C17 Theory of Tool Mark Identifcation

Ronald R. Scott, MA, MS, Arizona Ballistics & Firearms, 37881 North 10th Street, Phoenix, AZ 85086*

The goal of this presentation is to provide an appreciation and explanation of the theory of tool mark identification based on the hypothesis that "sufficient agreement" can lead a qualified firearms examiner to correctly identify tool marks which originate from a common origin; image exemplars will provide insight into the physical factors of general, sub-class, and individual characteristics which can lead to conclusions of identification, elimination, or inconclusive.

This presentation will impact the forensic science community by raising awareness of the underlying principles, methods, and procedures which must be applied by forensic examiners to interpret the comparison of tool marks on various items of evidence within the parameter of guidelines for reliability and validity as determined by the courts under *Daubert* and similar standards, the AFTE Theory of Identification, and will address the impact that external influences play in reported opinions.

Hypothetical Propositions:

1) Tool marks imparted to objects by different tools will rarely, if ever, display agreement sufficiently to lead a qualified examiner to conclude they were created by a single tool.

2) Most manufacturing processes involve the transfer of rapidly changing or random marks onto work pieces such as barrel bores, breechfaces, firing pins, and working surfaces of other common tools. Caused principally by the phenomena of tool wear and chip formation. Microscopic marks on tools continue to change from further wear or abuse.

Summary: Debate continues on the issue of tool mark identification and its impact in the legal arena. Decisions made by the courts in cases such as *Daubert* and *Frye* have brought the discipline under immense scrutiny. Supporters and foes have both put forth arguments which address reliability and validity of the physical tool mark and the issue of subjectivity in reaching conclusions.

The Association of Firearms and Tool Mark Examiners (AFTE) is widely recognized as the leading organization in this discipline and courts will reference the theory when making rulings.

The Theory of Tool Mark Identification is comprised of three main components:

1) Opinions of common origin can be made based on the principle of "sufficient agreement".

2) "Sufficient agreement" is defined by the pattern or combination of patterns of surface contours and that significance is determined by comparative examination of physical attributes which can indicate that agreement is significant when it exceeds the best agreement demonstrated between tool marks known to have been produced by different tools and is consistent with the agreement demonstrated by tool marks known to have been produced by the same tool and that the likelihood that another tool could have made the tool mark is so remote that it should be considered a practical impossibility.

3) Currently the interpretation of individualization/identification is subjective in nature, founded on scientific principles and based on the examiner's training and experience.

Numerous studies have been published which purport to show that the qualified tool mark examiner can identify marks of a single origin. These are based mostly on studies of "consecutively manufactured" firearms, or parts of firearms. However, not all studies provide adequate information indicating that the acquisition of these items was accomplished by monitoring the manufacturing process to ensure consecutiveness. Other studies involve the comparison of projectiles and/or cartridge cases fired in one firearm with conclusions being drawn after pre-determined quantities of shots being fired which are then compared for changes from prior shot batches.

The common denominator in all tool mark comparison is the subjectivity of each examiner in how he interprets the evidence and applies the theoretical principles for "sufficient agreement." Unlike DNA or other hard sciences, tool mark identification does not provide an objective standard on which to reach a conclusion.

Providing that the evidentiary item is suitable for comparison, the three conclusions available to examiners are "Identification", "Elimination", and "Inconclusive".

Some crime labs have adopted policies which influence the independence of the examiner. These include policies where the examiner is prohibited from reporting an elimination if the general class characteristics agree regardless of any significant disagreement of individual characteristics.

Another policy which places external influence on the opinions of examiners is when there are differing opinions between the primary examiner and the verifying examiner in the same lab. Protocol calls for them to attempt to rectify their differences before going to court and it is rare that a unified conclusion is not published. Instead, many labs interject a process which requires a board to review the circumstances and issue a decision. This means that the opinions of the examiners are overruled by personnel who may not be qualified to do so.

 ** Presenting Author*

Subjectivity could result in two examiners comparing tool marks on evidence and reach the same conclusion based on viewing differing areas of the evidence, or differing opinions even when examining the same tool marks. This is because each tool mark examiner is drawing upon his/her own experience and would be influenced by the standards of his/her mentor.

Under current methodology, the ability to determine and initiate a uniform national standard which must be met is under study but this is in its infancy. Until a standard is determined, if ever, the courts will continue to be the gatekeepers to evaluate whether expert testimony meets the prong of whether the expert is qualified to give the testimony, and the two *Daubert* prongs.

The relevancy prong: The relevancy of a testimony refers to whether or not the expert's evidence "fits" the facts of the case.

The reliability prong: The Supreme Court explained that in order for expert testimony to be considered reliable, the expert must have derived his or her conclusions from the scientific method.

- Empirical testing: the theory or technique must be testable.
- Subjected to peer review and publication.
- Known or potential error rate and the existence and maintenance of standards concerning its operation.
- Whether the theory and technique is generally accepted by a relevant scientific community.

The majority of rulings made by the courts when there are opposing expert opinions is that those conclusions are issues for the jury to decide providing that the relevance and reliability prongs have been met. **Tool Mark Orgins, Sufficient Agreement, Subjectivity of Opinions**

 ** Presenting Author*