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Article

**\*1187 INDIVIDUALIZATION CLAIMS IN FORENSIC SCIENCE: STILL UNWARRANTED**

Jonathan J. Koehler

[Michael J. Saks \[FNd1\]](#)

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I. Introduction

In a 2008 paper published in the Vanderbilt Law Review entitled *The Individualization Fallacy in Forensic Science Evidence*, [\[FN1\]](#) we argued that no scientific basis exists for the proposition that forensic scientists can “individualize” an unknown marking (such as a fingerprint, tire track, or handwriting sample) to a particular person or object to the exclusion of all others in the world.

In that article we made the following claims:

(1) the data necessary to achieve individualization have never been collected for any of the forensic science fields which aspire to individualize the source of crime scene evidence to its sole possible contributor;  
(2) the best available—and perhaps the only scientifically defensible— approach to forensic identification is the use of random match probability estimates (which are not yet employed by any of the traditional forensic identification sciences);

(3) the argument that all objects are discernibly unique stands on little more than an oft-repeated maxim of forensic science legend and the illusory intuition that small frequencies imply uniqueness;

(4) probability estimates (by definition) cannot lead to uniqueness or individualization;

**\*1188** (5) assertions of individualization generally exaggerate what is known or can be accomplished by forensic examiners. [\[FN2\]](#)

The central point and purpose of our article was a practical concern: to argue that because no field of forensic identification has adequate grounds for making individualization claims, expert witnesses from those fields should not make such claims in their reports and testimony. We recommended that, in the short term, expert witnesses should (a) revise their testimonial language to more accurately characterize the meaning and value of their findings, and (b) report only those inferences that can be supported by what is actually known by their fields. [\[FN3\]](#) We further suggested that, in the long term, empirical research should be undertaken to place the forensic disciplines on more solid scientific footing. [\[FN4\]](#)

In this issue of the Brooklyn Law Review, we clarify, refine, and extend some of the ideas presented in *Fallacy*. Some of the refinements are prompted by Professor David Kaye's paper, also in this issue of the Review, [\[FN5\]](#) in which he takes issue with some of the arguments we made in *Fallacy*.

**\*1189** At the same time, we think it is important to point out that Professor Kaye appears to agree with our key points. For example, Professor Kaye does not believe that uniqueness has been established in any of the traditional,

low-tech forensic sciences such as handwriting, toolmark identification, shoeprints, or fingerprints. [\[FN6\]](#) He does not believe that mere matching, without a showing of uniqueness, can establish individualization in the typical case. [\[FN7\]](#) He does not argue that testimony asserting that an object has been linked to its source to the exclusion of all others in the world is a scientifically reliable statement in any traditional forensic science discipline given the current state of knowledge. [\[FN8\]](#) He does not dispute our claim that probabilistic statements rather than absolutist statements would provide a more accurate characterization of forensic identification. [\[FN9\]](#) He agrees that there is a disconnect between the strong claims made by forensic scientists and the available scientific data. [\[FN10\]](#) And he agrees that reform is in order. [\[FN11\]](#)

If we agree on so much, [\[FN12\]](#) what is the disagreement? The overarching difference is that while our focus leans toward the practical implications for courts of the large problems (on which we agree), Professor Kaye's focus is on more abstract and conceptual issues—worthy of serious discussion, but with fewer implications for forensic science or judicial practice. Among **\*1190** these are: definitions (when can something properly be termed “metaphysical?”), logic and linguistics (when may probabilistic knowledge be expressed as an absolute? what are the customs of scientific communities for taking such linguistic shortcuts?), locating exceptions to general rules (are there current situations where an individualization claim is justifiable?), and thoughts about when an inferential leap might be small enough to be justified. [\[FN13\]](#)

**\*1191** Before responding to some of the issues that Professor Kaye raises, we offer a more specific definition of the “individualization fallacy” that we introduced in Fallacy. We also briefly compare and contrast this fallacy with others that appear in the literature.

## II. Defining the Individualization Fallacy

In Fallacy we did not offer a precise definition of the individualization fallacy. [\[FN14\]](#) We try to remedy that here. The individualization fallacy refers to the belief that a particular known person or object must be the source of questioned markings whenever (a) the examiner judges that a sufficient number of characteristics are observable in both the questioned markings and the known, and (b) the examiner cannot otherwise distinguish the questioned markings from the known. In other words, the fallacy arises when the forensic scientist rules out all other possible sources for the unknown marking, including the multitude he has not examined, once he has found a single object or person that matches the features of the unknown marking. The fallacy is deeply entrenched in forensic science practice, where most examiners say that their knowledge, training, and experience enable them to make the inferential leap from observed consistencies between markings and their putative source to a conclusion that no other object in the world could have produced those markings. [\[FN15\]](#)

Several subtleties and distinctions are worth noting concerning the notion of uniqueness and fallacies that are related to the individualization fallacy.

### A. Uniqueness

A belief that one can individualize or has individualized is often bolstered by the claim that no two objects in the **\*1192** universe leave indistinguishably similar markings. This claim of uniqueness (first expressed in the maxim that “nature never repeats”) is often proffered by forensic science practitioners, forensic science authorities, courts, and even federal agencies as “a defensible epistemological foundation for forensic testimonial claims of source attribution.” [\[FN16\]](#) Assuming uniqueness to be true shortens the inferential chain from the perception that two markings are indistinguishably alike to the claim that whatever made one set of markings must have made the other. [\[FN17\]](#)

But uniqueness is not essential to the practice of forensic individualization. [\[FN18\]](#) Some examiners assert that they need deal only with the samples in front of them—the questioned and the known—and need give no thought at all to the frequency with which particular characteristics or sets of characteristics exist within the population from which

those mark-producing objects came. Others claim to be able to discern “individualizing” characteristics from non-individualizing markings, again without concerning themselves with population distributions of mark-producing objects. To be sure, there are certain circumstances where individualization could be achieved without having to make reference to the full population of such objects. [\[FN19\]](#) But such circumstances are exceptional and do not explain why practitioners in virtually all areas of forensic identification—with the notable exception of DNA typing—behave as if the population of potential sources is of no consequence to the task of individualizing. [\[FN20\]](#)

#### \*1193 B. The Uniqueness Fallacy

In Fallacy, we mentioned that the individualization fallacy is a cousin of David Balding's uniqueness fallacy. [\[FN21\]](#) The uniqueness fallacy is the mistaken belief that whenever the expected number of people or objects sharing a set of known characteristics is less than one, then one may infer that the known person or object is unique. [\[FN22\]](#) Some proponents of individualization have made, and many courts have accepted, the argument that if the population is smaller than the inverse of the random match probability, then uniqueness is established. [\[FN23\]](#) For example, if there are 6 billion people on earth, and an analyst reports that the relevant random match probability for, say, a DNA profile is 1 in 20 billion, then it is fallacious to conclude that the DNA profile in question must be unique. Fallacy cites Balding to explain why this is a fallacy, and presents other illustrative explanations.

#### C. The Fingerprint Examiner's Fallacy

According to Simon Cole, the fingerprint examiner's fallacy occurs when the (assumed) uniqueness of fingerprints is invoked to support the asserted accuracy with which fingerprint examiners can identify the source of latent prints. [\[FN24\]](#) As Cole points out, the relationship between fingerprint uniqueness and examiner accuracy is a tenuous one. [\[FN25\]](#) Even if fingerprints are unique, it is fallacious to assume that uniqueness somehow confirms the accuracy of examiners' identifications. By analogy, the (assumed) fact that every \*1194 human face is distinguishable from every other human face does not assure that eyewitness identifications are always accurate. Cole argues that much more is involved in drawing conclusions and in evaluating the risk of error, and that claims of uniqueness do not get us very far in those regards. [\[FN26\]](#)

In sum, several related forensic science fallacies have been identified, but they are distinct. The uniqueness fallacy concerns the faulty reasoning that match probabilities smaller than the reciprocal of the population of interest lead to inferences of uniqueness. The fingerprint examiner's fallacy concerns the faulty reasoning that turns the alleged uniqueness of fingerprints into an argument for the accuracy of fingerprint identifications. The individualization fallacy, which was suggested in Fallacy, concerns the faulty reasoning that certain observations are sufficient to individualize, regardless of whether uniqueness is invoked in support.

### III. Responding to Professor Kaye

Professor Kaye takes issue with what he refers to as our “radical skepticism of uniqueness,” [\[FN27\]](#) though, as mentioned in the Introduction, he agrees with the gravamen of Fallacy. [\[FN28\]](#) The disagreements that Professor Kaye has with Fallacy have more to do with theoretical issues about what might be possible in forensic science than with practical concerns about what has been achieved and how those achievements are reflected in courtroom practice. Three topics on which we do appear to disagree are metaphysics, uniqueness, and individualization.

#### A. Metaphysics

Professor Kaye questions our suggestion that forensic individualization rests more on metaphysical and rhetorical grounds than on scientific and empirical grounds. As we understand his argument, Professor Kaye's position is that the individualization hypothesis is not metaphysical because “individuality [concerns] measurable characteristics that \*1195 can exhibit unequivocal differences and similarities.” [\[FN29\]](#) Although we largely agree with the quoted

statement, [\[FN30\]](#) it reflects only part of the picture. The larger and more pragmatic part is that individualization claims come to court supported mainly by exaggerated rhetoric and reasoning that is grounded in little empirical data. [\[FN31\]](#) Professor Kaye agrees that the rhetoric of forensic individualization far exceeds the science, [\[FN32\]](#) though he takes issue with our use of the word “metaphysical” to describe the foundations for the individualization claim. [\[FN33\]](#) We maintain that our use of the term in this context is accurate and appropriate.

In a concluding section in *Fallacy* titled “Unproved and Perhaps Unprovable,” we wrote:

In sum, no sound and rigorous evidence supports the assumption of unique individualization. Moreover, the assumption is so heroic and the research required to test it seriously would be so massive that one must doubt whether it is possible to conduct an empirical study or set of studies that would provide solid support for the hypothesis. [\[FN34\]](#)

Our claim, then, is not that there is a rule of logic or ontology that prevents individualization. Instead, we are concerned with the more practical issues of whether individualization has been proven, how amenable it is to testing, and whether the self-presentation of these fields in court accurately reflects the limitations of testing, proof, and case-specific conclusions. On all of these issues, we think forensic individualization science has fallen short despite being in the expert witness business for a century. Consequently, we think it is fair to characterize the individualization claim as predominantly rhetorical. As for our invocation of \*1196 “metaphysical,” readers who consult a good dictionary are likely to find that there are several meanings of this word that fit well with the situation we have described.

#### B. Uniqueness

Professor Kaye seems to agree with our central point about uniqueness. That is, he seems to agree that data—either in principle or in practice—cannot establish the truth of a uniqueness point prediction. [\[FN35\]](#) He says: “Uniqueness means that the proportion of objects with the given feature in the whole population of size  $N$  is exactly  $1/N$ . Yet, no matter how close the sample proportion comes to  $1/N$ , the next sample datum could establish that the population proportion is  $2/N$  or more.” [\[FN36\]](#) However, Professor Kaye does not think that the fact that empirical sampling has not and cannot demonstrate uniqueness is the important point. [\[FN37\]](#) Instead, he believes that \*1197 the focus should be on “whether criminalists are warranted in believing” that fingerprints are unique. [\[FN38\]](#)

We agree that the uniqueness question must turn on the issue of what the science supports, but it is not clear that we and Professor Kaye draw the same inferences from that science. In our view, the existing and foreseeable scientific knowledge falls far short of providing criminalists with enough scientific support to claim that the objects that they study are either unique or discernibly unique. Certainly the uniqueness question cannot turn on the beliefs that forensic scientists have about this issue based on their training and experience.

Throughout most of the twentieth century, criminalists may have felt that they had good justification for believing many things that subsequent scientific study revealed to be untrue. For example, at one time criminalists believed that they were impervious to context effects, or that bullets with similar trace element profiles necessarily had been manufactured in the same lead melt. But subsequent scientific study indicated that those beliefs were either untrue [\[FN39\]](#) or premature. [\[FN40\]](#) People hold sincere but mistaken and unsupported beliefs all the time and, in many cases, the negative consequences are minimal. But when representatives of an assertedly scientific discipline allow assumption and good faith belief to substitute for good grounds [\[FN41\]](#) and scientific knowledge, [\[FN42\]](#) the practical effects can hamper the advancement of the science as well as the search for justice in particular cases. When forensic scientists testify under oath that markings are unique, they rarely qualify that testimony by conceding that the claim reflects more of a personal belief than a scientific fact. [\[FN43\]](#) The practical reality is that most forensic scientists \*1198 bolster the perceived probative value of their individualization testimony at trial by asserting that evidentiary markings are unique, and that forensic scientists can individualize by discerning that uniqueness. [\[FN44\]](#) This is bad science, bad policy, and should not be welcome on grounds that the testifying expert is merely expressing a sincere belief.

### C. Individualization

Professor Kaye takes exception to our skepticism about whether individualization claims can be proved. In *Fal-lacy*, we argued that individualization—the process of linking an unknown marking to a source, to the exclusion of all other possible sources [\[FN45\]](#)—is “unproved and perhaps unprovable.” [\[FN46\]](#) Professor Kaye disagrees. But much of significance can be said about our disagreement, starting with what he means by the term “individualization,” which departs from the conventional meaning in important ways.

#### 1. Definitions

As we and forensic scientists themselves use the term, individualization refers to a finding that a particular print or marking was produced by a particular source, to the exclusion of all other possible sources on the planet. Importantly, individualization is not merely a conclusion that a particular source might be the source of a target marking, that many other possible sources can be ruled out as the source, or that there is only a slim chance that any source other than the named one would share the observed characteristics of the unknown marking. Individualization is a claim that all potential sources but one have been affirmatively ruled out as the person or object that produced the print or marking in **\*1199** question. That is the definition of individualization most widely understood within the forensic sciences. [\[FN47\]](#)

In the conventional practice of fingerprint examiners, a different term, “identification,” is considered a proper way to express a conclusion of “individualization.” [\[FN48\]](#) As Thornton and Peterson explain:

[I]n everyday usage, the term identification often is used when the concept of individualization is intended. One may hear testimony of the sort, “I identified the latent fingerprint as having been made from the right ring finger of the defendant.” The intent of the witness here is to declare clearly that the latent fingerprint was that of the defendant, to the total exclusion of all other fingers of all of the other people in the world. The use of the term “identified” here is not the most precise usage of the word; the term “individualized” would be more felicitous. But use of the term “individualization” and various other forms of the word would only confuse matters. If, in response to the question, “Did you have occasion to identify the suspect’s fingerprint on the knife?” the witness were to answer, “No, I individualized it,” communication would be thwarted and the listener confused. [\[FN49\]](#)

Although most examiners use the terms individualization and identification interchangeably—a practice that is sometimes promoted by forensic science working groups [\[FN50\]](#)—some fingerprint examiners have recently suggested a novel distinction between individualization and **\*1200** identification. This latest redefinition is significant for our purposes here because it may help explain how Professor Kaye arrives at his own definition of individualization.

In a recent Minnesota case, two forensic scientists testified that individualization claims cannot be proven: “The only way you could prove that is to look at every single person on the planet. It’s not physically possible and even if you could do that, that doesn’t mean someone tomorrow won’t be born with the same friction ridge skin.” [\[FN51\]](#) One of these examiners went on to draw a distinction between an individualization and an identification. According to this examiner, “identification” means that the examiner

made a decision that the chance that someone else could have left [the print] is so remotely small, he’s willing to dismiss it and say yes, I believe that this latent print in my opinion was produced by that individual. He did not say that he’s excluded everyone else on the planet and he left a theoretical possibility that there might be someone else on the planet that could have produced a similar looking latent print. And he has no way of calculating what that probably is at this time. [\[FN52\]](#)

One explanation for this novel attempt to distinguish between an individualization and an identification might be that it is an attempt to have one’s cake and eat it too. Examiners can, on the one hand, acknowledge the scientific

impossibility of “individualizing” while at the same time preserve the ability to pinpoint a suspected source by asserting an “identification” and standing it on a more humble foundation of personal opinion. [\[FN53\]](#)

Professor Kaye defines individualization much as examiner Langenburg seeks to define the weaker term identification: as “the conclusion that ‘this trace came from this \*1201 individual or this object.’” [\[FN54\]](#) But individualizations are more than subjective source conclusions or a witness’s personal feelings or hunches. They are bold statements about the world that require proof that cannot now (and probably never will be) obtained. The definition that Professor Kaye relies on reduces individualization to a subjective belief that is bolstered by evidence that falls far short of sufficient proof for this extreme claim. The difference between individualization as it is commonly understood and the definition offered by Professor Kaye is the difference between claiming that Alberto is the tallest man in the world because his measured height is greater than every other person in the world, and claiming that Alberto is the tallest man in the world either because an insufficiently tested theory assumes he is or because we have not seen anyone taller among those we have looked at.

## 2. Small Population Examples

Professor Kaye posits that “there are circumstances in which an analyst reasonably can testify to having determined the source of an object.” [\[FN55\]](#) He offers two such circumstances. In one, he describes an unusual situation where a fingerprint examiner likely would be justified in claiming that he individualized a latent print. The situation concerned a crime that was known with certainty to have occurred at sea and a latent print that was known with certainty to belong to one of a relatively small number of passengers, all of whom are available for testing. We agree that there are some circumstances in which the potential source population [\[FN56\]](#) of a print or marking may be narrowed to a small, accessible set. Indeed, such examples are not unfamiliar in discussions of individualization. [\[FN57\]](#) However, these examples provide more \*1202 support for the argument that individualization claims are generally unwarranted than they do for the argument that individualization should be broadly encouraged. Small, closed population examples “work” only because one can compare target latent prints to every member of the potential source population. The presence of this unusual circumstance is what sets the stage for an individualization claim (provided, of course, that all but one print can be eliminated as potential sources of the target latent).

But what about the more typical situation where the potential source population cannot be narrowed much beyond the general population or some other large population? In these cases, examiners are not able to eliminate every member of the potential source population, and therefore they are not about to identify a source using the logical rigor that arises in the small, closed population example. With this in mind, the relevance of the ship hypothetical that Professor Kaye offered is not to say “if individualization can be achieved in this context it can be achieved in others.” Instead, these types of hypotheticals remind us that the defensible approach of comparing a questioned print or marking to all prints or markings in the potential source population is often not possible. And when forensic examiners can do no better than sample from larger potential source populations and draw inferences from their findings, then they must forsake absolutes. In its place, forensic scientists should do what other scientists do: offer suitably cautious conclusions that make use of the tools of probability and statistics. [\[FN58\]](#)

## 3. Small Random Match Probabilities and the Inferential Leap

Professor Kaye argues that a second circumstance in which claims of unequivocal source and individualization claims are justified occurs when random match probabilities \*1203 are very small. [\[FN59\]](#) In a nutshell, his argument is that object uniqueness and individualization are, for all intents and purposes, proved even when there remains a chance that some objects are not unique or that an individualized marking was actually produced by some unexamined object. Science, he says, does not require absolute certainty. [\[FN60\]](#) Instead, we draw reasonable inferences from the data we have and proceed as if that inference were absolutely true.

Professor Kaye offers, as an example, the treatment of Ohm’s law: “Ohm’s law might not be exactly right, or it

might break down tomorrow, but electrical engineers can safely assume that it is absolutely true.” [\[FN61\]](#) The implication is that even if forensic examiners can’t be 100% sure of their ability to individualize, they are safe in proceeding on the assumption that their individualization conclusions are absolutely true.

An easy response is that Ohm’s law not only “might not be exactly right,” but it actually is demonstrably wrong under so many conditions that electrical engineers are not safe to assume that it is “absolutely true.” [\[FN62\]](#) The implication of the conditional nature of Ohm’s law for forensic science individualization claims is that it would not be safe for courts to simply regard individualization as absolutely true. But this is too easy. The example Professor Kaye chose was flawed, but we trust that there exist better illustrations of the point he wishes to make.

Our response to those better examples would be that even the best of them is not an apt analogy to the problem that forensic individualization presents to courts. First, engineers [\\*1204](#) and scientists have more intimate knowledge of their theories and data, and appreciate their limitations. Lawyers, judges, and jurors are much less likely to understand the limitations of the claims being made for forensic individualization, and the limitations of its theory, its data, and its conclusions. Second, the central claim of forensic individualization science is qualitatively different from all or virtually all other sciences. Where other sciences cautiously test hypotheses about relationships among variables, the forensic individualization sciences simply offer error-bar-free point predictions without backing those predictions with anything that approaches scientific validation. [\[FN63\]](#) At the risk of redundancy, it is important to be clear about what individualization is and is not. It is not simply a scientific classification claim in which the object in question is one of a small number of possible sources for the questioned marking. Nor is it a claim that the probability that another object is the source is low or even extremely low. It is a claim that the probability that an object other than the one identified by the examiner could be the source of the questioned marking is exactly zero. [\[FN64\]](#) The examiner justifies his impossibility thesis by making an unwarranted inferential leap from the mere observation of similar markings or, at best, an impression or intuition of a low frequency of such markings.

[\\*1205](#) One must remain mindful of where these shortcuts—these inferential leaps from probably to absolutely—typically occur. They do not take place primarily in classrooms, workplaces, or in conversations among mutually knowledgeable experts. They typically occur as expert testimony in courtrooms, where novice decisionmakers are charged with, among other things, weighing the value of that testimony. But the courtroom is a poor environment for elevating presumed probabilistic truths pertaining to forensic science evidence to scientific truths.

#### 4. Policy

Even if forensic science individualization claims were supported by rigorous scientific testing, and even if Professor Kaye’s view that very low random match probabilities (if and when they were determined to exist in the various forensic sciences) were accepted as providing sufficient support for claims of individualization, good policy reasons counsel against permitting individualization testimony in criminal litigation.

First, in light of the long history of untested techniques, insufficient research, testimonial exaggerations, and fabricated findings in the forensic sciences, [\[FN65\]](#) we should be hesitant about further elevating and legitimating unproven forensic science claims.

Second, given the adversarial nature of legal proceedings, the elevation of presumed truths or linguistic shortcuts [\[FN66\]](#) to scientific ones unfairly privileges the offering party (which is usually the government).

Third, a seemingly harmless inferential leap from a very low probability to zero probability in the context of a criminal trial might have unintended consequences. One consequence is the suppression of uncertainty. [\[FN67\]](#) When forensic scientists offer [\\*1206](#) an individualization conclusion, they signal to a factfinder that there is little point in weighing any evidence that militates against the expert’s conclusion. This could lead to serious errors by the factfinder.



The inordinate power of expert assertions is illustrated by a case in which a victim knew a suspect well and excluded him from a photo identification: she was sure he was not the man who raped her. Later, she was told that supposedly irrefutable scientific evidence pinpointed the man as her attacker. Induced to disbelieve her own personal knowledge, and given another opportunity to identify the suspect as being the rapist, she did so. At trial, the victim's eyewitness identification was more dramatic and compelling than the "scientific" evidence, though it was a byproduct of the "scientific" evidence. [\[FN68\]](#) The suspect, William O'Dell Harris, was convicted and sent to prison. Years later, it was learned that the "scientific" evidence had been fabricated. [\[FN69\]](#) When the biological evidence was subjected to DNA testing, Harris was excluded as the rapist. After eight years in prison he was exonerated and released. [\[FN70\]](#) If fabricated scientific evidence can cause a witness to disbelieve her own personal knowledge and accept a complete falsehood as true, surely factfinders are also susceptible to believing exaggerated testimony to the point of assuming that there is little uncertainty left to resolve in a case.

Fourth, research suggests that statements made by experts are given considerable deference by jurors and their impact is unlikely to be undone either through cross-examination or rebuttal witnesses. [\[FN71\]](#)

Fifth, when experts exaggerate the state of their science and their exaggerations find acceptance in the courtroom, **\*1207** researchers have less incentive for conducting the basic and applied research needed to put these assertions to the test. [\[FN72\]](#) Thus, research on the frequency with which various characteristics occur and on the best ways to convey forensic science evidence may not even get off the ground.

Even if we reach a state where rigorous scientific support for individualization is available, there are many practical and policy reasons for not permitting the traditional forensic sciences to make the individualization leap.

#### IV. Individualization Testimony: Not Helpful

The 2009 National Research Council report on the forensic sciences called for more transparency and less exaggeration: "Forensic reports, and any courtroom testimony stemming from them, must include clear characterizations of the limitations of the analyses, including measures of uncertainty in reported results and associated estimated probabilities where possible." [\[FN73\]](#) Fallacy offered a similar call. It argued that scientific foundations need to be improved, the application of those foundations to case-specific findings needs to be improved, and examiners' personal views about the evidence need to be kept out of reports and testimony.

Given (a) the current lack of scientific support for claims related to individualization in the traditional forensic sciences, and (b) the likelihood that jurors will not meaningfully differentiate an examiner's individualization opinions from a statement of scientific fact about individualization, [\[FN74\]](#) we suggest that forensic examiners should be barred from offering individualization opinions. Individualization opinions violate [Federal Rule of Evidence 702](#), which requires that scientific opinion testimony, to be admissible, must "assist the trier of fact to understand the evidence or to determine a fact in issue" **\*1208** and must be "based upon sufficient facts or data." [\[FN75\]](#) Opinions about whether a marking has been individualized to its one and only possible source ordinarily are not based upon sufficient facts or data. Nor do they provide assistance to the trier of fact beyond that which can be gained from a less grandiose presentation of the forensic science findings, and a more candid presentation of their limitations. Instead, individualization testimony has considerable potential to mislead factfinders rather than to assist them. Though [Federal Rule of Evidence 704](#) expressly permits the offer of an ultimate opinion (such as here, on identity), testimony admitted under [Rule 704](#) still must pass the helpfulness requirements of [Rule 702](#) and be based on adequate data to support the opinion. [\[FN76\]](#) A forensic scientist's opinion about source identification or individualization provides no more value to factfinders than what could be provided by more data-based statements, while having more potential to mislead. [\[FN77\]](#)

In conclusion, forensic scientists should not be permitted to capitalize on the lack of supportive scientific data about either characteristic frequency or their own diagnostic reliability by going beyond what is known and what can be stated on good grounds. They should not be permitted to say, in effect, "trust me: that's the source." Real scientists

don't say "trust me." They provide data.

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[FN1]. Michael J. Saks & Jonathan J. Koehler, The [Individualization Fallacy in Forensic Science Evidence](#), 61 [VAND. L. REV.](#) 199 (2008) [hereinafter Fallacy].

[FN2]. Moreover, we acknowledged that none of these essential insights is original to us. Others have discussed these problems for decades. We merely pulled these ideas together and discussed their implications.

[FN3]. Others have also called attention to the difficulty or impossibility of justifying claims of individualization. See Fallacy, *supra* note 1, at 214-16. Some thoughtful forensic scientists, such as Christophe Champod and his colleagues, have responded by attempting to develop probabilistic characterizations of fingerprint comparisons. See Christophe Champod & Ian W. Evett, A Probabilistic Approach to Fingerprint Evidence, 51 *J. FORENSIC IDENTIFICATION* 101 (2001); Cedric Neumann et al., Computation of Likelihood Ratios in Fingerprint Identification for Configurations of Any Number of Minutiae, 52 *J. FORENSIC SCI.* 54 (2007). Others have begun to tame the language used when reporting the meaning of a match. See, e.g., Firearms and Toolmark Identification, in 4 *MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY*, § 34:1 (David L. Faigman et al. eds., 2008-2009).

[FN4]. Cf. NAT'L RESEARCH COUNCIL OF THE NAT'L ACADS., *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD* 7 (2009) [hereinafter NRC Report] (recognizing that none of the techniques that were the focus of our article have "been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source"); Lyn Haber & Ralph Norman Haber, Scientific Validation of Fingerprint Evidence Under Daubert, 7 *LAW, PROBABILITY & RISK* 87, 88 (2008) (arguing that the validity of the ACE-V fingerprint methodology has not been established through rigorous scientific experiments); Jennifer L. Mnookin, The Validity of Latent Fingerprint Identification: Confessions of a Fingerprinting Moderate, 7 *LAW, PROBABILITY & RISK* 127, 134 (2008) ("[T]he undeniable reality is that the community of forensic science professionals has not done nearly as much as it reasonably could have done to establish either the validity of its approach or the accuracy of its practitioners' conclusions.").

[FN5]. David H. Kaye, [Probability, Individualization and Uniqueness in Forensic Science Evidence: Listening to the Academies](#), 75 [BROOK. L. REV.](#) 1163 (2010).

[FN6]. See generally *id.*

[FN7]. Although the heading of Section II in Professor Kaye's article reads "Individualization Without Uniqueness," it appears that he does not believe that individualization can be achieved in the typical case without uniqueness. Elsewhere he has written: "A true match establishes that the two samples of DNA have the same profile. Unless the profile is unique, however, a true match does not conclusively prove that the two samples came from the same source." DNA Typing, in 4 *MODERN SCIENTIFIC EVIDENCE*, *supra* note 3, § 30:1 (emphasis added) (App. 30B, defining "True Match").

[FN8]. "[U]nder normal relevance rules, existing theory and data on the discernible uniqueness of trace evidence typically are too weak to justify admission of an opinion that a pattern is unique." Kaye, *supra* note 5, at 1182-83.

[FN9]. Some leading forensic scientists agree and have discussed this issue in detail. See Champod & Evett, *supra* note 3.

[FN10]. “[I]t is clear that if forensic scientists are to contribute fully to the just resolution of criminal cases, they need a less absolutist and more nuanced theory of identification than the traditional presumption of characteristics that are intuitively judged to be individualizing.” Kaye, *supra* note 5, at 1185-86.

[FN11]. *Id.* at 1165 (“With the imprimatur of the National Academy of Sciences behind recommendations for major change, the need for forensic scientists or analysts to retreat from the most extreme claims finally should be apparent to the judiciary as well as the forensic science community.”).

[FN12]. “I agree with the critique of a great deal of forensic science testimony. . . .” *Id.* at 1166.

[FN13]. Another possible difference of note is that many of Kaye's illustrations and arguments are based on DNA or other normal sciences. However, Fallacy was concerned almost exclusively with non-DNA forensic identification: handwriting, tire impressions, shoe prints, fingerprints, toolmarks, firearms, etc. DNA databases and methods are not illustrative of how other forensic identification sciences operate. See NRC Report, *supra* note 4, at 7 (“With the exception of nuclear DNA analysis, however, no forensic method has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source.”).

Unlike most traditional forensic sciences, DNA typing stands out as an area that has, from its beginnings, respected the underlying probabilistic nature of forensic identification. Consider the following from a memo in which a crime laboratory informed the prosecutors with whom it works that it will cease using potentially misleading terminology and will limit its characterizations of the meaning of indistinguishably similar DNA samples to the associated random match probabilities:

The purpose of a forensic DNA analysis is to determine whether an individual can be excluded as the donor of a body fluid stain or other bodily substance, the source of which is in question. Once a comparison has been made between the DNA profile results from the questioned source and the DNA profile results from the reference person, one of two conclusions may be drawn:

- the reference person is excluded as the donor of the questioned sample, or
- the reference person cannot be excluded as the donor of the questioned sample

This memo is to advise you that, effective November 1, 2003, the term ‘match’ will no longer be used in the conclusions of CFS DNA reports, in an effort to more clearly link the conclusion drawn from an analysis to its purpose. For example, when a DNA profile from person ‘A’ matches a DNA profile from the crime scene, the conclusion in the CFS report will state that “person ‘A’ cannot be excluded as the contributor of the crime scene profile.”

The significance of DNA findings will continue to be defined using a statistical calculation which addresses the probability of coincidentally selecting someone from the general population who also would not be excluded as the source of a DNA profile.

The reported probability is the sole indicator of the significance of the finding that a person cannot be excluded as the source of a DNA profile.

Memorandum from R.J. Prime, Director of The Centre of Forensic Sciences for the province of Ontario to Crown attorneys for the province (October 24, 2003). Unfortunately, the U.S. FBI does not follow this policy. Constance Holden, DNA Fingerprinting Comes of Age, 278 *SCI.* 1407, 1407 (1997) (reporting that the FBI encourages examiners to testify that two samples are a perfect match in cases where the random match probability is less than one in 260 billion).

[FN14]. Simon Cole, *Against Uniqueness, Against Individualization, and how Wittgenstein Can Save Forensic Identification*, LAW, PROBABILITY & RISK (forthcoming).

[FN15]. The International Association for Identification, which is one of the oldest and largest organizations of forensic science professionals, expects its members to offer fingerprint individualizations whenever matches are found. INTL ASSOC. IDENTIFICATION, IAI POSITION CONCERNING LATENT FINGERPRINT IDENTIFICATION

1 (2007), [http://www.theiai.org/current\\_affairs/fingerprint\\_position\\_paper\\_20071129.pdf](http://www.theiai.org/current_affairs/fingerprint_position_paper_20071129.pdf) (“The IAI endorses the position that individuals may be identified as the source of a particular friction skin impression. . . .”).

[FN16]. Cole, *supra* note 14, at 12.

[FN17]. Compare the reasoning of examiners of fingerprints, firearms, handwriting, etc., to that of DNA examiners. The former go directly from the perception of great similarity to a conclusion of individualization. The latter must pause to calculate random match probabilities based on population data.

[FN18]. Cole, *supra* note 14, at 26 (“What distinguishes areas of friction ridge skin from these other objects is not ‘uniqueness’; it is their diagnosticity: our ability to assign traces of these objects to their correct source with a certain degree of specificity under certain parameters of detection and under certain rules governing such assignments.”).

[FN19]. See Kaye, *supra* note 5, at 1173-77.

[FN20]. This disregard of populations might be the result of the underlying assumption of uniqueness being so fully incorporated into forensic individualization practice that examiners have forgotten, or set aside, the argued basis for ignoring populations.

[FN21]. Fallacy, *supra* note 1, at 205; see DAVID J. BALDING, *WEIGHT-OF-EVIDENCE: DNA PROFILES* 148 (2005).

[FN22]. Fallacy, *supra* note 1, at 203.

[FN23]. *Id.* at 203-05.

[FN24]. Simon A. Cole, [Grandfathering Evidence: Fingerprint Admissibility Rulings from Jennings to Llera Plaza and Back Again](#), 41 *AM. CRIM. L. REV.* 1189, 1198 (2004) (defining this fallacy: “The fingerprint examiner's fallacy consists of reasoning that the uniqueness of the object of forensic study vouches for the validity of a forensic matching process.”). In the course of explicating the “fingerprint examiner's fallacy,” Cole summarizes other elements that we develop in Fallacy and which others have raised for a long time. Indeed, Cole's historical work shows that the problems associated with making justifiable individualization claims have been appreciated by forensic scientists and scholars for at least a century. *Id.* at 1199 (citing HENRY FAULDS, *GUIDE TO FINGER-PRINT IDENTIFICATION* 51 (1905)). However, this awareness has largely been hidden from the courts, which may help explain why the NRC Report, *supra* note 4, at 53, concludes that “the courts have been utterly ineffective” in filtering forensic identification evidence.

[FN25]. Cole, *supra* note 24, at 1198.

[FN26]. *Id.* at 1201-03.

[FN27]. We doubt that our position on uniqueness qualifies as “radical skepticism.” Our position is that it has not been proved and that it seems unlikely that so extreme a position as individualization-to-the-exclusion-of-all-others—a frequently-invoked foundation stone of forensic individualization—could be proved. Kaye, *supra* note 5, at 1166.

[FN28]. “Although I agree with the critique of a great deal of forensic science testimony. . . .” *Id.*

[FN29]. *Id.* at 1167.

[FN30]. “Unequivocal” is too strong. Perceptual and judgmental disagreements will be common in the process of making such assessments. See, e.g., I.W. Evett & R.L. Williams, A Review of the Sixteen Points Fingerprint Standard in England and Wales, 46 J. FORENSIC IDENTIFICATION 49 (1996).

[FN31]. NRC Report, supra note 4, at 188-89 (“In most forensic science disciplines, no studies have been conducted of large populations to establish the uniqueness of marks or features”); id. at 184 (“[T]he concept of ‘uniquely associated with’ must be replaced with a probabilistic association. . . .”); see also Harry T. Edwards, Solving the Problems That Plague the Forensic Science Community, 50 JURIMETRICS 5, 8-9 (2009) (referring to the “dearth of scientific research to establish limits of performance, to ascertain quantifiable measures of uncertainty, and to address the impact of the sources of variability and potential bias in fingerprint examinations and in other forensic disciplines that rely on subjective assessments of matching characteristics”).

[FN32]. See supra notes 8, 10-12 and accompanying text.

[FN33]. Kaye, supra note 5, at 1167.

[FN34]. Fallacy, supra note 1, at 213-14.

[FN35]. Professor Kaye objects to this characterization of his position. That is, whereas we say that he agrees with us that data cannot establish the truth of a uniqueness point prediction, he says that his position is that “data cannot establish to an absolute certainty the truth of any point estimate of any population parameter.” Email from David Kaye to Jay Koehler & Michael Saks (Feb. 21, 2010, 15:16) (on file with authors) (emphasis added). In this same correspondence, Professor Kaye also says that he believes that “one can ‘establish the truth’ of a proposition without being 100% certain that it is true.” Id. Apparently, then, our disagreement turns on what it means to “establish the truth” of a proposition. When we say “establish the truth” of a particular point prediction, we mean that all point predictions other than the target prediction have been ruled out by the data. We interpret Professor Kaye’s use of the phrase “establish the truth” to mean something substantially weaker, something more akin to a strong personal belief that has a solid foundation in data. Although language is often sufficiently imprecise that there is room for personal interpretation, we simply do not accept this weakened definitional form of “establish the truth.” Nor do we believe that this definition fits with a common understanding of the phrase. For example, we suspect that if an examiner claims that data have “established” that such-and-such is true, jurors will not interpret this to mean merely that the examiner has a strong belief in the proposition and has some data to back up this belief. Instead, jurors are likely to equate the examiner’s establishment claim with the indefensible claim that the data have established the claim to a certainty. In other words, there is no practical difference between a claim that data have established the truth of a uniqueness point prediction, and a claim that data have established that truth to an absolute certainty. And this is why we say that, linguistic preferences aside, there is no meaningful difference between our position and Professor Kaye’s on the issue of whether data can truly establish uniqueness: we all agree that they cannot.

[FN36]. Kaye, supra note 5, at 1170-71.

[FN37]. Professor Kaye objects to this characterization of his position for reasons similar to those described supra note 35. He thinks that sampling “can demonstrate uniqueness (in principle, in some populations) especially when considered together with an understanding of the sources of randomness.” Email from David Kaye to Jay Koehler & Michael Saks (Feb. 21, 2010, 15:16) (on file with authors) (emphasis added). Once again, we confront a linguistic problem where we and Professor Kaye are not using common words and phrases (like “demonstrate uniqueness”) in the same way.

[FN38]. Kaye, supra note 5, at 1172.

[FN39]. NAT’L RESEARCH COUNCIL, FORENSIC ANALYSIS: WEIGHING BULLET LEAD EVIDENCE

96-99 (2005); Itiel E. Dror et al., Contextual Information Renders Experts Vulnerable to Making Erroneous Identifications, 156 FORENSIC SCI. INT'L 74, 77 (2006) (“[I]t is possible to alter identification decisions on the same fingerprint, solely by presenting it in a different context.”).

[FN40]. NAT'L RESEARCH COUNCIL, BALLISTIC IMAGING 3 (2008) (Daniel L. Cork et al. eds. 2008) (“The validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related toolmarks has not yet been fully demonstrated.”).

[FN41]. “Proposed testimony must be supported by appropriate validation— i.e., ‘good grounds’. . . .” [Daubert v. Merrell Dow Pharm., Inc.](#), 509 U.S. 579, 590 (1993).

[FN42]. “[S]cientific’ implies a grounding in the methods and procedures of science. Similarly, the word ‘knowledge’ connotes more than subjective belief or unsupported speculation.” Id.

[FN43]. See supra note 31 and accompanying text.

[FN44]. SCIENTIFIC WORKING GROUP ON FRICTION RIDGE ANALYSIS (“SWGFAST”), 2009 Standards for Minimum Qualifications and Training to Competency for Friction Ridge Examiner Trainees (fingerprint examiner training document stating that examiners must “[u]nderstand the basic foundations for friction ridge examination (persistence and uniqueness) as a means of identifying the source of an impression”); see also NRC Report, supra note 4, at 43 (forensic scientists “believe that unique markings are acquired by a source item in random fashion and that such uniqueness is faithfully transmitted from the source item to the evidence item being examined”).

[FN45]. See The General Assumptions and Rationale of Forensic Identification, 4 MODERN SCIENTIFIC EVIDENCE, supra note 3, § 30:19.

[FN46]. Fallacy, supra note 1, at 208.

[FN47]. “The individualisation of an impression is established by finding agreement of corresponding individual characteristics of such number and significance as to preclude the possibility (or probability) of their having occurred by mere coincidence, and establishing that there are no differences that cannot be accounted for.” FORENSIC HUMAN IDENTIFICATION: AN INTRODUCTION 74 (Tim Thompson & Sue M. Black eds., 2007) (quoting HAROLD TUTHILL, INDIVIDUALIZATION: PRINCIPLES AND PROCEDURES IN CRIMINALISTICS (1994)); see also 4 MODERN SCIENTIFIC EVIDENCE, supra note 3, § 30:19; NRC Report, supra note 4, at 43-44; Keith Inman & Norah Rudin, The Origin of Evidence, in 126 FORENSIC SCI. INT'L 11, 11-16 (2002).

[FN48]. See SWGFAST, Quality Assurance Guidelines for Latent Print Examiners (ver. 3.0, 2006) available at [http://www.swgfast.org/Quality\\_Assurance\\_Guidelines\\_for\\_Latent\\_Print\\_Examiners\\_3.0.pdf](http://www.swgfast.org/Quality_Assurance_Guidelines_for_Latent_Print_Examiners_3.0.pdf) (referring to “individualization” throughout); Christophe Champod, The Inference of Identity of Source: Theory and Practice, Address at the First International Conference on Forensic Human Identification in The Millennium, at 1 (Oct. 1999), available at <http://www.latent-prints.com/images/The%20Inference%CC20and%CC20Identity%CC20of%20Source.pdf> (“Among identification fields, the term identification generally denotes individualization”). However, identification is also used by forensic scientists to refer to the process of determining the category to which an object belongs. This is the nature of the answer to the question, “what chemical substance is this white powder?” See, e.g., 4 MODERN SCIENTIFIC EVIDENCE, supra note 3, § 30:19; NRC Report, supra note 4, at 36; Inman & Rudin, supra note 47.

[FN49]. 4 MODERN SCIENTIFIC EVIDENCE, supra note 3, § 30:19.

[FN50]. See SWGFAST, supra note 48.

[FN51]. Transcript of Record at 148, [State v. Hull, 2008 WL 4301902 \(Minn. Ct. App. Aug. 28, 2008\)](#) (CR-07-2336) (cross-examination of Glenn Langenburg). A second forensic scientist testifying in this same hearing testified that, “the only way to really say an individualization could occur, is to actually do comparisons to all prints of everyone that has ever lived.” Id. at 48-49 (direct examination of Joshua Bergeron); see also Christophe Champod, Identification and Individualization 1 (Nov. 6, 2008) (unpublished manuscript) (concluding that “individualization conclusions are out of reach and cannot be easily substantiated, either in the classic identification fields (such as fingerprint evidence) or in DNA profiling”).

[FN52]. Transcript of Record at 149, [Hull, 2008 WL 4301902 \(CR-07-2336\)](#).

[FN53]. Champod & Evett, *supra* note 3, at 103 (demonstrating that “the inferential process of identification is essentially inductive and hence probabilistic”).

[FN54]. Kaye, *supra* note 5, at 1166.

[FN55]. Id.

[FN56]. The potential source population is “the group of people who might reasonably be the source of the recovered trace evidence.” Jonathan J. Koehler, [DNA Matches and Statistics: Important Questions, Surprising Answers, 76 JUDICATURE 222, 227 \(1993\)](#).

[FN57]. One of the authors has used it himself. See Michael J. Saks, Explaining the Tension Between the Supreme Court's Embrace of Validity as the Touchstone of Admissibility of Expert Testimony and Lower Courts' Rejection of Same, 5 *EPISTEME* 329, 342 n.1 (2008) (“There is at least one circumstance where certainty of individualization could be achieved: If the candidates for the perpetration of a crime could be narrowed to a finite group, and each member of the group had distinguishable markings (be they fingerprints or something else), and it was known that the perpetrator left his markings on the body (or on whatever), then the person who matched the crime scene markings would have to be the perpetrator.”).

[FN58]. See Champod & Evett, *supra* note 3. We should also note that a new breed of sophisticated forensic scientists working in the fingerprint area is developing models and procedures aimed at providing transparent, empirically based, probabilistic conclusions to replace individualization claims. Glenn Langenburg & Cedric Neumann, Moving Towards Using Statistics for Fingerprint Evidence in the Courtroom, *PROCEEDINGS OF THE AMERICAN ACADEMY OF FORENSIC SCIENCES*, Seattle, WA, February 26, 2010.

[FN59]. Kaye, *supra* note 5, at 1176 (“[A] well founded and extremely tiny random-match probability indicates that, even if some other pairs of objects do match, the match at issue is not merely a coincidence; rather, it is a true association to a single source. In appropriate cases, therefore, it is ethical and scientifically sound for an expert witness to offer an opinion as to the source of the trace evidence.” (footnote omitted)). Arguably, that final inferential leap is for the factfinder to make—using knowledge supplied by the expert—not for the expert to make for the factfinder, with no basis greater than what the factfinder now has. See Wells, *infra* note 77 and accompanying text.

[FN60]. Kaye, *supra* note 5, at 1174.

[FN61]. Kaye, *supra* note 5, at 1168.

[FN62]. Ohm's law—which states (in part) that the current between two points in a conductor is directly proportional to the potential difference (voltage) across the two points—“holds only approximately and under limited conditions

and not for all materials.” SCIENCE AND TECHNOLOGY ENCYCLOPEDIA 376 (1999). Although there are contexts within which electrical engineers may safely treat that the law as true, there are other contexts where such an assumption would spell disaster. Forensic individualization assumptions probably operate the same way, except that we know far less about the conditions under which they do and do not hold.

[FN63]. Summarizing a central theme in the NRC Report, one of the co-chairmen of the report refers to the “paucity of scientific research to confirm the validity and reliability of forensic disciplines.” See Edwards, *supra* note 31, at 2.

[FN64]. The notion that forensic individualization claims are extreme and fundamentally unscientific is neither a radical idea nor one that is original with us. Consider, for example, the following passage from a 1998 book by the highly respected forensic statistician Ian Evett and equally respected biostatistician Bruce Weir about the meaning of a fingerprint “identification”:

We should be in no doubt about the degree of certainty implicit in a fingerprint identification. The expert is, in effect, saying “I am certain that this latent mark and this control print were made by the same person and no amount of contrary evidence will shake my certainty”. Or, to look at this from a Bayesian perspective, no matter how small the prior odds are, the likelihood ratio is so large that the posterior odds approach infinity. Stoney sees that a fingerprint identification is based on a “leap of faith,” and he is quite correct to conclude that such a leap of faith has nothing to do with scientific principles. It is that leap of faith that characterizes the essence of a conclusion of identity of source and, as he points out, that is a fundamental difference between fingerprint evidence and DNA evidence. Stoney's “leap of faith” is equivalent to attaining an infinite likelihood ratio; this kind of belief cannot derive from any scientific process. IAN W. EVETT & BRUCE S. WEIR, INTERPRETING DNA EVIDENCE: STATISTICAL GENETICS FOR FORENSIC SCIENTISTS 240-41 (1998). Though Evett and Weir use the phrase “identification” rather than “individualization,” their perspective coincides perfectly with our own.

[FN65]. See generally NRC Report, *supra* note 4.

[FN66]. Professor Kaye writes that “scientists have indicated that opinions of general uniqueness or uniqueness of a particular DNA type within some smaller region are or will soon become scientifically acceptable.” Kaye, *supra* note 5, at 1186 (footnotes omitted). If true, this phenomenon is being driven more by the exigencies of litigation than by the results of scientific research. As others have noted, this is less of a “scientific breakthrough,” as the idea was characterized when first announced, and more of a “semantic breakthrough.” William C. Thompson & Simon A. Cole, Psychological Aspects of Forensic Identification Evidence, in EXPERT PSYCHOLOGICAL TESTIMONY FOR THE COURTS 31, 45 (Mark Costanzo, Daniel Krauss & Kathy Pezdek eds., 2007).

[FN67]. Cole, *supra* note 14, at 30.

[FN68]. See Jim Dwyer, Peter Neufeld & Barry Scheck, Actual Innocence 114-16 (2000) (describing the case).

[FN69]. This was just one of myriad cases that the forensic scientist in the case, Fred Zain, was eventually found to have fabricated. Zain's fabrications led the West Virginia Supreme Court to declare that, “as a matter of law, any testimonial or documentary evidence offered by Zain at any time in any criminal prosecution should be deemed invalid, unreliable, and inadmissible.” In re Investigation of the W. Va. State Police Crime Lab., Serology Div., 438 S.E.2d 501, 506 (W. Va. 1993) (adopting the findings of the Report of a special inquiry ordered by the Court).

[FN70]. The Innocence Project, Know the Cases, [http:// www.innocenceproject.org/know/](http://www.innocenceproject.org/know/) (last visited Feb. 8, 2010).

[FN71]. Shari Seidman Diamond et al., Juror Reactions to Attorneys at Trial, 87 J. CRIM. L. & CRIMINOLOGY 17, 41 (1996); see also Joseph Sanders, The Merits of the Paternalistic Justification for Restrictions on the Admissibility of Expert Evidence, 33 SETON HALL L. REV. 881, 913 (2003).

[FN72]. Cole, *supra* note 14, at 31-32 (discussing the “perverse incentives created by the current weak legal regime



that permits extremely strong claims like ‘individualization’ without empirical support”). Professor Kaye appreciates this point as well. He notes that “a strong argument can be made” for excluding comments by an examiner related to why he thinks a match is probative of identity “to encourage more extensive research.” Kaye, *supra* note 5, at 1185 n.86.

[FN73]. NRC Report, *supra* note 4, at 21-22; see also *id.* at 185.

[FN74]. Dawn McQuiston-Surrett & Michael J. Saks, The [Testimony of Forensic Identification Science: What Expert Witnesses Say and What Factfinders Hear](#), 33 *LAW & HUM. BEHAV.* 436 (2009); Dawn McQuiston-Surrett & Michael J. Saks, [Communicating Opinion Evidence in the Forensic Identification Sciences: Accuracy and Impact](#), 59 *HASTINGS L.J.* 1159, 1169 (2008).

[FN75]. [FED. R. EVID. 702](#).

[FN76]. “The abolition of the ultimate issue rule does not lower the bars so as to admit all opinions. Under [Rules 701](#) and [702](#), opinions must be helpful to the trier of fact. . . .” [FED. R. EVID 704](#) advisory committee's note.

[FN77]. Gary L. Wells, Naked Statistical Evidence of Liability: Is Subjective Probability Enough?, 62 *J. PERSONALITY & SOC. PSYCHOL.* 739, 747 (1992) (finding, in Experiment 4, that both judges and jurors were far more likely to find liability when provided with expert testimony consisting of the relevant data plus the expert's personal opinion that the defendant was the source, than when they were presented with all the same information but not the expert's conclusory opinion).

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