Chapter 3: Overview

Statistical Literacy 2009
Chapter Summaries

by

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www.StatLit.org/pdf/...

2009StatLitTextHandoutCh3.ppt

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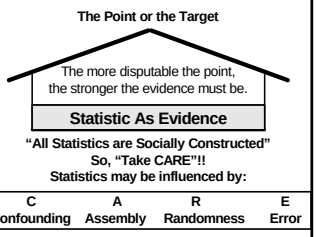
Ch 1. Review

Statistics are generally used as evidence to support an argument.

The influences on a statistic are of four kinds: Context, Assembly, Randomness or Error.



"All Statistics are Socially Constructed"
So, "Take CARE"!!
Statistics may be influenced by:

C	A	R	E
Confounding	Assembly	Randomness	Error

Review of C.A.R.E.

Context: Related factors taken into account; the confounders not taken into account.

Assembly: Choice in definition, measurement or presentation.

Randomness: Influence of chance.

Error: Systematic deviation of statistics from the underlying reality.

Describe Distributions: Percentiles

Table 7 Distribution of Heights for U.S. Twenty-year olds

Percentile	3rd	5th	10th	25th	50th	75th	90th	95th	97th
Male	64.3	65.0	66.0	67.7	69.6	71.5	73.2	74.2	74.9
Female	59.5	60.1	61.0	62.6	64.3	66.0	67.6	68.5	69.1

Table 8 Distribution of Weights for U.S. Twenty-year olds

Percentile	3rd	5th	10th	25th	50th	75th	90th	95th	97th
Boys	119	123	129	140	156	175	196	211	222
Girls	99	102	107	116	128	145	166	183	196

Describe Distributions: Mean, Median & Mode

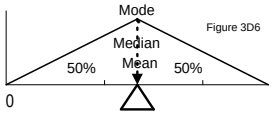


Figure 3D6

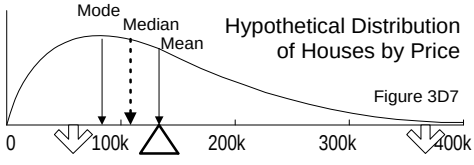


Figure 3D7

Describe Distributions: Comparisons

2000 U.S. Family Incomes by Number of Wage Earners

# Earners	Median Income	Mean Income	Income per family member
None	21,916	27,720	12,054
1	34,423	50,188	16,779
2 or more	67,600	82,267	23,762
2	63,816	79,113	24,965
3	76,566	90,330	21,270
4 or more	91,709	103,678	19,375
ALL	50,890	65,574	20,865

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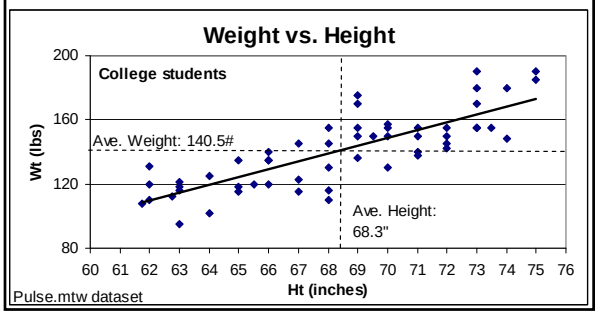
Compare Distributions: Trends



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Standardizing Totals: "taking into account"

State Prison Operating Expenses: CA vs. NY

State	Total	# Inmates	Per Inmate
CA	$2.9B	136K	$21,385
NY	$1.9B	69K	$28,426

Total	Per Inmate
50% more ↑ than	25% less ↓ than

Controlling for prison population *reverses* the association.

State Prison Operating Expenses: MD vs. KS

State	Total	# Inmates	Per Inmate
MD	$481M	21,623	$22,245
KS	$159M	7,148	$22,245

Total	Per Inmate
3 times ↑ as much as	Same ↔ as

Controlling for prison population *nullifies* the association.

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Standardizing Totals: "taking into account"

State Prison Operating Expenses: MN vs. ME

State	Total	# Inmates	Per Inmate
MN	$184M	4,865	$37,825
ME	$48M	1,424	$33,711

Total	Per Inmate
260% more ↑ than	12% more ↑ than

Controlling for prison population *decreases* the association.

State Prison Operating Expenses: MN vs. IA

State	Total	# Inmates	Per Inmate
MN	$184M	4,865	$37,825
IA	$144M	5,929	$24,286

Total	Per Inmate
27% more ↑ than	56% more ↑ than

Controlling for prison population *increases* the association.

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Standardizing Averages: "taking into account"

NAEP 2000 8th Grade Math Scores: VA vs. TX

	Encyclopedia at home		
State	**All**	**Yes**	**No**
Virginia (VA)	275 (100%)	278 (81%)	241 (19%)
Texas (TX)	↑273 (100%)	↓279 (73%)	↓242 (27%)

Virginia students did better than Texas students.

After ***taking into account*** encyclopedias at home, Texas students did better than Virginia students.

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Standardizing Averages: "taking into account"

SAT Verbal Scores by Race: 2002 vs. 1981

GROUP	1981	2002	CHANGE
White	519 (85%)	527 (65%)	+8
Black	412 (9%)	431 (11%)	+19
Asian	474 (3%)	501 (10%)	+27
Mexican	438 (2%)	446 (4%)	+8
Puerto Rican	437 (1%)	455 (3%)	+18
American Indian	471 (0%)	479 (1%)	+8
ALL Test takers	**504**	**504**	**ZERO**

SAT scores were the same in 2002 as in 1981.

After ***taking into account*** race, SAT scores were higher in 2002 than in 1981.

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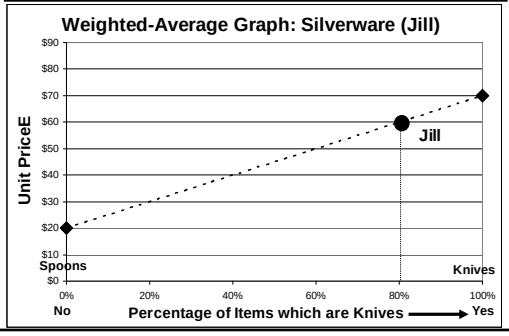
Single Weighted Average



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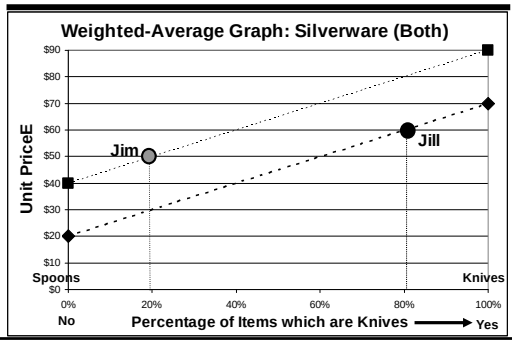
Comparing Weighted Averages



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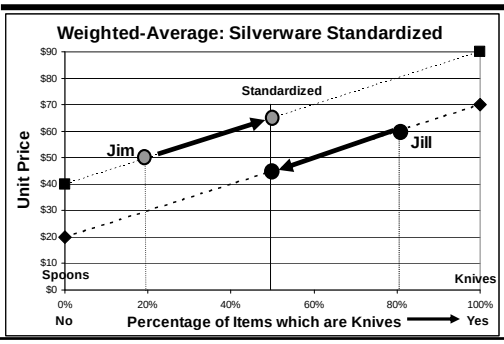
Standardizing: "Same mix"



Race	Married	Single
White (100%)	$60,600 (82%)	$26,700 (18%)
Black (100%)	$53,900 (48%)	$14,000 (52%)

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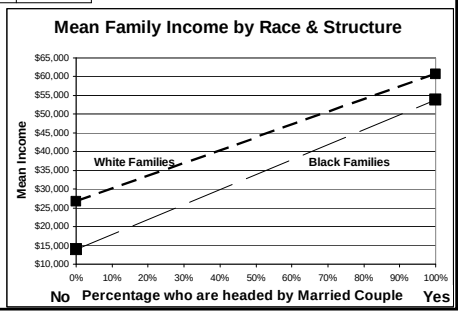
Family Income: Plotting the data



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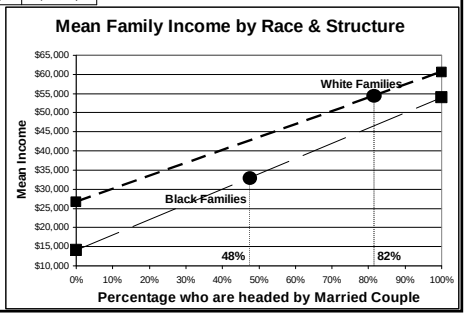
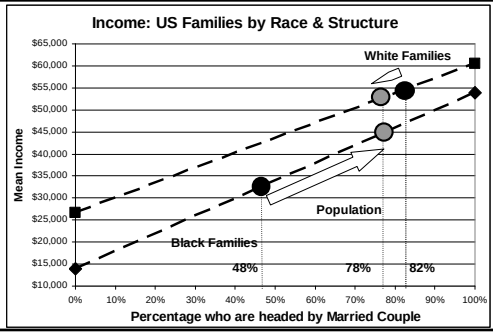
Calculate Averages



Standardizing

78% of all US families are headed by a married couple



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Comparisons: Black-White Income Gap

Average Income	Before	After
Whites	55K	53K
Blacks	33K	45K
Difference	22K	8K

Of the $22K black-white income gap, 14K (22-8) is ***explained by*** family structure.

67% (14/22) of the black-white income gap is ***explained by*** marital status.

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Three methods

If you're having difficulty using the graphical approach, you can use either proportional reasoning or the algebra of weighted averages. As you've seen, they give the same result as the graphical approach. A common error in using either is to multiply by the percentages. The proper approach is to convert the percentages to decimals before multiplying.

Here are problems associated with each of these three methods.

- Graphically: a common problem is identifying what numbers one places on the right and the left sides of the graph.
- Proportional reasoning: a common problem is identifying whether to add onto the smaller or subtract from the larger.
- Algebra: a common problem is deciding which percentage to apply to which value.

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Summary

Context involves what is (not) taken into account.

What is taken into account can influence

- Counts or totals (by forming ratios)
- Averages (by selection or standardizing)

Hypothetical thinking is required to think of what could have been taken into account (confounders).

"Presenting Confounding and Standardization Graphically" *STATS Magazine* at www.StatLit.org/pdf/2006SchieldSTATS.pdf