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Comments on “What is Statistics”

We agree wholeheartedly with Brown and Kass that something has indeed gone wrong with the way we attract and educate students in statistics. The problems begin with the standard unappealing and outdated introductory undergraduate course and persist through many if not most graduate programs. Our undergraduate courses focus on an exquisitely narrow set of topics that has changed little in 30 or more years. At the graduate level we still persist with the increasingly untenable notion that there should be a core (and rather large) body of knowledge that *all* statistics students should know.

We see parallels with the discipline of engineering. Specialization into sub-disciplines such as civil engineering and chemical engineering has existed for over a century and while all engineers may share a certain mode of thinking, specific technical knowledge and skills divide along sub-discipline lines. It is surely premature for statistics to subdivide into hard and fast sub-disciplines, but we believe some degree of specialization is in order. However, we also believe that specialization along applied versus theoretical lines is precisely the *wrong* type of specialization; this particular distinction reinforces the notion of the theoretical statistician developing mathematical artifacts without reference to any scientific enquiry while the applied statistician conducts the intellectually less challenging task of implementing the theory. The compleat statistician must span both.

We believe the characterization of statistics as a branch of mathematics also underlies many of the problems Brown and Kass describe. According to the wikipedia entry for “statistician,” the core work of a statistician is “to measure, interpret, and describe the world and human activity patterns within it.” This seems about right to us, so how is it then that statistics came to be seen as a branch of mathematics? It makes no more sense to us than considering chemical engineering as a branch of mathematics. Both are highly quantitative subjects and both use mathematics extensively. But in statistics a purely mathematical agenda is often at the forefront. And when a statistics department tries to go against these forces, there can be resistance. (A story: we know of a top statistics department that had an interesting applicant with a math GRE of 650. The dean tried to talk the department out of admitting this student. The department stuck to its guns and the student is doing well.) Statistics departments often recruit mathematically adept students without regard, for example, to their potential to take leading roles in scientific teams. The net result is that our discipline has many outstanding mathematicians but few scientists in the mold of Fred Mosteller.

An example of the new style of statistical thinking in the Brown and Kass article appears in the formula y = f(x) + epsilon. What is appealing about this expression is that the focus is on the deterministic model f(x), rather than (as is traditional in statistics) the error distribution. Recall that in standard statistical notation, the notation f (generic mathematical notation for "function") has the privileged meaning of "probability density function." We believe that it is generally more important to model the mean than the error function, and moving the generic "f" is a good start.

Statistics faculty recruiting provides another opportunity to effect change. Departments that kick start the discipline out of its current rut will have many faculty deeply engaged in *different* interdisciplinary endeavors. Skilled "statistical thinking" cannot derive from experience in just one area. Indeed, one of the difficulties in our occasional efforts within statistics to discuss the future of our discipline is the often narrow perspective that each one of us brings to the table. Brown and Kass have done an outstanding job of generalizing from their neuroscience perspective, but nonetheless, the perspective of a social science statistician or a clinical trials biostatistician, to pick two examples, would inevitably be different and no less important.

Finally, as statisticians we should show some humility when recommending methods to others. For example, education researchers have for a long time accepted the importance of randomization and other methods for facilitating "evidence-based" inference. But when deciding on our own educational plans, we resort to the usual mixture of introspection and anecdote that we deplore in others. We don't know of any easy way around this incoherence, but it should at least make us wary about over-certainty in our recommendations.