

# Measurement

Christopher Fariss (cjfariss@umich.edu)

Office: ISR, room 4248

Office Hours: Wednesday 1:30pm-3:30 and by appointment.

## Introduction

Political scientists are often interested in explaining concepts that are difficult or impossible to observe. Examples of unobservable concepts include political knowledge, political ideology, democracy, respect for human rights, or inequality. Even concepts that are based on directly observable information such as the number of individuals that reside in a state, the number of individuals killed during a conflict, or the level of economic output are often not easily observed. A key challenge for political scientists and social scientists generally, is creating models that can measure these concepts while also capturing the uncertainty associated with the processes by which they are measured.

This course will provide an introduction to measurement models generally with specific focus on Bayesian measurement models and measurement models that make use of text data. The course will emphasize the use of construct validity to assess new and existing measures in applied research. I motivate the development of the models introduced in this class with a discussion of the Bayesian perspective on the relationship between data and model parameters. This perspective is useful because it shifts the burden of validity from the primary source documentation and raw data to the model parameters that bind these diverse pieces of information together.

Though this class serves as an introduction to latent variable modeling specifically and measurement theory more generally, there is a lot of ground to cover and a lot fascinating research being done in political science and elsewhere. There are many articles, working papers, and books that could be on this syllabus that we do not have time to cover. I have tried to include much of this information in the suggested reading sections of this syllabus. We will also talk about much of this material during the final week or two of class.

## Class Expectations

The class will meet twice a week for 1.5 hours. We will split our time across two or three distinct activities during each class period: (1) lecture, (2) discussion, and (3) programming. The *Class Schedule* section below provides details about each of these sections across the 15 weeks of the semester. Read all of the assigned materials and be prepared to discuss each piece at the assigned class meeting. There are two replication problem sets for the course that are each worth 20% of the final grade. Each replication problem set should take approximately 5-20 hours to complete. 40% of the grade comes from the data project. The remaining 20% of the course grade is for participation in the classroom discussions.

## Assignments

1. **Discussion Reading:** There will be at least one discussion reading assigned per week. We will devote some of our time to discussing and assessing the measurement strategy employed by this article.
2. **Data project (individual version):** 5-10 page written summary of latent variable estimates derived from a set of manifest variables and fully specified model. The paper should justify the link between the theory and the model parameterization, which links the manifest variable with the latent variable. Describe each manifest variable in detail and assess the construct validity of each individually and the construct validity of the latent variable itself. Make sure to assess the **translational validities:** Face validity and Content validity, and the **criterion-related validities:** Predictive validity, Concurrent validity, Convergent validity, Discriminant validity. **I encourage students to work on the group version of this project. Student's who wish to incorporate this project into their dissertation can pursue the individual student version..**
3. **Data project (group version):** Complete a publication quality manuscript that motivates the use of a latent variable. The paper should fulfill all the requirements specified in the **Data project (individual version)** above. I expect that group projects will be submitted to at least one political science conference and should be submitted for journal review after additional revisions over the summer.
4. **Latent Variable and Text Replication Projects (2):** Complete two replication projects: select one of the papers from the week-9/week-10 reading list and one of the papers from the week-12/week-13 list. I encourage students to work on these replication projects in groups. Each student should complete each replication project and turn in their own code and a short (no more than 5 pages) write up. Make sure to assess the **translational validities:** Face validity and Content validity, and the **criterion-related validities:** Predictive validity, Concurrent validity, Convergent validity, Discriminant validity. Students will give short informal presentations of these projects as part of the weekly discussion during week 10 and week 13 respectively.

Due dates appear below in the *Class Schedule* section. Assignments are due at the beginning of the class in the week of the due date.

## Text Books

### Required Books

1. Borsboom, Denny. 2005. *Measuring the Mind*. Cambridge: Cambridge University Press.
2. Gelman, Andrew and Jennifer Hill. 2007. *Data Analysis Using Regression and Multilevel/Hierarchical Models*. Cambridge: Cambridge University Press. R code and data files:  
<http://www.stat.columbia.edu/~gelman/arm/software/>
3. Trochim and Donnelly — Trochim, William and James P. Donnelly. 2007. *The Research Methods Knowledge Base*, 3rd Edition. Cincinnati, OH, Atomic Dog Publishing.

### Coding Resources

1. Bolker, Ben. 2007. *Ecological Models and Data in R*. Princeton NJ: Princeton University Press.
2. Google's R Style Guide: <https://google.github.io/styleguide/Rguide.xml>
3. Matloff, Norman. 2011. *Art of R Programming: A Tour of Statistical Software Design*. no starch press.
4. JAGS: <http://mcmc-jags.sourceforge.net/>
5. Stan Development Team. 2015. "Stan Modeling Language: Users Guide and Reference Manual. Version 2.6.0." <http://mc-stan.org/manual.html>
6. Teetor, Paul. 2011. *R Cookbook* O'Reily.  
<https://ase.tufts.edu/bugs/guide/assets/R%20Cookbook.pdf>

# **Class Schedule**

## **Week 1: Introduction to the Class**

*Syllabus review and project discussion.*

## **Week 2: Designing Validity**

*Lecture and Discussion Readings:*

1. Trochim and Donnelly. Ch 1: "Introduction" and Ch 7: "Design."
2. Rubin, Donald B. 2008. "For Objective Causal Inference, Design Trumps Analysis." *Annals of Applied Statistics* 2(3):808-840.
3. Shadish, William R. 2010. "Campbell and Rubin: A Primer and Comparison of Their Approaches to Causal Inference in Field Settings." *Psychological Methods* 15(1):3-17.

## **Week 3: Models with Multiple Levels Using JAGS and STAN (part 1)**

*— no class on Monday in observance of Martin Luther King Day —*

*Lecture and Discussion Readings:*

1. Gelman, Andrew and Jennifer Hill. 2007. *Data Analysis Using Regression and Multilevel/Hierarchical Models*. Cambridge: Cambridge University Press. Ch.1, Ch.2., Ch.3., Ch.11.

*Suggested Readings:*

2. Gelman, Andrew and Jennifer Hill. 2007. *Data Analysis Using Regression and Multilevel/Hierarchical Models*. Cambridge: Cambridge University Press. Ch.4, Ch.12., Ch.13.

## **Week 4: Construct Validity and Measurement Theory (part 1)**

*Lecture and Discussion Readings:*

1. Jackman, Simon. 2008. "Measurement." In *The Oxford Handbook of Political Methodology*, edited by Janet M. Box-Steffensmeier, Henry E. Brady, and David Collier. Oxford University Press.
2. Stevens, S.S. 1946. "On the Theory of Scales of Measurement" *Science* 103(2684):677-680.
3. Trochim, William and James P. Donnelly. 2007. *The Research Methods Knowledge Base*, 3rd Edition. Cincinnati, OH, Atomic Dog Publishing. Ch 3: "The Theory of Measurement."

## **Week 5: Construct Validity and Measurement Theory (part 2)**

### ***Lecture and Discussion Readings:***

1. Adcock, Robert, and David Collier. 2001. "Measurement Validity: A Shared Standard for Qualitative and Quantitative Research." *American Political Science Review* 95(3):529–546.
2. Borsboom, Denny. 2005. *Measuring the Mind*. Cambridge: Cambridge University Press. Ch 1: "Introduction", and Ch.6: "The concept of validity".
3. Hand, D. J., 1996. "Statistics and the Theory of Measurement." *Journal of the Royal Statistical Society. Series A (Statistics in Society)*. 159(3):445-492.

### ***Suggested Readings:***

5. Zeller, Richard A., and Edward G. Carmines. 1980. *Measurement in the Social Sciences: The Link between Theory and Data*. Cambridge: Cambridge University Press.

## **Week 6: Models with Multiple Levels Using JAGS and STAN (part 2)**

### ***Lecture and Discussion Readings:***

1. Gelman, Andrew and Jennifer Hill. 2007. *Data Analysis Using Regression and Multilevel/Hierarchical Models*. Cambridge: Cambridge University Press. 2007. Ch.5, Ch.14, and Ch.18.

### ***Suggested Readings:***

2. Gelman, Andrew and Jennifer Hill. 2007. *Data Analysis Using Regression and Multilevel/Hierarchical Models*. Cambridge: Cambridge University Press. Ch.6, Ch.15., Ch.16., Ch.17.

## **Week 7: Developing Latent Variable Models (part 1)**

### ***Lecture and Discussion Readings:***

1. Borsboom, Denny. 2005. *Measuring the Mind*. Cambridge: Cambridge University Press. Ch 3: "Latent variables".
2. Blei, David M. 2014. "Build, compute, critique, repeat: data analysis with latent variable models." *Annual Review of Statistics and Its Application* 1:203-232.

### ***Suggested Readings:***

4. Albert, James H., and Val E. Johnson. 1999. *Ordinal Data Modeling*. New York: Springer-Verlag.
5. Armstrong, David, Ryan Bakker, Royce Carroll, Christopher Hare, Keith Poole, and Howard Rosenthal. 2014. *Analyzing Spatial Models of Choice and Judgment with R*, New York: CRC Press.
6. Bartholomew, David, Martin Knott, and Iriini Moustaki. 2011. *Latent Variable Models and Factor Analysis: A Unified Approach*. 3rd Edition. Wiley Series in Probability and Statistics.
7. Bollen, Kenneth A. 1989. *Structural Equations with Latent Variables* Wiley.
8. Bollen, Kenneth A., and Richard Lennox. 1991. "Conventional Wisdom on Measurement A: Structural Equation Perspective" *Psychological Bulletin* 110(2):305-314.
9. Cronbach Lee J. 1951. "Coefficient alpha and the internal structure of tests" *Psychometrika* 16(3):297-334.
10. Guttman, Louis. 1944. "A basis for scaling qualitative data." *American Sociological Review* 9:139-150.
11. Likert, Rensis. 1932. "A Technique for the Measurement of Attitudes." *Archives of Psychology* 22:5-55.
12. Lord, Frederic M. 1980. *Applications of Item Response Theory to Practical Testing Problems*. Hillsdale, NJ: Erlbaum Associates.
13. Lord, Frederic M., and Melvin R. Novick. 1968. *Statistical Theories of Mental Test Scores*. Reading, MA: Addison-Wesley.
14. Mislevy, Robert. 1991. "Randomization-based Inference about Latent Variables from Complex Samples." *Psychometrika* 56(2):177-196.
15. Quinn, Kevin M. 2004. "Bayesian Factor Analysis for Mixed Ordinal and Continuous Responses." *Political Analysis* 12(4):338-353.
16. Rasch, Georg. 1980. *Probabilistic Models for Some Intelligence and Attainment Tests*. Chicago: The University of Chicago Press.
17. Shepard, Roger N. 1987. "Toward a Universal Law of Generalization for Psychological Science." *Science* 237:1317-1323.
18. Sijtsma, Klaas, and Ivo W. Molenaar. 2002. *Introduction to Nonparametric Item Response Theory*. Thousand Oaks, CA: Sage.
19. Thurstone, Louis L. 1927. "The method of paired comparisons for social values." *Journal of Abnormal and Social Psychology* 21:384-400.
20. Thurstone, Louis L. 1928. "Attitudes can be measured." *American Journal of Sociology* 33:529-554.

21. van Schuur, Wijbrandt H. 2003. "Mokken Scale Analysis: Between the Guttman Scale and Parametric Item Response Theory." *Political Analysis* 11(2): 139-63.

## **Week 8: Developing Latent Variable Models (part 2): The Politics of Measurement**

### ***Lecture and Discussion Readings:***

1. Fariss, Christopher J. and Geoff Dancy. 2017. "Measuring the Impact of Human Rights: Conceptual and Methodological Debates" *Annual Review of Law and Social Science* 13:TBD.
2. Hare, Christopher, David A. Armstrong II, Ryan Bakker, Royce Carroll, and Keith T. Poole. Forthcoming. 2015. "Using Bayesian Aldrich-McKelvey Scaling to Study Citizens' Ideological Preferences and Perceptions." *American Journal of Political Science* 59(3):759-774.

### ***Suggested Readings:***

3. Aldrich, John H. and Richard D. McKelvey. 1977. "A Method of Scaling with Applications to the 1968 and 1972 Presidential Elections." *American Political Science Review* 71:111-130.
4. Bollen, Kenneth A. 1980. "Issues in the Comparative Measurement of Political Democracy" *American Sociological Review* 45(3):370-390.
5. Bollen, Kenneth A. 1990. "Political Democracy: Conceptual and Measurement Traps" *Studies in Comparative International Development* 25(1):7-24.
6. Bollen, Kenneth A. and Pamela Paxton. 1998. "Detection and Determinants of Bias in Subjective Measures" *American Sociological Review* 63():465-478.
7. Bollen, Kenneth A. and Pamela Paxton. 2000. "Subjective Measures of Liberal Democracy" *Comparative Political Studies* 33(1)58-86.
8. Brysk, Allison. 1994. "The Politics of Measurement: The Contested Count of the Disappearance in Argentina." *Human Rights Quarterly*, 16(4):676-692.
9. Davenport, Christian. 2009. *Media Bias, Perspective, and State Repression: The Black Panther Party*. Cambridge University Press.
10. Fariss, Christopher J. 2014. "Respect for Human Rights has Improved Over Time: Modeling the Changing Standard of Accountability." *American Political Science Review* 108(2):297-318.
11. Fariss, Christopher J., Charles D. Crabtree, Therese Anders, Zachary M. Jones, Fridolin J. Linder, and Jonathan N. Markowitz. "Latent Estimation of GDP, GDP per capita, and Population from Historic and Contemporary Sources".
12. Lustik, Ian S. 1996. "History, Historiography, and Political Science: Multiple Historical Records and the Problem of Selection Bias." *American Political Science Review* 90(3):605-618.
13. Scott, James C. 1999. *Seeing Like a State*. Yale University Press.

## — SPRING BREAK —

### Week 9: Dynamic Latent Variable Models

#### *Lecture and Discussion Readings:*

1. Martin, Andrew D. and Kevin M. Quinn. 2002. “Dynamic Ideal Point Estimation via Markov Chain Monte Carlo for the U.S. Supreme Court, 1953-1999.” *Political Analysis* 10(2):134-153.
2. Schnakenberg, Keith E. and Christopher J. Fariss. 2014. “Dynamic Patterns of Human Rights Practices.” *Political Science Research and Methods* 2(1):1-31.

#### *Suggested Readings:*

3. Clinton, Joshua, Simon Jackman, and Douglas Rivers. 2004. “The Statistical Analysis of Roll Call Data.” *American Political Science Review* 98(2):355-370.
4. Poole, Keith T. 2005. *Spatial Models of Parliamentary Voting*. Cambridge, UK: Cambridge University Press.
5. Poole, Keith T., and Howard. Rosenthal. 1991. “Patterns of Congressional Voting.” *American Journal of Political Science* 35(1):228-278.
6. Poole, Keith T., and Howard. Rosenthal. 1997. *A Political-Economic History of Roll Call Voting*. New York: Oxford University Press.

### Week 10: Latent Variable Model Innovations and Extensions

#### *Lecture and Discussion Readings (select one for the first replication project):*

1. Bailey, Michael A., Anton Strezhnev, Erik Voeten. 2015. “Estimating Dynamic State Preferences from United Nations Voting Data” *Journal of Conflict Resolution*
2. Barberá, Pablo. 2015. “Birds of the Same Feather Tweet Together. Bayesian Ideal Point Estimation Using Twitter Data.” *Political Analysis* 23(1):76-91.
3. Bonica, Adam. 2013. “Ideology and Interests in the Political Marketplace.” *American Journal of Political Science* 57(2):294-311.
4. Bonica, Adam. 2014. “Mapping the Ideological Marketplace” *American Journal of Political Science* 58(2): 367-387
5. Caughey, Devin and Christopher Warshaw. 2015. “Dynamic Estimation of Latent Opinion Using a Hierarchical Group-Level IRT Model.” *Political Analysis* 23(2): 197-211.



6. Imai, Kosuke, James Lo, and Jonathan Olmsted. “Fast Estimation of Ideal Points with Massive Data.” *American Political Science Review*.
7. Jesse, Stephen A. “Don’t Know Responses, Personality and the Measurement of Political Knowledge.” *Political Science Research and Methods*.
8. Lauderdale, Benjamin E. 2010. “Unpredictable Voters in Ideal Point Estimation” *Political Analysis* 18(2):151-171.
9. Pemstein, Daniel, Stephen A. Meserve, and James Melton. 2010. “Democratic Compromise: A Latent Variable Analysis to Ten Measure of Regime Type.” *Political Analysis* 18(4):426-449.
10. Rosas, Guillermo, Yael Shomer, and Stephen R. Haptonstahl. 2015. “No News Is News: Non-ignorable Non-response in Roll-call Data Analysis” 59(2):511-528.
11. Tahk, Alexander M. 2015. “Continuous-Time, Latent-Variable Model of Time Series Data” *Political Analysis* 23(2): 278-298.
12. Treier, Shawn, and Simon Jackman. 2008. “Democracy as a Latent Variable.” *American Journal of Political Science* 52(1):201-217.

**— Latent Variable Replication Presentations and Writeup due Monday and Wednesday —**

## **Week 11: Other Models of Scale Development and Assessment**

### ***Lecture and Discussion Readings:***

1. Borsboom, Denny. 2005. *Measuring the Mind*. Cambridge: Cambridge University Press. Ch.4: “Scales”.
2. Trochim, William and James P. Donnelly. 2007. *The Research Methods Knowledge Base*, 3rd Edition. Cincinnati, OH, Atomic Dog Publishing. Ch 5: “Scales and Indexes.”

### ***Suggested Readings:***

3. Bartholomew, David, Martin Knott, and Iirini Moustaki. 2011. *Latent Variable Models and Factor Analysis: A Unified Approach*. 3rd Edition. Wiley Series in Probability and Statistics.
4. Bond, Robert M., and Solomon Messing. Forthcoming. “Quantifying Social Media’s Political Space: Estimating Ideology from Publicly Revealed Preferences on Facebook.” *American Political Science Review* 109(1):62-78.
5. Borg, Ingwer and Patrick Groenen. 2005. *Modern Multidimensional Scaling: Theory and Applications* (2nd Edition). New York: Springer-Verlag. (See especially, Ch.1, Ch.2, Ch.4, and Ch.20).
6. Borsboom, Denny. 2005. *Measuring the Mind*. Cambridge: Cambridge University Press. Ch 2: “True scores”, and Ch.5: “Relations between the models”.
7. Coombs, Clyde. 1964. *A Theory of Data*. New York: John Wiley.

8. Londregan, John B. 2000. "Estimating Legislators' Preferred Points." *Political Analysis* 8:35-36.
9. Lupu, Yonatan. 2013. The Informative Power of Treaty Commitment: Using the Spatial Model to Address Selection Effects. *American Journal of Political Science* 57(4):912-925.
10. Lupu, Yonatan. Forthcoming. "Why Do States Join Some Universal Treaties but not Others? An Analysis of Treaty Commitment Preferences." *Journal of Conflict Resolution*.
11. Palfrey, Thomas R. and Keith T. Poole. 1987. "The Relationship Between Information, Ideology, and Voting Behavior." *American Journal of Political Science* 31:511-530.
12. Poole, Keith T. 1998. "Recovering a Basic Space From a Set of Issue Scales." *American Journal of Political Science* 42:954-993.
13. Rabinowitz, George. 1975. "An Introduction to Nonmetric Multidimensional Scaling." *American Journal of Political Science* 19:343-390.
14. Rusk, Jerrold G. and Herbert F. Weisberg. 1972. "Perceptions of Presidential Candidates." *Midwest Journal of Political Science* 16(3):388-410.
15. Voeten, Erik. 2000. "Clashes in the Assembly" *International Organization* 54(2):185-215.
16. Weisberg, Herbert F. and and Jerrold G. Rusk. 1970. "Dimensions of Candidate Evaluation." *American Political Science Review* 64:1167-1185.
17. Weisberg, Herbert F. 1974. "Dimensionland: An Excursion into Spaces." *American Journal of Political Science* 18:743-776.

## **Week 12: Text as Data**

### ***Lecture and Discussion Readings:***

1. Benoit, Kenneth, Drew Conway, Benjamin E. Lauderdale, Michael Laver, and Slava Mikhaylov. 2016. "Crowd-Sourced Text Analysis: Reproducible and Agile Production of Political Data" *American Political Science Review* 110(2):TBD.
2. Grimmer, Justin and Brandon M. Stewart. 2013. "Text as Data: The Promise and Pitfalls of Automatic Content Analysis Methods for Political Texts." *Political Analysis* 21(3):267-297.

### ***Suggested Readings:***

3. Berliner, Daniel and Benjamin Bagozzi. "The Politics of Scrutiny in Human Rights Monitoring: Evidence from Structural Topic Models of U.S. State Department Human Rights Reports" *Political Science Research and Methods*.
4. Blei, David M. 2012. "Probabilistic topic models." *Communications of the ACM* 55(4):77-84.
5. Däubler, Thomas, Kenneth Benoit, Slava Mikhaylov, and Michael Laver. 2012. "Natural Sentences as Valid Units for Coded Political Texts" *British Journal of Political Science* 42(4): 937-951.

6. Fariss, Christopher J., Fridolin J. Linder, Zachary M. Jones, Charles D. Crabtree, Megan A. Biek, Ana-Sophia M. Ross, Taranamol Kaur, and Michael Tsai. 2015. "Human Rights Texts: Converting Human Rights Primary Source Documents into Data" *PLOS ONE* 10(9):e0138935.
7. Grimmer Justin. 2010. "A Bayesian Hierarchical Topic Model for Political Texts: Measuring Expressed Agendas in Senate Press Releases" *Political Analysis* 18 (1):1-35.
8. Hopkins, Daniel J and Gary King. 2010. "A method of automated nonparametric content analysis for social science." *American Journal of Political Science* 54(1):229-247.
9. King, Gary, Patrick Lam, and Margaret E. Roberts. 2017. "Computer-Assisted Keyword and Document Set Discovery from Unstructured Text." *American Journal of Political Science* (forthcoming).
10. Monroe, Burt L., Michael P. Colaresi, and Kevin M. Quinn. 2008. "Fightin Words: Lexical Feature Selection and Evaluation for Identifying the Content of Political Conflict" *Political Analysis* 16:372-403.
11. Mikhaylov, Slava, Michael Laver, and Kenneth R. Benoit. 2012. "Coder Reliability and Misclassification in the Human Coding of Party Manifestos." *Political Analysis* 20(1): 78-91.
12. Quinn, Kevin M. and Burt L. Monroe, Michael Colaresi, Michael H. Crespin, Dragomir R. Radev. 2010. "How to Analyze Political Attention with Minimal Assumptions and Costs." *American Journal of Political Science* 54(1):209-228.
13. Roberts, Margaret E., Brandon M. Stewart, Dustin Tingley, Christopher Lucas, Jetson Leder-Luis, Shana Kushner Gadarian, Bethany Albertson, David G. Rand . Forthcoming. "Structural Topic Models for Open-Ended Survey Responses." *American Journal of Political Science* 58(4):1064-1082.
14. Schrodtt, Philip A., Gerner, Deborah J. 1994. "Validity Assessment of a Machine-Coded Event Data Set for the Middle East, 1982-92" *American Journal of Political Science* 38(3):825-854.
15. Schwartz, H. Andrew, Johannes C. Eichstaedt, Margaret L. Kern, Lukasz Dziurzynski, Stephanie M. Ramones, Megha Agrawal, Achal Shah, Michal Kosinski, David Stillwell, Martin E. P. Seligman, and Lyle H. Ungar "Personality, Gender, and Age in the Language of Social Media: The Open-Vocabulary Approach." *PLoS ONE* 8(9):e73791.

## **Week 13: Latent Variable Models Using Text as Data**

### ***Lecture and Discussion Readings:***

1. Lauderdale, Benjamin E and Tom S Clark. 2014. "Scaling politically meaningful dimensions using texts and votes." *American Journal of Political Science* 58(3):754-771.
2. Lo, James, Sven-Oliver Proksch and Jonathan B. Slapin. 2016. "Ideological Clarity in Multiparty Competition: A New Measure and Test Using Election Manifestos" *British Journal of Political Science* 46(3):591-610.

### ***Suggested Readings:***

3. Laver, Michael, Kenneth Benoit, and John Garry. 2003. "Extracting Policy Positions from Political Texts Using Words as Data." *American Political Science Review* 97(2):311-331.
4. Lowe, Will and Kenneth Benoit. 2013. "Validating Estimates of Latent Traits From Textual Data Using Human Judgment as a Benchmark" *Political Analysis* 21(3): 298-313.

— ***Text Replication Presentations and Writeup due Wednesday*** —

## **Week 14: Philosophy of Measurement**

### ***Lecture and Discussion Readings:***

1. Gelman, Andrew and Cosma Rohilla Shalizi. 2012. "Philosophy and the practice of Bayesian statistics." *British Journal of Mathematical and Statistical Psychology* 66(1):8-38.
2. Gelman, Andrew and Cosma Shalizi. 2012. "Rejoinder to discussion of Philosophy and the practice of Bayesian statistics." *British Journal of Mathematical and Statistical Psychology* 66(1):76-80.

### ***Suggested Readings (select at least one):***

3. Andrews, Mark and Thom Baguley. 2012. "Prior approval: The growth of Bayesian methods in psychology." *British Journal of Mathematical and Statistical Psychology* 66(1):1-7.
4. Borsboom, Denny and Brian D. Haig. 2012. "How to practice Bayesian statistics outside the Bayesian church: What philosophy for Bayesian statistical modeling?." *British Journal of Mathematical and Statistical Psychology* 66(1):39-44.
5. Kruschke, John K. 2012. "Posterior predictive checks can and should be Bayesian: Comment on Gelman and Shalizi, 'Philosophy and the practice of Bayesian statistics.'" *British Journal of Mathematical and Statistical Psychology* 66(1):45-56.
6. Mayo, Deborah G. 2012. "The error-statistical philosophy and the practice of Bayesian statistics: Comments on Gelman and Shalizi: 'Philosophy and the practice of Bayesian statistics.'" *British Journal of Mathematical and Statistical Psychology* 66(1):57-64.
7. Senn, Stephen. 2012. "Comment on Gelman and Shalizi." *British Journal of Mathematical and Statistical Psychology* 66(1):65-67.
8. Morey, Richard D., Jan-Willem Romeijn and Jeffrey N. Rouder. 2012. "The humble Bayesian: Model checking from a fully Bayesian perspective." *British Journal of Mathematical and Statistical Psychology* 66(1):68-75.

## **Week 14/Week 15: Project Presentations**

Presentations will begin Wednesday of week 14 and conclude on Monday of week 15.

## **Additional Course Information**

### **Student Mental Health and Wellbeing**

University of Michigan is committed to advancing the mental health and wellbeing of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available.

For help, contact Counseling and Psychological Services (CAPS) at (734) 764-8312 and <https://caps.umich.edu/> during and after hours, on weekends and holidays, or through its counselors physically located in schools on both North and Central Campus.

You may also consult University Health Service (UHS) at (734) 764-8320 and <https://www.uhs.umich.edu/mentalhealthsvcs>, or for alcohol or drug concerns, see [www.uhs.umich.edu/aodresources](http://www.uhs.umich.edu/aodresources).

For a listing of other mental health resources available on and off campus, visit: <http://umich.edu/mhealth/>.

### **Accommodations for Students with Disabilities**

If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way the course is usually taught may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Services for Students with Disabilities (SSD) office to help us determine appropriate academic accommodations. SSD (734-763-3000; <http://ssd.umich.edu>) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide is private and confidential and will be treated as such.

### **Religious and Academic Conflicts**

Although the University of Michigan, as an institution, does not observe religious holidays, it has long been the University's policy that every reasonable effort should be made to help students avoid negative academic consequences when their religious obligations conflict with academic requirements. Absence from classes or examinations for religious reasons does not relieve students from responsibility for any part of the course work required during the period of absence. Students who expect to miss classes, examinations, or other assignments as a consequence of their religious observance shall be provided with a reasonable alternative opportunity to complete such academic responsibilities.

It is the obligation of students to provide faculty with reasonable notice of the dates of religious holidays on which they will be absent. Such notice must be given by the drop/add deadline of the given term. Students who are absent on days of examinations or class assignments shall be offered an opportunity to make up the work, without penalty, unless it can be demonstrated that a make-up opportunity would interfere unreasonably with the delivery of the course. Should disagreement arise over any aspect of this policy, the parties involved should contact the Director of Undergraduate Studies/Director of Graduate Studies. Final appeals will be resolved by the Provost.

## **Students Representing the University of Michigan**

There may be instances when students must miss class due to their commitment to officially represent the University. These students may be involved in the performing arts, scientific or artistic endeavors, or intercollegiate athletics. Absence from classes while representing the University does not relieve students from responsibility for any part of the course missed during the period of absence. Students should provide reasonable notice for dates of anticipated absences and submit an individualized class excuse form.

## **Academic Integrity**

The LSA undergraduate academic community, like all communities, functions best when its members treat one another with honesty, fairness, respect, and trust. The College holds all members of its community to high standards of scholarship and integrity. To accomplish its mission of providing an optimal educational environment and developing leaders of society, the College promotes the assumption of personal responsibility and integrity and prohibits all forms of academic dishonesty and misconduct. Academic dishonesty may be understood as any action or attempted action that may result in creating an unfair academic advantage for oneself or an unfair academic advantage or disadvantage for any other member or members of the academic community. Conduct, without regard to motive, that violates the academic integrity and ethical standards of the College community cannot be tolerated. The College seeks vigorously to achieve compliance with its community standards of academic integrity. Violations of the standards will not be tolerated and will result in serious consequences and disciplinary action.

## **Grade Grievances**

If you believe a grade you have received is unfair or in error, you will need to do the following: Wait 24 hours after receiving the grade before approaching your instructor. Provide an explanation in writing for why the grade you received was unfair or in error. If you believe the instructor's response fails to address your claim of unfairness or error, you may petition the department's Director of Undergraduate Studies at the latest within the first five weeks of classes following the completion of the course. You must convey in writing the basis for the complaint, with specific evidence in support of the argument that the grade either was given in error or was unfairly determined. This formal complaint also should summarize the outcome of the initial inquiry to the course instructor, indicating which aspects are in dispute. Within three weeks of the receipt of the petition, the DUS will determine whether to convene the Undergraduate Affairs Committee, the student, and the instructor(s) for a formal hearing. Further details on this process are included on the department website under Advising > Contesting a Grade.

## **Late Assignments**

I will deduct one letter grade from an assignment for each week it is past due.

## **Resources for Harassment**

Title IX makes it clear that violence and harassment based on sex and gender, including violence and harassment based on sexual orientation, are a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race,

national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here: [www.bw.edu/resources/hr/harass/policy.pdf](http://www.bw.edu/resources/hr/harass/policy.pdf)

## Language and Gender

“Language is gender-inclusive and non-sexist when we use words that affirm and respect how people describe, express, and experience their gender. Just as sexist language excludes women’s experiences, non-gender-inclusive language excludes the experiences of individuals whose identities may not fit the gender binary, and/or who may not identify with the sex they were assigned at birth. Identities including trans, intersex, and genderqueer reflect personal descriptions, expressions, and experiences. Gender-inclusive/non-sexist language acknowledges people of any gender (for example, first year student versus freshman, chair versus chairman, humankind versus mankind, etc.). It also affirms non-binary gender identifications, and recognizes the difference between biological sex and gender expression. Teachers and students should use gender-inclusive words and language whenever possible in the classroom and in writing. *Students, faculty, and staff may share their preferred pronouns and names, either to the class or privately to the professor, and these gender identities and gender expressions should be honored.*” For more information:

[www.wstudies.pitt.edu/faculty/gender-inclusivenon-sexist-language-syllabi-statement](http://www.wstudies.pitt.edu/faculty/gender-inclusivenon-sexist-language-syllabi-statement).

## Syllabus Acknowledgments

This syllabus is based on several courses that I have taken and designed over the last several years. Some of the material is based on the Research Design (PL SC 501) course that I developed at Pennsylvania State University when I began teaching there in the fall of 2013, which itself is based on similar course developed by David Lake and Mathew McCubbins at the University of California, San Diego. It is also based on material that I developed for a graduate measurement theory class (PL SC 597) and undergraduate Social Data Analysis and Design class (SO DA 308) that I also developed at Pennsylvania State University. Elements of the syllabus and other class materials created for this class are also based in part on the Bayesian Statistics class offered by Seth Hill at University of California, San Diego and the Measurement class offered by Keith Poole at UCSD and now the University of Georgia.