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Statistical Literacy: An Overview

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0. Causation from Association

Fatal disease from secondhand smoke
Lung disease 3,000
Heart disease 35,000

By Rebecca Pollack and Kevin Kepple, USA TODAY
Source: American Cancer Society

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Statistical Literacy

To be literate about everyday arguments
that use statistics as evidence

Statistics are man-made, socially constructed.
Motto: “**Take CARE!**”

- C = Confounding (Predictors tangled up)
- A = Assembly (Define/Choose/Present)
- R = Randomness (Chance)
- E = Error or Bias (Mistakes, Sampling bias)

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Different Emphasis

Confounding: Predictors are tangled up.

- ‘Take control of’ by random assignment.
- ‘Control for’ by standardizing (regression).

Assembly:

- defining groups (bullying, heat-wave deaths)
- choosing statistics (centers, rates, percents)
- presenting statistics (graphs & comparisons).

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Traditional Statistics	Statistical Literacy
Association	Association
Descriptive Statistics	<i>Confounding</i> [New]
Randomness	<i>Assembly</i> [Mostly New]
	Randomness / Error

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C = Confounding Age of Respondents

Are piracy lawsuits OK?
7% NOT SURE
56% NO
37% YES

By Julia Neyman and Keith Carter, USA TODAY
Source: Ipsos for Findlaw

**C = Confounding
Size of the Group**

Table 1: State Prison Expenses: MN vs. IA

State	Total	# Inmates	Per Inmate
MN	\$186M	4,917	\$37,825
IA	\$146M	6,012	\$24,286
%	27%		56%

Table 2: State Prison Expenses: MN vs. ME

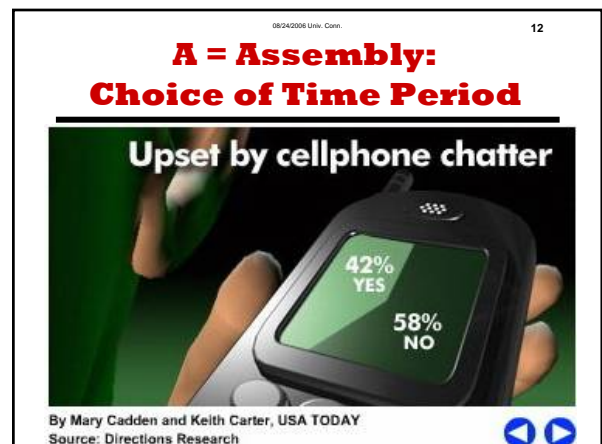
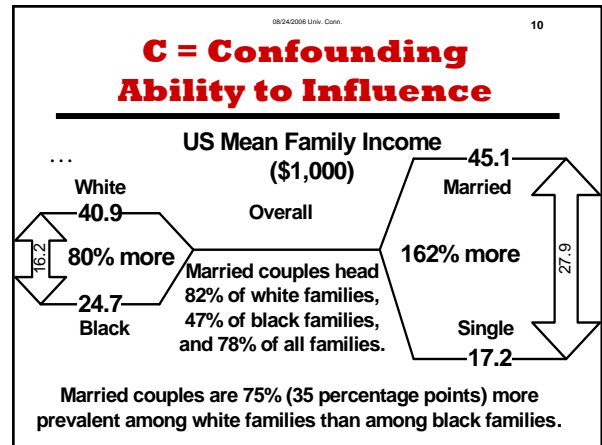
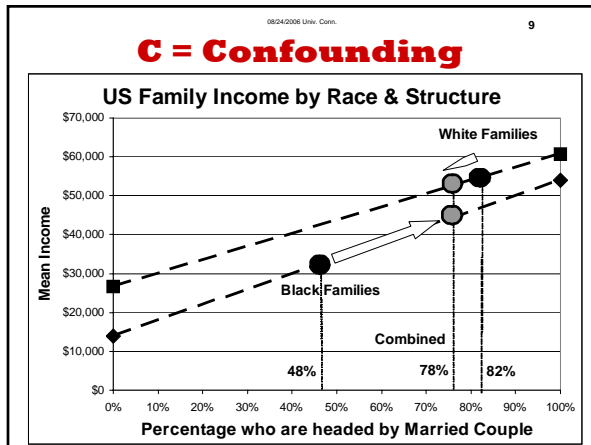
State	Total	# Inmates	Per Inmate
MN	\$186M	4,917	\$37,825
ME	\$52M	1,543	\$33,711
%	260%		12%

**C = Confounding
Size of the Group**

Table 3: State Prison Expenses: CA vs. NY

State	Total	# Inmates	Per Inmate
CA	\$3.0B	140	\$21,385
NY	\$2.2B	77	\$28,426
%	36%		-25%

Controlling for the influence of a confounder can ↑, ↓ or reverse an association of totals.
Q. Can we show this for an association of ratios?
A. YES!



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A = Assembly
1M Scouts; 2M Badges

Badges of honor Boy Scouts earn



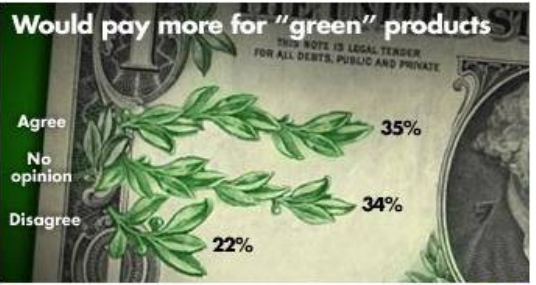
93,056 83,502 73,871
First Aid Swimming Environ. Science

By Cindy Clark and Rod Coddington, USA TODAY
Source: Boy Scouts of America

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A = Assembly
How Much More?

Would pay more for "green" products




Agree 35%
No opinion 34%
Disagree 22%

By Anne R. Carey and Jerry Mosemak, USA TODAY
Source: Simmons Market Research

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A = Assembly
"Many": 30% or 9%

Types of bumper stickers we have



Promotional	9%
University-related	9%
Political	6%
Humorous	6%

By Justin Dickerson and Rod Coddington, USA TODAY
Source: Roper for Mercedes-Benz

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A = Assembly
More/Most

Full Comparatives

- Women live longer than men.
- Autism more prevalent among boys than girls.

Incomplete (Null) comparatives.

- More doctors like Crest.

Superlatives (Majority vs. Plurality)


- Most doctors like Crest.

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A = Assembly
Part vs. Whole

Difficulty reading graphs in USA Today

Guests who bring gifts (by household income)



\$35,000 or less	15%
\$35,001-\$50,000	18%
\$50,001-\$75,000	24%
Over \$75,001	41%

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R = Randomness:
Not Due to Chance

Too Unlikely to be Due to Chance so the association must be causal.

- This statistic is central to arguments about ESP and Intelligent Design and to arguments about the safety of nuclear power plants, cell phones and cell-phone towers. .
- These arguments are central to education, to moral decisions and to legal liability.

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R = Randomness Evolution

Too Unlikely to be *Due Just to Chance*

- Evolving life *by chance alone* is as likely as having tornado turn a junk yard into a 747.

If a Robin = 1,000 “ones” on a 10-sided die.

- 10^{990} years *by chance alone* (~300/sec)
- 30 seconds by chance plus “genetic inheritance” or “natural selection”

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R = Randomness Many Coincidences

Explain coincidences (unlikely events):

- Winning lottery twice.
- 9/11 coincidences.

Law of Large Numbers

- Unlikely is almost certain given enough tries.
- 60% chance of 8 heads in 8 flips in 256 tries.

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E = Error/Bias: Casino’s Loose Money?

By Anne R. Carey and Keith Carter, USA TODAY
Source: Maritz Poll

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S

SUMMARY Peter Holmes (2003)

W. M. Keck Statistical Literacy course

- “is *different*”: “different emphasis”, “different background”, “a different package”
- “goes beyond Numeracy”
- is more in line with the statistical literacy “needed by most people in everyday life to read the news, by those in business commerce or management, and by policy makers.”

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To Get Educated

1. Read “*Statistical Literacy and Liberal Education at Augsburg College*” by Milo Schield (2004 AACU Peer Review)
2. Read *Damned Lies & Statistics and More Damned Lies & Statistics* by Joel Best
3. Read “*Statistical Literacy – Online at Capella University*” by Mark Isaacson.
4. Investigate Stat Lit at www.Statlit.org

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Next Steps

1. Network with faculty interested in critical thinking about arguments involving statistics.
2. Read “*The Case for Quantitative Literacy*” by Lynn Steen (or any of his other QL books)
3. Schedule faculty workshops to discuss different approaches to QR/QL.
4. Consider adopting Statistical Literacy as a QR/QL course for humanities majors.