ANTH 5083 - Quantitative Methods in Anthropology
Spring 2015
Patrick Livingood

Meeting: M 6:00-8:40, DHT 104
Office: Dale Hall Tower, Room 514, Office Hours: TTh 10:30-noon, or by appointment

Every anthropologists that counts or measures something is at some point faced with the challenge of what to do with the numbers. If it is worth your time to collect the numbers, it is almost certainly worth your time to think about them in a constructive way. This course will provide an introduction to some of the statistical techniques that anthropologists have found useful for analyzing and presenting quantitative data.

There are so many techniques, especially when one considers all of the specialized needs of each of the subdisciplines, that there is no way they can all be covered satisfactorily in a single semester. Therefore this course will be restricted to foundational concepts and some of the most widely applied techniques. The goal of this course is to give students the knowledge and experience necessary to determine the appropriate techniques for any given application, the skill to apply the most important analyses to your own data through practice on real datasets, background in argumentation using quantitative data, the ability to critique arguments and presentations utilizing quantitative information, and most importantly provide students with the resources necessary to facilitate these pursuits in the future. This last goal cannot be emphasized enough. Most anthropologists do not perform statistical analyses on a daily basis and it is important that students compile the notes, references, and textual resources that will enable them to apply these analyses in the future.

How this Course Is Unusual

This course is significantly different in content and structure from most other anthropology graduate courses, most of which are seminars. Most seminars have heavy reading loads, devote the majority of class time to discussion, and culminate in a project or paper. In this course (1) the reading load will be relatively light, but you will be expected to spend significant time each week on exercises, (2) the majority of class time will be spent on lecture, and (3) there will be no final project but there will be a final exam.

Prerequisites

This course is offered to graduate students in anthropology regardless of subdiscipline. I assume no background in math or statistics beyond high school algebra. However, students that are anxious about the math content are encouraged to find multiple statistical resources that work well for them and to review them before and after lecture.

Assignments and Grading

The final grade will be assigned according to this:

Category	Percentage of Final Grade
Weekly Exercises	50%
Independent Data Analysis Project	15%
Future Notes	15%
Final Exam	20%

Weekly Exercises
The most important component of the class and your grade. Each week you will receive an assignment containing exercises that utilize the concepts contained in lecture and in the readings. ***You are permitted, even encouraged, to talk with other students about the exercises but the analysis and the write-up must be your own.*** Since we discuss these in class the following week, I will not normally accept late submissions.

Independent Data Analysis
Every student will be required to locate an existing dataset, preferably in their own subfield, for analysis. If the students have existing datasets of their own, those may be ideal if they meet the other conditions. Students who don't have existing datasets that meet the criteria are welcome to talk to their advisors or to me.

The dataset should already exist in electronic form (a database or spreadsheet) or you must be able to get it in the format by the second week of class. The dataset should have several variables that pertain to some class of objects or cases. Some ideal datasets include records on an artifact analysis (including something on site or provenience as well as variables recorded for each artifact), skeletal analysis, or something similar.

Datasets that are problematic include ones with too few variables or cases. It also includes data that are excessively hierarchical or complicated. If the data exist or can be easily transformed into a single table with each row as a case, this should not be a problem. All students will work with the instructor to get early approval and confirmation that their data set is amenable for this exercise. Datasets that are too large also pose some problems, and in these cases the student and instructor will work together to decide on a subset of the data that will be used during the semester.

During the semester, there will be a few weeks in which students will apply previously learned types of analysis to their datasets and then write up the results. The goals are threefold. First, this will provide a form of review for each concept. Second, this will give you practice analyzing your own data and with dealing with the messiness of real world data. Finally, this will provide practice with writing and presenting quantitative results.

Future Notes
Learning quantitative methods shares some similarities to learning a foreign language. Both are learned best through immersion and repetition. Both skills can easily become rusty through lack of use. Because of this, I have noticed that while students have generally done well with

statistics during the semester, they often feel like they are starting from scratch when they try and pick it up again after a few months or years when it is time to do analyses for the thesis or dissertation.

In order to help address this, students will have several assignments throughout the course of the semester in which they will be asked to write summaries of their notes for several weeks and topics written as notes to their future selves. These will be turned in an evaluated. The best notes should help document how and why each method should be applied and include pointers to notes, readings, and texts that may be beneficial.

Final Exam
There will be take home final.

Software

The biggest advance in statistical techniques in the last few decades is the advent of the personal computer and statistics software. Most of the exercises we will do this semester will require you to use a computer to calculate, manipulate, and graph quantitative data. You are permitted to use whatever software you would like if you already have a favorite, but I will probably not be able to provide any assistance if you do not use the recommended software. I will provide instruction and guidance on two software packages and we will discuss these in our first meeting.

JMP

Most of the assignments this semester will be written assuming you will be using JMP. It is the best programs for doing Exploratory Data Analysis that I have used. This commercial software package permits the user to explore graphs interactively and makes intelligent decisions in presenting analysis options to the user. I consider this an indispensable tool for figuring out what is actually going on in my data. It is as easy to use as a statistics program could be. The only downside is that it is less robust at making publication-quality graphs as some other tools (although some of that has been addressed in recent versions) and there are a handful of more exotic analyses and options that it lacks compared to SPSS, SAS, or R.

It is available to students on a 6- or 12-month license for a reasonable cost ($30 for 6 months or $50 for 12 months through http://www.onthehub.com/jmp/). Available on PC and Macs.

R

This is a free open-source statistics package that is available for every platform. It is slowly becoming the lingua franca of statisticians. There is very little you might want to do in statistics or in graphing that this program does not support (it provides add-ons and there have been hundreds written to provide the capabilities that statisticians and others need). Also, its defaults for graphic display are the best I have ever seen. The biggest problem is that the program can be very complex and you need to use a text-based programming interface to access most of the power of this software. There is a graphical front end (R Commander and others) that you can use to simplify some steps. In short,

this is the most powerful program available but also the most complex and hard-to-use. It is also free. It is a rewarding program to learn to use well.

Readings

All of the assigned readings listed in the course schedule will be made available as PDF files. There are no *required* texts for this course, **but I highly recommend that all students acquire at least one or two reference texts as resources**. For the archaeologists, I recommend Drennan's *Statistics for archaeologists : a commonsense approach*. *Second Edition.* I would even recommend this book to non-archaeologists because it is one of the clearest and best-written applied statistics books I have used and references most of the methods we use this semester. The book is available electronically through OU Library, and I have provided a PDF on the D2L page.

I have written a whole other document about other books and resources in statistics you should consult for reference.

Course and University Policies

Students are expected to monitor their OU email account. Reminders, notices, changes in assignments, etc. may be sent via email and students are responsible for those. You can always forward your OU account to another if you like.

No plagiarism or cheating will be tolerated in this course. Any instances will be pursued according to the OU rules of Academic Misconduct and the student will receive severe penalties, including a zero on the assignment in question, as well as further sanctions from the Provost such as censure, suspension, or expulsion. Cheating includes the use of notes or other materials during exams and discussion of exam questions with other students during the exam period. Plagiarism includes the presentation of the work or ideas of others as your own. You are expected to know and understand university policy regarding academic misconduct (see http://integrity.ou.edu).

The University of Oklahoma is committed to providing reasonable accommodation for all students with disabilities. Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact me personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your educational opportunities. Students with disabilities must be registered with the Office of Disability Services prior to receiving accommodations in this course. The Office of Disability Services is located in Goddard Health Center, Suite 166, phone 405/325-3852 or TDD only 405/325-4173. Students whose first language is not English should discuss any concerns or needs with me as soon as possible.

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employment, financial aid, and educational services. For questions regarding discrimination, sexual assault, sexual misconduct, or sexual harassment, please contact the Office(s) of Institutional Equity as may be applicable: Norman campus at (405) 325-3546, the Health Sciences Center at (405) 271-2110, or the OU-Tulsa Title IX Office at (918) 660-3107. Please see www.ou.edu/eoo. The University of Oklahoma is an equal opportunity institution.

Schedule

Wk	Date	Assignment (do after lecture; IDA=Independent Data Analysis, FN= Future Notes)	Topic	Readings (Do after lecture)	Reference Texts							
					Shennan 1997	Drennan 2010	Baxter 2003	VanPool and Leonard 2011	Madrigal 1998	Freedman, et al. 2007	Sokal and Rohlf 2012	Zar 1999
1	Jan 12		Introduction, Mathematic nomenclature, basics of measurement and description, Univariate graphs, Measures of central tendency		Ch. 1-4	Ch. 1-6		Ch 2-4	Ch. 2, 3	Ch. 3-4	Ch. 4	Ch. 3-4
	Jan 19		**MLK Day (No Class)**									
2	Jan 26	IDA (get data, format, approve data)	What can you learn just from graphs and visual inspection?, Intuitive significance testing, Probability, Basic data coding,Using JMP, graphs in JMP	**Required** Whallon 1987 discusses the importance and value of simple statistics.			Ch. 3	Ch 3				

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					Shennan 1997	Drennan 2010	Baxter 2003	VanPool and Leonard 2011	Madrigal 1998	Freedman, et al. 2007	Sokal and Rohlf 2012	Zar 1999
3	Feb 02	IDA (graphing, EDA)	Comparing Means Graphically, Normal and Gaussian distributions, Testing for Normality, Comparing Means (t-test) Part I	**Required** Cowgill 1977 discusses the most common problem with the application of significance tests. Thomas 1978 catalogs the problems with statistics. **Suggested** There are numerous critiques of the classical approach to statistics. Nickerson 2000 discusses them in the context of psychology, but more importantly discusses the most common misconceptions in significance testing. Gelman and Stern 2006 point out the non obvious problems with arbitrary confidence intervals. Sterne, et al. 2001 apply the argument in the context of medicine, and Berger and Berry 1988 provide a statistician's perspective.	Ch. 5-6	Ch. 12		Ch 5-9	Ch. 4-6	Ch. 5-6, 17-18, 26-27, 29	Ch. 5-7	Ch. 5-7
4	Feb 09		Hypothesis Testing, Significance Levels, Comparing means (t-test) Part II, One-tail vs two-tailed tests, Stating Results, Presenting statistics to your reader	**Suggested** Gelman and Weakliem 2009 discuss the problems of detecting small effects.	Ch 6	Ch 12		Ch 5-9	Ch 4-6		Ch 5-7	

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					Shennan 1997	Drennan 2010	Baxter 2003	VanPool and Leonard 2011	Madrigal 1998	Freedman, et al. 2007	Sokal and Rohlf 2012	Zar 1999
5	Feb 16	FN	Making good graphs, Making good tables, Kernel Density Analysis, Silverman's Test, Using R	**Required** Kintigh 2005 discusses how to write about and think about statistics. Ehrenberg 1981 gives advice on making good tables. **Suggested Resource** The best single source on data visualization is Cleveland 1994 and I highly recommending browsing through it as some point. **Suggested** Schreiber and Kintigh 1996 show an example of how simple statistics can be extremely effective. Baxter and Cool 2010 document Silverman's test for archaeology.			Ch. 3	Ch 3				
6	Feb 23		Comparing Means (ANOVA), Transformations, Assumptions behind parametric tests, Non-parametric approaches to comparing means (Kruskal-Wallis)	**Suggested** Read Carr 1987 for theory on ensuring connection or concordance between data, problem, and the tool of quantitative analysis. Read Osborne 2010 for tips on identifying and dealing with outliers. Utermohle, et al. 1983, 1984 show examples of the value of significance testing in measuring differences between researchers measurements of crania.	Ch. 6	Ch. 13		Ch 10, 14	Ch. 7-8	Ch. 27	Ch. 8,9, 11, 13	Ch. 9, 10, 13

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					Shennan 1997	Drennan 2010	Baxter 2003	VanPool and Leonard 2011	Madrigal 1998	Freedman, et al. 2007	Sokal and Rohlf 2012	Zar 1999
7	Mar 02	IDA (univariate, significance)	Goodness of fit tests (chi-square and Spearman's rho), Correlation, Association, and Fitting Lines I	**Suggested** Lewis 1986 discusses the use of contingency tables. Cowgill 1990 evaluates Pearson's r for comparing collections. Speth and Johnson 1976 look at some of the problems with correlation in investigating lithics while Reijneveld 1990 investigates the same problem with birth data.	Ch. 7-8	Ch. 14, 15, 16	Ch 11	Ch 12	Ch. 10-11	Ch. 8-9,28	Ch. 15, 17	Ch. 17, 19, 22, 23
8	Mar 09	FN	Correlation, Association, and Fitting Lines II, Residuals, Linear Regression	**Suggested** A great application of regression can be found in Steponaitis 1981	Ch. 8-10		Ch 5	Ch 11, 13	Ch. 9	Ch. 10-12	Ch. 14, 16	Ch. 17-18
	Mar 16		**Spring Break**									
9	Mar 23		Cluster Analysis, Similarity and Distance Measurements, Numerical Taxonomy	**Required** Archaeology students should read Aldenderfer 1987. **Suggested Resources** The best guides in archaeology to the use of multivariate approaches are found in Shennan 1997and Baxter 1993.	Ch. 11	Ch 22, 25	Ch 6, 8					

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					Shennan 1997	Drennan 2010	Baxter 2003	VanPool and Leonard 2011	Madrigal 1998	Freedman, et al. 2007	Sokal and Rohlf 2012	Zar 1999
10	Mar 30	IDA	Principle Components Analysis/Factor Analysis	**Suggested Resources** Vierra and Carlson 1981 show that PCA will always give you an answer, you must interpret the meaning. The best guides in archaeology to the use of multivariate approaches are found in Shennan 1997 and Baxter 1993. One of the most common applications of PCA to archaeology is in sourcing studies, and Neff 2001 is the best reference.	Ch. 12	Ch 24	Ch 7	Ch 15				
11	Apr 06		Correspondence Analysis, Discriminate Analysis	**Required** Bio students should read Pietrusewsky 2008 concerning multivariate techniques in the study of skeletal remains. **Suggested Resources** The best guides in archaeology to the use of multivariate approaches are found in Shennan 1997and Baxter 1993.	Ch. 12-13	Ch 23	Ch 11					
12	Apr 13		Multidimensional Scaling, Seriation, Missing Data approaches	**Suggested** The canonical guide to seriation is Marquardt 1978. A great example of applying MDS to seriation is found in Kintigh 2006. For a review of more advanced multivariate techniques than we will cover this semester see Baxter 2006.	Ch. 12-13	Ch 23	Ch 11					

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					Shennan 1997	Drennan 2010	Baxter 2003	VanPool and Leonard 2011	Madrigal 1998	Freedman, et al. 2007	Sokal and Rohlf 2012	Zar 1999
13	Apr 20	IDA (multivariate)	Typology	**Required** Cowgill 1982 discusses the fundamental dichotomy in typology. **Suggested Resources** Whallon 1972 uses statistical methods to understand the rules behind an intuitively constructed typology. he current best text on typology is Read 2007. There are several good papers on archaeological typology in Whallon and Brown 1982.								
14	Apr 27	FN	Sampling and Diversity, Required sample sizes, Power analysis	**Suggested** Kintigh 1989 examines the use of diversity measurements for artifacts. Bobrowsky and Ball 1989 examines the math behind some diversity measurements. **Suggested Resources** Leonard and Jones 1989; Orton 2000.	Ch. 14	Ch. 7-8, 17-20	Ch 4, 20	Ch 16				
	May 4		Take home final exam due, noon	**Recommended** Aldenderfer 2005 summarizes the statistical methods and their history in archaeology.								

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