Comment

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We agree wholeheartedly with Brown and Kass that something has indeed gone wrong with the way in which 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 The problems begin with the standard unappealing and outdated introductory undergraduate course and persist through many, if not most, graduate programs.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 subdisciplines, 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 subdisciplinary lines. It is surely premature for statistics to subdivide into hard and fast subdisciplines, but we believe that 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 aspects.

We believe that 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. A statistics department attempting to go against these forces may meet resistance. (A story: We know of a top statistics department that had an interesting applicant with a math GRE of 650 (out of a possible 800). 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 to, for example, 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 described by Brown and Kass appears in the formula $y = f(x) + \varepsilon$. 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 to 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 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, inevitably would be different and no less important.

Finally, as statisticians we should show some humility when recommending methods to others. For example, education researchers have long accepted the importance of randomization and other methods for facilitating "evidence-based" inference. But when devising our own educational plans, we resort to the usual mixture of introspection and anecdote that we deplore in others. We know of no easy way around this incoherence, but it should at least make us wary about over-certainty in our recommendations.

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