

# The Political Methodologist

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## Notes From the Editors

Welcome to the newest issue of *The Political Methodologist*, and the first under our editorial regime. We hope to continue the high quality of *TPM* set by our predecessors and continue to provide information that members of the section will find useful.

This issue begins with an article by James S. Krueger and Michael S. Lewis-Beck revisiting a debate within these pages on the merits and common practices of reporting  $R^2$  and the standard error of the estimate. We then move to a trio of articles in our Computing and Software section. In the first article, David Darmofal discusses how to use the GeoBUGs module in WINBUGS for Bayesian spatial analysis. Next, Neal Beck provides a review of Stata 10, outlining its usefulness in both teaching and research. Tyler Johnson evaluates WordStat, a text analysis software designed for analyzing textual data, such as media data, journal articles, literary works and interviews. In our Book Reviews section, Timothy Hellwig provides a thorough discussion of *Data Analysis Using Regression and Multilevel/Hierarchical Models*, by Andrew Gelman and Jennifer Hill. We also have some important announcements by Michelle Dion, Simon Jackman, and Rob Franzese regarding upcoming events and section news that should be of interest to everyone. Finally, we close the issue with notes from our section president, Janet Box-Steffensmeier, which includes a list of events not to be missed at this year's APSA meeting.

Thanks to everyone who contributed to this issue. Please contact the editors with suggestions and ideas for future issues of *TPM*. We are especially interested in ideas related to teaching research methods.

*The Editors*

## Articles

### Goodness-of-Fit: R-Squared, SEE and ‘Best Practice’

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About fifteen years ago, the merits of the two leading goodness-of-fit statistics were hotly debated, in terms of their value for assessing a regression model. On one side were the R-squared advocates. On the other side were the standard error of estimate (SEE) advocates. With respect to the former view, Lewis-Beck and Skalaban (1990a, 153) argue “the  $R^2$  of regression analysis is a valuable statistic, telling you something that nothing else can.” Further, the SEE has “a boundary deficiency. . . [and] is not self-sufficient as a measure of relative predictive capability.” (Lewis-Beck and Skalaban 1990a, 57). With respect to the latter view, in contrast, “it is this quantity [SEE] that answers the substantively meaningful question: How close are the forecasts to actual outcomes?” (Achen 1990, 181). Further, remarks King (1990a, 196), “no new information. . . is added by knowing the value of the  $R^2$ .” This debate continued on the pages of the review at hand, *The Political Methodologist* (see King 1990b, Lewis-Beck and Skalaban 1990b, 1991).

At the time of the debate, differences between the two points of view were sharply drawn. However, a careful reading of the actual exchanges reveals that both sides admitted the potential value of the rival measure of fit. Lewis-Beck and Skalaban (1990a, 157) concede that the SEE shows “show well her [sic] model predicts” in the original units of the dependent variable. In other words, it “allows a judgment of absolute prediction error.” Lewis-Beck and Skalaban (1990a, 165). In another concession, Achen (1990, 180) says that the “ $R^2$ . . . may be helpful . . . in describing the shape of the point cloud.” King (1990a, 189) concedes that  $R^2$  “can be useful in comparing specifications for a single data set.”

We take these concessions, one side to the other, as suggesting a reconciliation of the debate. At least under certain, perhaps common, circumstances, “best practice” for assessing the goodness-of-fit of a regression model actually consists in the presentation of *both* measures. What exactly is meant by “best practice?” The notion originated in management studies, and has actually been around in some form since the days of Frederick Taylor. The concept says that, among the several ways of carrying out a task, one is better than all the others, according to some relevant evaluation standard. In other words, that method is “best.”

Explorations of best practice in the policy world are flourishing. For example, there exists a **Best Practices Database**, with over 2500 tested approaches, from over 140 countries, for solving economic and environmental problems. In social statistics itself, we recall the idea of “best” in Best Linear Unbiased Estimator (BLUE), designating the most efficient of its class.

With respect to the evaluation standard of “goodness-of-fit” for a model, there are a number of possible measures. (See the useful current review by Little (2004)). However, with the focus on quantitative regression models, as it is here, the choices among scalar measures narrow considerably, to some variant of the R-squared or the SEE. We argue that best practice in this case is to report both—the adjusted R-squared and the SEE—rather than one or the other. Below we explore the extent to which best practice, so defined, has been followed. The data-set comes out of our content analysis of statistics used in all quantitative research articles from the three leading general political science journals—*American Political Science Review*, *American Journal of Political Science*, *Journal of Politics*—for the period of 1990-2005. Clearly, the question of model fit is important. These articles total 1624, with 1036 reporting a model fit statistic of some kind.

Within this foregoing group, 69.8% ( $N = 723$ ), apply a regression model to account for a continuous (or interval) dependent variable. These regression analyses compose our target sample. We begin with three questions: How many reported an  $R^2$  (or adjusted  $R^2$ )? How many reported a SEE (or SER or RMSE)? How many reported both? Results are assembled in Table 1.

As can be seen, virtually all—99.0% (716/723)—reported a type of  $R^2$ . In contrast, very few—12.9% (93/723)—reported an SEE. Next, the subset that reported a version of both measures is even smaller—11.9% (86/723). Finally, to be technically correct, we should restrict “best practice” to those that reported the SEE and the adjusted  $R^2$  (thereby excluding its problematic unadjusted form, which capitalizes on chance); then, the percentage shrinks to 8.3% (60/723). The conclusion is stark: best practice, specifically defined as presentation of both the adjusted  $R^2$  and the SEE, is very seldom followed.

Table 1: Measures of Fit in Regression Analyses in Political Science Articles.<sup>+</sup>

Articles Reporting One Measure	
Adjusted $R^2$	244
$R^2$	315
SEE*	7
Subtotal	566
Articles Reporting Two Measures	
Adjusted $R^2$ and $R^2$	71
Adjusted $R^2$ and SEE	60
$R^2$ and SEE	26
Subtotal	157
Total	723

<sup>+</sup> Sampled from the *American Political Science Review*, the *American Journal of Political Science*, and the *Journal of Politics*, 1990-2005.

\*SEE stands for the Standard Error of Estimate (and includes the reporting of the Standard Error of the Regression and the Root Mean Squared Error).

Why is best practice so rare? To answer this question, we explored the verbal justifications the authors gave for why they used the fit statistic they used. To our surprise, in all but a handful of cases they offered no justification at all for reporting the fit statistic(s) they did. They simply reported. When they actually did speak to their fit statistics, they invariably just offered a conventional, or factual, interpretation. For example, “Does the relationship vary according to which party is included in, or excluded from, governing coalitions? Comparisons of the coefficients a and b and the  $R^2$  across equations . . . answer such questions . . . Tables 3 and 6 shows that, for all 163 observations and for various subsets of observations, the  $R^2$  tends to be a little lower, and the standard error of the estimate (SEE), a little higher, for the estimations in which the independent variable is either variant of the bargaining set (BPNc or BPCD).” (Mershon 2001, 286-289).

In some sense, then, the justification of the fit statistics use comes from the mere use itself. For applied regression analysts, its reporting and its essentially straightforward interpretation are taken as givens. The justification is silent. And, the justification gains weight through use. The  $R^2$  variant receives endorsement through its virtually universal presence. Likewise, the scarce presence of the SEE implies a lack of endorsement. Unfortunately, these practices, which continue largely unquestioned by political science researchers, keep the overwhelming majority of them away from achieving best practice. That is, reporting both measures when doing regressions on continuous dependent variables.

Why should both measures of fit be reported? Well, each one provides unique and important information about the predictive capability of the model. The  $R^2$ , with its linear fit, offers a valuable baseline for model evaluation,

assessing its relative predictive capacity. For example, suppose the adjusted  $R^2 = .72$ , in a multiple regression model of the US presidential popular vote percentage. The model, by accounting for 72 percent of the variation, suggests the linear theory has some utility. Thought of another way, it implies a 72 percent reduction in prediction error, once  $X_i$  are known. While linearity is not the only possible baseline, it is communicable, and frequently cannot be improved upon.

The SEE offers something that the adjusted  $R^2$  cannot—an assessment of the absolute predictive capacity of the model. Measured in the metric of the dependent variable, it registers the predictive accuracy of the model on its own terms. For example, in our multiple regression model of US presidential elections, suppose  $SEE = 3.00$ . This indicates that expected error, in predicting future presidential elections, would be roughly three percentage points, plus or minus. In other words, unless the prediction is for a landslide, the race might be judged “too close to call” because of the possibility of a fair amount of error.

Thus, in this example, the  $R^2$  and the SEE are both informative about model fit, but in different ways. The former, which shows a good amount of linearity, suggests the model does an adequate job of accounting for US presidential elections. The latter, which reveals not inconsequential error in point estimation of future elections, may temper enthusiasm for how well the model works. Neither assessment is wrong, and each alone misses a valuable piece of the story. To illustrate, we learn more about a model if we observe it has a good  $R^2$  but a poor SEE, or vice-versa (a poor  $R^2$  but a good SEE). All of this is not to say that each measure is flawless in its way. In particular, comparison of these goodness-of-fit measures across different populations can be problematic (Lewis-Beck and Skalaban 1990a, 164-

168). As always, care must be followed in the calculation and interpretation of any statistic.

### Guidelines for Research Practice

We observe that, routinely, quantitative political science researchers care about model fit. However, in their published regression analyses, they seldom follow best practice, defined as the reporting of the adjusted  $R^2$  and the SEE. Instead, they almost always rely on just one measure, and that one is usually the *unadjusted*  $R^2$ . This is to be discouraged, since this measure is inflated, capitalizing on a chance fit through exhaustion of degrees of freedom. Rather, the adjusted  $R^2$  should be reported, along with the SEE. The former, for the information it provides on relative predictive capacity, the latter, for the information it provides on absolute predictive capacity. With these two pieces of information, the goodness-of-fit of the model is more fully understood. It would certainly seem in order for manuscript reviewers, and journal editors, to urge this best practice on authors. After all, the production and publication of these statistics is essentially cost-free. The success of such a call for best practice may be judged in subsequent assessments of the statistical contents of quantitative articles in our leading journals.

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## Computing and Software

### Bayesian Spatial Survival Analysis in WinBUGS

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#### Introduction

Two of the most positive and visible developments in political methodology in the past decade have been the increased use of Markov Chain Monte Carlo (MCMC) methods and spatial analysis by political scientists. These twin developments have already paid significant dividends for the discipline, with the former allowing scholars to estimate models long thought intractable and the latter allowing researchers to model the spatial interactions predicted by many of our theories in political science. To date, however, these two developments have largely occurred along

separate tracks. Bayesian analyses in political science rarely model spatial dependence between units, and spatial applications in political science are almost exclusively frequentist. This is unfortunate, as the two developments are quite compatible and can both benefit from a greater integration. MCMC analyses can benefit from modeling the spatial autocorrelation common to many political phenomena. And spatial analyses can benefit from the inclusion of theoretically informed priors and the practical benefits of simulation from which non-spatial analyses have benefited.

The key to linking Bayesian and spatial analyses is

the incorporation of prior beliefs regarding the spatial autocorrelation between units. Biostatisticians focused on topics such as disease clusters and spatial dependence in deaths due to disease have made extensive use in recent years of Bayesian spatial models incorporating these priors. These studies (e.g., Banerjee and Carlin 2003; Banerjee, Wall, and Carlin 2003) employ random effects models in which spatial dependence is treated as a form of unmodeled heterogeneity in the behavior of interest. In contrast to standard random effects models in political science, random effects at “neighboring” locations (where neighbors are defined by the researcher, following substantive theory, and need not imply contiguity) are not assumed to be spatially independent. Instead, the random effects are allowed to exhibit spatial autocorrelation, as will often be the case when neighboring units interact with each other or share similar attributes that are not incorporated in the model specification.

The most commonly employed spatial prior linking the random effects at neighboring locations is the conditionally autoregressive (CAR) spatial prior that was originally developed by Besag, York, and Mollie (1991) in the context of Bayesian image analysis. The CAR spatial prior incorporates information on neighbor locations as well as any (dis)similarities in random effects at neighboring locations. The CAR prior can be easily incorporated by applied researchers employing Bayesian models via the GeoBUGS 1.2 module in WinBUGS 1.4.1.

GeoBUGS carries both the advantages and disadvantages associated with WinBUGS. On the one hand, researchers already familiar with the BUGS language will find GeoBUGS intuitive, with minimal start-up costs. On the other hand, for researchers unfamiliar with BUGS, GeoBUGS does carry the start-up costs associated with learning a new programming language. Researchers interested in using GeoBUGS in their research will also want to have some general familiarity with spatial autocorrelation and spatial analysis before diving into the program. For most quantitative researchers, the programming issue is likely to prove only a minor hurdle. And the benefits of GeoBUGS, both in terms of model estimation and mapping capabilities, are worth the investment of time and effort in familiarizing oneself with spatial analysis. This should be even more the case in coming years, as added functionality in future versions of GeoBUGS overcomes some of the limitations in the current module.

A wide variety of models can be estimated with WinBUGS and GeoBUGS. These include, but are not limited to, models for spatial mapping (e.g., use of a Poisson model

to determine whether there is spatial clustering in a phenomenon of interest), spatial kriging (in which values on a random variable at unobserved locations are predicted based on the values at observed locations), and spatial survival models. Political science is likely to see increased use of these types of models in the coming years.<sup>1</sup> In this review, I focus on the use of GeoBUGS to model spatial autocorrelation in survival models incorporating random effects, or frailty terms.

GeoBUGS includes three conditionally autoregressive priors: an improper CAR prior with a Gaussian distribution (`car.normal`), an improper CAR prior with a Laplace distribution (`car.l1`), and a proper CAR prior with a Gaussian distribution (`car.proper`). I focus here on the two improper CAR priors.

Both the improper Gaussian and Laplace priors take four arguments. These correspond to the definition of each observation’s neighbors (contained in the `adj []` vector), the spatial weights information (contained in the `weights []` vector), the number of neighbors for each observation (in the `num []` vector), and the precision parameter for the Gaussian CAR prior, or, alternatively, the inverse scale parameter for the Laplace CAR prior (the scalar argument, `tau`) (Thomas et al. 2004).

## Importing Neighbor Definitions into GeoBUGS

A critical step in all spatial analysis is the definition of neighbors (in GeoBUGS, this is the information included in the `adj []` vector). This is a critical step because it delimits the spatial autocorrelation that can be estimated. As a consequence, neighbor definitions should reflect substantive theory.

From a mechanical perspective, there are two approaches to defining neighbors in spatial analysis. On the one hand, researchers can input this information by hand. This is, needless to say, a tedious process that can introduce significant human error. In the absence of a preexisting digital map for a particular spatial application, however, inputting by hand is always an option.<sup>2</sup>

The second, more frequently used approach, is to utilize GIS software and corresponding geospatial data storage files to store the spatial locations of areal units. ESRI’s shapefile format (associated with its ArcView GIS program) has become the default format in spatial analysis for storing information on the geospatial locations of observations (for example, beyond ArcView, it is the default data format in Luc Anselin’s GeoDa software). Employing a shapefile,

<sup>1</sup>We can easily, for example, imagine kriging applications in political science both for sample data and as an approach for dealing with missing data.

<sup>2</sup>Even when a digital format exists it may prove difficult to use. For example, researchers interested in estimating spatial dependence across congressional districts must take extreme care when using geospatial files produced by GIS software, because several districts are actually composites of multiple polygons. As distinct areal units, these separate polygons within the same district will be treated by GIS software as neighbors of each other, even though the researcher’s interest is in dependence across, not within districts.

researchers can easily utilize spatial software to define neighbors according to various criteria (e.g., rook or queen criteria for contiguous neighbors,  $k$ -nearest neighbor definitions, distance decay definitions, etc.).

A critical limitation of GeoBUGS 1.2 is that it does not include a facility for directly importing ESRI shapefile information on the locations of observations (and their spatial relationships to each other) into BUGS.<sup>3</sup> Happily, Yue Cui has written programs for converting the shapefile format into R or S-Plus format for use in WinBUGS. These programs, `convert.r` and `convert.s`, respectively, can be downloaded at <http://www.biostat.umn.edu/~brad/yuecui/index.html>. (The webpage also includes user-friendly instructions for converting shapefile information into GeoBUGS.)

Once the shapefile information has been converted into R or S-Plus format, it can be used to produce the neighbor definitions for the `adj[]` vector in GeoBUGS. The researcher simply opens the adjacency tool in the map menu in WinBUGS, scrolls down to the appropriate map, and clicks on the *adj map* button to reproduce the map originally produced in ArcView. Clicking on the *adj matrix* button produces the neighbor definitions for each areal unit in one's data. A key point to note here, however, is the extremely limited option for defining neighbors in the current version of GeoBUGS. Currently, only a queen contiguity definition (in which each of the polygons directly contiguous to a polygon are treated as its neighbors) is supported in GeoBUGS. Researchers wishing to employ more complex neighbor definitions, or those not dependent on strict contiguity, will need to modify the `adj[]` vector to reflect their substantive theory.

The vector `weights[]` includes the spatial weights for each pair of observations denoted as neighbors in the `adj[]` vector. As such, it contains the same number of elements as contained in the `adj[]` vector. Of note here is the somewhat non-standard treatment of weights in GeoBUGS. Typically in spatial analyses the sum of weights for a particular unit  $i$ 's  $j$  neighbors are normalized to sum to 1. This aids in interpretation of spatial autocorrelation diagnostics such as Moran's  $I$ . For the two improper CAR priors in GeoBUGS, however, the weights are unnormalized, and are thus typically set to 1 for each pair of observations. The easiest way to incorporate this in BUGS code is through a simple loop in which the weights are set to 1 (e.g., `for (i in 1:nsum) [weights[i] <- 1]`), where `nsum` is the number of adjacencies in the data. The remaining two terms, `num[]` and `tau` are as defined before.

## Survival Modeling Application

The code below demonstrates how researchers can estimate spatial survival models in GeoBUGS. This particular code is for an application to the timing of U.S. House members' position announcements on the North American Free Trade Agreement. The data are from Box-Steffensmeier, Arnold, and Zorn (1997). In this example I employ a Weibull model with individual-level (i.e., district-level) random effects or frailties, in which the random effects capture unmodeled risk factors.<sup>4</sup> In contrast to the standard frailty modeling approach in political science, this model allows for spatial dependence in the random effects for neighboring units, rather than assuming that the unmodeled risk factors for neighboring units are spatially uncorrelated.

The code below models the timing of position announcements as a function of three covariates. *Pscenter* is the unionized proportion of private sector workers in the district (mean-centered), *hhcenter* is the median household income in the district (mean-centered), and *ncomact* is a dummy variable indicating whether the member was on a committee that acted on NAFTA (for full descriptions of these variables, see Box-Steffensmeier, Arnold, and Zorn 1997, 336). The model also includes an intercept term (*beta0* below) and a shape parameter,  $\rho$ .

The code to estimate this model builds on standard BUGS code for estimating Weibull models. Bradley Carlin at the University of Minnesota's School of Public Health provides some nice BUGS code for estimating a variety of spatial models on his software page: <http://www.biostat.umn.edu/~brad/software.html>.

Among the programs he provides on this page is code for estimating spatial shared frailty models (in both Weibull and Cox specifications) for cancer patients clustered in Iowa's 99 counties. I utilize Carlin's code for his spatial shared frailty Weibull model and the code for the random effects Weibull model in the WinBUGS Examples Volume I manual as foundations for the code for the spatial individual frailty Weibull model of NAFTA position timing.

The first portion of the WinBUGS code sets up the Weibull model. Because no members of the House are right-censored (all eventually take a position on NAFTA), I am able to discard with censoring times. `Nsubj` in the code below notes the number of members in the data; `W[district[i]]` denotes the district-specific random effects.

<sup>3</sup>Polygon formats produced by S-Plus, ArcInfo, and Epimap are supported in GeoBUGS.

<sup>4</sup>Darmofal (2007) examines the performance of seven additional models: a standard Weibull model (with no random effects), a standard Cox model (with no random effects), a Weibull model with non-spatial individual frailties, a Weibull model with non-spatial shared (i.e., state-level) frailties, a Weibull model with spatial shared frailties (in which the random effects across neighboring states are allowed to exhibit spatial dependence), a Cox model with non-spatial shared frailties, and a Cox model with spatial shared frailties.

```

model
{
  for(i in 1:Nsubj) {
    obs.t[i] ~ dweib(rho, mu[i])
    log(mu[i]) <- beta0 + beta[1]*pscenter[i] +
    beta[2]*hhcenter[i] + beta[3]*ncomact[i] +
    W[district[i]]
  }
}

```

Next, I include the loop to set each of the spatial weights to 1.

```
for (i in 1:nsum) {weights[i] <- 1}
```

Next, I include the `car.normal` prior, allowing for the estimation of spatial autocorrelation across neighboring frailties.

```
W[1:regions] ~ car.normal(adj[], weights[], num[], tau)
W.mean <- mean(W[])
```

Next, I set my noninformative priors for the intercept and the parameters for the covariates in the model.

```
beta0 ~ dnorm(0.0,0.001)
for(i in 1:3) {beta[i] ~ dnorm(0.0, 0.00001)}
```

The model portion of the code concludes with the priors on the remaining parameters in the model. Both  $\rho$ , the shape parameter for the Weibull model, and  $\tau$ , the precision of the random effects, are given gamma priors;  $\theta$  is the frailty variance parameter.

```
rho ~ dgamma(.01,.01)
tau ~ dgamma(.01,.01)
theta <- 1/tau
}
```

The first three terms in the data are `Nsubj` (the number of members), `regions` (the number of regions in the data) (these would differ from the number of members in a shared frailty model), and `nsum` (the number of adjacencies) in the data.

```
list(Nsubj=432, regions=432, nsum=2282,
```

Next comes the adjacency information for each district. Here, for example, is the adjacency information for the first three districts in the data, Alabama's 1st, 2nd, and 3rd Congressional Districts.

```
adj = c(
2, 7, 83, 229,
1, 3, 7, 83, 84, 107,
2, 4, 6, 7, 107, 108, 112,
```

Each district is identified by its order in the data. Thus, Alabama's 1st District is identified as 1, Alabama's 2nd District is identified as 2, ..., Florida's 1st District is identified as 83, etc. As can be seen, in the 103rd Congress, Alabama's 1st District had four neighbors (Alabama's 2nd District, Alabama's 7th District, Florida's 1st District, and Mississippi's 5th District), while Alabama's 2nd District had six neighbors and Alabama's 3rd District had seven neighbors. In GeoBUGS, neighbor definitions must be symmetrical (GeoBUGS notifies the user if they are not) and units cannot be specified as neighbors of themselves (GeoBUGS does not notify users if units are treated as their own neighbors). The data list is completed with the `num` vector (the number of neighbors for each unit), the observed failure times, and the data on the remaining covariates in the model.

In this particular example, I employed two separate Markov chains with overdispersed starting values (e.g., + and - 3 standard errors from the frequentist estimates in Box-Steffensmeier, Arnold, and Zorn 1997). I used five thousand burn-in iterations for each Markov Chain and 10,000 post burn-in iterations for each chain. The updating for the spatial survival model was quick, taking 230 seconds on a dual core Dell OptiPlex 745.

Table 1 presents the results for the Bayesian spatial Weibull model with this particular set of covariates. The first cell entries are the means of the posterior densities. The 95 percent Bayesian credible intervals are in parentheses below.

### Mapping in GeoBUGS

GeoBUGS is also equipped with mapping capabilities, which can be accessed using the *mapping tool* option in the *map* menu. The mapping tool is helpful for mapping posterior quantities of interest. For example, one can map the posterior means or medians of the random effects. Maps of the means of the non-spatial and spatial random effects can, for example, be quite helpful in visually demonstrating the inferential errors induced by erroneously assuming that frailties are spatially random when, in fact, they exhibit spatial dependence. The maps can then be saved as postscript files for inclusion in L<sup>A</sup>T<sub>E</sub>X documents or exported into word processing documents.

### Overview

The GeoBUGS module in WinBUGS is a user-friendly module by which scholars can incorporate spatial MCMC analysis in their research. Programming costs for scholars already familiar with WinBUGS are minimal. GeoBUGS is also quite versatile, allowing for the estimation of a variety of spatial models.

On the downside, the current version of GeoBUGS is still limited in some important ways. One would, for ex-

Table 1: Posterior Summaries for Bayesian Spatial Weibull Model

Constant	-48.440 (-51.030,-45.800)
Pscenter	1.214 (-0.686,3.090)
Hhcenter	0.005 (-0.116,0.125)
Ncomact	-0.027 (-0.238,0.179)
$\rho$	8.003 (7.570,8.428)
$\theta$	0.018 (0.003,0.060)

Cell entries are the posterior means, with 95% credible intervals in parentheses.

ample, like to see much greater versatility in neighbor definitions than the current version supports. An option for standardizing weights would also be a nice improvement. The error messages for non-symmetry could be improved to provide more specific information about the neighbors excluded for a particular unit. And future versions should also include an error message when units are included as their own neighbors.

Political scientists are likely to make increased use of spatial MCMC analyses in the coming years. On the modeling side, noninformative priors will continue to be used in the near term by most researchers employing Bayesian spatial analyses. This will change with time, however, as we come to understand more about how the two sources of spatial autocorrelation posed in Galton's problem – spatial interactions and common attributes – induce spatial dependence among neighboring observations. As future versions of GeoBUGS address some of the current limitations of the module, theoretical and methodological advances in Bayesian spatial analysis are likely to proceed together, producing benefits for both Bayesian and spatial research in political science in the process.

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## Stata 10: Another First Look

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As most readers of *TPM* are aware, Stata Corp. began shipping Version 10 in late June, 2007. Following a long standing tradition (going back at least two versions), I would like to share my first impressions of V10. The note is based mostly on how I use Stata in both teaching and research, and my guesses about common uses by readers of *TPM*. Clearly other users will find other features they love when they load V10.

I do not deal with the issue of whether it is worth it to upgrade; the answer is almost certainly either “for sure” or “no.” Stata makes it both very cheap and very easy to upgrade, so that anyone who uses Stata at all, or any lab, should clearly upgrade. Only those who expect to be considerably better off in the near future and with access to an upgraded lab (that is, graduate students) might not want to pay the upgrade cost now. One nice thing is that it is almost impossible to break anything in upgrading, and the user who is happy with earlier versions of Stata can use V10 without fear of having to see a whole new interface or having a bunch of old scripts break. This is particularly the case if one has taken care to follow Stata’s instructions about putting version numbers in ado files and keeping a consistent file system, but even people as sloppy as me will find it hard to break anything with this upgrade. (This all said, it would be nice if Stata adopted its totally seamless within version upgrade process to the between version process.)

As with previous upgrades, V10 is still very clearly Stata. The happy V9 (or V6) user will never know that they are working with V10. Nor will you need to upgrade your memory (so one need not feel like John Hodgman when facing this upgrade, even on a Windows box). But it would be a shame if the V9 user did not at least take some advantage of improvements in the user interface, which are quite helpful for both teaching and research.

For me the biggest new interface feature is the ability to save results either in memory or a file, and then recall those results, either separately or in a table. Anyone who has taught using Stata projected on a screen will appreciate how easy it is to now compare two sets of results. The ability to combine lots of results in a table makes comparison even simpler. (Try a series estimation commands each followed by `est store` and then `est tab _all`, and, when you figure out what statistics to put in the table, be impressed.) Obviously the same feature will be most useful to researchers comparing the properties of multiple specifications. One can now also have multiple log files open, submit multiple commands from the review window and copy any

output in the review window as either text or an exact picture of the screen.

There are similar improvements in graphics. One can take a nice graph and make it nicer through a fully featured point and click editor. The final graph can then be saved as a postscript file. Stata provides very nice low level graphics commands (similar to what R provides) so one can automate graphics production, but final hand editing can be helpful when one has a picky editor. (Quibble: why does Stata not save graphs in pdf? and why no contour plots?) Clearly undergraduates preparing theses will love the graphics editor; those who do not like it can simply ignore it.

Turning to statistical issues, there are big improvements in V10. But, unlike previous upgrades, there is no new big module (such as Mata or multivariate analysis in V9). While there are changes and improvements throughout the package, some of the modules have been given important new functionality. Others might put additional features on my list, but my list alone is quite impressive.

- Hierarchical (mixed) model to allow for binary and count dependent variables. The previous version provided for hierarchical (mixed) models with a continuous dependent variable. As a recent special issue of *Political Analysis*, and the new Gelman and Hill book (reviewed in this issue of *TPM*), show, hierarchical models are now an important part of our toolkit. The V9 introduction of its “mixed” routine was important. The extension to binary and count variables is just as important, given the nature of political science data. It should be noted that Stata has gone to great effort to make the new hierarchical logit routines very accurate.
- Better instrumental variable estimation routines, allowing for a variety of methods. More importantly, users can now assess “weak instruments.”
- Multinomial probit and nested multinomial logit routines that provide good flexibility and are straightforward to use. The old, clunky, `clogit` setup is no longer needed. The new routines are very nice, and easily allow for both conditional and unconditional data. The routines can deal with a wide variety of nesting situations, and a wide variety of covariance structures. For my Stata-based course I can now give serious exercises involving multicandidate elections. There is almost no reason to use LIMDEP now, other

than for its random parameter logit routines (which continue to hold much promise).

- Big improvements in the scaling module. Measurement was taking a back seat amongst methodologists until the recent spate of item response papers. The Stata routines allow all users to do good scale construction and to meaningfully understand those scales. V10 provides many new features for its multi-dimensional scaling routines (including non-metric MDS), and also has correspondence analysis (scaling for nominal variables). We have many fewer excuses now for not taking measurement seriously.
- Many new estimation methods for dynamic panels.
- Myriad other improvements (lots of new commands allow for stratified and clustered samples, exact logit for small samples, better non-linear estimation, and better estimation of systems of equations, for example)

I have saved the biggest improvement (for me) for last. Mata, the Stata matrix language, now has an optimizer, and quite a good one. Mata in V9 allowed students to write down a likelihood function, but did not provide any facility for them to find the maximum. This is now remedied with a full-featured optimizer (at least seven different maximization methods, numeric or analytic gradients and Hessians, linear constraints, and lots of other bells and whistles). As with all optimizers, one must pass one or more functions, so the calls are never totally trivial. Stata has gone for generality, which is good, but clearly requires the user to do a bit more work. (It will be interesting to see how friendly my students find this optimizer—that is, how easily they will be able to find the inevitable coding errors.) The optimizer looks very nice and at first glance it appears to be fast. If one really cares about speed, Stata has a multiprocessor version that should be really fast.

It is not the case the new optimizer will move people from R to Stata. But it may well allow those happy with Stata to stay with Stata. The optimizer allows me to teach my maximum likelihood-based course in Stata; I want students to write some maximization code, but the built-in routines in Stata work quite well after that. It is nice not to have to interrupt teaching likelihood to teach R. While this is not an issue for departments that get everyone using R from day one, it is a big issue at NYU.

The optimizer in Mata does not mean that R and Stata are converging. Stata will continue to appeal to the high-end package user while R will appeal more to those who want quick access to state-of-the-art developments. The R environment and community allow top researchers to easily add new packages; the downside of this is that quality control is uncertain. Stata's routines are written in-house, and

so likely go through more rigorous testing (both in terms of package integration and for numerical issues); the downside of this is that new methods are slower to be incorporated (though perhaps more likely to work once incorporated). While Stata and R are both extensible, only R is fully open. Both R and Stata have excellent communities, with the R development community being larger and more active (a compliment to the R community rather than a criticism of the Stata community). I doubt that Stata will ever be a front end for BUGS (there is an add-on Stata front end for BUGS, but it goes from Stata to R to Bugs!) and I doubt that R will ever have a point and click graphics editor. Serious people will use both R and Stata; but those who prefer to only use Stata are in a much better position with the new version than they were before. Serious researchers should clearly use the best tools rather than the best tool available in the one package they know. While R and Stata overlap, they also complement each other quite well. And of course R and Stata do not cover the world. I still prefer EVIEWS for time series analysis.

I cannot close without a criticism. Stata needs to work on its documentation. The full set of documentation is now 16 manuals. When I wanted to figure out how to do time series graphs with nice dates, I had to figure out whether to first look in the time series manual, the graphics manual or the user's guide. I only discovered that Stata could do rolling regressions (which I love) by chance. This makes no sense in the age of Wikis and Google. Now that printed encyclopedias are obsolete, maybe the next version of Stata will ship with only a printed User's Guide and a really good search facility.

This is not to say that the documentation is bad, just that it is less useful than it could be. The current `search` command is quite helpful (giving both information in the manuals and links to relevant web pages) but it feels limited in the age of Google. In a better world, `search xtreg` would come back with `did you mean xtpcse?`. The simpler `help` feature is also getting better. V10's help gives complete versions of the Mata and graphics manuals (though totally tied to the printed structure of the manuals), and, over the last few versions, help has gotten more complete, with more examples and better cross-referencing.

Given the R vs. Stata nature of this comment, it is only fair to note that R more or less solves the documentation problem by generally not providing anything helpful to the user, leaving said user to buy the appropriate Springer monograph by the package developer. Everyone I know learns how to use R's nice statistical features from the Venables and Ripley book. Obviously there are many texts on doing some type of statistics with Stata. Perhaps the problem is that Stata's documentation is sufficiently good that I feel they could provide excellent documentation in-house. Of course, what would I then have to complain about? No

iPhone support?

So what difference does V10 make for me at NYU? We use Stata for all undergraduate quantitative work; students doing theses will probably most like the point-and-click graphics and other new interface features. For my maximum likelihood graduate teaching the big improvement is clearly the Mata optimizer, allowing us to postpone R until the third semester. The improvements in the multinomial routines and the addition of binary dependent variables to the hierarchical routines will allow me to have more exercises in these areas, and to have more students do their research in Stata if they prefer (as they so often do). Since we, like all modern departments, are obsessed with causality, the new instrumental variables are also quite helpful (though I think R is still needed to keep up more with the burgeoning matching literature). The hierarchical logit routines will probably have the biggest impact on my research. My simulation work will still be in R (mostly because my co-authors

do all the work). If we were starting anew it would be an interesting question as to whether we would use Stata/Mata for simulations, but there is path dependency here. I wonder whether new simulators who feel comfortable in Stata will take advantage of Mata's capabilities.

Stata has had a series of impressive upgrades over the years. Some bring functionality in a whole new statistical area, while others provide more general enhancements in a variety of areas where Stata already had functionality. This upgrade is of the latter sort. But for those interested in choice modeling, hierarchical modeling, endogeneity, scaling or dynamic panels, to say nothing of using a matrix language to estimate or assess maximum likelihood models, this is a "big" upgrade. And even for those who only benefit from a better interface or better help, the upgrade is well worth the small cost. Maybe in V11 the big "thing" will be to provide modern ways to document Stata that are up to the high level of excellence of the rest of the product.

## Review of WordStat 5.1, SIMSTAT 2.5, and QDA Miner 2.0

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As the process of performing content analysis continues to shift further from humans reading scores of documents and making judgments, and instead toward having computers do the coding, the need for software that can perform a wide variety of analysis-related tasks is ever increasing. Unfortunately, for those individuals seeking to undertake content analysis in their line of research, there has been no industry standard when it comes to choosing a computer program with which to quantify text; an internet search for applicable software reveals that over forty such software packages exist to date, and that number can be expected to rise as computer-based analysis grows in popularity.

More often than not, those looking for a dependable and powerful content analysis tool are looking for three things: the need for flexibility in the capabilities of what a package of software can do, a sense of transparency in the coding process, and, perhaps most importantly, accuracy in the decisions that the software makes. WordStat, SIMSTAT, and QDA Miner, a suite of software packages produced by Provalis Research, provide just that, offering a combination of features that go above and beyond the usual content analysis software programs. Each program provides a unique function useful to the content analyst; WordStat is the quantitative content analysis program, SIMSTAT serves

as the base from which WordStat runs (as well as offering a multitude of statistical analysis features), and QDA Miner offers a wide variety of coding options for the qualitative scholar. The suite of software options allows for a more highly focused examination of what text truly is saying, while at the same time offering a wider variety of ways to display results and a stronger statistical foundation upon which users can conduct analyses than most content analysis software currently available on the market.

### How The Content Analysis Package Works

Quantitative content analysis tends to require two major steps before usable data can be culled from text: preparation of the content for software readability and construction of dictionaries or word lists that capture the types of concepts the user wants to examine in his or her statistical model. Both of these functions can be performed relatively easily using WordStat and SIMSTAT, and can lead to a variety of interesting outputs.

#### *Preparing The Content*

Preparation of text for use in WordStat and its complementary software packages is straightforward. Text set to be analyzed must eventually be located in a SIMSTAT data file, but this task can be accomplished in several ways. So long as the text to be examined is raw text or plain ASCII

text, it can either be cut and pasted into a SIMSTAT data file directly, or one can use the Document Conversion Wizard located within WordStat to transfer word processing documents, PDF files, HTML, and spreadsheet files to a format readable by the software.

There are only a handful of restrictions when it comes to transferring information from other sources into SIMSTAT files. One such fix that individuals might have to perform as they prep content for placement in usable files is the removal or alteration of hyphens; hyphens force the software to treat compound words as separate words. Also, the use of brackets or braces within the text is not advised; these punctuation marks are used by WordStat to instruct the software to include and ignore certain portions of the text. Using brackets or braces for another function would potentially lead to coding mistakes. Finally, WordStat obviously cannot fix spelling mistakes as it analyzes content, so the creators advise running content files through a spell-checking program (one such program is located within the WordStat package) before proceeding with analysis. Users must handle these problems themselves before running a text file through WordStat (or be sure to address them through some fixes available in the Options menu); the software itself will not clean the text and remove punctuation issues. However, other than these three minimal modifications (which are not necessarily going to be problems for most users), the process of moving text from the original source to a SIMSTAT readable file is simple and quick.

#### *Dictionary Building*

With text set to be studied converted to the proper file format, the next step for the content analyst is to determine what he or she is looking for within said content. WordStat can perform simple frequency analyses on pieces of text to determine which words appear the most, but the real power in content analysis lies in the creation of customized dictionaries that group words to fit various specific or broad concepts or themes one is looking to study. Creating dictionaries in WordStat is simple enough; one merely needs to click a button on the Dictionaries page located within the software and add the words you want to search for to the window that appears. In addition, WordStat has a built-in Dictionary Builder that suggests alternate spellings, synonyms, and antonyms. The key strength to Wordstat's dictionary-creation ability (and a strength that sets it apart from many other content analysis software), however, lies in the multitude of rules one can set up to define how WordStat searches for a word within text.

Most of the complex coding rules one can create in WordStat use Boolean words to search for word combinations in a sentence, paragraph, or document, or they utilize what the software's creators call "proximity operators," which allow one to learn how often a word occurs near, before, or after another word (or category of words as the case

may be). Such rules are extremely helpful in making sure analyses include the definitions or forms of a word that are wanted and excluding those that are unwanted. For example, let us say that we are seeking to find language pertaining to the strength of the economy. Being able to distinguish the word "strong" from the words "not strong" is essential; after all, saying the economy is strong and not strong are two opposite ideas. Most dictionary-based content analysis software merely records the number of times a word (like "strong") appears within some text, regardless of the context of the sentence or paragraph that the word is couched in. Therefore, inferior software would count "strong" and "not strong" as two exactly equal concepts.

Using a proximity operator in WordStat would allow one to tell the program not to count occurrences of "strong" that are preceded by "not" or even occurrences that exist within a user-chosen number of words from "not" or any form of negation for that matter. This flexibility in coding rules ensures the user gets the concepts he or she wants and is able to exclude potentially harmful coding errors. WordStat also offers a Keyword-In-Context page that allows the user to see all the appearances of a word within the text; this function allows for an even more finely tuned sense of how additional coding rules might continue to ensure that the right words and phrases are being captured. The types of coding rules included in the software can be applied broadly as well; WordStat can be also be told to ignore words during analysis through the creation of exclusion dictionaries. One might use this to keep forms of specific root words from analysis, or to eliminate words following any type of negation (for example, one could tell the software to ignore all words that follow the word "no" or "not").

#### *Outputs*

After directing WordStat to analyze a document, the program offers a wide variety of ways in which the analysis can be presented. The most basic output delivered by WordStat is the Frequencies table, which delivers the list of words (or, if the words in the dictionary are placed into groups of words, the group names), how often they appeared in the text, and how that frequency of appearance breaks down into percent of total words analyzed. These raw numbers will probably provide the bulk of any sort of statistical analysis being performed after content analysis. Data derived from content analysis can then be exported into a spreadsheet-like document usable in SIMSTAT or other statistical programs. One could then use SIMSTAT to merge together multiple sets of results into a master file. This feature might be especially useful for users looking to examine and compare content over time (for example, months or quarters of newspaper coverage drawn from Lexis-Nexis); it is, however, somewhat unclear as to whether WordStat and SIMSTAT will recognize dates and produce useful time-series graphics accordingly.

What separates WordStat from many other content analysis programs in the output department, however, are the graphics that can be produced to illustrate the raw findings of the analysis. WordStat allows the user to create bar charts, line charts, pie charts, and heat maps that might serve to enhance the presentation of results beyond that of a simple table. Other ways to graphically represent outputs include hierarchical clustering and multidimensional scaling, both of which use dendograms and cluster maps to express relationships between words and concepts.

#### *Qualitative Alternatives*

Of course, not all content analyzers are looking for quantitative coding of documents. Some seek a more qualitative approach to categorizing text before they produce statistical outputs. The QDA Miner software is key in executing this type of analysis. QDA Miner allows for the categorization of sentences and paragraphs within a larger text file via manual coding. To build upon an example given by the creators of the software, let us say that a user wanted to analyze a speech given by a political candidate for the use of economic themes. The user could come up with a list of economic words, create a dictionary in WordStat, and search for those words. On the other hand, using QDA Miner, the user would enter the speech text into a data file and code applicable sections of the text by hand as being “economic” sections. If the user did this for every speech given by the candidate, he or she would be able to build a data set that offers insight into where said themes occurred in speeches, how often, and how close in proximity to other potential themes being coded simultaneously.

#### *Moving From Content Analysis to Quantitative Modeling*

The results of content analysis are often interesting on their own, but they have the potential to make broader statements about the political world when combined with other data as part of a larger theory. The SIMSTAT program allows the user to execute a range of empirical models using the data derived from analyses of text performed by WordStat. SIMSTAT offers all the functionality one would expect from a statistical package broadly defined; one can perform such standards as correlations, regression analysis, logistic regression, and time-series modeling. In fact, it should be noted that SIMSTAT can be used separately from content analysis if one so chose. In this way, it functions much like newer versions of SPSS, where data would be entered into a spreadsheet-like data screen and modeling functions would be executed via the use of a series of drop-down boxes and clickable pop-up boxes, allowing the user to spell out and enumerate specific functions. What might separate SIMSTAT from other statistical packages, then, for the content analyst might be the ability to transition data from one programming forum to the next (i.e., from WordStat right into SIMSTAT).

## Strengths and Weaknesses

The obvious strengths of WordStat, SIMSTAT, and QDA Miner lie in the transparency available in the process. A major problem inherent to many popular content analysis software programs is the problem of the black box; one knows what is going into the software and one sees what is coming out, but one never knows what decisions the software is making. WordStat allows the user to make a series of choices along the way to ensure that the output desired is the output received. The wide variety of potential outputs is also a strong suit for WordStat; although some of the graphical outputs might look out of place in a scholarly journal or book, they would be well suited for the atmosphere of a conference presentation, where offering visual examples of the power of content analysis might be what separates an interesting talk from a dull one.

The compatibility between different types of potential statistical analyses that can be executed by using WordStat in conjunction with SIMSTAT is also a key selling point when it comes to separating this software from others. Most content analysis packages sell you on only that feature because they have no other features. The fact that WordStat works as a module within the broader SIMSTAT package sends the message that a seamless transition from content analysis to statistical modeling is both possible and the ideal. For some uses of the data derived from content analysis, the ability to use it in SIMSTAT eliminates the need to then transfer results to yet another statistical package for subsequent attempts at analysis.

One threshold the software makers fail to cross, however, might be in selling the capability of the SIMSTAT software to execute advanced methodological techniques beyond various types of regression. This is not to say that SIMSTAT cannot handle such modeling; rather, such powers of the software are given short shrift in the program’s codebook, making it at times hard to get a grasp on the full possibilities of the software. Users of specialized software packages might take extra amounts of convincing to execute their models in SIMSTAT rather than just taking the content analysis outputs and converting them to software they are more comfortable with; spending only three pages in the codebook explaining, for example, the time-series functions available might not meet the burden of proof some scholars need in order to make the switch from RATS or STATA. Another shortcoming of the software (depending on one’s operating system preferences) is the fact that it is only available for Windows users, a fact all too common in the software community.

In total, however, it is clear that the packages offered by Provalis Research are a step in the right direction. Combining content analysis with a highly capable statistical package is clearly a welcome development. In addition, the user-friendly nature of the software throughout every step

of the content analysis process ensures that the analyst can find what he or she needs in the text being studied without fear of a computer program making coding decisions out of ignorance.

WordStat 5.1, SIMSTAT 2.5, and QDA Miner 2.0 are available from the Provalis Research web site at <http://www.provalisresearch.com>. Cost for Academic Licenses: Wordstat/SIMSTAT \$545.00, Wordstat/QDA Miner \$635.00, Wordstat/SIMSTAT/QDA Miner \$995.00

## Book Review

### Review of Andrew Gelman and Jennifer Hill Data Analysis Using Regression and Multilevel/Hierarchical Models

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**Data Analysis Using Regression and Multilevel/Hierarchical Models. Andrew Gelman and Jennifer Hill. Cambridge University Press, New York, 2007, 648 pages. \$39.99, ISBN 052168689X (paperback); \$90.00, ISBN 9780521686891 (hardcover).**

#### Introduction

Andrew Gelman and Jennifer Hill's new text, *Data Analysis Using Regression and Multilevel/Hierarchical Models*, is unlike any other on the market. Calling it simply a textbook does it a disservice. It is more of a hybrid—a cross between a standard text for a course in multilevel modeling and an extended argument for developing a set of standards building and inferring from multilevel regression models, approximating King's *Unifying Political Methodology* (1989) in its approach. That said, consumers of statistical methods in political science will likely find the text most useful as a how-to manual for doing multilevel research. And, to the extent that Gelman and Hill (GH) convince scholars to think of classical regression simply as a specific limiting case of the multilevel framework, then text can be thought of as a hands-on manual for analyzing cross-sectional data more generally.

*Data Analysis* combines statistical theory and equations with examples from their own research and software code necessary to reproduce all results. This practical component provides three important services for those aspiring to use multilevel techniques in their research. First, the text illustrates the relevance of multilevel techniques for political science in ways that other texts do not. Indeed, after reading it, one begins to wonder what sort of applications cannot be thought of as “multilevel”—particularly if we use the tools of multilevel analysis to get more information from our predictors, even if they are not explicitly

collected at different levels. Most of the examples will be familiar to political scientists—if not taken directly from a politics application (as in Gelman et al.'s “red state, blue state” work), then they at least will be better understood than applications used by other texts in the market, most of which are written by specialists in education or public health (e.g., Rabe-Hesketh and Skrondal 2005; Raudenbush and Bryk 2002; Snijders and Bosker 1999). In these disciplines, “multilevel” often equates to longitudinal where, say, a single individual is the level two unit (or what GH call the “group-level” unit) and time of recorded observation is the level one unit (“data-level” unit). Equally important, the text progresses from more familiar single-level models and builds from these in ways in that anticipate the move to multilevel frameworks in later sections of the book by driving home the need for analysts to consider, for instance, data transformations, interaction effects, and analysis of subpopulations.

Second, *Data Analysis* strives to provide a standard approach to model building. Standard operating procedure—to the extent it exists—has heretofore been to draw on insights from Steenbergen and Jones's (2002) article-length treatment or from a collection of articles published in a special issue of *Political Analysis* (Kedar and Shively 2005). Recommendations made by these pieces, however, are necessarily too specific or too cursory to provide a general approach to model building. Perhaps for this reason, we continue to see a wide range of estimation, comparison, and diagnostic and checking standards for multilevel applications in the political science journals, even as the number of these applications continues to grow. For example, researchers often specify and report models with varying slopes without providing information on whether relaxing the assumption of common slopes across units is justified (e.g., reporting the ratio of within-group to between-

group variance explained). In my experience, it is still more rare to see analysts report comparisons of multiple specifications based on model fit (e.g., likelihood ratio statistic). Gelman and Hill's attempt to provide some structure to modeling multilevel data structures is therefore a welcome contribution. GH walk readers through the steps, beginning with a classical single-level model, respecifying it as a multilevel framework, adding complexity to the multilevel model (i.e.: varying slopes and varying coefficients), model checking, and then, in the last part of the book, implementing multilevel analysis using Bayesian inference. This covers a lot of ground, and the modal political science methods consumer or graduate student may find it overwhelming. Yet the authors do the best they can to keep it accessible, relegating the more complicated aspects of derivation and estimation to certain areas (for example, Chapter 18 covers theoretical and applied issues of Bayesian inference; Chapter 19 addresses debugging and building confidence in models).

The third and perhaps most notable feature of *Data Analysis* is its advocacy of a single software package, R-project (and WinBUGS called from R). For better or worse, basic cross-sectional (and, increasingly, time series) regression has coordinated on Stata as the software of choice. No such user community exists, however, for users of multilevel models in the discipline.<sup>1</sup> In the past five years I have seen multilevel analyses appearing in top political science journals using HLM, MLWin, Stata (`xtmixed` command and the `gllamm` package) and, with less frequency, R and BUGS. While there is nothing wrong with this multiplicity of packages per se, it does impede the flow of shared routines, code, and practical advice among colleagues. The authors' advocacy of R and BUGS makes sense, given their flexibility and (for Bugs') capabilities for Bayesian methods. Equally important, however, is that using R makes possible the book's approach of toggling back and forth between statistical theory and applications since a model written in R is, for all practical purposes, the model as it appears in equation form.<sup>2</sup>

## Coverage and Organization

The book is organized in three main sections corresponding to classical (single-level) regression, specifying and estimating multilevel models, and checking and understanding multilevel models. Part 1A covers the essentials of linear, logistic, and generalized linear models. Though covered in a first-year graduate statistics sequence, the coverage of these topics in *Data Analysis* reads less as a review than as a way to reprogram how we think about data.

As a "reprogramming," Part 1B (Chapters 7-10) is particularly useful. Here, the emphasis is on working with regression inferences—frequently through visual displays—

in order to teach applied researchers how to (better) present their quantitative findings to the reader. In chapters 9 and 10 the authors make the transition from statistical analysis with the objective of making predictive comparisons to the use of statistics for causal inference. They emphasize the fundamental problem of causal inference and highlight how randomization and statistical adjustment can be used—separately and in combination—to overcome this problem. While the material in these chapters will be familiar to many readers, there are some reminders of principles that many may not have retained during our first pass through these topics. For example, section 9.7 discusses the perils of controlling for post-treatment variables, a welcome reminder against the penchant of many analysts to blindly estimate "garbage can" models (Achen 2005). Also along these lines, GH include a section (10.3) on matching techniques as a way to approximate randomized experiments when our ability to assign treatments is compromised for ethical, budgetary, or other reasons.

Part 2 takes up multilevel modeling. Chapters 11-15 cover the theory of multilevel analysis and helps the reader make her/his way through the many choices one confronts in multilevel pursuits. Chapter 12 serves as the flagship chapter. Here the application of predicting home radon levels in 85 Minnesota counties is introduced as a running example for specifying and fitting multilevel linear models in R (using the `lmer()` function) and WinBUGS. Even casual readers should take the time to download these data and run the models while working their way through the text. GH treat multilevel regression as a general form of the no-pooling and complete-pooling specifications (which should be familiar to users of classical regression, even if not by name). They illustrate how we see more pooling for level 2 units with fewer observations compared to those with more observations. This discussion is put in more concrete terms than the frequent (and mildly mysterious) explanation of the benefits of multilevel modeling as "borrowing strength" across levels of data. Chapter 13 discusses more complex linear models, beginning by relaxing the assumption of constant slopes across groups and discussing varying slopes as interactions with individual-level predictors (cross-level interactions) and then moving to more complex situations. Chapters 14 and 15 discuss how to fit multilevel logistic and generalized linear models in R, a discussion which parallels Chapters 5 and 6 for single-level models.

The focus of Chapters 16-19 is on fitting multilevel models using WinBUGS. Taking the plunge and learning BUGS is motivated by the shortcomings of approximate likelihood routines like `lmer()`. The concept of informed priors is conveyed as the information provided by the group-level (i.e.,

<sup>1</sup>Gelman and Hill continue the recent calls of advocating transparency in how we incorporate and report uncertainty in statistical results, particularly through graphical techniques. On this note, King et al.'s (2000) *Clarify* package has become the industry standard, a consequence of which has likely been to steer more and more users to Stata

<sup>2</sup>Adopting R and BUGS will also enable users to tap into the procedures developed in Bayesian texts (e.g., Congdon 2005; 2007).

level 2) model. GH explain that Bayesian inference achieves partial pooling for multilevel models by treating the group-level model as defining prior distributions for varying intercepts and slopes. This means that the key step of multilevel analysis using Bayesian inference is estimation of the data-level (i.e., level 1) regression coefficients given (informed by) the data and variance hyperparameters from the group-level model.

Chapter 16 demonstrates how to use `WinBUGS`, as called from `R`, to estimate a multilevel linear model. Code is provided for estimating models on the radon data, first presented all at once and then parsed into the individual-level model, the group-level model, and the assignment of priors. It is helpful to read this in tandem with Chapter 12, which provides much of the same information, but using `lmer()`. Chapter 17 then presents `WinBUGS` code for some of the more complex linear and generalized linear models from Chapters 13-15, including those with varying intercepts and slopes and non-nested models. Gelman and Hill take a break from walking through code and examples in Chapter 18, which provides a quick sketch of the principles of Bayesian inference, as built up from the mathematics of least squares regression and maximum likelihood and ending with a very intuitive treatment of how Gibbs sampling works. This chapter might be better placed before introducing readers to `WinBUGS`, as it provides a more extensive motivation for going Bayesian than more or less having to take the authors at their word.

Finally, Part 3 covers a variety of topics to help the analyst make better use of his or her results. This includes tips on displaying large sets of parameter estimates, on doing ANOVA using multilevel techniques, on post-convergence checking and model comparison, and on missing-data imputation. Examples are provided in the contexts of models in `BUGS` but, as the authors emphasize, many of the recommendations outlined in Part 3 will also apply to simpler single- or multi-level contexts.

## Concluding Remarks

*Data Analysis Using Regression and Multi-level/Hierarchical Models* is the book I wish I had in graduate school. It is my sense that if graduate students and junior scholars in political science do learn the analytical and presentational techniques (or “tricks,” we could call them) described in the text, they generally do so through informal conversation with each other, in collaborating with more senior scholars, or through a process of trial and error based on attempts at replicating analyses from conference papers or published work—in short, at lots of places other than classroom. Armed with Gelman and Hill’s text, reliance on these less systematic practices will be far less essential than before.

There are few criticisms to be leveled. More could

be done, for example, to discuss the application of Bayesian and/or multilevel techniques for time series and time series-cross sectional designs. One might argue that we still need a book that is targeted even more specifically at our discipline (e.g., it would be a misnomer to add “for Political Scientists” to the title). Some of the examples seem needlessly narrow and complex, as in the example of storable votes in section 6.5. And at times the text could be more explicit about which file names (from Gelman’s website) correspond to the examples in the text to make it easier to follow along. By and large, however, the text succeeds in its goals.

The text is an obvious candidate for use in courses or course modules on multilevel modeling, especially in Part 2. Beyond that, where should it be used? Instructors of first-year graduate methods courses should consider complementing their texts with material from Part I. Many use Kennedy’s *A Guide to Econometrics* (2003) to provide an alternative take in the essentials. *Data Analysis* is better suited for taking on this role. Students will find its coverage less redundant of what they get from standard texts, and the use of non-economics based examples should also help sell quantitative research to skeptical incomers into the profession.

More importantly, however, is the complementary approach used in *Data Analysis*. Standard econometrics texts emphasize how to “correct” for the violations of parameter inconsistency and bias. Lost in discussions of heteroskedasticity and correlated disturbances, however, are more fundamental issues of research design and causal effects. Additionally, parts of Part 1B, particularly Chapters 9 and 10 on inference, would fit nicely into more general research design seminars. *Data Analysis* also would provide courses in Bayesian methods with the best compendium of worked examples and unworked exercises to facilitate learning. Thus, the best advice may be for students to use the text at different stages of their training.

Finally, it is worth considering the broader implications for methods training of texts like *Data Analysis* which emphasize “learning by doing” over “learning by lecturing.” While I am an advocate of this approach, an obvious question arises: if GH’s text represents the future of pedagogy in political science methods courses—in terms of what we as instructors are building up to—then how will this reshape instruction at the introductory level? Should we be less concerned with teaching matrix algebra or with demonstrating the consequences of violating the Gauss Markov assumptions? Instructors often grapple with how much theoretical depth to provide their students. Gelman and Hill’s well-designed and wide-ranging text suggests that we be more concerned with confronting and transforming data than with statistical theory, at least at the introductory level.

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## Teaching and Research

### APSA TLC: Call for papers and discussants

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APSA has posted its call for paper proposals and workshops call for paper proposals and workshops for the 2008 Teaching and Learning Conference. The meeting will occur in San Jose, California, on February 22-24, 2008. The deadline for paper and workshop proposals is September 17, 2007, and proposals should be submitted online through the APSA website.

Paper presenters and conference attendees choose one working group in which to participate throughout the conference, and each year, the conference includes a "Teaching Research Methods" working group. In addition to discussion of the papers presented in the working group, each

group seeks to identify important issues, best practices, and future goals related to the group's theme. Summaries of the working group discussions are typically published on the APSA website or in *PS: Political Science and Politics*. (See the 2007, 2006, and 2005 summaries.)

In addition to the working groups, the meeting hosts 90 minute workshops that introduce participants to new tools for or approaches to teaching.

Please consider submitting a paper or workshop proposal or participating in this year's Teaching Research Methods working group at the TLC meeting in San Jose.

## Section Activities

### Chris Achen winner of the Section's first Career Achievement Award

At the request of section President Janet Box-Steffensmeier, I chaired a committee comprising of Mike Alvarez, Liz Gerber and Marco Steenbergen, to award the Society for Political Methodology's inaugural Career Achievement Award. On behalf of my fellow committee members, I write to thank the many colleagues who submitted nominations and letters of support.

We are delighted to announce that Chris Achen will be the recipient of the Society's first Career Achievement Award, and we will be presenting Chris with this award at our business meeting at APSA.

The citation for Chris's award that went up to APSA reads as follows:

Christopher H. Achen is the inaugural recipient of the Career Achievement Award of the Society for Political Methodology. Achen is the Roger William Straus Professor of Social Sciences in the Woodrow Wilson School of Public and International Affairs, and Professor of Politics in the Department of Politics, at Princeton University. He was a founding member and first president of the Society for Political Methodology, and has held faculty appointments at the University of Michigan, the University of California, Berkeley, the University of Chicago, the University of Rochester, and Yale University. He has a Ph.D. from Yale, and was an undergraduate at Berkeley.

In the words of one of the many colleagues writing to nominate Achen for this award, "Chris more or less made the field of political methodology". In a series of articles and books produced over a span of some thirty years, Achen has consistently reminded us of the intimate connection between methodological rigor and substantive insight in political science. To summarize (and again, borrowing from another colleague's letter of nomination), Achen's methodological contributions are "invariably practical, invariably forceful, and invariably presented with clarity and liveliness". In a series of papers in 1970s, Chris basically showed how us how to *do* political methodology, elegantly demonstrating how methodological insights are indispensable to understanding a phenomenon as central to political science as rep-

resentation. Achen's "little green Sage book", *Interpreting and Using Regression* (1982) has remained in print for 25 years, and has provided generations of social scientists with a compact yet rigorous introduction to the linear regression model (the workhorse of quantitative social science), and is probably the most widely read methodological book authored by a political methodologist. Achen's 1983 review essay "Towards Theories of Data: The State of Political Methodology" set an agenda for the field that still powerfully shapes both the practice of political methodology and the field's self-conception. Achen's 1986 book *The Statistical Analysis of Quasi-Experiments* provides a brilliant exposition of the statistical problems stemming from non-random assignment to "treatment", a topic very much in vogue again today. Achen's 1995 book with Phil Shively, *Cross-Level Inference*, provides a similarly clear and wise exposition of the issues arising when aggregated data are used to make inferences about individual behavior ("ecological inference"). A series of papers on party identification—an influential 1989 conference paper, "Social Psychology, Demographic Variables, and Linear Regression: Breaking the Iron Triangle in Voting Research" (*Political Behavior*, 1992) and "Parental Socialization and Rational Party Identification" (*Political Behavior*, 2002)—have helped formalize the "revisionist" theory of party identification outlined by Fiorina in his 1981 *Retrospective Voting* book, and now the subject of a lively debate among scholars of American politics.

In addition to being a productive and extremely influential scholar, Achen has an especially distinguished record in training graduate students in methodology, American politics, comparative politics, and international relations. His students at Berkeley in the late 1970s and early 1980s included Larry Bartels (now at Princeton), Barbara Geddes (UCLA), Steven Rosenstone (Minnesota), and John Zaller (UCLA), among many others. His students at Michigan in the 1990s include Bear Braumoeller (now at Harvard), Ken Goldstein (Wisconsin), Simon Hug (Texas-Austin), Anne Sartori (Princeton), and Karen Long Jusko (Stanford). In addition to being the founding president of the Society for Political Methodology,

Chris has been a fellow at the Center for Advanced Study in the Behavioral Sciences, has served as a member of the APSA Council, has won campus-wide awards for both research and teaching, and is a member of the American Academy of Arts and Sciences.

Simon Jackman  
Stanford University

## Announcement for PolMeth 2008

The University of Michigan will host the 25th (Silver Edition!) Summer Meeting of the Society for Political Methodology at the University of Michigan, Ann Arbor on July 10-12, 2008. (This moves the conference ahead one weekend from its usual schedule to avoid coinciding with the Ann Arbor Summer Art Fairs.) The host committee—Rob Franzese (chair), Nancy Burns, Bill Clark, Liz Gerber, John Jackson, Don Kinder, and Walter Mebane—aims to accommodate at PolMeth 2008 the ongoing expansion of the Society and of demand from its graduate-student and faculty to attend and to present work at the conference. The hosting committee and, once formed, the conference committee will receive comments and advice, including feedback from this year's conference attendees, from past years' host and conference committees and from the Society's executive, long-range-planning, and other committees on how best to continue the experimentation with formats for the conference sessions so as to reconcile optimally the new, larger sizes of conferences going forward with the widely and deeply revered intellectual (and social) atmosphere and content of meetings past. Please respond to requests from those committees for feedback and suggestions on the meetings; you may also send comments directly to the host-committee chair, if you prefer. We look forward to welcoming as many of you as possible to Ann Arbor next July!

Rob Franzese  
*University of Michigan, Ann Arbor*

## A note from our Section President

We have a very active section and one of the largest in the APSA. A list of committees and their activities is available on our webpage: <http://polmeth.wustl.edu/society.php>. Please check it out and get involved! A sample of the committees hard at work include the Long Range Strategic Planning Committee chaired by Gary King, the Diversity Committee chaired by Caroline Tolbert, and the Undergraduate and Graduate Methodology Committee chaired by Lonna Atkeson. Please contact them with comments and suggestions.

A heartfelt thank you to Robert Erikson for his leadership and service as editor of *Political Analysis*. The journal has flourished under his editorship and is a critical part of our section activity. We welcome Christopher Zorn as the new editor. Similarly, we thank Adam Berinsky, Michael Herron, and Jeff Lewis for their service as editors of *The Political Methodologist*. Our newsletter is an important source of computing and teaching information for our broad section membership. The new editorial team is at Texas A&M University—Paul Kellstedt, David Peterson, and Guy Whitten. I am pleased to announce that the 25th Annual Political Methodology Conference will be held in 2008 at the University of Michigan. Rob Franzese is spearheading the local organizing. It is a larger and larger undertaking as we work to expand participation and we appreciate and look forward to meeting in Ann Arbor. We are also pleased to announce that Yale will be hosting in 2009, and thank Alan Gerber and Donald Green for their enthusiasm in hosting us then. I would like to thank Tom Carsey, chair of the Annual Meeting Selection Committee, as well as committee members Suzanna DeBoef, John Freeman, Jeff Gill, and Simon Jackman for their help and advice in selecting the next hosts. Please join us for our annual business meeting, which is held at the APSA meetings. The date is Thursday, August 30, 2007 at 12:00 p.m. Our annual awards will be presented at the business meeting. Our awards include:

- The Gosnell Prize for Excellence in Political Methodology to Alberto Abadie, Alexis Diamond, and Jens Hainmueller for “Synthetic Control Methods for Comparative Case Studies.”
- The Miller Prize for the best work appearing in *Political Analysis* in 2006 will be awarded to Fred Boehmke for “The Influence of Unobserved Factors on Position Timing and Content in the NAFTA Vote.”
- The John T. Williams Award for the best dissertation proposal in the area of political methodology will be awarded to Arthur Spirling for “Bringing Intuition to Fruition: Turning Points and Power in Political Methodology.”
- The Society for Political Methodology's Best Poster Award for 2006 is awarded to Jong Hee Park for “Modeling Structural Changes: Bayesian Estimation of Multiple Changepoint Models and State Space Models.”
- The First Career Achievement Medal of the Society of Political Methodology will awarded to Christopher Achen.

I thank all the award committee members for their hard work. Gosnell Award Committee: Michael Ward (chair), Michael Crespin, and Patrick Brandt; Miller Prize Committee: Brian Pollins (chair), Robert Franzese, and William

Berry; John T. Williams Dissertation Prize Committee: John Aldrich (chair), Michael Colaresi, and Tse-Min Lin; Best Poster Award Committee 2006: Andrew Whitford (chair), Jake Bowers, Kris Kanthak, Luke Keele, David Kimball, and Matthew Lebo; and Political Methodology Career Achievement Award: Simon Jackman (chair), Elisabeth Gerber, Marco Steenbergen, and R. Michael Alvarez.

We are also having a reception at APSA, which is on Thursday, August 30th, at 7:00 p.m. and it is co-sponsored by the Qualitative Methods Organized Section. We will be honoring Robert Erikson for his term as editor of *Political Analysis* as well as Hank Heitowit for his vital advances made as the director of ICPSR.

I would like to thank Greg Wawro, Columbia University, for putting together the Political Methodology Section's APSA panels. Our section is sponsoring a working group again this year at the APSA meeting. It is led by Rick Wilson, Rice University, on the topic of Experiments, Causality, and the Study of Politics. We have two APSA Short Courses this year. One on the topic of Creating Powerful and Effective Graphic Displays taught by William Jacoby, Michigan State University, and one on Applied Politi-

cal Network Analysis taught by Paul Thurner, University of Mannheim. We appreciate their ingenuity and organization of these intellectual adventures.

Finally, we are pleased to announce that the National Science Foundation has recommended funding for a grant to continue funding for graduate students, women, minorities, and junior faculty to attend the Annual Political Methodology Conference. The other two key parts of the proposal are to fund new meetings for women in political methodology and for smaller theme meetings on a specific methodological topic. A call for proposals for the latter will be issued pending final approval from NSF.

The Nominations Committee, Larry Bartels (chair), William Jacoby, Meg Shannon, and Christopher Zorn, have put forth Phil Schrodtt for President and Jeff Gill for Vice President. It has been a pleasure to serve the section and I look forward to its continued growth and vibrancy.

Cheers,

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Subscriptions to *TPM* are free to members of the APSA's Methodology Section. Please contact APSA (202-483-2512, <http://www.apsanet.org/section.71.cfm>) to join the section. Dues are \$25.00 per year and include a free subscription to *Political Analysis*, the quarterly journal of the section.

Submissions to *TPM* are always welcome. Articles should be sent to the editors by e-mail ([tpm@polisci.tamu.edu](mailto:tpm@polisci.tamu.edu)) if possible. Alternatively, submissions can be made on diskette as plain ascii files sent to Paul Kellstedt, Department of Political Science, 4348 TAMU, College Station, TX 77843-4348. L<sup>A</sup>T<sub>E</sub>X format files are especially encouraged. See the *TPM* web-site, <http://polmeth.wustl.edu/tpm.html>, for the latest information and for downloadable versions of previous issues of *The Political Methodologist*.

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