F20 Quantification of Scientific Opinions and the American Jury System

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The goal of this presentation is to share concerns with colleagues regarding the conceptual incompatibility of quantification of forensic opinions with the heuristic of the American jury.

This presentation will impact the forensic science community by encouraging thought as to whether quantification is compatible with the current American jury system heuristic. If not, judges, lawyers, and forensic scientists must find ways to adapt the jury system and its present heuristic to a new paradigm that integrates quantification.

Opinions of forensic scientists are generally quantified either in numerical terms or value language that suggest a numerical quantification. Currently, quantification of DNA evidence is typical, but there is an effort to quantify fingerprints, pattern evidence, ballistics, and others. The American jury is not educated in statistics nor in how to integrate quantification into their deliberations. Jurors are generally asked to "weigh" evidence and compare it to a vague "burden of proof" in determining which party wins.

The folk ideal of the American jury is one in which the jurors deliberate impartially, weighing each part of the evidence, considering all the evidence, and then "applying" it to the law; however, the folk ideal of the American jury is seldom, if ever, met in practice. Jurors are human and subject to bias and prejudices, and they are not equipped with the knowledge required to perform statistical analysis. As a result, they employ a folk heuristic.

Lawyers, judges, and forensic scientists must evaluate whether quantification — presenting evidence of Frequentist (F), Random Match Probability (RMP), Likelihood Ratios (LR), Bayesian Analysis (BA), or Bayesian Network analysis (BN) — is compatible with either the folk ideal or the heuristic that characterize the American jury. In other words, if an expert expresses an opinion as to one item of evidence (by F, RMP, or LR) or an opinion about the interrelation of one item of multiple items of evidence (by BA or BN), is this compatible with how the American jury functions ideally or in practice?

It is the position of this presentation that quantification is not compatible with the current American jury system. Juries, in fact, engage in a type of largely non-numerical BN analysis. On a good day (when they do not corrupt the process with, for instance, bigotry), they give some type of folk quantification to the individual pieces of evidence. They then evaluate the evidence as a whole using a heuristic similar to a folk BN analysis, which is then compared to a vague standard of the burden of proof. The jury's enterprise is that of uncertainty, just as is the statistician's. The folk ideal is that the American jury will make an overall network analysis resulting in an LR that favors the unknowable truth within the tolerance stated in the burden of proof.

It is observed anecdotally that expert opinions may carry too much or too little weight with jurors. This intuitive observation is supported conceptually in that quantification by an expert is incompatible with the American jury's heuristic in which one piece of evidence is quantified in a scientific manner and the jury is given no means to integrate that quantification into the heuristic that they are intuitively using to weigh the rest of the evidence. For example, the jury is given the probability of randomly finding a match in a data base (RMP) regarding the DNA profile taken from an object at the scene that corresponds to the defendant's sample. Yet this is only a part of the heuristic by which the jury determines whether the case against the defendant was proven. They weigh this evidence with a network of unquantified evidence before they can weigh whether this quantified evidence even creates a likelihood that the defendant was at the scene (e.g., was the object moved, was there transfer DNA, was the evidence contaminated, was the evidence properly analyzed, was the evidence planted, or was the defendant being framed?). And, if the defendant was at the scene, did the defendant do it? Yet, among these important, unquantified, interrelated, or non-interrelated pieces of evidence, there is a glaring DNA quantification that cannot be statistically multiplied, divided, added, or subtracted with anything else in the jury's analysis.

As we move from quantification of DNA analysis to quantification of fingerprints, pattern evidence, ballistics, and other evidence, thought must be given as to whether quantification is compatible with the current American jury heuristic. If not, judges, lawyers, and forensic scientists need to find ways to adapt the jury system and its present heuristic to a new a paradigm of integrating quantification.

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