B118 History of Identification Criteria in Firearms and Tool Marks Examinations

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The goals of this presentation are to present to the forensic community a discussion of the historical development of identification criteria for the firearms and tool mark identification discipline, including qualitative and quantitative criteria.

Along with all other disciplines within the forensic science community, the firearms and tool mark identification discipline is coming under much closer scrutiny within the courtroom. The primary concern appears to be the ability to articulate one's criteria for identification. The purpose of this presentation is to provide the audience with a thorough discussion of the historical development of identification criteria for the firearms and tool mark identification discipline, thus providing a foundation for those seeking to better articulate their own criteria for identification. In addition, this presentation seeks to examine the current stateof-the-art in context of recent court decisions and to provide better education with regard to the oft-misunderstood concept of consecutive matching striations (CMS).

The foundational question within all identification disciplines seeks to discover the basis for any identification that was effected. A recent court decision, *Ramirez v. Florida* (December 2001), has made it apparent to the end-users of forensic services that there are no standard criteria for identification. Further, what criteria that does exist is subjective and differs from examiner to examiner. This presentation will work from this foundational question to demonstrate that there is a basis for standardized criteria for identification, and that it is not as subjective as it may appear to the end-user.

One of the relevant historical debates that will be addressed in this presentation is the question of whether firearms and tool mark identification is an art or a science and whether it is objective or subjective. It will be demonstrated that rather then being mutually exclusive of one another, each word has a place and a role within the discipline and that there is nothing about the four terms that should cause one to look askance at the discipline, provided that their place and role is properly articulated.

There is a current, accepted standard criterion for identification offered by the Association of Firearm and Toolmark Examiners (AFTE), published in 1992. A committee that was formed in 1985 by the Association formulated this criterion for identification. It is based on a plethora of studies performed in the discipline, fifty-two that are summarized in the presentation. Published in the forensic science literature since 1942, these articles deal in some part with the ability of the examiner to identify the tool responsible for producing a particular tool mark. These articles deal with a variety of tools including bullets and barrels (qualitative and quantitative studies), cartridge case markings, screwdrivers, bolt cutters, knives, pliers, and others. In addition, several articles deal with mathematical and computer models along with statistical concerns.

Within this selection of articles, several deal with the concept of consecutive matching striations (CMS) as a basis for developing identification criteria for striated tool marks. This approach simply describes the pattern that is being observed and this quantitative description is then compared against a threshold that has been established through repeated testing under different circumstances and test variables. It is important to understand that CMS is not an alternative to what has been referred to as the traditional pattern matching approach, but simply permits a more standardized means of communicating and articulating the basis for an identification, inconclusive or exclusion.

First proposed in 1997 by Biasotti and Murdock (*Modern Scientific Evidence: The Law and Science of Expert Testimony, Volume 2*, Chapter 23, pages 131-151, 1997), the minimum criterion for identification was based on cumulative data gathered during CMS exercises with students and other casework and studies published between 1957 and 1997. This criterion states that for three dimensional tool marks, when at least two different groups of at least three consecutive matching striae appear in the same relative position, or one group of six consecutive matching striae are in agreement in an evidence tool mark compared to a test tool mark, then an identification as to a single source may be declared. For two dimensional tool marks, when at least two groups of at least five consecutive striae appear in the same relative position, or one group of eight consecutive matching striae are in agreement in an evidence tool mark compared to a test tool mark, then an identification as to a single source may be declared. They do indicate that in order to apply such criteria, the possibility of subclass characteristics must be ruled out.

Extensive testing has supported the use of the conservative criterion for identification, in that use of this criterion would not permit even a single false identification in any of the work published to date, which includes 2,908 known non-matching 3-dimensional impression comparisons and 800 known non-matching 2-dimensional impression comparisons. Testing performed by the author on bullets known to have been fired from consecutively manufactured barrels and tool marks made by consecutively manufactured knives has also support the use of this criterion.

CMS is not a substitute for or in conflict with the traditional pattern matching approach. Pattern matching has a quantifiable aspect whether it is conscious or subconscious. CMS is simply a conscious tabulation of that

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quantifiable aspect. The traditional pattern matching approach defines an identification in language that is relative and non-specific, thus susceptible to communication and articulation difficulties. Using CMS, the examiner can easily articulate the basis for an identification in language that is consistent and easily understood by colleagues and the end-user.

In summary, there is a wealth of published literature dealing with identification criteria in the firearms and tool mark discipline. The literature that examines the quantitative aspect of pattern matching, i.e., consecutive matching striations, strongly supports the use of the conservative criterion for identification as proposed by Biasotti and Murdock. Understanding the available information should allow the firearms and tool mark examiner a solid foundation upon which he or she can develop a well-articulated criterion of identification.

Firearms and Tool Mark Identification, Criteria for Identification, Consecutive Matching Striations (CMS)

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