D28 Do I Really Have to Measure Everything Twice in My Forensic Investigation: Isn't Error Analysis Just Something One Does in Bench Science?

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After attending this presentation, attendees will be provided with an orientation to uncertainty estimates in the reporting of forensic conclusions and, in particular, to the talks immediately following which will explore the topic in detail.

This presentation will impact the forensic science community by providing one of the most important of the recommendations of the 2009 National Academy of Sciences (NAS) Report, *Strengthening Forensic Science in the United States: A Path Forward*, dealing with forensic practice in the United States.

This presentation leads off a half-day program examining the aspects of reliability analysis across a wide range of forensic practices. To set the stage for this program, it appears useful to lay out the reasons why such an examination is important so long after the NAS Report that sent shock waves through the public, this country's system of justice, and the forensic community. The shock came from the NAS Report's pointing to serious shortcomings in the practice of forensic science in this country. One of these shortcomings was the lack of appreciation the NAS Report's authors found of the importance of reliability analysis applied to stated forensic conclusions: "Few forensic science methods have developed adequate measures of the accuracy of inferences made by forensic scientists. All results for every forensic science method should indicate the uncertainty in the measurements that are made, and studies must be conducted that enable the estimation of those values."[1]

This statement is embedded in several of the Report's thirteen recommendations, especially Recommendation 3 (Ibid, page 190.) Since the February 2009 issuance of the Report, the resolve within the forensic scientific community and within all three branches of the federal government to act has been mounting year by year. This reaction began within the American Academy of Forensic Sciences, which in August 2009, following Academy-wide consultations, endorsed all thirteen of the NAS Report's recommendations.

With all of the efforts expended, by forensic practitioners, by professional forensic organizations, and by the United States Congress and the White House, why is it still necessary to take time to address one of the most fundamental aspects of the NAS Report's observations, the need to report forensic results in such a manner that those receiving them can immediately grasp their reliability? Where the results are in numerical form (for example, the weight of a drug sample, the impact speed of a wrecked train, the relative humidity the night a crime took place), the reliability can be stated in terms of the likelihood that the number given could deviate by as much as plus or minus 10% from the true value. If that likelihood is very low, one might conclude that the result given was quite reliable, and conversely. Regardless of that likelihood, the conveyor of the number would have done his or her duty scientifically. If the numerical result is presented in naked form, with no "error bars," those receiving it have no way to weigh its importance and, in a scientifically ideal world, should not accept it.

But many forensic results (for example, the medical testimony that a deceased person died from a blow to the head) are not delivered in the form of a quantitative statement. Nevertheless, in addition to stating the basis for such qualitative conclusions, the person delivering them should be able to estimate the likelihood that he or she is incorrect. That is the way science must be done and forensic science should be no different.

Furthermore, as stressed by the NAS Report backed by the American Academy of Forensic Sciences through its 2009 Position Statement, if reliability estimates in a particular field are impossible or difficult to accomplish, the work necessary to correct this situation must be done and the results presented in the peer-reviewed literature.

The acceptance of the need to make quantitative reliability estimates varies across the forensic practice fields. For those that are specialized applications of a broader scientific tradition, the need to provide "error bars" with results has always been recognized. For those that originated with police practice, not so much. That there still exists resistance in some of the latter fields appears to result from two distinct problems. The easiest of these to deal with is actually one of the problems spotlighted by the NAS Report: the need to have a uniform nomenclature understood across all types of forensic practices. It should be added in connection with reliability estimates that there must be agreement across the practices as the words to be used with such estimates. It has been repeatedly noted that certain classes of practitioners strongly resist using such words as "error" and "uncertainty." Given the baggage that these words carry from the non-technical society, such resistance should not be criticized. Rather, there has to be a broad-based attempt to settle on words that convey what needs to be conveyed in the scientific context without at the same time smuggling in misleading meanings from the world at large.

The other problem that needs to be overcome is a conceptual one. Most simply, it can be illustrated by the question: What relevance can studies of error over the last ten years across the entire field of handwriting identification have to assessing uncertainty in the work of a *specific* examiner in a *specific* case today? In order to achieve the goal of habituating all forensic practitioners to providing quantitative reliability estimates to all their conclusions, this question has to be answered in a convincing manner.

Reference:

1. 2009 National Academy of Sciences Report, Strengthening Forensic Science in the United States: A Path Forward, *The National Academies Press*, Washington, DC, 2009, page 184.

Reliability, Error Rate, Uncertainty