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DAUBERT CHALLENGES TO FIREARMS ("BALLISTICS") IDENTIFICATIONS

Paul C. Giannelli*

"Firearms identification is the forensic science discipline that identifies a bullet, cartridge case or other ammunition component as having been fired by a particular firearm to the exclusion of all other firearms."¹ Apparently, the first written reference to the subject appeared in 1900.² The topic gained considerable attention in the 1920s due to the work of Calvin Goddard³ and played a controversial role in the Sacco and Vanzetti case during the same decade.⁴ Goddard also analyzed the bullet evidence in the St. Valentine's Day Massacre in 1929, in which five gangsters and two acquaintances were gunned down in Chicago. Goddard tested and excluded all police-issued Thompson submachine guns as the murder weapons and months later matched the bullets to two machine guns seized from the home of Fred Burke, a suspect in the killings.⁵ It was later learned that the murders were instigated by a rival gang, headed by Al Capone.⁶

In 1923, the Illinois Supreme Court wrote that positive identification of a

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¹ FBI HANDBOOK OF FORENSIC SCIENCE 57 (1994).

² See Albert L. Hall, *The Missile and the Weapon*, 39 BUFFALO MED. J. 727 (1900).

³ Calvin Goddard, often credited as the "father" of firearms identification, was responsible for much of the early work on the subject. E.g., Calvin H. Goddard, *Scientific Identification of Firearms and Bullets*, 17 J. CRIM. L., CRIMINOLOGY & POLICE SCI. 254 (1926).

⁴ See LOUIS JOUGHIN & EDMUND M. MORGAN, *THE LEGACY OF SACCO & VANZETTI* 15 (1948) (The firearms identification testimony was "carelessly assembled, incompletely and confusedly presented, and . . . beyond the comprehension" of the jury); James E. Starrs, *Once More Unto the Breech: The Firearms Evidence in the Sacco and Vanzetti Case Revisited*, 31 J. FORENSIC SCI. 630 (1986) (Part I); 31 J. FORENSIC SCI. 1050 (1986) (Part II).

⁵ See Calvin H. Goddard, *The Valentine Day Massacre: A Study in Ammunition-Tracing*, 1 AM. J. POLICE SCI. 60, 76 (1930) ("Since two of the members of the execution squad had worn police uniforms, and since it had been subsequently intimated by various persons that the wearers of the uniforms might really have been policemen rather than disguised gangsters, it became a matter of no little importance to ascertain, if possible, whether these rumors had any foundation in fact.").

⁶ See Jim Ritter, *St. Valentine's Hit Spurred Creation of Nation's First Lab*, CHICAGO SUN-TIMES, Feb. 9, 1997, at 40 ("Sixty-eight years ago this Friday, Al Capone's hit men dressed as cops and gunned down seven men in the Clark Street headquarters of rival mobster Bugs Moran.").

bullet was not only impossible but “preposterous.”⁷ Seven years later, however, the same court became one of the first in this country to admit firearms identification evidence.⁸ The technique gained widespread judicial acceptance and was not seriously challenged in court until recently.

Although this subject is popularly known as “ballistics,” that term is not correct. Ballistics is the study of the motion of a projectile. Interior ballistics concerns the study of the projectile within the firearm;⁹ exterior ballistics concerns the study of the projectile after it leaves the firearm;¹⁰ and terminal (wound) ballistics concerns the study of the effects of the projectile on a target. Firearms identification does not directly involve ballistics. Accordingly, a true “ballistics” expert may know very little about forensic firearms identification. Similarly, a firearms expert — a person knowledgeable about weapons and ammunition — may not be acquainted with this technique.¹¹

I. FIREARMS & AMMUNITION

An understanding of firearms identification requires some appreciation of firearms and ammunition. Typically, three types of firearms — rifles, handguns, and shotguns — are examined.¹²

A. Rifles & Handguns

The barrels of modern rifles and handguns are *rifled*; that is, parallel spiral grooves are cut into the inner surface (bore) of the barrel.¹³ The surfaces between the grooves are called lands. The lands and grooves twist in a direction: right twist or left twist. Each manufacturer specifies the number of lands and grooves, the direction of twist, the angle of twist (pitch), the depth

⁷ *People v. Berkman*, 307 Ill. 492, 139 N.E. 91, 94 (1923).

⁸ *People v. Fisher*, 340 Ill. 216, 172 N.E. 743, 753 (1930).

⁹ Interior ballistics includes such matters as chamber configuration, chamber pressure, and rifling.

¹⁰ Exterior ballistics includes such matters as velocity and trajectory. *See People v. Bloyd*, 43 Cal. 3d 333, 233 Cal. Rptr. 368, 729 P.2d 802, 816-17 (1987) (rejected on other grounds by, *State v. Jenks*, 61 Ohio St. 3d 259, 574 N.E.2d 492 (1991)) (firearms identification examiner qualified to testify about “trajectory” of bullet).

¹¹ *See State v. Leonard*, 243 N.W.2d 887, 892 (Iowa 1976) (distinguishing between “ballistics” and “firearms” expert). *See also U.S. v. Bonavia*, 927 F.2d 565, 567 n.2 (11th Cir. 1991) (firearms expert permitted to testify where a particular weapon had been manufactured to establish required interstate nexus for federal prosecution).

¹² Other types of firearms, such as machine guns, tear gas guns, zip guns, and flare guns, may also be examined. *See generally* Bruce B. Koffler, *Zip Guns and Crude Conversions — Identifying Characteristics and Problems*, 61 J. CRIM. L., CRIMINOLOGY & POLICE SCI. 115 (1970).

¹³ The end of the bore from which the projectile emerges is the muzzle; the end of the bore into which the cartridge is inserted is the breech.

of the grooves, and the width of the lands and grooves. As a bullet passes through the bore, the lands and grooves force the bullet to rotate, giving it stability in flight and thus increased accuracy. Because the lands “bite” into the bullet surface, land and groove impressions are imprinted on the bullets and microscopic details in the land and groove impressions play an important role in firearms identification.

Rifles and handguns are classified according to their caliber. The caliber is the diameter of the bore of the firearm; it is expressed in either hundredths or thousandths of an inch (*e.g.*, .22, .45, .357 caliber) or millimeters (*e.g.*, 9 mm).¹⁴

The two major types of handguns are revolvers¹⁵ and semiautomatic pistols. One difference between these two types of weapons is that the cartridge case is automatically ejected when a semiautomatic pistol is fired. If recovered at the crime scene, it may be possible to identify the cartridge case with the firearm from which it was fired.¹⁶ The case is not ejected when a revolver is discharged.

Rifle and handgun cartridges (ammunition) consist of the projectile (bullet),¹⁷ case,¹⁸ propellant (powder), and primer. The primer contains a small amount of an explosive mixture, which detonates when struck by the firing pin. When the firing pin detonates the primer, an explosion occurs which ignites the propellant. Modern propellant is smokeless powder.

B. Shotguns

Shotguns are smooth bore firearms; they do not have lands and grooves. They can be double or single barrel and can be semiautomatic, pump, bolt, or break open firearms. Shotgun shells most often consist of a case, primer, propellant, projectiles, and wadding. Generally, the projectiles in a shot shell are spherical balls (pellets). Shotguns, however, can also fire bullets, called

¹⁴ The caliber is measured from land to land in a rifled weapon. Typically, the designated caliber is more an approximation than an accurate measurement. See 1 J. HOWARD MATHEWS, *FIREARMS IDENTIFICATION* 17 (1962) (“‘nominal caliber’ would be a more proper term”).

¹⁵ Revolvers have a cylindrical magazine which rotates behind the barrel. The cylinder typically holds five to nine cartridges, each within a separate chamber. When a revolver is fired, the cylinder rotates and the next chamber is aligned with the barrel. A single-action revolver requires the manual cocking of the hammer; in a double-action revolver the trigger cocks the hammer. Revolvers may also be classified by their loading mechanism — swing-out cylinder, removable cylinder, or top-break cylinder.

¹⁶ See *infra* text accompanying notes 57-66 for a discussion of cartridge case identification.

¹⁷ Bullets are generally composed of lead and small amounts of other elements (hardeners). They may be completely covered with another metal (jacketed) or partially covered (semijacketed).

¹⁸ Cartridge cases are generally made of brass.

slugs.¹⁹ Except for the .410 caliber shotgun, shotguns and shot shells are classified according to their gauge — for example, 12, 16, or 20 gauge. The gauge is the number of spherical balls of pure lead, each exactly fitting the bore, which equals one pound. The wadding keeps the powder and the pellets in position inside the shell.

II. BULLET IDENTIFICATION

Firearms identifications may be based on either bullet or cartridge case examinations.²⁰ Identifying features include class, subclass, and individual characteristics.²¹

A. Class Characteristics

The class characteristics of a firearm result from design factors and are determined prior to manufacture. They include the caliber and rifling specifications: (1) the land and groove diameters, (2) the direction of rifling (left or right twist), (3) the number of lands and grooves, (4) the width of the lands and grooves, and (5) the degree of the rifling twist.²² A .38 caliber bullet with six land and groove impressions and with a right twist could have been fired only from a firearm with those same characteristics. It could not have been fired from a .32 caliber firearm, or from a .38 caliber firearm with a different number of lands and grooves or a left twist. In sum, if the class characteristics do not match, the firearm could not have fired the bullet.

Class characteristics play another role in criminal investigations. Frequently, the bullet is recovered before the firearm comes into the possession of the police. In this situation, the class characteristics provide significant information concerning the type of firearm that could have fired the bullet.

B. Subclass Characteristics

Subclass characteristics are produced at the time of manufacture and are

¹⁹ See generally David G. Townshend, *Identification of Rifled Shotgun Slugs*, 15 J. FORENSIC SCI. 173 (1970).

²⁰ In rare cases, it may be possible to physically match bullet fragments. See Asne Klein et al., *Physical Match of Fragmented Bullets*, 45 J. FORENSIC SCI. 722 (2000).

²¹ “Accidental” characteristics are unique to a single firing. The discussion in the text focuses on the typical case. Sometimes the examiner is faced with an atypical case — for example, one in which the firearm has been altered or an undersized bullet has been used. See generally 1 MATHEWS, *supra* note 14, ch. 6 (*Pitfalls for the Unwary*); Burton D. Munhall, *Firearms Identification Problems Pertaining to Supplemental Chambers, Auxiliary Cartridges, Insert Barrels and Conversion Units*, 5 J. FORENSIC SCI. 319 (1960); Calvin H. Goddard, *The Unexpected in Firearms Identification*, 1 J. FORENSIC SCI. 57 (1956).

²² 1 MATHEWS, *supra* note 14, at 17.

limited to a discrete subset of weapons in a production run.²³ According to the Association of Firearm and Tool Mark Examiners (AFTE),²⁴ subclass characteristics are discernable surface features that are more restrictive than class characteristics in that they are (1) “produced incidental to manufacture,” (2) “relate to a smaller group source (a subset to which they belong),” and (3) can arise from a source that changes over time.²⁵ One study concluded that subclass characteristics were found only on groove-engraved areas of test fired bullets and not on land-engraved areas.²⁶ Nevertheless, “one critical problem with the *AFTE Theory* is the lack of objective standards for deciding whether a particular mark is a subclass or individual characteristic.”²⁷ Indeed, the AFTE states that “[c]aution should be exercised in distinguishing subclass characteristics from class characteristics.”²⁸

C. Individual Characteristics

Bullet identification involves a comparison of the evidence bullet and a test bullet fired from the firearm.²⁹ The two bullets are examined by means of a comparison microscope, which permits a split-screen view of the two bul-

²³ See *U.S. v. Monteiro*, 407 F. Supp. 2d 351, 360, 69 Fed. R. Evid. Serv. 156 (D. Mass. 2006) (“Subclass characteristics appear on a smaller subset of a particular make and model of a firearm Subclass characteristics, then, may be present on a group of guns within a certain make or model, such as those manufactured at a particular time and place.”); *U.S. v. Green*, 405 F. Supp. 2d 104, 111 (D. Mass. 2005) (“Sub-class characteristics are markings that temporarily become part of the manufacturing process and therefore create a marking on perhaps hundreds of weapons in a given production run, though they are not a permanent feature of the design. In effect, sub-class characteristics indicate an imperfection in the method used to produce a limited number of firearms.”) (citing to *Daubert* hearing). See also Adina Schwartz, *A Systemic Challenge to the Reliability and Admissibility of Firearms and Toolmark Identification*, 6 COLUM. SCI. & TECH. L. REV. 2, 5 (2005) (“Subclass characteristics, which are present in only some toolmarks, arise when manufacturing processes create batches of tools with similarities in appearance, size, or surface finish distinguishing them from other tools of the same type.”).

²⁴ The Association of Firearm and Tool Mark Examiners is the leading professional organization in the field. There is also a Scientific Working Group for Firearms and Toolmarks (SWGgun), which promulgates consensus standards.

²⁵ *Theory of Identification as it Relates to Toolmarks*, 30 AFTE J. 86, 88 (1998) [hereinafter *AFTE Theory*]. See also Roger G. Nichols, *Firearm and Toolmark Identification Criteria: A Review of the Literature, Part II*, 48 J. FORENSIC SCI. 318, 324 (2003) (discussing different uses of the term “subclass”).

²⁶ Frederic A. Tulleners & James S. Hamiel, *Sub Class Characteristics of Sequentially Rifled 38 Special S & W Revolver Barrels*, 31 AFTE J. 117 (1999) (discussing study of ten sequentially manufactured revolvers).

²⁷ *Monteiro*, 407 F. Supp.2d at 371.

²⁸ *AFTE Theory*, *supra* note 25, at 88.

²⁹ Test bullets are obtained by firing a firearm into a recovery box or bullet trap, which is usually filled with cotton, or a recovery tank, which is filled with water.

lets and manipulation so that the striations (marks) on both bullets may be aligned.³⁰ A camera, attached to the microscope, can be used to take photomicrographs.

The identification of a bullet as having been fired from a particular firearm is based on individual barrel characteristics. Barrels are machined during the manufacturing process³¹ and imperfections in the tools used in the machining process are imprinted on the bore.³² The subsequent use of the firearm adds additional individual imperfections. For example, mechanical action (erosion) caused by the friction of bullets passing through the bore of the firearm produces accidental imperfections. Similarly, chemical action (corrosion) caused by moisture (rust), as well as primer and propellant chemicals, produces other imperfections.

The critical issue, however, is whether this uniqueness is transferred to a particular bullet in sufficient detail for the examiner to reach an accurate conclusion. When a bullet is fired, microscopic striations are imprinted on the bullet surface as it passes through the bore of the firearm.³³ These bullet markings are produced by the individual imperfections of the bore, and since these bore imperfections are randomly produced, they are considered unique to each firearm.³⁴ The probability that another firearm would have identical bore imperfections is considered so remote that firearms identification

³⁰ In effect, the comparison microscope is two microscopes, optically paired. Both microscopes are connected so that two objects may be viewed at the same time. For a description of the comparison microscope, see 1 MATHEWS, *supra* note 14, ch. 4 (*Instrumentation*). Some examiners have used a scanning electron microscope, a far more powerful instrument. See Mary-Jacque Mann & Edgard O. Espinoza, *Firearms Examinations By Scanning Electron Microscopy: Observations and an Update on Current and Future Approaches*, 24 AFTE J. 294 (1992) (pointing out that SEM provides better depth of field, magnification, and imaging than conventional optical microscopy).

³¹ Methods of rifling, such as the scrape cutter, hook cutter, broaching, and swaging methods, are described in 1 MATHEWS, *supra* note 14, at 4-9.

³² See *Monteiro*, 407 F. Supp.2d at 359 ("Although modern manufacturing methods have reduced the amount of handiwork performed on an individual gun, the final step in production of most firearm parts requires some degree of hand-filing which imparts individual characteristics to the firearm part.").

³³ See Richard E. Tontarski & Robert M. Thompson, *Automated Firearms Evidence Comparison: A Forensic Tool for Firearms Identification — An Update*, 43 J. FORENSIC SCI. 641, 642 (1998) ("When a cartridge is fired in a firearm, the generated forces act on both the casing in the firearm's chamber and the bullet being driven down the barrel. The microscopic imperfections made during the manufacture of the firearm's barrel, breech face, firing pin, and action leave toolmarks on the softer bullet and cartridge casing metals Experience has shown that for bullets, the most reproducible marks are normally found in the land impressions near the base.").

³⁴ "No two barrels are microscopically identical, as the surfaces of their bores all possess individual and characteristic markings." GERALD BURRARD, *THE IDENTIFICATION OF FIREARMS AND FORENSIC BALLISTICS* 138 (1962); 1 MATHEWS, *supra* note 14, at 3 ("Experience has shown that no two firearms,

examiners often conclude that a bullet has been fired from a particular firearm and could not have been fired by any other firearm.³⁵ In effect, this opinion is based on probability theory. As McCormick has noted:

[A]ny expert giving any opinion on whether the scientific test identifies the defendant as being the person who left the incriminating trace, such as a . . . bullet, . . . necessarily bases this conclusion on an understanding or impression of how similar the items being compared are and how common it is to find items with these similarities. If these beliefs have any basis in fact, it is to be found in the general experience of the criminalists or more exacting statistical studies of these matters.³⁶

Firearms identification falls into the former category; it is based on the “general experience” of firearms identification examiners and not on statistical studies.³⁷ It is the reliance on this general experience, instead of empirical studies, that critics question.³⁸

Moreover, there is no such thing as a perfect match.³⁹ As one court observed:

The task of telling [the casings] apart is not an easy one: Even if the marks on all of the casings are the *same*, this does not necessarily mean they came from the *same gun*. Similar marks could reflect class or sub-class characteristics, which would define large numbers of guns manufactured by a given company. Just because the marks on the casings are *different* does not mean that they came from *different guns*. Repeated firings from

even those of the same make and model and made consecutively by the same tools, will produce the same markings on a bullet or a cartridge.”).

³⁵ The condition of a firearm or evidence bullet may preclude a positive identification. For example, there may be insufficient marks on the bullet or, due to mutilation, an insufficient amount of the bullet may have been recovered. Similarly, if the barrel of the firearm has changed significantly, due to erosion or corrosion, a positive identification may be impossible. In these situations, the examiner may render a “no conclusion” determination. Such a conclusion, however, may have some evidentiary value; that is, the firearm could have fired the bullet because the class characteristics match. See *infra* text accompanying notes 79-82 (citing cases admitting such testimony).

³⁶ 1 C. MCCORMICK, EVIDENCE § 210, at 913 (6th ed. 2006).

³⁷ For articles on the statistical basis of firearms identification, see Alfred A. Biasotti, *A Statistical Study of the Individual Characteristics of Fired Bullets*, 4 J. FORENSIC SCI. 34 (1959); Alfred A. Biasotti, *The Principles of Evidence Evaluation as Applied to Firearms and Tool Mark Identification*, 9 J. FORENSIC SCI. 428, 432 (1964) (“[W]e lack the fundamental statistical data needed to develop verifiable criteria.”); Werner Deinet, *Studies of Models of Striated Marks Generated by Random Processes*, 26 J. FORENSIC SCI. 35 (1981).

³⁸ See Schwartz, *supra* note 23, at 2 (contending that “because of systemic scientific problems, firearms and toolmark identifications should be inadmissible across-the-board”).

³⁹ Alfred A. Biasotti, *A Statistical Study of the Individual Characteristics of Fired Bullets*, 4 J. FORENSIC SCI. 34, 44 (1959) (noting the “erroneous conception of a ‘perfect match’ which is actually only a theoretical possibility and a practical impossibility”).

the same weapon, particularly over a long period of time, could produce different marks as a result of wear or simply by accident.⁴⁰

D. Subjectivity

Although a positive identification is based on objective data (*i.e.*, the striations on the bullet surface), the examiner's conclusion is essentially a subjective judgment. The AFTE describes the traditional pattern recognition methodology as "subjective in nature, founded on scientific principles and based on the examiner's training and experience."⁴¹ There are no objective criteria used for this determination: "Ultimately, unless other issues are involved, it remains for the examiner to determine for himself the modicum of proof necessary to arrive at a definitive opinion."⁴² In this sense, firearms identification is more of an art than a science.⁴³

Because of the subjective nature of the examination, a confirmatory review by a second examiner should be required.⁴⁴ Ideally, the review should

⁴⁰ U.S. v. Green, 405 F. Supp.2d 104, 107 (D. Mass. 2005).

⁴¹ *AFTE Theory*, *supra* note 25, at 86.

⁴² JOSEPH L. PETERSON ET AL., CRIME LABORATORY PROFICIENCY TESTING RESEARCH PROGRAM 207 (October 1978) [hereinafter LABORATORY PROFICIENCY TEST]. See also Alfred A. Biasotti, *The Principles of Evidence Evaluation as Applied to Firearms and Tool Mark Identification*, 9 J. FORENSIC SCI. 428, 429 (1964) ("In general, the texts on firearms identification take the position that each practitioner must develop his own intuitive criteria of identity gained through practical experience."); Stephen G. Bunch, *Consecutive Matching Striation Criteria: A General Critique*, 45 J. FORENSIC SCI. 955, 959, 962 (2000) ("[P]resent-day firearm identification, in the final analysis is subjective."; "Indeed, some questions do arise regarding the scientific status of present day subjective examinations; but with measures such as professional certification and rigorous validation/proficiency testing, the traditional, subjective examinations regime can strengthen its scientific grounding.").

⁴³ "From the number of texts devoted exclusively to the subject of firearms and tool mark identification, it might appear that this specialized area of physical comparison is a highly developed science with well defined criteria for evidence evaluation. On the contrary, a review of the literature reveals a very superficial treatment of this basic problem of evaluating results and establishing identity." Biasotti, *supra* note 42, at 428. See also Eliot Springer, *Toolmark Examinations — A Review of its Development in the Literature*, 40 J. FORENSIC SCI. 964, 966-67 (1995) ("According to the Association of Firearms and Toolmarks Examiners' Criteria for Identification Committee, interpretation of toolmark individualization and identification is still considered to be subjective in nature, based on one's training and experience.").

⁴⁴ See JULIAN S. HATCHER ET AL., FIREARMS INVESTIGATION, IDENTIFICATION, AND EVIDENCE 383 (1957) ("A positive match should be confirmed by a second examination. The usual laboratory personnel should check the comparison").

be blind — *i.e.*, the second examiner should not know the first examiner's opinion. Some courts have commented on the absence of such a review.⁴⁵

E. Proficiency Testing

Given the subjective nature of the comparison, it is not surprising that examiners may disagree or be mistaken.⁴⁶ Also, the Crime Laboratory Proficiency Testing Program (1978) raised questions about the competence of some firearms identification examiners. In one test, 5.3% of the participating laboratories misidentified firearms evidence, and in another test 13.6% erred. These tests involved bullet and cartridge case comparisons. The Project Advisory Committee considered these errors “particularly grave in nature” and concluded that they probably resulted from carelessness, inexperience, or inadequate supervision.⁴⁷ A third test required the examination of two bullets and two cartridge cases to identify the “most probable weapon” from which each was fired. The error rate was 28.2%.

In later proficiency tests, “[e]xaminers generally did very well in making the comparisons. For all fifteen tests combined, examiners made a total of 2106 [bullet and cartridge case] comparisons and provided responses which agreed with the manufacturer responses 88% of the time, disagreed in only 1.4% of responses, and reported inconclusive results in 10% of cases.”⁴⁸

More recent tests show a high proficiency for many examiners but problems still remain.⁴⁹ Moreover, questions have arisen concerning the validity of some of the tests. First, such testing is not required of all firearms examiners, only those working in labs voluntarily seeking accreditation by

⁴⁵ *U.S. v. Monteiro*, 407 F. Supp. 2d 351, 374, 69 Fed. R. Evid. Serv. 156 (D. Mass. 2006) (“There is no evidence that Sgt. Weddleton had an independent second examiner from his lab review his work or conclusions in accordance with the generally accepted standard in the field.”).

⁴⁶ See *infra* text accompanying notes 109-18 (discussing disagreements and mistakes).

⁴⁷ LABORATORY PROFICIENCY TEST, *supra* note 42, at 207-08.

⁴⁸ Joseph L. Peterson & Penelope N. Markham, *Crime Laboratory Proficiency Testing Results, 1978-1991, II: Resolving Questions of Common Origin*, 40 J. FORENSIC SCI. 1009, 1018 (1995). The authors also stated: “The performance of laboratories in the firearms tests was comparable to that of the earlier LEAA study, although the rate of successful identifications actually was slightly over-88% vs. 91%. Laboratories cut the rate of errant identifications by half (3% to 1.4%) but the rate of inconclusive responses doubled, from 5% to 10%.” *Id.* at 1019.

⁴⁹ See Schwartz, *supra* note 23, at 26 (“On CTS firearms identification tests in 2003, 100% and 90% of test takers respectively reached the correct conclusion that the firearm that fired a ‘known’ cartridge case had also fired two ‘suspect’ cartridge cases but not a third; 10% reported inconclusives instead of exclusions. On a similar exercise with bullets, 92% and 93% of test takers respectively concluded correctly that the same gun had fired both a ‘known’ bullet and each of two ‘suspect’ bullets; 8% and 7% reported inconclusives. While 45% correctly concluded that the gun had not fired a third ‘suspect’ bullet, 52% reached inconclusives and 3% made wrong identifications.”).

the American Society of Crime Laboratory Directors (ASCLD) — “meaning that the sample is self-selecting and may not be representative of the complete universe of firearms examiners.”⁵⁰ Second, examiners know when they are being tested — *i.e.*, the examinations are not blind. Third, there is some variation in evaluation, depending on whether an “inconclusive” answer is counted. One witness testified that in a 2005 cartridge case examination, *none* of the 255 test-takers nationwide answered incorrectly. The court observed: “One could read these results to mean that the technique is foolproof, but the results might instead indicate that the test was somewhat elementary.”⁵¹

F. Fingerprints Compared

An analogy between firearms identification and fingerprint identification may be more misleading than helpful. A person’s fingerprints do not change, whereas the markings on the bore of a firearm may change every time the weapon is fired. For example, rust or dirt in the bore may leave a mark on one bullet that will not be found on a subsequently fired bullet because the rust or dirt may have been dislodged from the barrel when the first bullet was fired. Metal fouling, which is common with lead bullets, may also change the interior surface of the barrel.⁵² The examiner, therefore, must distinguish unimportant dissimilar markings from significant dissimilar markings.⁵³ One commentator has written:

[O]ne of the most surprising things which must strike any observer who is examining fired bullets is the astonishing differences which seem to be present on bullets which are known to have been fired through the same barrel. These differences are due to the sliding imprint, but with practice it is possible to detect the difference between variations resulting from the sliding imprint and variations due to different barrels.⁵⁴

G. Consecutive Matching Striae

In an attempt to make firearms identification more objective, some commentators advocate a procedure known as Consecutive Matching Striae (CMS). As the name implies, this method is based on finding a specified

⁵⁰ *Monteiro*, 407 F. Supp.2d at 367.

⁵¹ *Monteiro*, 407 F. Supp.2d at 367.

⁵² See 1 MATHEWS, *supra* note 14, at 21 (“If a test bullet is fired through a barrel which has become fouled subsequent to the passage of the evidence bullet through it, the markings on the test and evidence bullets may be quite different.”).

⁵³ In this respect, fingerprint comparisons are similar.

⁵⁴ BURRARD, *supra* note 34, at 145. See also Calvin H. Goddard, *Scientific Identification of Firearms and Bullets*, 17 J. CRIM. L., CRIMINOLOGY & POLICE SCI. 254, 262 (1956) (“All the fine striations will not match together by any means, but enough will do so to dispel any doubt as to the fact that their arm of origin was identical.”).

number of consecutive striae on two bullets. Threshold numbers are set. Critics have questioned this approach,⁵⁵ and it remains a minority position.⁵⁶

III. CARTRIDGE CASE IDENTIFICATION

Cartridge cases are most often identified by breech face,⁵⁷ firing pin impression,⁵⁸ extractor,⁵⁹ ejector,⁶⁰ or chamber marks. Cartridge case identification is based on the same theory as bullet identification:

[T]he whole principle of identification is based on the fact that since the breech face of every weapon must be individually distinct, the cartridge cases which it fires are imprinted with this individuality. The imprints on all cartridges fired from the same weapon are the same, and those on cartridges fired from different weapons must always be different.⁶¹

As with barrels, defects produced in the manufacturing process leave distinctive characteristics on the breech face, firing pin, chamber, extractor, and ejector. The subsequent use of the firearm produces additional distinctive defects. When the trigger is pulled, the firing pin strikes the primer of the cartridge, causing the primer to detonate. This detonation ignites the

⁵⁵ See Bunch, *supra* note 42 (finding the traditional methodology superior); Schwartz, *supra* note 23, at 24 ("Because they have yet to develop objective criteria for counting striae or to base calculations of the frequency of matching numbers and combinations of striae on relevant and representative tool databases, the supporters of CMS cannot possibly know how likely or unlikely it is that their criteria will lead to misidentifications.").

⁵⁶ Nichols, *supra* note 25, at 326 (CMS "has not been promoted as an alternative [to traditional pattern recognition], but as a numerical threshold.").

⁵⁷ See J.K. Sinha et al., *Direct Breech Face Comparison*, 4 J. POLICE SCI. & ADMIN. 261 (1976).

⁵⁸ The firing pin or striker has a distinctive shape. See C.A. Grove et al., *Evaluation of SEM Potential in the Examination of Shotgun and Rifle Firing Pin Impressions*, 19 J. FORENSIC SCI. 441 (1974); C.A. Grove et al., *Examination of Firing Pin Impressions by Scanning Electron Microscopy*, 17 J. FORENSIC SCI. 645 (1972).

⁵⁹ The extractor is the mechanism that withdraws the cartridge case from the chamber after the firearm has been fired. See generally Charles M. Wilson, *The Identification of Extractor Marks on Fired Shells*, 29 J. CRIM. L. & CRIMINOLOGY 724 (1939).

⁶⁰ The ejector is the mechanism that throws or "kicks out" the cartridge case from the firearm after it has been fired.

⁶¹ BURRARD, *supra* note 34, at 107. Bullet and cartridge case identifications differ in several respects. Since the bullet is traveling through the barrel at the time it is imprinted with the bore imperfections, these marks are "sliding" imprints, called striated marks. In contrast, the cartridge case receives "static" imprints, called impressed marks. *Id.* at 145. Thus, cartridge case marks may be easier to match. Nevertheless, since some firearms, such as revolvers, do not automatically eject the cartridge case at the scene when fired, cartridge case identification is probably not as common as bullet identification.

propellant (powder). In the process of combustion, the powder is converted rapidly into gases. The pressure produced by this process propels the bullet from the weapon and also forces the base of the cartridge case backwards against the breech face, imprinting breech face marks on the base of the cartridge case. Similarly, the firing pin, ejector, and extractor may leave characteristic marks on a cartridge case.⁶²

Cartridge case identification involves a comparison of the cartridge case recovered at the crime scene and a test cartridge case obtained from the firearm after it has been fired. Shot shell casings as well as cartridge cases inserted into handguns and rifles may be identified in this way.⁶³ As in bullet identification, the comparison microscope is used for the examination. "According to the Association of Firearms and Toolmarks Examiners' Criteria for Identification Committee, interpretation of toolmark individualization and identification is still considered to be subjective in nature, based on one's training and experience."⁶⁴

As with bullet identification, cartridge case identification was part of the Laboratory Proficiency Testing Program (1978). Two cartridge cases, each fired in a different firearm, were tested. The test required the comparison of both cartridge cases to determine if they had been fired in the same firearm. Five laboratories, representing 3.8% of those participating in the test, misidentified a cartridge case.⁶⁵ In later proficiency tests, examiners did very well.⁶⁶

IV. AUTOMATED IDENTIFICATION SYSTEMS

Automated firearms identification systems are now on-line. One early system, "Bulletproof," analyzed bullets and was sponsored in part by the Bureau of Alcohol, Tobacco, and Firearms. Another system, "Drugfire," analyzed cartridge cases; this program was sponsored by the F.B.I.⁶⁷ "These ballistic imaging systems use the powerful searching capabilities of the com-

⁶² See Tontarski & Thompson, *supra* note 33, at 642 ("When a cartridge is fired in a firearm, the generated forces act on both the casing in the firearm's chamber and the bullet being driven down the barrel. The microscopic imperfections made during the manufacture of the firearm's barrel, breech face, firing pin, and action leave toolmarks on the softer bullet and cartridge casing metals. . . . [T]he breech face and firing pin impressions found on an expended casing are primary areas for comparison of identifiable microscopic marks.").

⁶³ Ejector and extractor marks by themselves may indicate only that the cartridge case had been *loaded in*, not fired from, a particular firearm.

⁶⁴ Springer, *supra* note 43, at 966-67.

⁶⁵ LABORATORY PROFICIENCY TEST, *supra* note 42, at 207-08.

⁶⁶ See *supra* text accompany note 48.

⁶⁷ R.N. Sibert, *Drugfire: Revolutionizing Forensic Firearms Identification and Providing the Foundation for a National Firearms Identification Network*, 21 CRIME LAB. DIGEST 63 (1994); R.N. Sibert, *Drugfire: Responding to Gang and Drug-Related Shootings*, 19 CRIME LAB. DIGEST 6 (1992).

puter to match the images of recovered crime scene evidence against digitized images stored in a computer database.”⁶⁸ The present system is called the Integrated Ballistics Information System (IBIS).⁶⁹ The automated systems “give[] firearms examiners the ability to screen virtually unlimited numbers of bullets and cartridge casings for possible matches.”⁷⁰ These systems, however, do not replace the examiner, who still must make the final comparison: “‘High Confidence’ candidates (likely hits) are referred to a firearms examiner for examination on a comparison microscope.”⁷¹ IBIS, however, is not without its shortcomings.⁷²

V. ADMISSIBILITY & WEIGHT OF FIREARMS EVIDENCE

Firearms identification developed in the early part of the last century, and by 1930 courts were admitting firearms identification evidence.⁷³

⁶⁸ *Benchmark Evaluation Studies of the Bulletproof and Drugfire Ballistic Imaging Systems*, 22 CRIME LAB. DIGEST 51 (1995). See also Jan De Kinder & Monica Bonfanti, *Automated Comparisons of Bullet Striations Based on 3D Topography*, 101 FORENSIC SCI. INT’L 85, 86 (1999) (“[A]n automatic system will cut the time demanding and tedious manual searches for one specific item in large open case files.”).

⁶⁹ See Jan De Kinder et al., *Reference Ballistic Imaging Database Performance*, 140 FORENSIC SCI. INT’L 207 (2004); Rurecht Nennstiel & Joachim Rahm, *Parameter Study Regarding IBIS(tm) Correlator*, 51 J. FORENSIC SCI. 18 (2006); Tontarski & Thompson, *supra* note 33. See also Nicola Senin et al., *Three-Dimensional Surface Topography Acquisition and Analysis for Firearm Identification*, 51 J. FORENSIC SCI. 282 (2006); Benjamin Bachrach, *Development of a 3D-based Automated Firearms Evidence Comparison System*, 47 J. FORENSIC SCI. 1253 (2002).

⁷⁰ Tontarski & Thompson, *supra* note 33.

⁷¹ Tontarski & Thompson, *supra* note 33.

⁷² See *U.S. v. Green*, 405 F. Supp. 2d 104, 116 (D. Mass. 2005) (“A national computer database, IBIS allows examiners to identify the most likely matches for the evidence in a given case. IBIS uses a laser measuring device to evaluate shell casings and provides the examiner with a list of possible matches. In fact, the IBIS system has been widely criticized. Its efficacy is limited by the detail with which police departments have scanned old shell casings into the computer and the accuracy of the mathematical algorithms used to compare casings.”) (citations omitted); Schwartz, *supra* note 23, at 30 (“In the studies, the IBIS database was expanded to include hundreds of cartridge cases that were test fired by guns of the same caliber and make. The studies found that as the size of the database increased, IBIS increasingly failed to rank cartridge cases that were known to have been test fired by the same gun within the top ten or even fifteen candidate matches for the queried cartridge case.”).

⁷³ *E.g.*, *People v. Fisher*, 340 Ill. 216, 172 N.E. 743 (1930); *Evans v. Commonwealth*, 230 Ky. 411, 19 S.W.2d 1091, 66 A.L.R. 360 (1929); *Burchett v. State*, 35 Ohio App. 463, 8 Ohio L. Abs. 401, 172 N.E. 555 (4th Dist. Hocking County

Subsequent cases followed these precedents, admitting evidence of bullet,⁷⁴ cartridge case,⁷⁵ and shot shell⁷⁶ identifications. The test bullet itself, however, need not be admitted in evidence.⁷⁷ If the firearm used in the crime is not recovered and therefore a test bullet or cartridge case cannot be obtained, a bullet or cartridge case fired by that firearm at a different time may be used for comparison purposes.⁷⁸

A number of courts have also permitted an expert to testify that a bullet

1930). *But see* *People v. Berkman*, 307 Ill. 492, 139 N.E. 91, 94 (1923) (positive identification of bullet "preposterous").

⁷⁴ E.g., *U. S. v. Wolff*, 5 M.J. 923, 926 (N.C.M.R. 1978); *State v. Harriman*, 469 So. 2d 298, 306-07 (La. Ct. App. 2d Cir. 1985), writ denied, 474 So. 2d 1304 (La. 1985); *State v. Anderson*, 175 N.C. App. 444, 624 S.E.2d 393 (2006), appeal dismissed, review denied, 360 N.C. 484, 632 S.E.2d 492 (2006) (no abuse of discretion in admitting bullet identification evidence); *State v. Mack*, 73 Ohio St. 3d 502, 1995-Ohio-273, 653 N.E.2d 329 (1995) (The examiner "compared the test shot with the morgue bullet recovered from the victim, . . . and the spent shell casings recovered from the crime scene, concluding that all had been discharged from appellant's gun.").

⁷⁵ E.g., *Bentley v. Scully*, 41 F.3d 818, 825 (2d Cir. 1994) ("[A] ballistic expert found that the spent nine millimeter bullet casing recovered from the scene of the shooting was fired from the pistol found on the rooftop."); *State v. Samonte*, 83 Haw. 507, 928 P.2d 1, 6, 60 A.L.R.5th 765 (1996) ("Upon examining the striation patterns on the casings, Christensen concluded that the casing she had fired matched six casings that police had recovered from the house."); *State v. Riley*, 568 N.W.2d 518, 526 (Minn. 1997) ("At trial, Papke, the state's ballistics expert testified that he compared shell casings recovered at the scene with casings test-fired from the 9 mm handgun recovered from Bobo's home. Papke testified that he had never seen two guns leave identical marks on casings and that to a 'reasonable degree of scientific certainty,' casings recovered from the murder scene were fired from the 9 mm Smith & Wesson handgun that was recovered at the Bobo residence."); *Goins v. Com.*, 251 Va. 442, 470 S.E.2d 114, 120 (1996) (Expert "testified that she compared the markings on one of the cartridge casings found at the crime scene with the markings on the unfired .45 caliber cartridge found in the home of . . . Goins' girlfriend . . . and [the expert] concluded that both items had been in the same weapon.").

⁷⁶ E.g., *Williams v. State*, 384 So. 2d 1205, 1210-11 (Ala. Crim. App. 1980); *Burge v. State*, 282 So. 2d 223, 229 (Miss. 1973); *Com. v. Whitacre*, 2005 PA Super 221, 878 A.2d 96, 101 (2005), appeal denied, 586 Pa. 750, 892 A.2d 823 (2005) ("no abuse of discretion in the trial court's decision to permit admission of the evidence regarding comparison of the two shell casings with the shotgun owned by Appellant").

⁷⁷ *See Ex parte Hinton*, 548 So. 2d 562, 568 (Ala. 1989).

⁷⁸ E.g., *State v. Lane*, 72 Ariz. 220, 233 P.2d 437, 440-41 (1951); *Com. v. Ellis*, 373 Mass. 1, 364 N.E.2d 808, 811-12 (1977); *People v. Williams*, 15 Mich. App. 683, 167 N.W.2d 358, 360 (1969); *State v. Boccadoro*, 105 N.J.L. 352, 144 A. 612, 613 (N.J. Ct. Err. & App. 1929). *See also* *Goins v. Com.*, 251 Va. 442, 470 S.E.2d 114, 120 (1996) (Expert "testified that she compared the markings on one of the cartridge casings found at the crime scene with the markings on the unfired .45 caliber cartridge found in the home of . . . Goins' girlfriend . . . and [the expert] concluded that both items had been in the same weapon.").

could have been fired from a particular firearm;⁷⁹ that is, the class characteristics of the bullet and the firearm are consistent.⁸⁰ Although this type of evidence is not as probative as a positive identification, it nevertheless has some probative value and satisfies the evidentiary test for relevancy.⁸¹ As one court commented, the expert's "testimony, which established that the bullet which killed [the victim] could have been fired from the same caliber and make of gun found in the possession of [the defendant], significantly advanced the inquiry."⁸²

A. Federal Rules

The Federal Rules of Evidence, enacted in 1975, treated this issue as one of authentication. Rule 901(b)(3) provides that an item of evidence may be identified by an expert witness through a comparison of the item and specimens that have been authenticated. The federal drafters specifically mentioned "ballistics" comparisons.⁸³ Under this federal rule, bullet or cartridge case identification evidence is admissible if evidence sufficient to support a finding of identification has been introduced.⁸⁴

Rule 702, which governs expert testimony, is also relevant. Indeed, that rule, as interpreted by the Supreme Court in *Daubert v. Merrell Dow*

⁷⁹ *E.g.*, *People v. Horning*, 34 Cal. 4th 871, 22 Cal. Rptr. 3d 305, 102 P.3d 228, 236 (2004), cert. denied, 126 S. Ct. 45, 163 L. Ed. 2d 77 (U.S. 2005) (expert "opined that both bullets and the casing could have been fired from the same gun . . . ; because of their condition he could not say for sure"); *Luttrell v. Com.*, 952 S.W.2d 216, 218 (Ky. 1997) (expert "testified only that the bullets which killed the victim could have been fired from Luttrell's gun"); *State v. Reynolds*, 307 N.C. 184, 297 S.E.2d 532, 539-40, 31 A.L.R.4th 473 (1982); *Com. v. Moore*, 462 Pa. 231, 340 A.2d 447, 451 (1975). *See also* *State v. Gainey*, 355 N.C. 73, 558 S.E.2d 463, 474 (2002) ("Agent Bishop testified that the six fired cartridge cases found at the Campbell trailer and the five unfired bullets supplied to the Harnett County Sheriff's Department by defendant's father were all .22-caliber bullets manufactured by Federal. He was also able to conclude that bullet fragments removed from the victim's body were also .22-caliber").

⁸⁰ *See* *State v. Treadwell*, 1998 WL 50138, at *1 (Wis. Ct. App. 1998) ("[T]he bullets found in Powell's car were analyzed and a ballistics report was issued which stated that, although the bullets found in Powell's car could not be positively identified as coming from [the defendant's] gun, the bullets were consistent with bullets fired from [the defendant's] gun"; defendant's attorney informed him that the ballistics report showed a "match" between the defendant's bullets and the bullets in the car; he then pled guilty).

⁸¹ *See* FED. R. EVID. 401 ("'Relevant evidence' means evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence.").

⁸² *Com. v. Hoss*, 445 Pa. 98, 283 A.2d 58, 68 (1971).

⁸³ FED. R. EVID. 901 advisory committee's note.

⁸⁴ FED. R. EVID. 901(a).

*Pharmaceuticals, Inc.*⁸⁵ has trumped Rule 901. Once *Daubert* attacks on the admissibility of handwriting and fingerprint evidence had been launched,⁸⁶ it was inevitable that firearms and tool mark identifications would also be challenged. The initial attacks failed.⁸⁷ For example, the Fifth Circuit in *U.S. v. Hicks*⁸⁸ upheld admissibility, ruling that “the matching of spent shell casings to the weapon that fired them has been a recognized method of ballistics testing in this circuit for decades.”⁸⁹ That court further found that “[b]ased on the widespread acceptance of firearms comparison testing, the existence of standards governing such testing, and [an expert’s] testimony about the negligible rate of error for comparison tests, the district court had sufficient evidence to find that [the expert’s] methodology was reliable.”⁹⁰

B. *U.S. v. Green*

In the space of about two weeks, however, a pair of decisions by federal district courts in Boston changed the legal landscape. The first case, *U.S. v.*

⁸⁵ 509 U.S. 579, 113 S. Ct. 2786, 125 L. Ed. 2d 469, 27 U.S.P.Q.2d 1200, Prod. Liab. Rep. (CCH) P 13494, 37 Fed. R. Evid. Serv. 1, 23 Env’t. L. Rep. 20979 (1993). For a discussion of *Daubert*, See Chapter 1.

⁸⁶ See Paul C. Giannelli, *Daubert Challenges to Fingerprints*, 43 CRIM. L. BULL. 624 (2006); Paul C. Giannelli & Carin Cozza, *Daubert Challenges to Handwriting Comparisons*, 42 CRIM. L. BULL. 347 (2006).

⁸⁷ In one case, the court wrote: “Ballistics evidence has been accepted in criminal cases for many years In the years since *Daubert*, numerous cases have confirmed the reliability of ballistics identification.” *U.S. v. Foster*, 300 F. Supp. 2d 375, 377 n. 1 (D. Md. 2004). See also *U.S. v. Santiago*, 199 F. Supp. 2d 101, 111, 59 Fed. R. Evid. Serv. 223 (S.D. N.Y. 2002) (“The Court has not found a single case in this Circuit that would suggest that the entire field of ballistics identification is unreliable.”); *State v. Anderson*, 175 N.C. App. 444, 624 S.E.2d 393 (2006), appeal dismissed, review denied, 360 N.C. 484, 632 S.E.2d 492 (2006) (no abuse of discretion in admitting bullet identification evidence); *Com. v. Whitacre*, 2005 PA Super 221, 878 A.2d 96, 101 (2005), *appeal denied*, 586 Pa. 750, 892 A.2d 823 (2005) (“no abuse of discretion in the trial court’s decision to permit admission of the evidence regarding comparison of the two shell casings with the shotgun owned by Appellant”).

In *People v. Hawkins*, 10 Cal. 4th 920, 42 Cal. Rptr. 2d 636, 897 P.2d 574 (1995), *as modified on denial of reh’g*, 1 (Oct. 18, 1995) and (abrogated on other grounds by, *People v. Lasko*, 23 Cal. 4th 101, 96 Cal. Rptr. 2d 441, 999 P.2d 666 (2000)), the defendant challenged the scientific basis of firearms identification evidence. The experts “conceded that ballistics identification is not an exact science. Rather, ballistics experts develop proficiency by microscopically observing a large number of bullets known to have been fired from the same gun, and from different guns, so that they acquire knowledge of when the similarities of the bullets’ striations are sufficient to establish that the bullets were discharged from the same firearm.” *Id.* at 650. The California Supreme Court upheld admissibility under the *Frye* test.

⁸⁸ 389 F.3d 514, 65 Fed. R. Evid. Serv. 880 (5th Cir. 2004), *cert. denied*, 126 S. Ct. 1022, 163 L. Ed. 2d 853 (U.S. 2006).

⁸⁹ *Hicks*, 389 F.3d at 526.

⁹⁰ *Hicks*, 389 F.3d at 526.

Green,⁹¹ was a frontal attack on the lack of empirical testing. The court wrote that “O’Shea [the expert] declared that this match could be made ‘to the exclusion of every other firearm in the world.’ . . . That conclusion, needless to say, is extraordinary, particularly given O’Shea’s data and methods.”⁹² Although the expert had seven years of experience in the field, he was not certified, and his lab was not accredited. Moreover, he had never been formally tested by a neutral proficiency examination. Finally, he could not cite any reliable error rates. The expert “conceded, over and over again, that he relied mainly on his subjective judgment. There were no reference materials of any specificity, no national or even local database on which he relied. And although he relied on his past experience with these weapons, he had no notes or pictures memorializing his past observations.”⁹³

Despite “serious reservations,” the court felt “compelled” to allow the testimony.⁹⁴ Significantly, however, the testimony was limited: The expert could only describe and explain the ways in which the casings were similar but not that they came from a specific weapon “to the exclusion of every other firearm in the world.”⁹⁵ In the court’s view, the latter conclusion “stretches well beyond O’Shea’s data and methodology.”⁹⁶ The most riveting aspect of the case came in the following paragraph:

I reluctantly come to the above conclusion because of my confidence that any other decision will be rejected by appellate courts, in light of precedents across the country While I recognize that the *Daubert-Kumho* standard does not require the illusory perfection of a television show (CSI, this wasn’t), when liberty hangs in the balance — and, in the case of the defendants facing the death penalty, life itself — the standards should be higher than were met in this case, and than have been imposed across the country. The more courts admit this type of toolmark evidence without requiring documentation, proficiency testing, or evidence of reliability, the more sloppy practices will endure; we should require more.⁹⁷

C. U.S. v. Monterio

The second case to question cartridge case identification, *U.S. v. Monteiro*,⁹⁸ resulted in a six-day evidentiary hearing:

Based on the extensive documentary record replete with photographs, demonstratives, and journal articles, this Court holds that the underlying scientific principle behind firearm identification — that firearms transfer unique toolmarks to spent cartridge cases — is valid under *Daubert*. However, the process of deciding that a cartridge case was fired by a par-

⁹¹ 405 F. Supp. 2d 104 (D. Mass. 2005).

⁹² *Green*, 405 F. Supp.2d at 107 (citations omitted).

⁹³ *Green*, 405 F. Supp.2d at 107.

⁹⁴ *Green*, 405 F. Supp.2d at 108.

⁹⁵ *Green*, 405 F. Supp.2d at 109.

⁹⁶ *Green*, 405 F. Supp.2d at 109.

⁹⁷ *Green*, 405 F. Supp.2d at 109.

⁹⁸ 407 F. Supp. 2d 351, 69 Fed. R. Evid. Serv. 156 (D. Mass. 2006).

ticular gun is based primarily on a visual inspection of patterns of toolmarks, and is largely a subjective determination based on experience and expertise. Because of the subjective nature of the matching analysis, a firearms examiner must be qualified through training, experience, and/or proficiency testing to provide expert testimony. Moreover, an examiner must follow the established standards for intellectual rigor in the toolmark identification field with respect to documentation of the reasons for concluding there is a match (including, where appropriate, diagrams, photographs or written descriptions), and peer review of the results by another trained examiner in the laboratory. These standards ensure the reliability of the expert's results and the testability of the opinion.

If the government meets these standards at trial, the expert may give an opinion of a match to a reasonable degree of certainty in the ballistics field. However, the expert may not testify that there is a match to an exact statistical certainty.⁹⁹

The expert, in the court's view, had yet to satisfy these standards. Because the expert did not make any sketches or take any photographs, adequate documentation was lacking: "Until the basis for the identification is described in such a way that the procedure performed by Sgt. Weddleton is reproducible and verifiable, it is inadmissible under Rule 702."¹⁰⁰ Moreover, an independent second examiner had not confirmed the identification, which was particularly important because replacement parts had been used in the test-firing.

Moreover, the court had reservations about the traditional methodology:

[T]he *AFTE Theory*, upon which the government relies, is tautological: it requires each examiner to decide when there is "sufficient agreement" of toolmarks to constitute an "identification." . . . This threshold is surpassed when the examiner finds that the agreement of toolmarks "exceeds the best agreement demonstrated between toolmarks known to have been produced by different tools and is consistent with agreement demonstrated by toolmarks known to have been produced by the same tool." . . . Toolmark analysis does not follow an objective standard requiring, say, a certain percentage of marks to match. Rather, as noted, this "threshold is currently held in the minds eye of the examiner and is based largely on training and experience."¹⁰¹

The court concluded that "the *AFTE Theory* appears to be more of a description of the process of firearm identification rather than a strictly followed charter for the field."¹⁰² Moreover, while the *AFTE Theory* appears to be widely accepted by trained firearms examiners, it is not universally followed. "Weddleton testified that he had never before even seen or heard of it. Not only that, Mary Kate McGilvray, of the Massachusetts State Police

⁹⁹ *Monteiro*, 407 F. Supp.2d at 355.

¹⁰⁰ *Monteiro*, 407 F. Supp.2d at 374.

¹⁰¹ *Monteiro*, 407 F. Supp.2d at 370 (citations omitted) (citing *AFTE Theory*, *supra* note 25).

¹⁰² *Monteiro*, 407 F. Supp.2d at 371.

Crime Lab, also testified that she had never before read the *AFTE Theory* and that it was not the policy in her lab.”¹⁰³

Finally, the court observed that, because an examiner’s opinion is largely a subjective one, the expert may not testify to a match with an absolute certainty: “Allowing the firearms examiner to testify to a reasonable degree of ballistic certainty permits the expert to offer her findings, but does not allow her to say more than is currently justified by the prevailing methodology.”¹⁰⁴ The court, however, defined a “reasonable degree of ballistic certainty” as more likely than not, which is the traditional preponderance-of-evidence standard, a standard that does not imply “certainty.”

Several other cases are worth noting. In *Commonwealth v. Meeks*,¹⁰⁵ after a ten-day admissibility hearing, a Massachusetts trial court concluded: “The theory and process of firearms identification are generally accepted and reliable, and the process has been reliably applied in these cases. Accordingly, the firearms identification evidence, including opinions as to matches, may be presented to the juries for their consideration, but only if that evidence includes a detailed statement of the reasons for those opinions together with appropriate documentation.”¹⁰⁶

In *State v. Sexton*,¹⁰⁷ an expert testified that cartridge cases from *unfired* bullets found in the appellant’s apartment had distinct marks that matched fired cartridge cases found at the scene of the offense. The Texas Criminal Court of Appeals ruled the testimony inadmissible: “This record qualifies Crumley as a firearms identification expert, but does not support his capacity to identify cartridge cases on the basis of magazine marks only.”¹⁰⁸

D. Errors & Disagreements

Given the subjective nature of the identification process, it is not surprising that experts might disagree. In *State v. Nemeth*,¹⁰⁹ one expert testified “that he was unable to determine whether the bullets had been fired from the same gun,” whereas another “testified that both bullets had been fired from the same gun.”¹¹⁰ The court held that such a disagreement did not affect the

¹⁰³ *Monteiro*, 407 F. Supp.2d at 370-71.

¹⁰⁴ *Monteiro*, 407 F. Supp.2d at 372.

¹⁰⁵ 2006 WL 2819423 (Mass. Super. Ct. 2006).

¹⁰⁶ *Meeks*, 2006 WL 2819423, at *50.

¹⁰⁷ 2002 WL 1787946 (Tenn. Crim. App. 2002).

¹⁰⁸ *Sexton*, 93 S.W.3d at 101 (“[T]he magazine or magazines that made the marks upon which Crumley based his identification were not found by the police. Therefore Crumley was not able to make test marks for comparison. Also, Crumley did not say whether he was familiar with the manufacturing process of the magazine or magazines that he said left identifiable marks on the live rounds and cartridge cases . . .”).

¹⁰⁹ 182 Conn. 403, 438 A.2d 120 (1980).

¹¹⁰ *Nemeth*, 438 A.2d at 123.

admissibility of the evidence, only the weight of the evidence, thus creating an issue for the jury. In another case, *Commonwealth v. Ellis*,¹¹¹ the "Commonwealth's two experts did not fully agree."¹¹²

Mistaken identifications have also occurred. In *People v. Kirschke*,¹¹³ a prosecution expert testified that an evidence bullet had been fired by a particular firearm and that "no other in the world was the murder weapon."¹¹⁴ However, in post-conviction proceedings court-appointed experts testified that a positive identification could not be made. Although the court found that the expert had "negligently presented false demonstrative evidence in support of his ballistics testimony,"¹¹⁵ it denied post-conviction relief because the defendant had failed to challenge the testimony at trial, even though he had the opportunity to do so.

Another case involved the 1989 arrest of Rickey Ross for the murder of three prostitutes. An expert, the head of a firearms identification unit, made a positive identification after comparing the murder bullets and a bullet fired from Ross' 9 mm Smith & Wesson. One of the defense attorneys later admitted, "I suppose I was like the average citizen . . . They said it was a match, I thought it was like a fingerprint."¹¹⁶ Based on the same evidence, however, a defense expert reached the opposite conclusion — Ross' gun could not have fired the fatal bullets. Two independent experts came to yet another conclusion: there was insufficient evidence to reach any definite conclusion. The case against Ross was dropped.

A misidentification also occurred in the investigation of Sirhan Sirhan for the assassination of Bobby Kennedy:

In [*People v. Sirhan*] seven independent examiners were appointed by the presiding judge of the Superior Court of Los Angeles County to reexamine the purported firearms bullet comparison post trial. The examiners were unanimous in their findings that the identification[s] testified to at the grand jury indictment and in the trial were misrepresented in that the purported identification[s] of bullets lodged in victim Kennedy . . . with Sirhan's gun were non-existent. In both of these cases discovery and cross examination were lacking.¹¹⁷

Other, more disturbing problems have surfaced. For example, a grand

¹¹¹ 73 Mass. 1, 364 N.E.2d 808 (1977). See also *Ex parte Hinton*, 548 So. 2d 562, 565 (Ala. 1989) (defense expert disagreed with prosecution experts' positive identification).

¹¹² *Ellis*, 364 N.E.2d at 812.

¹¹³ 53 Cal. App. 3d 405, 125 Cal. Rptr. 680, 683 (2d Dist. 1975).

¹¹⁴ *Kirschke*, 125 Cal. Rptr. at 683.

¹¹⁵ *Kirschke*, 125 Cal. Rptr. at 682.

¹¹⁶ Bob Baker & Paul Lieberman, *Faulty Ballistics in Deputy's Arrest; Eagerness to "Make" Gun Cited in LAPD Lab Error*, L.A. TIMES, May 22, 1989, at 1; David Freed, *LAPD Probing What Went Wrong With Ballistics Tests on Ross' Gun*, L.A. TIMES, May 16, 1989, at 26.

¹¹⁷ Lowell W. Bradford, *Forensic Firearms Identification: Competence or Incompetence*, 5 FORUM 14 (July/Aug. 1978).

jury report noted that the “testimony of the firearms examiner that he could not have refused to sign what he believed was an inadequate and preliminary report on pain of potential discharge is highly alarming. If true, it could undermine public confidence in all scientific analysis performed by this agency.”¹¹⁸

E. Defense Experts

Given the subjective nature of the comparison, a defense attorney must often consult with an expert. Under some circumstances, an indigent defendant would have a right to the appointment of a firearms identification expert.¹¹⁹ Indeed, the failure to retain a defense expert may constitute ineffective assistance of counsel.¹²⁰

CONCLUSION

Like handwriting and fingerprint comparisons, firearms identification testimony has been challenged under the *Daubert* standard. The basic problem with firearms identification, however, remains — lack of empirical testing. This is somewhat mystifying given that *Daubert* was decided fourteen years ago. A British scholar stated it this way: “To put the point more bluntly: if the state does not test the scientific evidence with which it seeks to convict defendants, it should forfeit the right to use it.”¹²¹

In any event, the rules of admissibility have changed. There are no longer free passes to admissibility. The Advisory Committee’s note to the 2000 amendment to Federal Rule 702 states: “If the witness is relying solely or primarily on experience, then the witness must explain how that experience leads to the conclusion reached, why that experience is a sufficient basis for the opinion, and how that experience is reliably applied to the facts.”

¹¹⁸ Lowell W. Bradford, *Problems of Ethics and Behavior in the Forensic Sciences*, 21 J. FORENSIC SCI. 763, 767 (1976) (quoting *Report of January 1970 Grand Jury*, U.S. District Court, Northern District of Illinois, Eastern Div., at 121).

¹¹⁹ The right to expert assistance is discussed in Paul C. Giannelli, *Ake v. Oklahoma: The Right to Expert Assistance in a Post-Daubert, Post-DNA World*, 89 CORNELL L. REV. 1305 (2004). See also Michael J. Yaworsky, Annotation, *Right of Indigent Defendant in State Criminal Case to Assistance of Ballistics Experts*, 71 A.L.R.4TH 638 (1989).

¹²⁰ See *Soffar v. Dretke*, 368 F.3d 441, 476 (5th Cir. 2004), amended on reh’g in part by, 391 F.3d 703 (5th Cir. 2004) (“We also agree with Soffar that his defense counsel were deficient in not seeking out a ballistics expert when there were such readily apparent discrepancies between the ballistics evidence and the State’s theory of the case.”).

¹²¹ MIKE REDMAYNE, *EXPERT EVIDENCE AND CRIMINAL JUSTICE* 139 (2001).