Statistical Science
2011, Vol. 26, No. 2, 235–237
DOI: 10.1214/11-STS331C
Main article DOI: 10.1214/10-STS331

Sampling from a Bayesian Menu

Alan M. Zaslavsky

I am pleased that Steve Fienberg's article opens a discussion aimed at broadening the scope of statistical methods applied to policy problems. His *mezes* platter of case studies whets the appetite for a deeper study of these application areas. My further thoughts largely center on just what it means to say that the examples he gives (some quite delicious, especially the aged wine of electoral projections) are "Bayesian." Fienberg argues on a combination of intellectual and historical grounds for a unitary view of Bayesian statistics, thus bringing a broad range of statistical practice and applications under the Bayesian awning. Despite the advantages of such a comprehensive view, it is also useful to distinguish the components, both to clarify their relationships and so consumers of methodology who are not prepared to eat the entire *prix fixe* dinner can still order off the menu what suits their tastes and nutritional needs. While Fienberg's presentation emphasizes the inferential entrée, the assessment of posterior probabilities, it may help to detail the offerings on the Bayesian menu:

Main courses:

- A subjectivist understanding of probability, allowing for meaningful probability statements about singular events.
- Comprehensive model specification, including
  - Likelihoods.
  - Prior distributions.
- Use of Bayes's theorem to "turn the Bayesian crank," making inferences about parameters (and possibly predictive statements about unobserved or future populations).

Optional dishes:

- Subjective priors incorporating substantive prior beliefs.
- Model selection by Bayesian methods; model mixing.
- Hierarchical modeling.

Alan M. Zaslavsky is Professor of Health Care Policy (Statistics), Department of Health Care Policy, Harvard Medical School 180 Longwood Ave., Boston, Massachusetts 02115, USA (e-mail: zaslavsk@hcp.med.harvard.edu).

Some of these dishes are commonly ordered *a la carte*. Obviously, modeling is a central component of statistical practice for statisticians of a variety of schools, although a non-Bayesian generally has more leeway to introduce nonmodel-based procedures (such as resampling methods) into the mix. In particular, despite the theoretical and historical connections Fienberg notes of hierarchical modeling to Bayesian concepts of exchangeability, one need not be a Bayesian to use hierarchical models, applying maximum likelihood estimation at the top level, so-called Maximum Likelihood Empirical Bayes (MLEB), or with some other non-Bayesian procedure. Estimation for level 2 parameters ("random effects" for the frequentist) may proceed using Bayes's law, or by appealing to completely non-Bayesian arguments like BLUP (best linear unbiased prediction), thus eating the Bayesian omelet while getting only the faintest whiff of the Bayesian eggs.

Distaste for Bayesian statistical approaches in policy settings arises at various points in this menu. For the census, which each of the 435 members of the House of Representatives views through the lens of its impact on his or her own district, any use of modeling aroused immediate suspicion due to fears of manipulation of possibly arbitrary model specifications. Similar concerns contribute to the general dominance of "design-consistent" classical survey sampling methods in government statistics, even when "model-assisted." It is noteworthy that the statistical objections to using hierarchical models in estimation of census undercount centered on the use of any regression model that pooled information across states, not particularly on the use of a hierarchical model (fully Bayesian or MLEB). Finally, the Supreme Court ruled in 1999 against any use of sampling for census apportionment counts, even with estimation based on the purest of "design-based" principles of unbiased survey estimation, citing concerns of susceptibility to manipulation, or at least to controversy. (Oddly enough, the deciding opinion by Justice O'Connor hinged largely on interpretation of a grammatical construction in two apparently conflicting sections of the Census Act, as well as the interpretation of the constitutional phrase "actual enumeration.") It is noteworthy that nonstatistical details