

Comment: The Polygraph and the PVP

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Joseph Gastwirth's paper concerns an increasingly important issue affecting public policy—the estimation of error rates in tests for such things as diseases, deception, and drugs. Gastwirth explores the estimator \hat{C} of the predictive value of a positive test (PVP or $P(D | S)$) and the variance of \hat{C} . He explains how \hat{C} depends on the sensitivity η , the specificity θ , the base rate π , and the sample proportion p of those whom the diagnostic test classifies as having the disease. Furthermore, for large samples, he demonstrates how the variance of \hat{C} depends on η , θ , π and the sample sizes used in estimating these quantities.

Not being a statistician, I shall not attempt to address the technical aspects of Gastwirth's analysis. As an attorney, I am drawn to his discussion of the admissibility of polygraph evidence. First, I shall elaborate on his description of the standards for admissibility of such evidence. Then I shall consider the extent to which his analysis of \hat{C} and $\text{Var}(\hat{C})$ might be brought to bear on the legal question of the admissibility of polygraph evidence.

1. STANDARDS FOR ADMISSIBILITY

As Gastwirth observes, the leading case on the admissibility of scientific evidence is *Frye v. United States*, 293 F.1013 (D.C. 1923). Without explanation or precedent, *Frye* created a special test for the admission of scientific evidence—the general acceptance standard. As applied to the polygraph, most scientists in the appropriate fields must agree that conscious deception can be deduced from elevated physiologic responses and that the polygraph accurately detects these responses. In other words, there must be a consensus among scientists that the psychologic theory underlying polygraph testing is valid, and there must be a consensus that the technology for implementing this theory works with reasonable accuracy.

Although many jurisdictions have adopted and adhered to the general acceptance test, a large number have not. Cleary (1983, pages 626–631) collects many of the cases and discusses the merits of the various alternatives. The most popular alternative simply applies the principles of relevance that govern all evidence and the additional constraints on expert testimony generally. Relevant evidence typically is

defined as evidence having any tendency to make the existence of any pertinent fact more probable or less probable than it would be without the evidence. At the same time, it is also recognized that even relevant evidence should be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, misleading the jury or undue delay or waste of time. In addition, to testify as an expert, a witness must possess some special qualifications, and the specialized knowledge that he or she proposes to impart must be capable of assisting the judge or jury.

Although Gastwirth describes the judicial reception of polygraph evidence as “somewhat mixed,” I think it fairer to say that almost all courts exclude such evidence under either of the standards for admissibility outlined above. Within the United States, in only one jurisdiction, New Mexico, is polygraph evidence admitted over the objection of a party. Almost all courts applying the general acceptance standard have concluded that scientific acceptance of the polygraph as a lie detector is lacking. Similarly, almost all courts applying relevance principles have concluded that the balance of probative value and prejudice counsels against admitting the evidence (Cleary, 1983 and 1987 supplement).

2. THE IMPLICATIONS OF ESTIMATING PVP

With this quick and crude sketch of the legal doctrine as a backdrop, I turn to Gastwirth's suggestion that for the purpose of deciding on the admissibility of polygraph tests, “[f]ocusing on C or the PVP, as well as on the sensitivity and specificity may help in the determination of whether a technique is sufficiently reliable in a particular case.” For clarity, it should be noted that when the courts speak of the “reliability” of scientific evidence, they do not mean reliability in the technical sense of statistical precision. They mean that the evidence comes from both a valid and a reliable process of measurement.

In the jurisdictions that require general acceptance, informing the judge or jury of estimates of $P(D | S)$ or its components in a particular case should make no difference. What counts is the attitude of the pertinent scientific community, as expressed in the testimony, publications and professional presentations of these scientists. One premise of the general acceptance test is that the courts are not competent to evaluate scientific disputes for themselves, so that they must rely

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