A27 Variability in a Mossberg Model 500 Shotgun's Firing Pin and Breech Face Impressions

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After attending this presentation, attendees will understand how firing pin impressions correlate back to a specific shotgun, and how this information helps fill the gap between the uniqueness of shotgun evidence and its interpretation.

This presentation will impact the forensic science community by providing statistical data that helps support the reliability and use of the IBIS within the justice system.

The purpose of this study is to examine the precision (inter-day variability), repeatability (intra-day variability), reliability (consistency and stability of results), and correlations (degree to which variables are related as opposed to causality) between firing pin and breech face impressions in shotgun evidence.[5]

There is much controversy related to firearms evidence, specifically, in analyzing the relationship between crime scene evidence and evidence found in the possession of a suspect. Minimal research exists investigating the value of this evidence. Ogihara *et al*., (1983) and Shem & Striupait (1983) performed comparisons of 5001 and 501 consecutively fired bullets with .45 and .25 caliber semi-automatic handguns, respectively, by firing pin impressions.[1,2] Grove, Judd, & Horn (1972) also examined firing pin impressions using scanning electron microscopy.[3]

The research used the Integrated Ballistics Identification System and a Leica FS-C comparison macroscope. The IBIS system uses bullets and casings from case evidence from a crime scene and compares them to a database of known fired weapons. IBIS consists of a fully automated projectile and cartridge case comparison systems, BULLETPROOF® and BRASSCATCHER™, respectively.[4] These systems allow the IBIS examiner to compare across a known database within minutes. IBIS provides a relative score for each comparison, and a list of highest matching breech face and firing pin scores is generated that represents the highest matching comparisons in the database.[4]

The Leica FS-C comparison macroscope was used to test the reliability of the IBIS. The reliability was tested by using best known non-matches when present. The macroscope compared those to other casings that have been integrated into the IBIS and known to have been fired using the same firing pin. The FS-C was also used to compare the firing pins against corresponding firing pin impressions.

A Mossberg Model 500 twelve-gauge shotgun was used to perform all test firings. Remington ammunition (2¾ Express,) was used while varying the pellet size (00, #4, #6, and #8 (all lead). The firing pin in the shotgun had an unknown history. The firing pin scores generated with this firing pin were used as a baseline. All tests were repeated with four new firing pins.

The test fires were conducted at an outdoor shooting range and each shotshell was collected directly after firing. Upon logging the shotshells, they were then entered in the IBIS system and the correlation worksheets were generated.[4] The breech face and firing pin scores were analyzed using Microsoft Excel™. The effects of shot type on firing pin scores were evaluated. The intra-variability and inter-variability of firing pin scores relative to individual firing pins were contrasted. Receiver Operating Characteristic curves demonstrating the ability of using the firing pin score to effect identification was constructed. Since the breech face impression of all shots fired remained constant, it provided a basis for evaluating the intra-variability of breech face scores, and allowed for the examination of cartridge cases in firearms where the firing pin has been modified or replaced.

The data was evaluated to test the following hypotheses: (1) there is a higher correlation between the same load sizes shot from the same firearm (or the intra-variability of different load sizes fired by the same firearm is smaller than the inter-variability of varying load sizes); and, (2) fired ammunition will have higher breech face and firing pin scores when comparing intra-firearm scores and inter-firearm scores.

The data was exported into Netica™, a program for designing decision diagrams. A Bayesian network was created using the data to represent the variability relationships graphically. The output was a likelihood ratio estimating the probability of the prosecutorial hypotheses relative to the probability of the defensive hypotheses thus providing an indication of the weight of the evidence.

References:

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 ** Presenting Author*

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Firing Pin, IBIS, Mossberg Model 500

