suppose we have, say, a complex chemical system for which k kinetic models are considered, all of which happen to be totally wrong. Suppose that one of these wrong models nevertheless produces a posterior probability say 20 times as large as its nearest competitor. It can still be true that residuals from this best wrong model will be many times their standard deviation and so on a frequentist's argument will indicate lack of fit. Consequent study by a subject matter specialist of the pattern of these residuals and of appropriate diagnostic checking functions could suggest a different model or class of models not previously conceived of. This use of Bayes' theorem for the purpose of criticism would thus seem to abort the scientific process. Arguments of equal force can be made against frequency theory when used for estimation. The scientist and engineer are rightly suspicious of statistical procedures that seem to hamstring their creativity.

Comment

A. P. Dempster

I am an active supporter of the main thrust of Glenn Shafer's remarks, both on the need to restore the subjectivist interpretation of probability to a central position that forms a unified whole with frequentist interpretations and on the need to reform and revitalize departments of statistics by redesigning and strengthening ties to less mathematically oriented disciplines. The near term health and long term survival of statistics as an independent academic discipline depend on departmental policy discussions, for example on curriculum, recruiting and promotion, that place these items high on agendas.

Views may differ on details and strategies. For example, I see the main ideological split lying not between frequentism and subjectivism, where as Glenn says the debate long ago grew stale. Rather it lies between advocates of a nearly exclusive emphasis on methods, and proponents of formal reasoning about uncertainty, whether in the spirit of R. A. Fisher, or in the similar but more recent style of Bayesian or belief function modeling and inference that appears to me to be the obvious and natural way to do statistical science. As with the related but narrower differences between frequentists and subjectivists, there is in fact a fundamental unity between methods and reasoning, in the sense that the former are vehicles for the latter. What does not fly, in my opinion, is the widespread tacit assumption that statistics is mainly about choosing and applying correct or good methods. We need to learn how to understand and teach a more active logic of the processes of doing statistics, including formal probabilistic reasoning about uncertainty.

Glenn is on target when he argues that joint appointments based on the model of statistical technology flowing from core departments to users is rapidly losing viability as user fields become increasingly technical and able to produce their own technologists. In a sense, we have succeeded too well at that game and must use our wits to stay several steps ahead of the competition. As Glenn suggests, emphasis on mathematical statistics, however high its quality, is unlikely to produce the required innovations. I do, however, see a long term market niche for mathematically talented individuals able to match understanding of empirical phenomena with formal mathematical representations of both the phenomena themselves and the scientist's uncertain knowledge of the phenomena. Such work concerns not statistical generalities, but specific problem-solving in many fields and opens the way to a multitude of creative initiatives in the way mathematics is used. The successful statistician will be a generalist drawing on knowledge and experience gained from several fields and will base competitive advantage on having broad understanding and knowledge of statistical methodologies that training in a particular user discipline can rarely provide.

Each institution needs to develop fitting mechanisms that promote and sustain live connections between the statistical generalists that I see occupying the core of our discipline and both mathematicians and substantive researchers. For instance, Glenn points to the need to teach students in the biological and social sciences "not only the logic of the subject [of statistics] but also the decades-long record of its successes and failures in their discipline," and in effect links the excessive mathematization of statistics to our failure to develop teachers sufficiently broad in their knowledge and training to do such teaching as a source of the "growing isolation of the statistics department." Leading departments need to formulate specific plans to turn this situation around. In my view, growth, or in some cases survival, lies that way.

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