B135 Quantitative Assessment of the Accuracy of Fiber Comparisons

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Attendees of this presentation will learn about a framework developed for assessing the accuracy of experience-based analytical methods, which can be applied to a variety of trace evidence types, and the application of this model to fiber comparisons.

One interpretation of recent Supreme Court rulings that address the admissibility of expert opinion testimony, such as *Daubert* and *Kumho*, is that analytical method error rates must be known and quantifiable. This has traditionally been difficult for experiential examinations, such as microscopic comparison of fibers. Additionally, it has been difficult to quantify the amount, if any, of improvement in discrimination obtained by the addition of another analytical method to an existing protocol. In this study, a blind-testing protocol using gray automotive carpet fibers was defined and evaluated as a model for assessing the accuracy of experienced-based analytical methods. Such a protocol may provide a numerical estimation of the frequency of correct identification of fiber sources, as well as aid in the comparison of current and proposed analytical methods in fiber comparison protocols. The forensic science community may also implement the framework developed in this study to assess analytical methods in individual laboratories for a variety of trace evidence types.

The sample set selected for this blind test is a set of 30 gray nylon automotive carpet fiber samples from several sources, the total of which is less than the number of samples (i.e., some sources may appear more than once in the test set). Macroscopically-similar gray nylon fibers were selected as the test set in order to assure a level of difficulty that would adequately test the discrimination capability of fiber examinations as performed by experienced fiber examiners. The fibers were collected from late model (1990-1999) automobiles with interior carpets that were nominally gray in color. Whenever possible, fiber samples were taken from two diagonally opposite distant locations (front and back) within the vehicle in order to obtain a measure of the variability of the carpet within the vehicle. This sampling approach should identify the presence of multiple carpet sources within the vehicle, if present. Fiber samples were coded so that the identities of the vehicles from which they originated were unknown to the examiners.

Because of the experiential nature of fiber comparisons, this project required much time investment from qualified fiber examiners. Using the FB protocol for casework, comparisons of all pairwise combinations (435 pairs) of these fiber samples were performed independently by two experienced fiber examiners. Notes and measurements for all properties compared were recorded in order to permit the determination of the sensitivity and specificity of each analytical measurement. For the purposes of this study, all optical microscopical measurements were considered as one analytical measurement. The results provide a numerical measure of the number of incorrect associations (more appropriately expressed as a lack of distinguishable features among fibers from two sources) and incorrect exclusions for each analytical method used. The robustness of the statistics is controlled by selection of the number of samples and sources. Using this model, the effects of variables such as analytical method and specific fiber characteristics can be tested. The evidential value of the addition of non-routine tests, such as elemental analysis, to the analytical protocol for source discrimination was also assessed with this model.

This paper will detail the salient features of the test design and present its application to fiber comparisons. An evaluation of the results of this blind test, using fiber comparisons, and an assessment of the relative discrimination capability of each analytical method, including elemental composition, will be presented.

Fibers, Criminalistics, Trace Evidence

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