



NUMBERS IN EVERYDAY LIFE

Union College Academy for Lifelong Learning: Spring 2008

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Open a newspaper or turn on a TV--numbers are everywhere from political polls to health studies to sports. They can provide valuable, even life-and-death, information—or mislead. This course will provide insights to interpreting numbers and being well-informed citizens. Seasoned experts (all Ph.D.s) will help you understand the latest statistics from medical studies, public opinion polls, business and industry, this week's media and more. Class discussion will be encouraged.

MENU (all presentations are from 1 to 3 p.m.)

April 3: Some examples and basic concepts--Gerry and Jane

We begin with a critical examination of how numbers are used by the media and impact our lives, using specific examples. These include assessing the “effect” of public actions, such as the NY State Clean Indoor Act; evaluating the impact of marriage on longevity; and that of prayer on the outcome of bypass surgery. We will discuss the basic concepts that each of these examples illustrates. We also will describe (to the degree time allows) how “data mining” is used to gain useful information from massive data sets, the use and misuse of the bell-shaped curve and of averages (using, as an example, the President's claim of “average savings” from the 2006 Medicare Drug Plan).

April 10: Public opinion polls (and elections forecasts)—Josef

In this election year not a day passes without polling results being widely publicized in the media. Earlier primaries have shown that polls conducted by national research organization may be seriously flawed. This session covers political polling at a non-technical level. We will define and explain

basic polling concepts including such terms as representative sample and margin of sampling error. We will use these to show how polls are conducted and why they work. We will identify the basic ingredients of a valid poll. We will also discuss the pitfalls that have led to this year's problems with polls in California and New Hampshire, including problems with non-response, demographic weighting and volatile voting behavior. We will end with simple guidelines to recognize a legitimate poll.

April 17 Medical and health studies: Ricki

The session on use of numbers in health studies begins with a perusal of a recent issue of The New England Journal of Medicine – eight articles point out the diversity of types of health studies, and how they use numbers. Next we will learn the lingo of clinical trial design. The second hour will address “10 sources of distortion” in health studies, with many examples “ripped from the headlines.” If time permits, we will brainstorm a clinical trial to test the hypothesis: “Researchers who have worked with insects do not get bug bites.”

April 24: Business and industrial applications: Necip

In this talk we will describe how numbers and statistics are used in business and industry to improve product design and manufacturing, to reduce waste and operate more efficiently, and to run service businesses, such as financial operations, most effectively. Recent examples will be used to illustrate the concepts. These are expected to include the development of quality standards for TV closed captions, the detection of fraudulent activities on the Internet, and the building of an automated scheme, based on sensors, that shuts down a locomotive to avoid potential costly failures.

May 1: Further examples and wrap-up—Gerry and Jane

We will continue the critical examination of how numbers are used by the media and impact our lives by considering testing in schools (to satisfy the No Child Left Behind Act); the U.S. News and World Report yearly college rankings; and the claimed occurrence of a “one in a million chance” event. We will also briefly describe some good and bad ways of presenting data graphically, some added ways that numbers are being used to advance human knowledge; and sources of further information. We will conclude by reviewing the basic principles that the course has strived to bring to the fore.

NUMBERS IN EVERYDAY LIFE SOME FURTHER READING AND SURFING

GENERAL

Best, Joel *Dammed Lies and Statistics: Untangling Numbers from the Media, Politicians, and Activists*, University of California Press, 2001. “A lively guide to spotting bad statistics and learning critically about these influential numbers... (based on) a wide assortment of contemporary issues that have garnered much recent media attention.” This highly readable book considers mainly social and public issues. It also provides added references.

Best, Joel, *More Dammed Lies and Statistics: How Numbers Confuse Public Issues*, University of California Press, 2004. A follow-up to the 2001 book, providing added examples and discussion.

Peck, R. et al, *Statistics: A Guide to the Unknown*, 4th edition, Duxbury, 2006. “A new collection of essays that illustrate how statistics can provide an organized way of learning from data and how the ensuing knowledge can be used to address important, social, environmental, and economic problems.” Earlier editions provide different essays.

Utts, J. M., *Seeing Through Statistics*, 2nd edition, Duxbury Press, 1999. “This book’s first objective is to help you...sift the useful and the accurate from the useless and misleading.” The book was developed for a one-quarter course on introductory statistics taught “as part of the general education curriculum” at the University of California at Davis and is a little more technical than the others listed above.

THE MISUSE AND ABUSE OF STATISTICS

Hooke, R., *How to Tell the Liars from the Statisticians*, Marcel Dekker, 1983. The title tells it all.

Huff, Darrell, *How to Lie with Statistics*, Norton, New York, 1954. This book has become somewhat of a classic.

DISPLAYING NUMBERS GRAPHICALLY

Tufte, E. R., *The Visual Display of Quantitative Information*, Graphics Press, Cheshire, Conn., 1983: Another classic.

Wainer, H., *Visual Revelations*, Springer-Verlag, New York, 1997.

RELATED TOPICS

Devlin, K and Lorden, G., *The Numbers behind Numb3rs: Solving Crime with Mathematics*, Plume, 2007. Explains some of the math behind the TV show Numb3rs.

Gigerenzer, G., *Calculated Risks: How to Know when Numbers Deceive You*, Simon and Schuster, New York, 2002. Provides examples of misinterpreting probabilities and exaggeration of rare events (e.g., fatal shark attacks); somewhat more technical.

Levitt, S. S. and Dubner, S. J., *Freakonomics: A Rogue Economist Explains the Hidden Side of Everything*, Revised and Expanded Edition, Harper Collins, New York, 2005. A New York Times best seller by an economist about “the riddles of everyday life.”

Lewis, M. *Moneyball: The Art of Winning an Unfair Game*, Norton 2003. Applying numbers to building a baseball team and winning strategy (applied to the Oakland A’s).

Paulos, J.A., *Beyond Numeracy: Ruminations of a Numbers Man*, Alfred A. Knopf, New York, 1991. A set of short (somewhat technical) essays on topics in mathematics, arranged alphabetically from Algebra—Some Basic Principles to Zeno and Motion.

GETTING THE PICTURE

Gonick, L. and Smith, W., *Cartoon Guide to Statistics*, Harper Collins, 1993. Explains elementary statistics via cartoons.

MAGAZINE

Chance, A Magazine of the American Statistical Association, published quarterly by Springer. “Articles showcase statistical methods in the social, biological, physical, and medical sciences....Columns and departments (deal with) such areas as government studies and sports.” Some articles are somewhat technical.

GREAT WEB SITES

http://chance.dartmouth.edu/chancewiki/index.php/Chance_News_33

“*Chance News* is a newsletter that reviews articles in the news that use probability or statistical concepts...It is aimed at helping the general public better understand current chance news and assisting teachers of probability and statistics who want to liven up their courses by using current chance news.” News stories are accompanied with analyses and discussion questions. Each of the 33 issues to date, published since 1992, can be readily accessed (above link is to latest issue). Send email to jlsnell@dartmouth.edu to be notified of new issues of the newsletter.

<http://blogs.wsj.com/numbersguy/>

Site for **Carl Bialik**, The Numbers Guy, “examines numbers in the news, business and politics. Some numbers are flat-out wrong or biased, while others are valid and help us make informed decisions.” This blog provides access to all articles since January 2005; they are currently published every other Friday in the Wall Street Journal.