ARE THE COURTS LISTENING TO VOICEPRINTS?

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INTRODUCTION

The technique of spectrographic analysis of a human voice, or voiceprint, was developed during the Second World War at the request of the United States government. The technique was to be used to track German troop movements by identifying the voice of an individual radio operator. In response to the government’s request, Bell Telephone, under the direction of Lawrence Kresta, began the study and developed the technology to resolve complex sound waves into component frequencies and plot them in respective intensities.

The very basic theory of spectogram concerns the measurement of time, frequency and amplitude. A recorded voice is passed through an electronic filter to an impulse sensitive stylus. The stylus moves parallel to the axis of a drum bearing paper; the movement occasions an ink impression on the paper as the drum revolves. The result is a pattern of closely spaced lines of differing shades, more commonly known as the voiceprint. Identifying the speaker requires matching a known voiceprint with an exemplar. In this respect, the technique is similar to a fingerprint comparison; however, it is arguable whether the technique is as reliable as

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5. Identification of a voice rests on three assumptions: each voice is unique; the voiceprint shows the unique qualities; and an examiner can accurately determine a match. United States v. McDaniel, 538 F.2d 408, 412 (D.C. Cir. 1976).
A preeminent authority in the field, and advocate of voiceprints for identification is Professor Oscar Tosi. He asserts that a voiceprint can be used either to eliminate or identify a suspect with an error rate of approximately two percent in elimination. Other experts in the field of spectrographic analysis have likewise supported this principle.

However, not all commentators are convinced of the reliability of the technique. It is reasonably believed by some that analysis by human observation is too imprecise, and that it leaves room for mistakes in subjective judgment. Edward Welch, Jr., a scholar in the field, has suggested that the matching process should be done with the aid of computer technology. After programming, matching would be accomplished on a purely objective basis eliminating judgments that allow for human error.

Before exploring the question of admissibility on evidentiary grounds, it is important to first question whether the taking of compulsory voice exemplars is a violation of constitutional protections guaranteed by the fourth or fifth amendments. The seminal case on this issue is United States v. Dionisio. In Dionisio, a criminal defendant refused to submit a voice exemplar to a grand jury. As a result, he was held in civil contempt and confined for the duration of the grand jury term.

Mr. Justice Stewart speaking for the Court, stated that to compel a witness to appear before a grand jury and submit a voice exemplar is not a seizure under the fourth amendment. A voice exemplar merely requires a person to provide physical evidence

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6. In People v. King, 266 Cal. App. 2d 437, 442, 72 Cal. Rptr. 478, 481 (1968), Mr. Lawrence Kersta, chief prosecution witness and an expert in the area of sound engineering, phonetics, and acoustics stated that voiceprints have the "infallibility of fingerprints." Id. Later studies have questioned the accuracy of this statement.

7. Voiceprint Identification, supra note 1, at 44. See United States v. Baller, 518 F.2d 463 (4th Cir. 1975). In connection with the Michigan State Police and principally with Lt. Ernest Nash, Professor Tosi has conducted around 35,000 experimental trials using the voiceprint technique of identification. Voiceprint Identification, supra note 1, at 44.


11. Id. at 46.


13. Id. at 3.

14. Id. at 4.

15. Id. at 13.
similar to providing fingerprints. Furthermore, no preliminary showing of reasonableness would be required. The Court also held that requiring a voice exemplar did not violate the fifth amendment proscription against self-incrimination because the evidence obtained is nontestimonial in nature.

In light of Dionisio, acts of state officers compelling one to submit to producing voiceprints are no longer constitutionally suspect under the fourth and fifth amendments. Similarly, courts now recognize that a person may be compelled to give a voice exemplar without a preliminary showing of reasonableness or probable cause. The issue, however, is not conceded by all authorities. One commentator suggests that requiring a person to speak exact words is tantamount to obtaining testimonial evidence to which constitutional protections adhere. Such arguments, however, lack a fundamental understanding of the nature of voiceprint evidence. Concerning the spectrogram, it is the visual recorded character of the words, and not their conventional meaning which constitutes the relevant evidence. A voiceprint analysis, therefore, is an examination of the physical characteristics of a voice represented as such and printed on paper.

**VOICEPRINTS AND THE STANDARD FOR SCIENTIFIC EVIDENCE**

**MEETING THE STANDARD**

The germinal case on the admission of scientific evidence is Frye v. United States. In that decision the standard for admitting scientific evidence was articulated as follows: "[W]hile the courts will go a long way in admitting expert testimony deduced from a

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16. Id. at 14.
17. Mr. Justice Douglas dissented under the rationale that such an invasion of privacy would require a preliminary showing of reasonableness. His dissent in Dionisio was filed in United States v. Mara, 410 U.S. 19, 23 (1973), and is equally applicable to the former. Id. (Douglas, J., dissenting).
19. But see In re Grand Jury Proceedings, 486 F.2d 85 (3d Cir. 1973), where a preliminary showing of relevance was required. Id. at 93.
21. Analysis is usually conducted upon common words such as "the," "me," "is," "on," and "it." See People v. Kelly, 13 Cal. App. 3d 24, —, 129 Cal. Rptr. 144, 147 (1976).
24. 293 F. 1013 (D.C. Cir. 1923).
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.*

A review of the case law reveals that the application of *Frye* is the single most important point in admitting voiceprints into evidence.

Although the case law bears out a general acceptance of the *Frye* standard, there is some scholarly criticism of its hypertechnical application. The most notable of the critics is Dean McCormick; he noted that juries decide questions of identification based upon probabilities, not absolute certainty. Using this rationale, a guaranteed errorless match between suspect voiceprints would not be required. There is also judicial support requiring less than actuarial certainty in an identification.

In *Reed v. State*, a Maryland court held that even proof beyond a reasonable doubt does not require proof to a mathematical certainty. That court noted that if similarly exacting standards were placed upon other types of scientific evidence, their test results would not be admitted into evidence. When compared to these other types of evidence, voiceprints compare quite favorably. Notwithstanding the legal practicality of admitting scientific evidence without applying the general acceptance standard, courts continue to apply the *Frye* test.

When courts admit voiceprints, they have found that the technique meets the *Frye* test for admission of scientific evidence. An early case involving a military court, in which the court followed the tack suggested by Dean McCormick was *United States v.*

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25. Id. at 1014 (emphasis added).
28. United States v. Addison, 498 F.2d 741, 743-45 (D.C. Cir. 1974); cf. United States v. McDaniel, 538 F.2d 408, 412-13 (D.C. Cir. 1976) (court admitted that although in the two years since *Addison* there had been widespread recognition of the reliability of spectograph identification in other jurisdictions, it was bound by *Addison* absent a clear showing of reliability or en banc reconsideration of *Addison*).
31. Id. at —, 372 A.2d at 249-50.
32. Id. at —, 372 A.2d at 250. For example, bullets fired from the same gun in rapid succession will not have exactly the same striations. A. Moensses, R. Moses & F. Inbau, SCIENTIFIC EVIDENCE IN CRIMINAL CASES 440 (1973).
34. C. McCormick, supra note 29, at § 203.
Wright. The defendant in Wright was tried for making threatening and obscene phone calls to two women. Lawrence Kresta testified as the prosecution's expert witness. Relying upon the high degree of accuracy of voiceprints and requiring less than 100% reliability, the court admitted the voiceprint evidence and the defendant was convicted.

In 1971, the Minnesota Supreme Court admitted the voiceprint of a criminal defendant charged with luring two police officers into an ambush. The prosecution offered evidence against the accused based upon aural identification and corroborated by expert testimony on the voiceprint. The defendant appealed from an order of the district court in a habeas corpus action and a hearing was held to determine the admissibility of the voiceprints; the district court ruled in favor of admission. The Minnesota Supreme Court settled the issue by admitting the expert testimony, holding further that the weight of the evidence would be determined by the jury.

In Worley v. State, the Florida Court of Appeals similarly allowed admission of voiceprints for purposes of corroborating other evidence. The facts of Worley reveal that a bomb threat was delivered over the phone. The evidence against the defendant included aural identification, the defendant's fingerprints on the phone from which the call was placed, and a witness who saw the defendant near the phone at the time the threatening call was placed. The court allowed the voiceprint evidence to stand, holding that such was within the discretion of the trial judge. The Worley court, however, specifically declined to state whether the voiceprint evidence alone would sustain the conviction vel non.

The decisions of the Minnesota and Florida courts emphasized the corroborative value of voiceprints; neither court discussed the issue of voiceprints and the scientific standard set out in Frye. In 1975, the Supreme Judicial Court of Massachusetts decided Commonwealth v. Lykus, a case involving a kidnapping and a murder. In Lykus the state offered six aural identifications and other

36. Id.
38. Id. at —, 192 N.W.2d at 433.
39. Id. at —, 192 N.W.2d at 441.
41. Id. at 614. See also Alea v. State, 265 So. 2d 96, 98 (Fla. Dist. Ct. App. 1972).
42. 263 So. 2d 613 (Fla. Dist. Ct. App. 1972).
evidence corroborated by voiceprints. In a decision that had a
great impact on future cases throughout the country,\textsuperscript{45} that court
held that voiceprints had met the \textit{Frye} test of general acceptance
within the scientific community and “neither infallibility nor
unanimous acceptance of the principle need be proved to justify its
admission in evidence.”\textsuperscript{46}

The Fourth and Sixth Circuit Courts of Appeals both accept
voiceprints into evidence. In the case of \textit{United States v. Baller},\textsuperscript{47} a
defendant was convicted of making a phone threat to the coal mine
where he was employed. The expert witness for the government,
Lieutenant Ernest Nash of the Michigan State Police, identified
the defendant as the caller; the identification was based upon a
positive voiceprint match on three of four exemplars.\textsuperscript{48} Noting that
an error arises in approximately two percent of the identifications,
the court admitted the evidence.\textsuperscript{49} Furthermore, the court opined
that absolute certainty is not required for the admission of scien-
tific evidence.\textsuperscript{50} Thus, in the Fourth Circuit, voiceprints meet the
requirement of general acceptance within the scientific commu-
nity. The \textit{Baller} court, however, added a specific cautionary in-
struction on the weight of the scientific evidence.\textsuperscript{51}

The Sixth Circuit Court of Appeals, in \textit{United States v. Franks},\textsuperscript{52} culled many of the divergent viewpoints from various ju-
risdictions and found that “the trend favors the admissibility of
voiceprints.”\textsuperscript{53} The \textit{Franks} court ruled that admissibility of
voiceprints rests in the discretion of the trial judge.\textsuperscript{54} The court’s
criticism was directed toward the issue concerning the appropriate
weight of the evidence, and not admissibility.

In \textit{United States v. Williams},\textsuperscript{55} prior to trial, the government
made known its intention to offer spectrograph evidence of a voice
exemplar furnished by the defendant.\textsuperscript{56} Finding no proscription in

\textsuperscript{45} See, e.g., \textit{United States v. McDaniel}, 538 F.2d 408 (D.C. Cir. 1976); \textit{United
States v. Baller}, 519 F.2d 463 (4th Cir. 1975); \textit{People v. Tobey}, 401 Mich. 141, 257
\textsuperscript{46} 367 Mass. at —, 327 N.E.2d at 675.
\textsuperscript{47} 519 F.2d 463 (4th Cir. 1975), cert. denied, 432 U.S. 1019 (1975).
\textsuperscript{48} Id. at 464.
\textsuperscript{49} Id. at 466.
\textsuperscript{50} “[I]t is better to admit relevant scientific evidence . . . and allow its weight
to be attacked by cross-examination and refutation.” \textit{Id}.
\textsuperscript{51} Id. at 467.
\textsuperscript{52} 511 F.2d 25 (6th Cir. 1975), cert. denied, 422 U.S. 1042 (1975).
\textsuperscript{53} Id. at 33.
\textsuperscript{54} \textit{Accord}, \textit{United States v. Jenkins}, 525 F.2d 819, 827 (6th Cir. 1975).
\textsuperscript{56} \textit{Id} at 273.
the Second Circuit, but noting the case law against admissibility, the court admitted the evidence. Although the court mentioned the view of Dean McCormick on a differing standard of scientific evidence admissibility, it found that there was "a sufficient showing of acceptance by the scientific community of the use of spectrographic analysis for voice identification to warrant its admissibility."

Judge Broderick concluded his memorandum order with a brief discussion of another key issue in voiceprint admissions—fear of misleading the jury. Judge Broderick noted that fear of prejudicial jury appeal could be alleviated without suppression of the evidence. He reasoned:

The jurors are presented with the evidence as an aid to their determination of whether the voices are or are not the same, not as a substitute for that determination. The defendant may submit evidence questioning the reliability of the spectrographic identifications, and the jury will be instructed that it may consider all such evidence in determining what weight, if any, to give the evidence.

Failing the Standard

Voiceprints have not received favorable treatment in all federal courts. United States v. Raymond, an ambush case, revealed that at the evidentiary hearing, two experts testified without opposition that voiceprints were scientifically reliable and that the possibility of an error in identification was negligible. The trial court admitted the evidence and delegated the weight and credibility assessment to the jury. The defendant was convicted and he appealed.

On appeal the District of Columbia Circuit did not criticize the research of Professor Tosi or his conclusion; it ruled that admission of the voiceprint evidence was harmless error. Thus, in direct conflict with the Fourth and Sixth Circuits, the District of Columbia Circuit ruled in United States v. Addison that

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58. 443 F. Supp. at 271.
59. See discussion at notes 27-29 and accompanying text supra.
60. 443 F. Supp. at 271.
61. Id. at 273.
63. Id. at 645.
65. 498 F.2d 741, 745 (D.C. Cir. 1974).
voiceprints had not reached the standard for admissibility as scientific evidence. The court, however, did not wholly foreclose future admission of voiceprints, finding that "portions of the record suggest that spectrogram analysis may become a useful tool for the resolution of questions of criminal liability."66

In a later and more comprehensive opinion the District of Columbia Circuit reaffirmed Addison. In United States v. McDaniel,67 that circuit court, reversing the trial court, stated that the weight of authority supporting the admission of voiceprints into evidence was outside the District of Columbia Circuit.68 The court relied upon its earlier holding in Addison, rejecting the voiceprint evidence.69 In its decision, however, the court showed some sign of reservation stating that it may be time to re-examine Addison in view of "increased reliability and the general acceptance in the scientific community of using spectrographic analysis techniques."70 It is critical to observe that without a demonstration of the scientific acceptance of voiceprints by the party urging their admissibility,71 the court felt bound by its former decision in Addison. However, the court declined to give any indication of the type of proof that would clearly demonstrate scientific acceptance and cause it to discard the Addison rule.

JUDICIAL SCRUTINY IN THE STATE COURTS

California state courts have scrutinized voiceprints extensively. An exhaustive analysis of spectrographic evidence was articulated in People v. Kelly.72 Kelly placed major emphasis on a strict application of the Frye standard for scientific evidence,73 in-

66. Id.
67. 538 F.2d 408 (D.C. Cir. 1976). Several police officers were caught in a bribery scheme and decided to cooperate with the internal affairs division of the police department. During the investigation, phone calls made by the cooperating officers were recorded. Voiceprints were made and examined by Lt. Ernest Nash, who testified that the defendant was the unknown speaker. The trial court admitted the evidence relying upon the weight of judicial authority and found that the voiceprint technique had become generally accepted within the scientific community. Id. at 412.
68. "Since Addison, numerous other courts have examined the question of whether so-called voiceprints are sufficiently reliable to justify their admissibility, and all but a few have concluded that they are." Id. at 412-13.
69. Id.
70. Id. at 413.
71. Generally, it is the prosecution that attempts to introduce voiceprint evidence, but this is not always the case. See, e.g., United States v. Goldstein, 532 F.2d 1305 (9th Cir. 1976), in which the defendant unsuccessfully argued that it was error for the court not to require identification by voiceprint. Id. at 1315.
72. 17 Cal. 3d 24, 549 F.2d 1240, 130 Cal. Rptr. 144 (1976).
interpreting the *Frye* decision as a deliberate and substantial hurdle in the admission of scientific evidence. The court indicated that the exercise of restraint was especially warranted where scientific evidence was in question.\(^7\)

The framework of the *Kelly* opinion reveals the court's three major concerns with scientific evidence: (1) establishing reliability of the scientific principle; (2) qualifying the expert; and (3) establishing that correct procedures were used in production of the evidence and evaluating the results. Finding neither an established trend in the case law nor any conclusive authority, the court turned to the specific facts of *Kelly*, particularly the qualifications of the state's expert and his authority to speak for the scientific community.

Lieutenant Ernest Nash was the state's only expert witness. The court carefully reviewed his credentials and held his testimony insufficient to sustain the state's burden. The court remained unpersuaded that one person could adequately represent himself as the spokesperson for the scientific community.\(^7\) To establish the tenor of scientific thought on this matter, the court would require a typical cross section of scientists.\(^7\) The question remains whether that court would continue to require a cross section polling of scientists in the event that subsequent cases establish the acceptance of voiceprints in collective scientific thought.

The *Kelly* court questioned Lieutenant Nash's impartiality, as well as his qualifications as an expert. At the time of his testimony, Lieutenant Nash had approximately fifty hours of college credits but no formal college degree. The court conceded that he had impressive credentials, but classified him as a technician not a scientist. Therefore, the court found that he could not be considered an expert who could deliver a credible opinion concerning voiceprints.\(^7\)

The *Kelly* court's reasoning restricts the category of expert to persons who have attained a formal college degree, for this reason alone it is at best specious. True experts are persons who "may be men of science educated in the art, or persons possessing special or peculiar knowledge acquired from practical experience."\(^7\) Lieutenant Nash certainly fits the latter half of this well-accepted


\(^7\) 17 Cal. 3d 24, 37, 549 P.2d 1240, 1249, 130 Cal. Rptr. 144, 152 (1976).

\(^7\) The court also suggested sua sponte questioning by the trial court on the issue of the witness' knowledge of experts with divergent viewpoints. *Id.* at 39, 549 P.2d at 1250, 130 Cal. Rptr. at 153.

\(^7\) *See* note 75 *supra*.

\(^7\) Black's Law Dictionary 688 (Rev. 4th ed. 1968).
definition. Furthermore, it is noteworthy that no other court presented with Lieutenant Nash's background failed to accept him as an expert in voiceprint analysis. Those courts that have discounted his testimony have done so on the basis that he is not impartial; his qualifications otherwise apparently satisfy the courts.

The Supreme Court of Michigan, in People v. Tobey, rejected voiceprint evidence. It did not rule, however, that voiceprints would never be admissible. In Tobey, a criminal defendant was convicted for selling heroin to an undercover police officer. After the sale, the police officer phoned the defendant and recorded their conversations. Voiceprints were prepared and a match was confirmed. The supreme court ruled that the trial court erred in admitting the voiceprint evidence.

Judge Levin ruled, articulating the Frye test, that the scientific principle must be shown to be generally accepted by impartial experts. The experts for the state in Tobey were Professor Tosi and Lieutenant Nash. The court cogently reasoned that since the careers of both were so interconnected with voiceprints they could not qualify as impartial witnesses. The decision chronicled other recent state cases from California and Pennsylvania and found that the state failed to meet its burden of establishing general acceptance. However, the court made special mention that its opinion was not to be read to preclude the admission of voiceprints when the offering party can establish scientific approval and support.

It would appear that those courts rejecting voiceprint evidence have intimated that if general scientific acceptance can be established that evidence will be welcomed. The Pennsylvania Superior Court reflected this observation in Commonwealth v. Topa. The Topa record revealed that a person phoned the Scranton police, gave his name as Roger Ferretti and confessed to a stabbing. In the normal course of police operations, the phone call was re-

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82. 401 Mich. at —, 257 N.W.2d at 538.
83. Id. at —, 257 N.W.2d at 539.
86. 401 Mich. at —, 257 N.W.2d at 540.
corded. The state's expert witness on voiceprints was Lieutenant Nash; he stated that the caller was definitely the defendant.

Other evidence connecting the defendant to the crime included a witness who saw the defendant and the victim together shortly before the stabbing, a button from the defendant's coat found near the crime scene, and traces of the victim's blood on the defendant's coat sleeve. The court rejected the voiceprint evidence stating that the prosecution failed to establish general acceptance in the scientific community. The testimony of only one expert could not speak for the collective scientific community involved in this area. Had the state produced other experts, the evidence would probably have been accepted.88

Immediately after Topa was decided,89 the Maryland Court of Appeals admitted voiceprints on the grounds that the Frye test had been satisfied. In the case of Reed v. State,90 "[a]fter hearing 'everything you always wanted to know about spectrographs but were afraid to ask,'"91 Judge McAuliffe admitted the voiceprints into evidence. On one critical point, Reed is totally inapposite to Topa92 or Tobey;93 in Reed, the state produced four expert witnesses who testified concerning the reliability of voiceprint analysis. The court articulated that despite error rates in identification ranging from two to sixteen percent the Frye test could be satisfied.94 The court noted that even proof beyond a reasonable doubt does not require a mathematical certainty. By analogy, the court recognized that if absolute certainty were required, other types of evidence, incapable of an exact identification, would also be excluded including blood stains, fiber tests, semen stains and handwriting analysis.95

Reed held that voiceprints meet the Frye standard, and that with the proper safeguards, they are admissible in Maryland.96 The court reasoned that it is better to admit relevant scientific evidence, and allow the jury to assess its weight after cross-examination and refutation, unless there is widespread exaggerated
popular opinion of accuracy that would distort the jury's evaluation of the evidence.97

CONCLUSION

The issue of whether or not to admit voiceprints cannot be resolved by aligning the cases into two columns.98 There is no well-defined controlling authority in the case law. However, several common concerns are manifested in the decisions and require scrutiny in any discussion on voiceprint admissibility. Three major points of analysis often recur: (1) the impact of the evidence upon the jury; (2) establishing voiceprint evidence as generally accepted within the scientific community; and (3) qualifying the expert.

The impact of a voiceprint upon a jury is an issue that has caused considerable discussion in both jurisdictions that accept voiceprints and in those that reject them.99 In jurisdictions which admit voiceprints courts have guarded their admission with the use of carefully worded jury instructions. In this manner the jury remains free to exercise its traditional role of weighing the evidence and assessing the credibility of the expert. This view also reflects a general attitude of appellate courts to refrain from emasculating the trial judges' power to admit evidence at their discretion.

Of critical importance in any case involving scientific evidence is the problem of deciding whether the particular scientific principle underlying the technique has been generally accepted by scientists who are qualified in that area or specialization. In numerous cases where the courts rejected the voiceprint evidence, there are indications that general acceptance could have been proved.100 The major weakness in the cases analyzed throughout this article has been the prosecution's reliance upon one or two well-known experts to speak for the scientific community. In all but isolated cases, the experts have been Professor Tosi and Lieutenant Nash. Although these two men are unquestionably experts in spectrographic analysis of the human voice,101 they are also advocates of the technique and their opinion is justifiably subjected

97. Id. at __, 372 A.2d at 251.
100. E.g., United States v. McDaniel, 538 F.2d 408, 413 (D.C. Cir. 1976).
to careful cross-examination.\textsuperscript{102}

A final thread of concern that runs through many of the voiceprint cases is the problem of establishing the offering party's witness as an expert. As with other forensic science witnesses, the trial court must be convinced that the witness has attained the requisite knowledge, through formal training or experience, to satisfy the title of expert. Notwithstanding \textit{People v. Kelly},\textsuperscript{103} which appeared to require of experts a college degree, most courts and rules of evidence are satisfied if the witness is able to demonstrate specific skill, knowledge, or training in his field of expertise.\textsuperscript{104} With the aid of cross-examination it is the jury's function to determine the weight and credibility to be given to the expert's testimony.\textsuperscript{105}

The final resolution of the admissibility problems presented by voiceprints may depend upon the judiciary's balancing the evidentiary worth of the scientific principle against these three recurring fears. Whether the voiceprint analysis will ever gain general acceptance as a tool for identification or elimination of suspects remains to be seen. For the present, it would appear that admissibility of voiceprint evidence will be handled on a case by case analysis; in the words of Mr. Justice Holmes: "Any solution in general terms seems . . . to mark a want of analytic power."\textsuperscript{106}

\textsuperscript{102} For material useful in cross-examining the voiceprint expert witness, see Siegel, \textit{Cross-Examination of a "Voiceprint Expert"}, 2 NAT'TL. J. CRIM. DEF. 79 (1976). \textit{But see Reed v. State}, 35 Md. App. 472, 372 A.2d 243 (1977), where four experts testified on the value and reliability of voiceprinting. The evidence was admitted in the wake of two cogent opinions rejecting voiceprints since the court was satisfied that the four experts presented sufficient testimony upon which the court could find that voiceprints were generally accepted by the scientists involved in the study of audio analysis.

\textsuperscript{103} 17 Cal. 3d 24, 36, 549 P.2d 1240, 1248, 130 Cal. Rptr. 144, 152 (1976). \textit{See} discussion at notes 72-79 and accompanying text \textit{supra}.


\textsuperscript{105} In refutation, the opposing party is free to offer the testimony of its own witness. \textit{Fed. R. Evid.} 706(d).

\textsuperscript{106} Holmes, \textit{Law In Science and Science in Law}, 12 \textit{Harv. L. Rev.} 443, 462 (1899).