

November 16, 1998

Dr Y Harvey, President
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Dear Sir:

For your perusal I enclosed copies of correspondence with Dr J E Udd, Chairman, CIM Central Publications Committee, and some notes on the differences between applied statistics and geostatistics. Before I explore these differences with you, I want to pose a few questions. Did the President of the CIM Geological Society give his own opinion or that of his Members when he alluded to "*the glorification of applied statistics and analysis of variance*" in a letter to The Northern Miner? Did he write his letter on CIM letterhead? Does CIM's Code of Ethics allow your Officers to advance their own agendas? Given that applied statistics predates geostatistics, and that it has served science and engineering so well, do you agree with his comment? Do you not agree that the fundamental differences between geostatistics and applied statistics ought to be debated in a public forum. Do you not agree that such a debate would be in the best interest of our industry?

It is fortuitous that you have followed several courses in geostatistics. I trust that Soquem's library has a copy of David's "*Geostatistical Ore Reserve Estimation*". Please take a look at Table 1.IV on page 25 and you will find an accidental reference to those much maligned degrees of freedom. Nowhere else in David's work, not even in the index, do degrees of freedom surface again! Please take a look at *A remark about Student-t* on page 34. The values of the t-distribution are *not* a function of n , the number of samples, but of $df = n - 1$, the degrees of freedom for a randomly distributed set of n measured values, or of $df = 2(n - j)$, the degrees of freedom associated with the j th variance term for the ordered set.

In October 1992, a prominent geostatistical theorist declared my work "*too encumbered with degrees of freedom*". In April 1995, a reviewer declared degrees of freedom irrelevant not only in geostatistics but also in applied statistics. That edict much amused, if not perplexed, colleagues on technical committees on sampling and applied statistics. Geostatistics has its roots in probability theory and applied statistics where the corollary of the requirement of functional or mathematical independence is the concept of degrees of freedom. Thus, degrees of freedom will remain relevant until probability theory is repealed.

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On page 34, David struggles with *independent* but the fundamental difference between functional dependence and associative dependence is beyond his grasp. In Figure 203 on page 286, the author displays a pattern of sixteen points, each *estimated* from the same nine holes, and explains how to *calculate* such *estimates*. In applied statistics, each point is a functionally dependent variable of the same set of measured values, and each has its own variance. In geostatistics, the kriging variances of sets of kriged estimates somehow make sense!

On the same page David pontificates that *writing all the necessary covariances for that system of equations might be a good test to find out whether one really understands geostatistics*. I propose that *calculating the degrees of freedom for that system of equations might be a good test to find out whether one really understands applied statistics*. Indeed, page 34 inspired a statistical proficiency test (see attached copy), the significance of which continues to elude CIM's presidents and reviewers alike. Did any of your predecessors ever contact a mathematical statistician at a Canadian university to find out what functional independence and degrees of freedom are all about? Will you, too, accept that such rudiments are irrelevant?

My views are detailed in "*Applied Statistics in Mineral Exploration*" (Mining Engineering, February 1997) and in "*Abuse of Statistics*" (CIM Bulletin, January 1993), but neither has prompted a single response. That evasiveness flies in the face of the furious protestations by anonymous reviewers in response to papers with unpopular opinions on geoscience fiction by consensus.

I have submitted for review a paper presented at the PDAC Seminar on *The Role of the Economic Geologist in Financing Exploration and Mining Projects*. I shall not revise it either to appease CIM's "*competent people*" or to comply with CIM's geostatistical teachings. A copy of my letter, and of your reply, will be mailed to others who care about professional ethics and scientific integrity. Bre-X proved that the principles of probability and statistics cannot be ignored with impunity but the President of the CIM Geological Society is troubled by "*the glorification of applied statistics and analysis of variance*". He ought to respond to criticism in a public forum.

Yours truly,

J W Merks
President

Miscellaneous Enclosures