encouraging this trend by forming the International Association of Voice Identification which certifies operators who have completed the Association's course.⁹⁰ They are now claiming that only IAVI members are competent to testify on the reliability of voiceprints.⁹¹ This is patently false. It is not necessary that another scientist actually engage in the production of spectrograms in order to properly analyze the published results of an experiment to determine if it comports with the scientific method and is otherwise valid. Such an analysis was conducted in the Second Bolt Study and the results of Dr. Tosi's experiments were seriously called into question. The opinions of these researchers were approved by the professional society of a related field and cannot reasonably be ignored in considering whether or not spectrographic analysis has achieved general scientific acceptance. Under the *Hodo* rationale, polygraph evidence, which has long been rejected by the courts, could be admissible, or for that matter evidence derived from palmistry or a crystal ball, because only active practitioners would be permitted to testify as to its validity.

Another major factor leading to the admission of voiceprint evidence has been the availability and motivation of expert witnesses. In the majority of cases the defense did not have sufficient resources to obtain expert witnesses to counter those of the prosecution.⁹² In addition, the prosecution witnesses have had much greater incentive to testify: Kersta, because he is a manufacturer of sound

90. Thomas, *supra* note 84, at 36-37.

91. *Id.* at 36.

92. Jones, *supra* note 11, at 301-02.

spectrographs; Dr. Tosi, because he has become the leading proponent of admissibility and is in need of a forum. None of the opponents of admissibility have anything to be gained either monetarily or professionally by testifying.

A third reason for acceptance is the misinterpretation by some courts of the disagreement among the experts. In several of the cases, it was pointed out that disagreement in other scientific fields did not preclude testimony by experts in those fields.⁹³ A good example is the often diametrically opposed opinions of psychiatrists regarding the sanity of a criminal defendant. The controversy there involves a disagreement between two practitioners of a well-established scientific discipline over an issue that often arises within that discipline. In contrast, the present debate about voiceprints is not a contest in which one expert testifies that two spectrograms were produced by the same voice and another testifies that they were not. Rather the argument is whether the whole field of endeavor has any validity at all. The validity of psychiatric methods is generally accepted within the medical profession. The validity of voice identification by the sound spectrograph is not generally accepted in the speech and acoustics professions. The first meets the *Frye* standard and the second does not.

A fourth factor is the often-drawn false analogy to fingerprints which have been proven to be reliable after a long and careful development.⁹⁴ The use of the term "voiceprint" is largely responsible and has led to great confusion. A fingerprint is direct physical evidence: an impression of the fingertips produced by oil on the skin. A spectrogram is a visual depiction of something else. Its quality is a function of the temperature, humidity and barometric pressure of the air that the sound passes through, the quality of the recording device and recording tape, and the quality of the electronic filter and paper of the spectrograph. Fingerprints are truly invariant, absent surgery or trauma, while spectrograms will vary from minute to minute. A classification system exists for fingerprints while spectrograms can only be used in one-shot comparisons.

There is also a growing tendency to use prior case law as authority for the proposition that the *Frye* rule has been satisfied. The counting of cases is a valid approach where a question of law or public policy is involved, but it cannot serve as a substitute for the exhaustive inquiry necessary to determine the soundness of a scientific principle.

93. See, e.g., *State ex rel. Trimble v. Hedman*, 291 Minn. 422, 458, 192 N.W.2d 432, 440 (1971).

94. Jones, *supra* note 11, at 318.

And finally, there is a trend throughout the law of evidence to eliminate artificial barriers to admissibility. Rule 402 of the Federal Rules of Evidence and Rule 402 of the Uniform Rules of Evidence provide that "All relevant evidence is admissible . . .",⁹⁵ except as otherwise limited elsewhere in the Rules or by statute or constitution. While most of the jurisdictions operating under these rules still use the *Frye* rule as the standard for the admissibility of scientific evidence,⁹⁶ the bias toward admissibility in these rules can only aid the proponents of such evidence.

VI. CONCLUSION

The technique of identifying voices by use of the sound spectrograph has not achieved sufficient scientific acceptance to satisfy the *Frye* rule, and thus, evidence based on this should not be admissible in court. At a minimum, its use should be confined to establishing probable cause. Most of the courts that have accepted the technique seem to have done so with an awareness of the difficulties involved, and have limited its use to corroboration of other forms of identification. However, the very fact that its usefulness is limited, when compared with the potential prejudice involved, argues against its admissibility.⁹⁷ When a trier of fact is faced with the difficult task of choosing between two conflicting and often self-serving versions of the facts in dispute, the injection of evidence obtained from a supposedly unimpeachable and objective machine is almost certain to be given more weight than its accuracy entitles it. This undue influence, when present in criminal cases, is extremely unfair to the defendant, and while it may not amount to a denial of due process, its prejudicial effect is great enough to warrant exclusion based on the principles of the law of evidence.

Terry Timblin

95. FED. R. EVID. 402; UNIFORM R. EVID. 402.

96. Jones, *supra* note 11, at 314.

97. Rule 403 of the Federal Rules and Rule 403 of the Uniform Rules provide that even relevant evidence may be excluded if its probative value is substantially outweighed by the danger of prejudice or other factors.