



A166 The Relevance of Firing Pin and Breechface Scores in the Interpretation of Firearms Evidence

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After attending this presentation, attendees will understand how firing pin and breechface scores can be used to interpret firearms evidence and provide a clearer understanding of variability within firearms.

This presentation will impact the forensic science community by providing greater understanding of the underlying features of impression evidence and how to apply such knowledge during examination.

The terms class- and individual-characteristics are used on a daily basis in the practice of forensic science. There are, however, various interpretations and usages of these terms in the general literature. Generally, a classification process is considered to be grouping of results based upon the outcome of a particular analytical method. The examination of impression evidence is a basic classification problem (match/non-match). Identification, or individualization, is sometimes thought to be the summation of a variety of multiple characteristics until a unitary class is developed. According to the Association of Firearm and Tool Mark Examiners (AFTE) in their *theory of identification*, the concept of *sufficient agreement* is achieved when the agreement: (1) exceeds the best agreement demonstrated between tool marks known to have been produced by different tools; and, (2) the agreement is consistent with tool marks known to have been produced by the same tool.

Conceptually, an analyst needs to understand both the variability of the characteristic being evaluated within the sample under consideration as well as the variability of the same characteristics within the relevant population of similar objects. In order to apply the mechanism of *sufficient agreement* when considering firearms, one needs to evaluate these characteristics. To consider firing pin impressions on a cartridge case, it is necessary to study its variability within a particular firearm. It is possible or likely that factors such as the type of ammunition, primer type, rate of fire, and the structure of a particular cartridge will influence this variability. Second, it is necessary to understand the variability within the particular make and model of the firearm. Third, how the characteristics of the particular type of firearm and the general class of caliber will influence the comparison must be understood.

The challenge in a firearms examination is that, in many cases, there is but a single cartridge case from the scene. The firearms examiner may collect two, three, or five cartridge cases from a suspect firearm to serve as controls for the comparison. The inter-variability of these cartridge cases is evaluated and a representative cartridge case is used to affect the comparison. Commonly, the firearms examiner will evaluate the evidence using a comparison microscope. Another tool in their arsenal is the Integrated Ballistic Identification System/National Integrated Ballistic Identification Network (IBIS/NIBIN) System (Forensic Technologies Inc./Bureau of Alcohol, Tobacco, Firearms and Explosives). The IBIS system provides scores between the firing pin, breech face, and ejector marks of a cartridge against those in the database. Generally, the system is used to identify links between cases.

In this study, 100 cartridges were fired through 16 9mm firearms. All of these cartridge cases were entered into the system and their breech face and firing pin images were collected. Within the database all unidentified firearms/cartridge cases were designated unknown. All firearms entered were newly purchased. The images were then correlated against the database and the full list of candidates and their scores were obtained. A match was designated between the sample and database cartridge if both were fired from the same firearm (irrespective of the score). All other records were designated as a non-match. The SigSauer® P250 was run against the database and generated 17,478 records. All records were classified as either match or non-match. The resultant plot of the firing pin against the breech face scores indicates the variability in both. A distinct separation between the P250 and all other firearms are given. Unknown plots of background data are used in this study.

Generally speaking, the data suggest that discrimination within the dataset is affected by the size of the database and the type of firearm. The variability in cartridge cases (as demonstrated by their scores) for a single firearm is significant. This variability may mask the effect of other variables.

Firearms Examination, Evidence Interpretation, IBIS