F38 Are All Instruments Always Valid and Reliable in Ascertaining a Crime?

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After attending this presentation, attendees will better understand of the role of instruments and metrology in forensic sciences and whether instruments used in ascertaining crimes are valid and reliable, under the considered circumstances, in order to help the trier of facts in employing the results of scientific tests and in rendering a decision beyond any reasonable doubt.

This presentation will impact the forensic science community by providing a clearer insight into the basic concepts of metrology and illustrating that instruments often used to understand how a crime has been committed and who committed it are not always valid and the obtained result is not totally reliable. This presentation will broaden understanding among the law community of how the fundamental concepts of metrology can help clarify how valid and reliable the measurement results are and, consequently, quantify the doubt on how correct a decision is based on an experimental test.

Forensic measurements are an important source of evidence in criminal trials and investigations. As a result, metrology, the science of measurement, is critical to both the field of forensic measurement as well as the implementation of justice.[1,2] The ubiquity of measurement tools in daily life leads to their often being employed outside their primary scope in an attempt to ascertain facts or provide scientific support to other propositions and pieces of evidence. One of the most commonly used such instruments is the cell phone as its location in space and time can be estimated utilizing phone company records and triangulation measurements. This makes it possible, in principle, to locate a suspect by tracing his cell phone.

More recently, smart meters have been used in Italy to assess, through the analysis of the electric loads in use in the victim's house, when the murder has been committed and to verify the defendant's alibi. Other measuring instruments are similarly used in so-called technoprisons, to locate prisoners and identify their activities.[3]

Such unvalidated use of these instruments raises critical questions about the reliability and validity of the use to which they are put. It is generally accepted that a measurement is valid to the extent that the instruments relied upon are employed within the primary scope for which they have been designed and validated.[4] On the other hand, metrology clearly shows that measurement results are never totally reliable and quantifies the lack of total reliability with the metrological concept of measurement uncertainty.[5]

It is evident that a cell phone's primary function is to facilitate communication, and that the ability for it to assist in determining locations is more an accidental consequence of the way it is operated. Similarly, the primary function of a smart meter is measuring the electrical energy flowing in through a meter, not that of tracking the time of operation of the single loads. When such measurements are made utilizing instruments beyond the scope of their validation, the reliability of measured results must be carefully considered in order to avoid drawing incorrect conclusions. This will be discussed in addition to some practical examples illustrating the limits of the validity of measurement results obtained utilizing instruments outside their scope of validation.

Reference(s):

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Forensic Metrology, Measurement Uncertainty, Improper Use of Instruments