Letters to the Editor

My attention has been drawn to an article by Mr. Lawson and Dr. Framan (*Journal of Forensic Sciences*, Vol. 18, No. 2, April 1973, pp. 110-117). The authors state that they are using the Karl Pearson chi-squared test for goodness of fit on data in the form of a contingency table. It is with some regret that I suggest this cannot be so, in fact.

On p. 111 they represent two data points (Subjects 1 and 2) in a 7-dimensional log-normal space. Their 2 by 7 form of tabulation cannot by any means qualify as a contingency table. Such a table can refer *only* to qualitative characteristics and each member of the total frequency (here equal to two) is allocated according to two such bases of classification. For quantitative characteristics there can also be a form of two-way table but it is *not* a contingency table.

Also on p. 111, it is clear that the authors are using a bastard interpretation of the chi-squared statistic as some measure of distance between the two sample points in the 7-dimensional space. This is certainly no "goodness-of-fit" test since that test requires the chi-squared statistic to be referred to its sampling distribution with appropriate degrees of freedom. It may also be noted that there are other more appropriate measures of distance between sample points in multidimensional space.

For the kind of data under discussion by the authors, there are methods of statistical analysis already noted in the literature of forensic sciences as well as the third reference quoted in the paper.

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Authors' Reply

We have read Dr. Buckland's letter concerning our paper, "Numerical Correlation and Evaluation in the Comparison of Evidentiary Materials." We maintain that our utilization of the chi-squared statistic as a measure of goodness of fit, as shown in the paper, is sound and not some "bastard interpretation." Its use in comparing observed and expected sample distributions is well documented. In a rigorous sense, the comparison of two curves using this approach is valid regardless of which is termed "observed" and which is "expected." With a multiplicity of curves, any one can serve as the expected and the others would reference to it. By rotating the "expected" label among the curves, one obtains a set of results as shown in the evaluation array of Table 2B, p. 112 of the paper. One must further remember that the purpose of the denominator in the chi-squared formula is to provide a weight to each measurement along the curve. The intent and utility of this is, of course, retained in the demonstrated application. It should be eminently clear that in the proposed forensic application, one must be cognizant of what one is in fact doing, taking care in maintaining consistency in laying out arrays and in the evaluation of them. As noted in the paper, the lack of a clear criterion suggests retaining both chi-squared values at this time. This will present no problem if one remains aware of their derivation.

Regarding the contingency table, a standard mathematical dictionary definition was used (James & James, *Mathematical Dictionary*, 3rd ed., Van Nostrand Reinhold, New York, 1968), and as an added precaution we included a glossary of terms at the end of the paper.

Both the authors feel that more research should be conducted in the area of forensic statistical methods with an emphasis on general usage in the criminalistic laboratory.

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