



ZEB 110

<http://www2.fiu.edu/~dwright/qm4psych/index.htm>

Welcome to Quantitative Methods for Psychologists 1. This is a course for psychology PhD students and if you are taking this you should also be taking the Wednesday afternoon course with Dr. Stephens. If you plan to audit it (which requires permission and the room may be near maximum occupancy), you still have to do some assignments and presentations. The content of the course is a rapid review of some underlying issues in statistics, review of basic tests (like ANOVA, regression, Chi-square), and making sure that you can conduct these analyses in SPSS and R. The emphasis is on knowing *why* you are doing the statistics. It is expected you already learned *how to* do most of these statistics during your undergraduate.

Teaching assistant: Andrea Arndorfer (aarndorfer@gmail.com). She will discuss various issues about the course with you and we will discuss when will be the best time for her office hour.

My Office hours will be sometime on Monday. We will discuss *when* during the first lecture to make sure it fits into your timetables. Email me (dwright@fiu.edu) so I know when you are coming and if there are several of you.

Learning Outcomes

Applying basics statistics and graphical procedures to psychological research.

Requirements

40% journal (details below)

20% two how-to/crib sheet page to go along with your presentations

40% exam

0% group function (but you must get A- or better to receive either a happy face or a star)

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|-----|----|-----|----|-----|---------|
| 93% | A | 90% | A- | | |
| 87% | B+ | 83% | B | 83% | B- |
| 77% | C+ | 73% | C | 73% | C- |
| 67% | D+ | 63% | D | 63% | D- |
| | | | | | below F |

Below B for PhD track students may create problems. So, do well.

Attendance. Required, but email Andrea and me *before* the lecture if you have to miss due to illness, religious reasons, conference, etc. If you use facebook and things like that during lectures, I'll do what I can to get you removed from FIU.

Cheating. Don't. If you are planning on cheating see me beforehand to discuss the penalties.

Journal (40%). You will have little assignments and exercises to do each week. Bring these with you. Some weeks we will discuss them (sometimes handing them to others in the class to evaluate). At the end of each week it should be submitted to Andrea who will mark them. You must turn in all of these. Andrea and I will discuss them and contact people who are not keeping up.

How-to pages (20%, 10% each). In groups you will write a brief handout (one page in whatever format you think facilitates learning) for classmates to supplement your presentation. You have at least two presentations. The handouts must be handed out to the class and an electronic copy can be put on this web page. It is normal for us to meet on the Monday to talk about the presentation. Put your names on the handouts. There will often be a biography that you will need to do.

Group R function (0%). In groups you will write and present a function to do something in R.

Exam (40%). This will allow you to show that you can interpret output from R and SPSS and that you understand some statistical concepts.

Reading

Books (if you are in a lab with others, see what they have. I wouldn't buy anything until you see what others have)

Field, A.P. (2009). *Discovering statistics using SPSS: and sex and drugs and rock 'n' roll* (third edition). London: Sage publications. Amazon. \$60, down from \$80. There are older versions of this around, but the new version does a lot more. This course will focus more on the SPSS bit than the S, D and R&R. Don't get the DVD version, most of that stuff is on his web page. An R version should be out for second term.

Wright, D. B. & London, K. (2009). *First (and Second) Steps in Statistics (2nd ed)*. London: Sage. Amazon \$35 down from \$46.

Software

Many of you will have already encountered SPSS. It is a fairly common package. Most of you are TAs/RAs so as staff members you can get a discounted version. Again, check around your lab.

The second software system is R, which is rapidly growing in academic circles and beyond. There are about a 100 books on it, but also much that is freely available (as is the program, it is free, see <http://cran.r-project.org/>). I think we can get by just using free sources for this course.

No need to buy a new calculator; computers all have these. As a PhD student, you will want to have access to a computer at home.

Articles

Throughout this course there will several articles to read. I will try to choose ones that can be accessed electronically through the FIU library page. As part of doing a PhD you should read, throughout your PhD time and beyond, the occasional methods paper. Niel Waller put together a good start here <http://www.psych.umn.edu/faculty/waller/readings.htm>, and the "classics" page has some too (see <http://psychclassics.asu.edu/topic.htm#statsmeth>).

Data

Most of the data used for this course is either <http://www.uk.sagepub.com/field3e/SPSSdata.htm> for Field or <http://www2.fiu.edu/~dwright/1ststeps/index.htm> for Wright and London.



Hurricanes: Term may get interrupted. Assignment deadlines still hold, we will just push topics into the Spring term. The university is good about telling people if it is closed (get it so they txt you). They sometimes will close because a storm is heading for the Keys because we are a shelter for Monroe county.

SYLLABUS (but it gets updated! Check the web)

Course Structure

The typical lecture will be me talking for a while about the topic, having 120 seconds for a coffee break, and then two or three of you presenting "how-to" exercises. Sometimes we will have time to work through exercises and Andrea and I will walk around to help with these.

Reading (* required, # worth doing). Many of the items listed include links to the papers. Email Andrea or me if a link is not working. Where it is says "slides", the up-to-date ones get put on the Monday of the lecture. Many of last year's slides are still up, so you can look ahead, but the topics sometimes change a bit (particularly if our timing gets blown off).

Many of these reading are hyperlinks to the sources.

Week 1 (Aug 24) . Introduction, why statistics, what are SPSS and R, and what psychologists want from statistics.

Reading

- * Chapter 1 of first steps. Read all the exercises
- * The following introduction to R: [Chapter One PDF](#)
- # [Facets of R](#) (Chambers, 2009).
- # Paul Meehl on philosophy of psychology [here](#)

The Star Trek stuff (or R, I get them confused) is from [Chambers, J.M. \(2008\). *Software for data analysis: Programming with R*](#). Springer. This book describes in detail the philosophy and mechanics about R (and therefore S, S-Plus). It is more for people interested in software than people for people interested in statistics (but if you are really into statistics you should be interested in the software too).

Week 2 (Aug 31): Boxplots, quantiles, histogram: intro to probability.

Reading.

- * Chapter 2 of first steps. Read exercises.
- * Gould, S.J. (1985). The median isn't the message. *Discover*, 6 (June), 40-42. [here](#).
- # The intro from Jeffrey's book (a copy will be brought to class) or the Howell chapter.
- # Reese, R.A. (2005). Boxplots. *Significance*, 2, 134-135. [here](#).

The Vox Populi paper <http://galton.org/essays/1900-1911/galton-1907-vox-populi.pdf>

The Stigler reference is: Stigler, S.M. (1983). Who discovered Bayes's theorem? *The American Statistician*, 37, 290-296.

Week 3 (Sept 7). Means, standard deviation, skewness, transformations, making bad graphs.

- * Chapter 2 of Steps (see also Appendix F)
- * [Powerpoint is evil](#).
- * Look at <http://www.edwardtufte.com/tufte/>

Bland and Altman on transformations [here](#). Martin Bland and Doug Altman have dozens of brief articles on statistical methods in British Medical Journal (kind of like what Reese does in Significance). These are good sources.

Howard Wainer's "How to display data badly" [here](#).

Week 4 (Sept 14). Categorical data, bar charts, measurement, ranking

* Chapter 3 of Steps

* Lord, F. (1953) On the statistical treatment of football numbers. *American Psychologist*, 8, 750-751. reprinted [here](#) and copies brought to class.

(but you should read sometime) Stevens, S.S. (1946). On the theory of scales of measurement. *Science*, 103, 677-680. [here](#).

Further reading on Lord's example from a recent issue of *J of Math Psych* [here](#).

Reese, R.A. (2007). [Bah! Bar charts](#). *Significance*, 4, 41-44.

Week 5 (Sept 21). Sampling and allocation

* Chapter 4 of Steps

* Wright, D. B. (2006). [Causal and associative hypotheses in psychology: Examples from eyewitness testimony research](#). *Psychology, Public Policy, and Law*, 12, 190-213. This is a long paper, but covers really the main points I want to make in the lecture (and relates to eyewitness stuff so prepares you a bit for my talk in the afternoon class).

* Feinberg, S. E. (1971). Randomization and social affairs: The 1970 draft lottery. *Science*, 171, 255-261. This is a great description of what probability is!

Bland, M. (2005). The *Horizon* homeopathic dilution experiment. *Significance*, 2, 106-109. Should be able to access [here](#). This is a good descriptions of the complexities of random allocation. The study was done for the BBC. BBC coverage [here](#). It began with a paper that supposedly showed homeopathy worked. Bland describes how failures in randomization may have produced these results and concludes about the original author of the *Nature* paper: "I think it is safe to say that this episode destroyed Benveniste's career" (p. 107). *Significance* is the magazine for the *Royal Statistical Society*. It is pretty cool!

Cronbach, L. J. (1957). [The two disciplines of scientific psychology](#). *American Psychologist*, 12, 671-684. This is an important paper in the history of psychology. You should read this at some point in your PhD.

Holland, P. W. (1986). [Statistics and causal inference](#). *Journal of American Statistical Association*, 81, 945-960. This is a fairly long paper. It describes Rubin's model of causality, which we will discuss at a few points in the course (and which is described in the APA Task force report). It is aimed at statisticians, but is not heavily mathematical.

Starr, N. (1997). Nonrandom Risk: The 1970 Draft Lottery. *Journal of Statistics Education*, 5 (2). <http://www.amstat.org/publications/jse/v5n2/datasets.starr.html>. This is about the same data as Fienberg's describing using it as a teaching resource. It includes some of the data. Also cited in lecture:

"Student" (1931). [The Lanarkshire milk experiment](#). *Biometrika*, 23, 398-406. This is a good read. Critical commentaries were more direct back in the 1930s.

Week 6 (Sept 28). Inference, confidence intervals, power

* Chapter 5 of First Steps

* [Baguley, T. \(2004\). Understanding statistical power in the context of applied research. *Applied Ergonomics*, 35, 73-80.](#) *I really like this paper! It points out that people should think about why they are doing power analysis.*

* Cohen, J. (1988). A power primer. *Psychological Bulletin*, 112, 155-159. *This paper provides tables that can be used to calculate power and this will be explained in a how-to session. It also describes what Cohen calls small, medium, and large effect sizes. It is being brought to class (but is available on many web sites)*

Glass' website [here](#) for calculating confidence intervals. You will see this in a how-to. Power tutorial by Jeremy Miles [here](#). *This is a nice tutorial for power!*
To download the G*Power program press [here](#).
For a tutorial on G*Power go [here](#).
Lenth's power page [here](#).

Week 7 (Oct 5). t-test, Wilcoxon, NHST and alternatives



Student's t-test is covered pretty well in every intro textbook (my favorite based on him discussing the alternatives really well, is Wilcox's *Applying Contemporary Statistical Techniques*). His 1908 paper was a real landmark (he used z rather than t, I have the paper somewhere). Wilcoxon and Mann-Whitney is covered less (and used less). We cover them briefly in First Steps, but other intro books tend to cover them a bit more (the other intro books are all really long, so if you use them for a 1 term course you can't really have extra readings ... and not many people read the 800 page books anyway). The classic book for teaching ranked-based methods is Siegel and Castellan, but it has a different approach than how people write now (i.e., they show how to do it by hand in a recipe like fashion).

- * Chapter 6 of First Steps.
- * [Cohen, J. \(1990\)](#). Things I have learned (so far). *American Psychologist*, 45, 1304-1312. *A wonderful read about how to think about statistics. [Note, don't print this, copies will be brought to class]*
 - # Meehl, P. Several publications [here](#), including the two cited in the lecture, published in [1967](#) and [1978](#). *Look at one of these two. The web page is also an excellent source for taxometric analysis and how people make bad decisions.*
 - # Cohen, J. (1994). The earth is round ($p < .05$). *American Psychologist*, 49, 997-1003. *More specific than his 1990 paper. This paper focuses on NHST. This is on FIU e-library.*
 - # [Wilkinson, L. and the Task Force on Statistical Inference, APA Board of Scientific Affairs \(1999\)](#). Statistical methods in psychology journals: Guidelines and explanations. *American Psychologist*, 54, 594-604. *The APA report! You should have already read this, but it is worth reading again.*
 - # Wright, D. B. (2006). [The art of statistics: A survey of modern statistics](#). In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology (2nd ed.)* (pp. 879-901). Mahwah, NJ: Lawrence Erlbaum. This also discusses some topics that we will get into next term.

Week 8 (Oct 12). ANOVA, Kruskal-Wallis, etc., and the Bootstrap

- * Chapter 7 of First Steps
- * The Wright part of: Wright, D.B. & Field, A.P. (2009). [Giving your data the bootstrap](#) (earlier version). *Psychologist*, 22, 412-413.
- * [R Guide -- Analysis of Variance](#) ANOVA (particularly repeated measures) is tricky in R (for some good reasons).
 - # Richard Lowry on ANOVA [here](#). The VassarStats site is good. One of his big projects is trying to get a web-based free statistics software (with lots of how-to info).

Efron, B & Gong, G. (1983). A Leisurely Look at the Bootstrap, the Jackknife, and Cross-Validation. The American Statistician, Vol. 37, No. 1, (Feb., 1983), pp. 36-48. [here](#). This is a stats introduction, so skim the equations.

Week 9 (Oct 19). Regression intro

* Chapter 8 of First Steps

* Handout

Doherty, M.E., & Anderson, R.B. (2009). Variation in scatterplot displays. *Behavior Research Methods*, **41**, 55-60. The authors talk about guidelines for making scatter plots, but most important, stress thinking about how to make scatter plots.

Reese, R.A. (2006). Scatterplots, *Significance*, **3**, 136-138.

Reese, R.A. (2008). Scatterplots revisited. *Significance*, **5**, 87-89. [This one is on adding more info into scatter plots but keeping 2-d.

Ocean temperature data: [fishstock.sav](#) (SPSS), [fishstock.dat](#) (in ASCII for read.table in R)

So, for .sav either click and open in SPSS, or save onto your computer and use read.spss.

For .dat, do fishstock <- read.table("<http://www.fiu.edu/~dwright/qm4psych/fishstock.dat>")

Week 10 (Oct 26). Chi-square

* Chapter 10 of First Steps

* Get your journals in order and write a table of contents.

Agresti, A. (2002). *Categorical data analysis (2nd Edition)*. Hoboken, NJ: John Wiley & Sons. This is a textbook appropriate for an entire course on categorical/qualitative data analysis. It is more detailed than most of you will need (and goes beyond the content of this course and the next one ... if I teach a course on CDA, this will be the text). Alan Agresti has a web site for this book [here](#).

On correspondence analysis, [here](#) is some R code.

Week 11 (Nov 2)

Presenting your functions

Week 12 (Nov 9) Applied measurement

Week 13 (Nov 16). Advanced Glance and review

This is a review lecture, and looking forward. You have enough work you don't need more required reading.

Week 14 (Nov 23)

EXAM

