

The Political Methodologist

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year and will contain articles on topics related to teaching, research, methodological debates and computing. We can only hope to continue the high quality of our predecessor, Susie DeBoef.

In this issue we continue mainstays of the past and introduce some new regular features. We begin with the Software and Technology corner. Andrew Martin and Kevin Croker provide an introduction to recent advances in clustered computing that facilitate the estimation of computationally expensive models and give a primer on the use of such technologies. And Kosuke Imai, Gary King, and Olivia Lau, discuss Zelig, a new computer program that unifies R code from many researchers in a single package. We also continue the "L^AT_EX Corner" with a piece by Tze Kwang Teo on the use of packages in L^AT_EX . We hope to continue this column, so please submit tips and share your L^AT_EX wisdom with the rest of the field.

Finally, we begin a new column "Research in Practice" where we ask scholars to describe the intellectual history of one of their prominent research projects from its genesis to its completion. This new feature kicks off with James Stimson writing on the development of his policy mood measure.

Being the new guys on the block, we want to end our notes with a plea for contributions to TPM. Our next issue is shaping up well. We will have a piece on changes in methods training over the last 30 years, with contributions from Chris Achen, Larry Bartels, Simon Jackman, and Joshua Clinton. But we are always looking for more contributions, including articles, software reviews, and book reviews.

Note From the Editors

Welcome to TPM. This is the first issue under our joint editorship, and we hope that you agree that it was worth the wait. The newsletter will appear in your mailbox twice a

The Editors

Software and Technology

Clustered Computing for Political Science

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Introduction: Why Clusters?

Up and down the halls of universities throughout the world, computers sit in offices and labs doing nothing. Perhaps these computers are looking for alien life as part of the SETI project when not being used, but more likely, they are idle. Have you ever wondered how you could harness these available cycles for your computation needs? Or, perhaps you are tired of using your workstation for model estimation, grinding your other programs to a halt, and are looking for a way to use other available computing power to solve your problem. Some recent advances in clustered computing make putting to use available resources relatively straight forward. Not only does this ameliorate the need to purchase additional hardware, but it makes it possible to harness available spare cycles already available in nearly every academic building.

But why would a political scientist need these sorts of resources? Simply put, many problems in political methodology are computationally expensive. As models get more and more complicated, the computational power needed to estimate them increases. Many likelihood functions are not easily maximized, and various optimizers require significant time to converge. Other optimization problems rely on simulations, sometimes to evaluate the likelihood function (e.g., the use of the Geweke-Hajivassiliou-Keane probability simulator to compute multivariate Normal integrals), other times to use sophisticated genetic algorithms as the optimization routine itself (Mebane and Sekhon 2004). Markov chain Monte Carlo (MCMC) methods—the workhorse of applied Bayesian inference—also require significant computer time, whether in an interpreter such as R or WinBUGS, or in a compiled language like C or FORTRAN. It is not uncommon for political scientists to fit models that take days, weeks, or even months to estimate on state-of-the-art hardware.

Moreover, fitting a single model does not make for good social science. Indeed, all robustness and sensitivity analysis that goes into applied statistical work in political science requires the researcher to fit models with slightly different covariates, perhaps different priors, and different assumed model structures. Having to fit multiple instances of compu-

tationally expensive models becomes practically impossible on a single workstation.

In this article we review two state-of-the-art clustering technologies: openMosix and Xgrid. openMosix is used for clustering Linux workstations, and Xgrid is used for clustering MacOS X machines. We are not aware of (nor would we consider using) clustering systems for Windows systems. We have used openMosix for over two years to run a small cluster of Linux machines that we use for running long simulations in R and C++. We have also installed a beta version of Xgrid on some local computers to test its reliability.

Before we describe how each of these technologies works, it is important to draw a distinction between a cluster and a supercomputer. A supercomputer is one physical unit able to process instructions at speeds many times greater than your average workstation. A cluster, on the other hand, is one *virtual* unit consisting of several workstations connected over some sort of network. Supercomputers have highly accelerated input/output, memory access, and processor speed, and typically have shared memory access. As such, they are useful for problems that can be solved in parallel. Supercomputers have been used in political science; Poole and Rosenthal (1997) estimated their two-dimensional D-NOMINATE model on the CYBER 205 supercomputer at Purdue University in the late 1980s. As discussed in the conclusion, clusters can also be used to attack problems that can be implemented in parallel, often at greatly reduced cost. While we have limited experience with explicitly parallel code, in principle this could be used for a number of problems in political science using the same clustering technology discussed below.

openMosix

When constructing our cluster, we chose openMosix¹ for its transparent operation and ease of deployment. Among the other options available at the time, Beowulf and commercial MOSIX, we felt that openMosix represented the best potential for growth and flexibility. How transparent is openMosix? Working on an openMosix cluster is as simple as working on a regular workstation; the user never has

¹<http://openmosix.sourceforge.net/>

```

11:37am up 2 days, 30 min, 9 users,
load average: 2.31, 1.12, 0.87 115
processes: 112 sleeping, 3 running, 0 zombie, 0 stopped
CPU states: 792.6% user, 5.4% system, 0.0% nice, 0.0% idle
Mem: 1030332K av, 658444K used, 371888K free, 0K shrd, 6480K buff Swap:
2040244K av, 3272K used, 2036972K free 189600K cached

```

PID	USER	PRI	NI	SIZE	RSS	SHARE	STAT	N#	MGS	%CPU	%MEM	TIME	COMMAND
25785	adm	17	0	116M	116M	1352	S	4	1	99.9	11.6	1:04	R.bin
25794	adm	15	0	117M	117M	468	S	2	1	99.9	11.6	1:45	R.bin
25758	adm	16	0	116M	116M	1352	S	2	1	99.7	11.6	1:11	R.bin
25776	adm	15	0	115M	115M	468	S	4	2	99.7	11.5	1:23	R.bin
25731	adm	17	0	115M	115M	468	S	3	2	99.2	11.4	1:11	R.bin
25740	adm	17	0	115M	115M	468	S	3	2	99.2	11.5	1:12	R.bin
25749	adm	18	0	115M	115M	468	R	0	2	95.5	11.5	1:00	R.bin
25767	adm	13	0	115M	115M	468	R	0	2	94.7	11.5	0:55	R.bin
22659	adm	9	-1	29420	11M	2232	S	0	0	3.3	1.1	1:02	X
25888	adm	9	0	26196	9796	6852	D	0	0	2.7	0.9	0:02	openmosixv
25887	adm	12	0	892	892	716	R	0	0	1.3	0.0	0:00	mtop
22	root	9	0	0	0	0	SW	0	0	0.3	0.0	0:21	memsorter

Table 1: Output of the openMosix mtop command.

to worry about viewing the particular computer system she is on as part of a special entity. When a user starts a program, openMosix looks at all other workstations running openMosix and asks them: “Hey, how busy are you?” The other machines reply, and based on the replies, the user’s program is invisibly relocated over the network to the machine where it will run most efficiently. To the user, it still appears as if the process is running locally, but it is actually not. Migration is dynamic and takes place in real-time. openMosix is therefore constantly tuning the performance of all programs that are running on the cluster without ever needing user intervention. Of course, this has limitations, particularly with jobs that are input/output or memory intensive. In these cases, the programs simply stay on the local machine and other programs that can be efficiently relocated are moved. openMosix shines in CPU intensive tasks, which are typical problems in political science.

openMosix is nothing more than an extension to a Linux kernel and is freely available as a fully open-source project. openMosix can be run on a variety of Linux platforms, but for a particular cluster, it is necessary to have homogeneous architectures on all computers in the cluster. (This does not mean that all machines have to be the same; one just cannot mix machines running Linux on PowerPC chips and Pentium chips.) Installation can be as simple as installing the appropriate packages for your Linux distribution (a bare minimum is the openMosix enabled kernel and the userland tools). Once installed, it is easy to see the advantages of

openMosix. In Table 1 we show typical output from the mtop command, which is a part of the userland tools and is a replacement for the top command. Here you will see that we started eight computationally expensive R jobs, which have automatically been migrated to available nodes on our cluster. Each job is pulling nearly 100% of a processor; the N# column shows which of our dual-processor machines the job has migrated to.

openMosix can be used to share resources across a number of workstations. To the extent that most political science departments are not full of Linux users, we suspect most people will use openMosix for clustering dedicated machines. There are also ways to harness spare Windows machines by booting them into Linux (perhaps for a short while) from either a CD or over a network. As an example, our cluster consists of a master node with a number of slave computers which boot off of a private network. Each slave node consists of just a motherboard, power supply, memory, and a network interface card. We have released a set of scripts to build an auto-assimilating cluster (Croker and Martin 2004). The ClusterKnoppix² project also has released a number of innovative ways to automatically configure a cluster using network and CD booting. We view the upside of openMosix to be its kernel-level implementation. With it, working on a cluster appears just the same as working on a machine with a large number of processors. Installation and administration are required, but no more so than administering a Linux workstation.

²<http://bofh.be/clusterknoppix/>

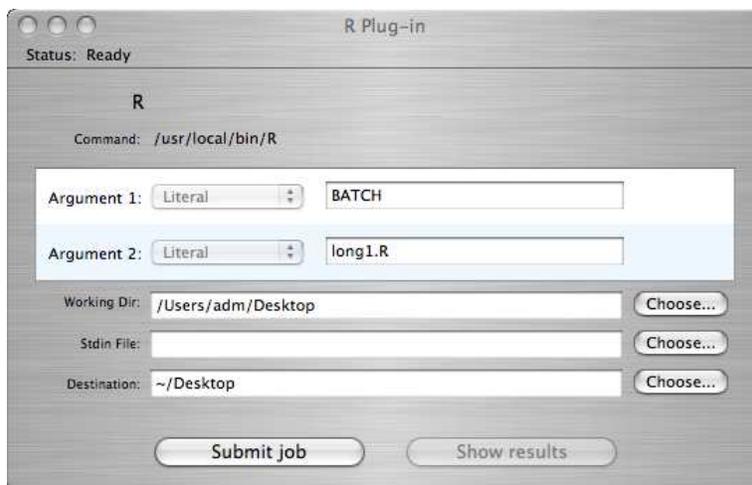


Figure 1: Xgrid Interface for Submitting an R Program

Xgrid

The Advanced Computing Group at Apple Computer has recently released a package to enable clustering of MacOS X machines. Their technology is called Xgrid³. It can be used to harness spare cycles on G4s and G5s that are configured to be part of the cluster. Xgrid is not a kernel-level clustering solution; it resides at the user level, and is a controller/client protocol. Users submit jobs to the controller machine, which distributes them to available client processors. Some clients may be dedicated servers; others might be workstations on the network that have registered with the controller. Xgrid moves jobs automatically, and balances the load across available machines. Each user controls how much, if any, of their processing power they wish to contribute to the cluster. The default setup is to only use workstations when they are not in active use. When a job is completed, the output is returned to the user who submitted the job.

Since Xgrid is not a kernel extension, its installation is as easy as installing a software package. One uses the System Preferences panel to configure the cluster, including setting what machine is the controller, setting up secure passwords to access the controller, the clients, etc. Once configured, the user submits a job to the cluster using a graphical interface. In Figure 1 we show how one would submit a long R job to the cluster. As with openMosix, Xgrid can be used to execute truly parallel programs. As a demonstration, Apple distributes a parallel program used to search DNA and protein databases. The Xgrid program contains a number of graphical tools one can use to see how much available processing power is in use at a given time. The

upside to Xgrid for applied work in political science is the availability of hardware; surely more political scientists use MacOS X than Linux. The installation and configuration is trivial, and one can even install Xgrid on ones' colleagues' machines without ever sitting at the terminal (if you have root access). The down side, compared with openMosix, is the batch submission process, which adds an additional step to executing a large program.

Conclusion

In our experience, the time invested in learning and deploying these technologies is well worth it. Being able to estimate ten or more instances of a single model that takes two or three weeks with different priors and covariates *at the same time* considerably speeds up the research process. As our models become increasingly complicated, having technologies that can make computing as easy and quick as possible is of great utility.

Moreover, there are additional gains to be had when our software can take into account these available computation resources by "going parallel." Both openMosix and Xgrid work seamlessly with MPI⁴, the protocol most often used to implement parallel algorithms in FORTRAN and C. Due to communication latency, clusters are not quite as fast as traditional supercomputers with shared memory, however they are far more economical. As such, clusters serve as a viable platform for implementing parallel algorithms. We look forward to seeing interesting applications in political science in the future. Happy computing, and happy clustering.

³At the moment, Xgrid is freely available at: <http://www.apple.com/acg/xgrid/>

⁴<http://www.lam-mpi.org>

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Zelig: Everyone's Statistical Software

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A growing proportion of statisticians and methodologists from many disciplines are converging on R, a powerful statistics package and programming language. As an open source project, R is freely accessible. With thousands of contributors who have written hundreds of packaged routines, R can deal with nearly any statistical problem. Although this high level of participation may be its greatest strength, the enormous diversity in approaches to statistical inference covered by R often results in a virtual babel of competing functions and inconsistent syntax.

To address these problems from a common perspective, we have created Zelig, a single, easy-to-use program, with a unified framework and syntax, that can estimate, help interpret, and present the results of a large range of statistical methods. It literally *is* "everyone's statistical software" because Zelig uses R code from many researchers. We also hope it will *become* "everyone's statistical software" for applications, and we have designed it so that anyone can use it or add their methods to it. Zelig comes with detailed, self-contained documentation that minimizes startup costs for Zelig and R, automates graphics and summaries for all models, and, with only three simple commands required, generally makes the power of R accessible for all users. Zelig also works well for teaching, and is designed so that scholars can use the same program they use for their research.

Zelig adds considerable infrastructure to improve the use of existing methods. Zelig

- implements and generalizes the program Clarify (for Stata), which translates hard-to-interpret coefficients into quantities of interest;

- combines multiply imputed data sets (such as output from Amelia) to deal with missing data;
- automates bootstrapping for all models;
- uses sophisticated nonparametric matching commands which improve parametric procedures (via MatchIt);
- allows one-line commands to run analyses in all designated strata;
- automates the creation of replication data files so that you (or, if you wish, anyone else) can replicate the results of your analyses (hence satisfying the replication standard); and
- makes conditional population and superpopulation inferences.

If you wish to add your methods to Zelig, the documentation also includes simple instructions for how to do so. The process is easy and quick, and can be done by writing a few bridge functions and without rewriting or "porting" your R code. If you don't know how to program in R, the Zelig documentation provides all the information you need. R also interfaces seamlessly with C and Fortran if you prefer to write in those languages. A variety of the best methodologists are currently working to include their methods in Zelig. As Zelig grows, you will have access to an increasing range of cutting edge methods and models.

You may also be interested in an APSA short course on Zelig, held on Wednesday, September 1st, at 1 p.m. There is no fee, but preregistration is required; please email Olivia Lau (olau@fas.harvard.edu) to sign up.

The L^AT_EX Corner

L^AT_EX 102

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Introduction

For users who are relatively new to T_EX/L^AT_EX but have overcome the initial learning curve, the next step involves learning how to move beyond typesetting plain text, and simple equations and tables. As the T_EX typesetting system is modular in nature, getting L^AT_EX to do more of what you want is often accomplished by using various “packages,” which is L^AT_EX -speak for these add-on modules. Thus, a high proportion of L^AT_EX tips and tricks are really about becoming aware of packages, and learning to use their features.

In this article, I introduce some of the packages that I have found myself using frequently, over the course of learning to typeset in L^AT_EX. Uniform Resource Identifiers (URIs,¹ i.e. “hyperlinks”) for their manuals, if available, are included as footnotes.² I think these packages will improve the typesetting experience of most beginners—they did for me—and perhaps even some who are already well-acquainted with L^AT_EX. The packages are all downloadable from the Comprehensive T_EX Archive Network (CTAN),³ or more conveniently, can be installed via one’s favorite T_EX distribution (C_MacT_EX, f_PT_EX, M_iKT_EX, t_ET_EX, T_EXShop, to name a few), regardless of choice of operating system.

Before proceeding further, I recap the command syntax for invoking a package. When there is a need to specify optional settings for a package, insert the command

```
\usepackage[option1,option2]{package-name}
```

in the preamble to invoke that package. (The preamble is the portion of the .tex file between `\documentclass{}` and `\begin{document}`.) Package names are always enclosed in curly braces, and package options in square brackets. You can invoke multiple packages with a single command

```
\usepackage{name1,name2,etc}
```

if no options are specified for those packages. Multiple `\usepackage{}` commands are allowed, and because certain packages have to be invoked before or after others, there may be a need to juggle the order by which the `\usepackage{}` commands appear in the preamble.

Page and Text Layout

Resetting Page Margins with geometry

I personally find the standard margins for L^AT_EX documents too big, especially when the regular text size is 12pt or above. Purists contend, admittedly with good reason, that fitting fewer characters onto each line aids in reading. On the other hand, the additional paper usage is rather wasteful, and those who have submitted manuscripts to journals know that page and text layout is not always a trivial issue.

At first, I inserted a pair of `\setlength{}` commands in the preamble to reduce the width of the left and right margins. But I also wanted to reduce the height of the top and bottom margins. All this entailed scouring L^AT_EX manuals for page layout specifications, and then a lot of trial and error to get the commands correct. Enter the `geometry`⁴ package. For example, if you want margins of 1.2 inches all around, simply specify

```
\usepackage[margin=1.2in]{geometry}
```

in the preamble of the document. The `[margin=]` option is just the tip of `geometry`’s iceberg—it is extremely flexible in that you can include multiple options to suit your exact page layout needs. This is why I prefer it to the `fullpage`⁵ package, which only allows the choice of two margin sizes (1 inch and 1.5 cm).

Headers and Footers with fancyhdr

Let us now turn to headers and footers. `fancyhdr`⁶ lets you specify the contents of left/center/right headers and footers. An

¹Note: the term Uniform Resource Locator (URL) has been deprecated by the World Wide Web Consortium, in favor of Uniform Resource Identifier.

²Most manuals are at <http://www.ctan.org/tex-archive/macros/latex/contrib/>. Further footnotes will usually be to specific files at that path.

³<http://www.ctan.org/>

⁴[geometry/manual.pdf](#)

⁵[preprint/fullpage.pdf](#)

⁶[fancyhdr/fancyhdr.pdf](#)

example preamble that also invokes `geometry`—and I will explain why I deliberately do so—is:

```
\usepackage[margin=1.2in]{geometry}
\usepackage{fancyhdr}

\pagestyle{fancy} \lhead{left header}
\chead{center header}
\rhead{right header}
```

The `\pagestyle{fancy}` declaration is mandatory when using `fancyhdr`. Insert it and the `\lhead{}`, `\rhead{}`, etc. commands after `\usepackage{fancyhdr}`. And, if you are using both `geometry` and `fancyhdr`, *always* place `\usepackage{geometry}` before the `\pagestyle{fancy}` and header/footer contents commands. If not, the header and footer contents will be misaligned.

Line Spacing with `setspace`

The `setspace`⁷ package lets you set line spacing. Insert either a `\singlespacing` (the default), `\onehalfspacing`, or `\doublespacing` command in the preamble to set the overall type of line spacing for the entire document. Use the `singlespace`, `doublespace`, and `onehalfspace` environments (i.e. `\begin{doublespace}` and `\end{doublespace}`, for example) in-text whenever you need line spacing that is different from the overall setting.

Typesetting Tables

Better-Looking Tables with `booktabs`

I like to use the `booktabs`⁸ package whenever I typeset tabular material. Use `\toprule`, `\midrule`, and `\bottomrule` in place of `\hline`, and `\cmidrule{}` in place of `\cline{}`. The new commands create more space between the rules and the tabular material, which makes for better looking tables, and perhaps more importantly, are named such that they logically relate to the structure of the table. The next subsection contains simple applications of `booktabs`.

Aligning Decimal Points with `dcolumn`

In *TPM*, vol. 11, no. 1, Jeff Gill touched on aligning decimal points. Here I describe two other methods I have used. The first method takes less code, but it has constraints that make it less useful for more complex tabular material. First, the number of decimal places has to be the same across rows in the same column. Second, this in turn means that our oh-so-important asterisks cannot be inserted beside parameter or standard error estimates. However, if the constraints do not pose problems (and one is willing to stop feeling p-value envy), then I think this method is simple but effective.

Col. 1	Col. 2
1.23	1.234
12.34	12.345

is generated by the following code:

```
\begin{tabular}{rr}
\toprule
\multicolumn{1}{c}{Col. 1} &
\multicolumn{1}{c}{Col. 2} \\
\midrule
1.23 & 1.234 \\
12.34 & 12.345 \\
\bottomrule
\end{tabular}
```

The “trick” here is: since the number of decimal places is the same for all rows in the same column, right-aligning the contents of each column will result in the decimal points being aligned. I also use the `\multicolumn` command to center the column headings. The code would have been cleaner if I had also let the column headers be right-aligned, but that can be too restrictive on the overall appearance of a table.

The second method uses the `dcolumn`⁹ package, which Jeff Gill mentioned in passing. `dcolumn` is flexible enough to allow the inclusion of asterisks, parentheses, and the like. It defines `D` as a column alignment specifier (just like `l` (left), `c` (center), and `r` (right)), but with three compulsory arguments:

```
D{<sep1>}{<sep2>}{<#decimals>}
```

where `<sep1>` is a single character used as the decimal point separator in the `.tex` file, usually “.”; `<sep2>` is a math-mode-compatible character used as the separator in the actual output, which again is usually “.”; and `<#decimals>` is the maximum number of decimal places in the column (including the asterisks and right parenthesis). To avoid having to specify the full argument for every column that needs to be decimal-aligned, you can “globally” define a new decimal alignment specifier, which is `d` in the example below, by placing the command

```
\newcolumnntype{d}{D}{.}{5}
```

in the preamble, after `\usepackage{dcolumn}` (modify the `\newcolumnntype` command to suit your needs).

```
\begin{tabular}{dd}
\toprule
\multicolumn{1}{c}{Col. 1} &
\multicolumn{1}{c}{Col. 2} \\
\midrule
```

⁷Instructions are found in the package “style” file itself: `/setspace/setspace.sty`

⁸`/booktabs/booktabs.pdf` The `booktabs` manual also contains an excellent discussion of how to produce publication quality tables.

⁹Part of the `tools` bundle of packages. L^AT_EX or pdfL^AT_EX the file <http://www.ctan.org/tex-archive/macros/latex/required/tools/dcolumn.dtx> twice to create the manual in DVI and PDF format, respectively.

```
1.23^{***} & 1.234^{**} \\
(12.34) & (12.345) \\
\bottomrule
\end{tabular}
```

now produces

Col. 1	Col. 2
1.23 ^{***}	1.234 ^{**}
(12.34)	(12.345)

(Note: All numerical cell entries within the “D” (or, in this example, “d”) columns are automatically typeset in math mode. This explains why I did not have to enclose entries like `1.23^{***}` within `$$`.)

Creating Contingency Tables with `sgame`

In *TPM*, vol. 11, no. 2, Tamar London demonstrated the typesetting of extensive form games using the `egame` package. It turns out that the `sgame`¹⁰ package for strategic form games may be suitable for typesetting simple $r \times c$ contingency tables as well.

`sgame` defines the `game` environment, with mandatory syntax and optional arguments along the lines of

```
\begin{game}{row}{col}[row-label][col-label]
<body> \end{game}
```

where `row` is the number of rows, `col` is the number of columns, `row-label` and `col-label` are (player) labels, and `<body>` is the contents of the game or contingency table.

```
\begin{game}{2}{2}[Effect][Cause]
& Present & Absent \\
Present & Cell A & Cell B \\
Absent & Cell C & Cell D
\end{game}
```

produces a simple 2×2 contingency table with “Cause” and “Effect” as the labels.

		Cause	
		Present	Absent
Effect	Present	Cell A	Cell B
	Absent	Cell C	Cell D

Contingency table produced using `sgame`

¹⁰<http://www.chass.utoronto.ca/~osborne/latex/sgame.pdf> `sgame` requires the `color` package to be invoked as well. Both `sgame` and `egame` are written by Martin J. Osborne.

¹¹[/hyperref/doc/manual.pdf](http://hyperref/doc/manual.pdf)

PDF Bookmarks and Hyperlinks with `hyperref`

Adobe Systems’ now-widespread Portable Document Format (PDF) has features such as the display of bookmarks and page thumbnails, and embedding of hyperlinks and cross-references. The `hyperref`¹¹ package lets you use these features in your L^AT_EX documents. For example:

```
\usepackage[bookmarks,pdftex]{hyperref}
```

The `bookmarks` option specifies the creation of bookmarks similar to the table of contents, which is usually displayed by default in Adobe Acrobat (Reader), alongside the document. By default, `hyperref` does not create bookmarks (nor entries in the `\tableofcontents`) for unnumbered section headings, but you can create bookmarks for those yourself with the `\addcontentsline` command:

```
\subsection*{Heading}
\addcontentsline{toc}{subsection}{Heading}
```

(This command also works when you have unnumbered figures and tables and want to create entries for those in the `\listoffigures` and `\listoftables`. Replace the `toc` specifier with `lof` and `lot`, and `subsection` with `figure` and `table`, respectively. Captions must also be created, using `\caption{}`, in order for the entries to appear.)

To create links to URIs, use either `\href{URI}{text}` or `\url{URI}`. The former creates a link to the URI with description. For example,

```
\href{http://polmeth.wustl.edu/}{PolMeth}
```

produces “PolMeth” as the hyperlink. The latter command is for URIs that do not require description.

```
\url{http://www.ctan.org/}
```

is just <http://www.ctan.org/>. Email addresses can be hyperlinked as well:

```
\href{mailto:name@domain.com}{name@domain.com}
```

creates `<name@domain.com>` which, when clicked on will activate the default email client’s “compose new email” function, with the email address in the `To:` field.

`hyperref` also needs to know what program will be used to compile the `.tex` file. In the `\usepackage{}` command above, the `pdftex` option informs `hyperref` that the program will be pdf(La)T_EX. If other drivers are used instead, specify the appropriate option (`dvips`, `dvipdfm`, `vtex`, etc) so that `hyperref` will work properly. Note that `hyperref` should usually be the last package invoked in the preamble, and the `.tex` file should always be L^AT_EX ed or pdfL^AT_EX ed twice.

Concluding Remarks

Obviously, there are many more packages available on CTAN, which I have not introduced; you can search for them using CTAN's search facilities.¹² Nonetheless, some of these packages merit at least a mention here. These include `longtable` for typesetting tables longer than a page, `rotating` and `rotfloat` for displaying tables sideways, and `multirow` for tabular cells span-

ning multiple rows. `beamer`, `FoilTeX`, `prosper`, `pdfscreen` and `pdfslide` are examples of packages for creating presentations ("slides").¹³ Neither should one forget the `graphicx` package for insertion of graphics (images, graphs, etc).

To conclude, I hope this article will at least be of some benefit to my fellow \TeX ies. Who knows, someday you and I may be exchanging more \LaTeX tips and tricks!¹⁴

Research in Practice

Public Policy Mood: A Personal Narrative

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Origins

The development of the concept and measure of Mood began with John Kingdon's treatment of "national mood" in Kingdon (1984). Kingdon's interviews elicited commentary that policy-makers sometimes acted when a national mood suggested that the time was right. Such a mood was real, Kingdon argued, something that Washington policy actors both sensed and agreed upon. And then he wrote that the concept was not the sort of thing that could be measured. I latched on that assertion as a point worthy of a seminar discussion in the Fall of 1987. If mood were real and the basis for a Washington consensus, then there had to be traces of evidence which produced it, I thought. Otherwise the Washington consensus was an exercise in mutual delusion.

Most of the ideas that I have produced in thirty-some years of research evolved slowly. Ideas gradually took shape in months and years of trying this and that and in interacting with data. The issue evolution theory that is the unifying idea of my work with Ted Carmines (Carmines & Stimson 1989), for example, did not exist when we started and did not emerge until we were several years into the study of racial politics. Mood was the exception. The very evening of the American politics seminar in Iowa City I went home and wrote a memo of a few pages which laid out all the essential ideas of Mood and dynamic representation. It felt creative and I wrote feverishly—and I've had few new

ideas on the subject since then. All that followed was fleshing out.¹ The idea was Kingdon's, but turned into a full blown research program around a measured concept.

The evidence, I believed, would be something like fuzzy processing of multiple indicators, none very meaningful in itself. A "mood" was a sense that lots of things were tending in the same direction. Naturally the evidence would come from looking at lots of things, policy preferences, and seeing if they moved together.

Estimation

It became apparent pretty quickly that this was a principal components sort of problem. If multiple "variables" were moving together over time, then it should be possible to estimate the dimension underlying the movement and use it to produce a summary measure. That idea, more or less correct, proved to be a two-year distraction. The idea is not altogether wrong. In concept it *is* a principal components kind of problem. The two years were spent discovering that application of principal components to the estimation of mood was not merely difficult; it was impossible.

Things that covary over time produce correlations. Correlations can be assembled into a matrix. And matrices can be solved for their underlying principal dimensions. But there was a serious missing values issue: most policy pref-

¹²<http://www.ctan.org/search/?action=/index.html>

¹³Michael Wiedmann maintains an excellent list and summary of several presentation tools at <http://www.miwie.org/presentations/presentations.html>

¹⁴I gladly welcome email correspondence, too.

¹And dynamic representation was a supreme example of the virtues of a priori theory. It was five years before the very first test of the thesis was possible.



Figure 1: Public policy mood since 1952

erence questions are not posed to a national sample of respondents in most time units (originally years). A first failed thought was just to take a little mathematical liberty and estimate a pair-wise correlation matrix. That turns out to be impossible, because most of the potential elements of such a matrix are undefined for lack of overlap in the same time periods.² Interpolation was another dead-end. With the biennial NES in mind it seemed reasonable to assume continuity of views and fill in missing odd numbered years. But most series are measured neither at the starting time period of analysis nor at its end. And assuming values before or after they were ever measured quickly becomes an excursion into fantasyland.

Imputing Correlations? After that failure a logical follow-on was the idea of imputing the undefined correlations. If policy preference a never were measured at the same time as policy preference b , then we could locate a third preference c which overlapped both and estimate r_{ab} from r_{ac} and r_{bc} . *In principle*, this could lead to a solution. So I started writing code to solve the imputation problem, not for the example setup but for the general case in which there might be 50-100 “ c ’s” and the imputed value would be a weighted average. That is doable, but it quickly became apparent that the numbers of correlations imputed would overwhelm those based on direct observation. And even then the problem is not quite solved. Such an artificial

matrix can be the basis of studying the dimensional structure. But to estimate the dimension, i.e., to derive a “factor score,” you need real data! And as the imputation approach became more and more artificial, I reached the point where I doubted that I could sell a measure to myself, much less to a critical reader.

The problem underlying these failures is that the missing values issue for these data is nothing like the smaller problem with which we are all familiar. For this problem, in its original guise, the problem is that about 85% of all possible values are missing and the remaining 15% are observed.³ When it is the other way around we can have limited confidence that missing values assumptions do not drive results.

The beginning of an eventual solution was the realization that the first requisite of principal components was to have “variables,”—that is, measures for all cases—and that luxury simply does not exist for policy preference questions. Without variables, the whole apparatus collapses into undefined mathematical confusion.

Estimation Without Variables

Giving up on principal components meant abandoning a well developed model and a huge literature. But lacking appropriate data, it had to be done. Treating the data as they were—as irregular measures of an issue at n times, a subset of N , the number of years in the study, led to two es-

²Imagine the various Michigan election study formats which, in general, never appear in the same study, and you can see the problem.

³And there was also the likely problem that the missing values had perverse properties. Given that survey organizations are driven in part by news judgments, it was likely that questions would be posed when the issues were ‘hot,’ and potentially at atypical values. A randomness assumption would not survive scrutiny.

timization approaches. One of these is a regression approach that I developed with considerable assistance from Chris Achen. The idea is to have two classes of dummy variables, one set for issue measures to treat each question wording as unique, and one for time points. Each measured preference then would have a question dummy and a time dummy. The regression then uses the actual data on the left hand side, L_{it} —liberal percent on question i for time t —and two matrices of dummies on the right. N for this problem is the actual number of measured values, not the much larger $N \times T$, all measures for all times. No missing values need be imputed or have their properties assumed. After estimation the question dummies are meaningless controls and the time dummies (plus the intercept) form estimates of the longitudinal concept.

This works to a point. Its problem is that regression is not a measurement technique and does not incorporate validity ideas. A reasonable a priori view of the data is that some measures (questions on welfare, race, education, cities, healthcare, for example) tapped the central issues in the left-right size and scope of government debate. Others, e.g., spending on space exploration, might be related, but would be less central. And others still, controversies about highways, agriculture, and national parks, for example, might be completely orthogonal to left v. right, having zero validity. Unable to estimate validity, the regression approach necessarily assumed equal validity, a pretty serious assumption failure for a measurement technique.⁴

Standardization is an appealing solution to the missing values issue, albeit one with a problem. If a variable has a constructed mean of zero, then the solution to missing values is to use their expectation, also zero. And then an average across items for each year would produce a measure. But not quite. The solution is illusory because the available time points for each item are *not* a random sample of times. Thus the sample estimates of mean and standard deviation, are not μ and σ^2 —and $E(z_t) \neq 0.0$

The (near) final solution converts measured values for any two time points to ratios so that expectations for unobserved cases are 1.0.⁵ The solution starts with an arbitrary assumption about the value of one time point and is then recursive in time, either forward from the beginning or backward from the end. The algorithm works both forward and backward, taking an average of the two. After initial estimation, it estimates validities from squared

item-scale correlations and, borrowing the logic of iterative principal components, reestimates iteratively using the successively better validity estimates until a convergence result is obtained in which successive validity estimates are only trivially different.

This solution was presented to the summer meetings in Minneapolis in 1989. Two responses to that presentation led to changes and one was ignored. Gary King looked at the year to year variation in the earliest years of the measure and suggested that something was wrong with a measure that showed too much unpatterned annual variation. The problem I well knew was that the measure needed large numbers of observed item ratios for reliability and the survey research record was thin for those early years. Neal Beck, either at the meeting or later by email, suggested a smoothness prior as a means to bring more order. Neal's theoretical suggestion proved to be the answer to Gary's concern and a newer version of the algorithm incorporated a smoothness prior which imposed smooth (exponentially weighted moving averages) ratios over the empirical ones, solving the excess zig-zag of the early years—and eventually making possible estimation for very small time periods (down to daily for some problems, such as presidential horse race polls) as a result.⁶

I well recall the other reception to that first paper. Necessarily, evaluating the missing values issue required thinking about why survey organizations choose to pose particular questions at particular times. I concluded that in a worst case scenario such decisions might be endogenous to the expected value of the preference.⁷ Discussion from the floor quickly focused on this issue as one suitable for a two stage estimator and colleagues urged me to redirect my work toward solving that problem. Well, most of the time PolMeth criticism is really helpful. This one struck me as a diversion from a really interesting problem into a truly trivial one. It was better to me to assume the possibility of endogenous missing values and develop a technique that did not require missing value assumptions. I ignored the advice.

Context

As every dissertation author quickly learns, no matter how intriguing an idea might be, research, when it is the basis for eight hour days, every day, can become grim. I don't know if my experience is typical or atypical in this matter, but when I approach research as play—i.e., when it is not

⁴Of course I could have chosen items selectively for their intuitive fit to left v. right, but that would have produced too little data for reliable estimation and made the measurement suspect as biased by researcher prior judgments. I did implement the regression setup which served as a useful test bed for later developments. By itself it would be fine for problems such as approval, partisanship, and horse race polls in which it is reasonable to assume approximately equal validity across question forms and survey houses.

⁵The algorithm is too lengthy for exposition here. See Stimson (1991 1998). These unfortunately omit much technical detail.

⁶The dimensional extraction algorithm, wcalc.exe (for Windows) is available from my website <http://www.unc.edu/~jstimson> as are recent releases of Mood.

⁷This truly is a worst case, a problem now almost eliminated by the standing decisions of many survey organizations to pose the same questions at regular intervals.

my official task—I am at my best. Just from the fun of playing around, I do things better, quicker, and smarter than I do normally when I get to slogging through the trenches of completion.

Mood was play. I was committed at the time to finishing the issue evolution project and working on mood was the nonserious and light-hearted part of my day. No one was demanding a manuscript. There was no thought of outrageous and unreasonable (like myself) journal referees. It was just fun, doing what needed to be done to make it work, a lark.

At the time I was meeting regularly with Chris Wlezien, then an Iowa graduate student. The meetings were ostensibly about Chris's dissertation on budgeting, but the conversation pretty often turned to mood. Chris' enthusiasm for the concept and measure, which he then already anticipated using, spurred me to keep going.

Programming

Computer programming is a quasi-hobby of very long standing. Not quite a hobby, because I get excited only by things that have application to my professional work, it is also not quite a professional skill, because I could not fully justify the time I put into it except by recognizing that it is partly play, leisure activity a step up from video games or solitaire.

What is a little quirky about my research is that I gravitate to problems that require a programming solution, things too massive to do by hand and things that can't be done with commercial software. Estimating mood is very much one of those problems. From the time that I gave up on the possibility of a principal components analysis it became obvious that a solution would require custom software that could combine data management of the highly irregular quasi-series that constitute public policy preference data with an estimation algorithm that had to be designed from the ground up. I get so excited by the challenges of problems of this order that I can hardly stop myself from working on them. No discipline is ever required.

As soon as I saw the outline of a solution, the work-play involved in finishing happened very quickly, at least relative to my more plodding norm. Had there been a conventional solution, I doubt that the problem would ever have held my rapt attention as it in fact did.

Theory: Origins and Development

I set out to expand on Kingdon's concept of mood. And so I naturally called it by that name, becoming variously, "Mood," "Policy Mood," or "Public Policy Mood." That nondecision on my part had a theoretical consequence. In-

advertently using the language of psychology, I created a concept and measure that seem to demand psychological explanation. Why do electorates have moods? The measure actually is something like the first principle component of domestic policy preferences. And I wish I had called it "Preference." For there was no psychology in the concept. Where it actually belonged was in spatial theories of politics, which derive from economic thinking. Mood is—and was always intended to be—an operational indicator of left-right ideology. It captures the idea that the size and scope of government are issues underlying virtually all domestic policy controversies, that government's role in welfare, health-care, or education are really controversies first and foremost about government.

Psychology Back Again When I was asked to review John Zaller's (1992) book for the *American Political Science Review* I discovered—five years and one book into the project—that there was a psychological basis for mood. The theory, also due to Zaller and Feldman (1988 1992), of sampling from competing considerations provides a theoretical basis for mood. Mood is the dominant "consideration" which underlies response to domestic policy queries. A query on say government spending levels on education naturally primes three sorts of considerations, "how much do I value education?," "how do I feel about spending?," and "how do I feel about government solutions, in general?" It is an empirical issue which of these, or which combinations of these, is dominant. For most domestic issues the evidence is starkly consistent with "government" as the dominant consideration. A reader—presumably one who put a very low value on his or her time—reading in chronological sequence what I have written about mood, (alone or with coauthors), would see a transition from my reading of Zaller. The early works have a fairly pure Downsian angle on preferences and the later ones, Erikson, MacKuen, and Stimson (2002) and Stimson (2004) show the return of psychological thinking.

Absolute and Relative Preferences The public opinion literature is not very sensitive to what it is that we are actually measuring when we ask respondent preferences. And I was equally unconscious. I set out to measure preferences for government policy, implicitly, the answer to the question, "what do citizens want government to do." I used whatever questions were available and conceived of the enterprise in absolute left-right terms, where the electorate stood on all the questions that confront government. But this "absolute preference" view of public opinion turns out not to be very descriptive of most policy preference questions.⁸ Many more questions are of the variety, "Do you want government to do more than it is now doing, less than

⁸The most prominent exceptions, however, are the seven point scales of the National Election Studies, which by themselves dominate much of what political scientists write about policy preferences.

it is now doing, or about the same as it is now doing on . . .”

As I estimated mood time after time under various conditions I began to notice a uniform pattern, the relative “more or less” questions consistently contributed more valid variance to the estimates than did the relatively unusual absolute forms (e.g., “Do you approve or disapprove a five day waiting period for the purchase of a handgun?”). I gradually began to see a pattern that I didn’t particularly like, that the measure seemed to perform best viewed as relative, not absolute, ideology.⁹

Enter Chris Wlezien again. Those Iowa City conversations were the origin of what became Chris’ “thermostatic” model of public opinion (Wlezien 1995). The thermostatic view is that citizens know what they want from government (if they are not particularly articulate about stating it in the complex and specific terms of absolute policy questions) and can easily recognize when government has gone too far or not far enough. Like the beauty of the thermostat controlling heat with only the ability to say more or less, public opinion of a thermostatic sort can govern government policy disputes vastly too complicated for part time spectators to understand. I came gradually, resisting some along the way, to the view that public opinion *is* relative in its normal expression. A matter of considerable debate among coauthors Bob Erikson, Mike MacKuen, and me, and in itself a source of many months delay in completing *The Macro Polity*, the final view is expressed in the section “Mood as Error Correction” in chapter 9 of that volume (Erikson, MacKuen & Stimson 2002). Its argument is that “Preference,” an absolute understanding of public opinion, exists, but is very difficult to measure, and can be leveraged (and we still don’t agree on whether adequately or not) from knowing government policy and Mood, the error correction process.

Publication

The central theoretical and empirical developments of the concept of mood are nowhere to be found in our journal literature. This is traditional in our discipline. Serious measurement development in political science is published only with the camouflage of structural analysis. Journals will publish applications of measures and maybe even critiques of them after they are in circulation, but a piece of pure measurement development, starting with concept, ending in measure, would not survive peer review. I know this not from rejection, for I know the peer review system well enough that I never designed, wrote, or submitted such an article.¹⁰

It is unfortunate that when measures come to be widely used they are based upon obscure working papers and in-

sider scholarship, not open for inspection to the scholarly community. Because it could not be published, no such article was ever written. And what exists instead are working papers and book treatments that stress readability over scholarly development. The original development, in *Public Opinion in America* (Stimson 1991) is a matter of some regret to me. The publisher, Westview Press, quickly became a pawn in the corporate restructuring game, with the result of musical chairs editorial leadership, changing missions, and no particular interest in keeping its list in print. The experience gave me renewed appreciation for the wonderful institution of the university press.

Reflections

Developing a concept and a set of operations for a measure is not a normal path of scholarship in political science. We base acceptance and esteem for work primarily on theoretical innovation, where it is understood that theories are tested with some form of structural estimation. No thoughtful person can disagree that elucidating theory and then estimating structural models to test it is a sensible way to do science.

Measurement is never an end in itself. We judge measurement efforts by whether or not they become useful for testing theories. (And by this standard the Poole and Rosenthal (1997) D-, W-, and DW-NOMINATE scores are the all-time champions of measurement development.) But measurement is a vital part of science of all kinds. Blunt and confused measures of convenience can never support a science of elegant theories.

There once was a time when measurement was virtually the meaning of political methodology. That failed to be very productive of new knowledge and was abandoned with little regret. We political methodologists moved on to better things and we have flourished doing so. But I think it would improve our science if we could find some way to encourage better work on measurement, in effect to treat it as scholarship in itself. It doesn’t now fit our world view of who we are and what we do. But a science that lacks respect for measurement can never aspire to be more than a quasi-science.

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⁹This issue gets its fullest treatment in my newest work, *Tides of Consent* (Stimson 2004), an attempt to go public on opinion dynamics in a book written for general readers, due out in July.

¹⁰And *Political Analysis*, the one journal that might have welcomed such scholarship, was unavailable to me at the time. I was its editor.

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Section Activities

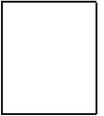
2004 Summer Methods Meetings

The 21st annual summer meetings of the Society for Political Methodology will be held at Stanford University, Thursday July 29 through Saturday July 31, 2004. The program will run from 9 a.m. to 5 p.m. all days, with software workshops running for the hour from 8 a.m. to 9 a.m. on Friday and Saturday. The preliminary program is available at the conference website: <http://polmeth04.stanford.edu/>

New Section Website

This spring the Society for Political Methodology website was moved to Washington University in St. Louis: <http://polmeth.wustl.edu>. Many thanks to Jeff Gill for his service as the webmaster over the last five years. We are in the process of developing a new site for the society, with the intention of a preview at the methods meeting this summer at Stanford. Please email suggestions to admartin@wustl.edu.

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Submissions to *TPM* are always welcome. Articles should be sent to the editor by e-mail (jblewis@ucla.edu) if possible. Alternatively, submissions can be made on diskette as plain ascii files sent to Jeffrey B. Lewis, Department of Political Science, 4289 Bunche Hall, University of California at Los Angeles, Los Angeles, CA 90095-1475. L^AT_EX format files are especially encouraged. See the *TPM* website, <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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