

Statistical Fallacies

Critical Thinking

Lies, Damn Lies, and Statistics

- Statistics can be easily abused to persuade those:
 - who don't have an affinity with numbers (intimidation and obfuscation: “snow them with the math!”)
 - who do have an affinity with numbers (appeal to numbers: “I love numbers. Numbers are yay! This claim contains numbers. So this claim must be true”).
- In both cases, statistics appeals to precision, hardness, and objectivity ... but:
- *precision is not the same as accuracy!*

Pitfalls when it comes to Statistical Reasoning

- Possible pitfalls:
 - Small Sample
 - Biased Sample
 - Biased Method
 - Biased Reporting
 - And just bad conclusions!

Small Sample

- “28% of all students ...!”
- ... Turns out it was 2 out of 7

Anecdotal Evidence and Personal Experience

- Perhaps the most compelling argument against dredging the river came from 101-year-old Alfred Z. Solomon of Mad Cap's Farm on the Hudson in Northumberland. His proof, he said, that PCB's aren't bad for you is the fact that he's still standing.
 - "Dredge Proposal foes rap EPA", Times Union
- Problem: sample size = 1!

Hasty, Sweeping, and Hasty Refutations by Generalizations

- A hasty generalization is where we fallaciously infer some general claim from just a few (too few!) instances
 - E.g. Yolanda is good at X. Therefore, women are good at X.
 - Look at the warm spell: global warming, I tell you!
- A sweeping generalization is where we fallaciously apply some general claim to a specific instance
 - E.g. In general, women are good at X. Therefore, Yolanda is good at X.
- A hasty refutation of a generalization is where we point to just a few (too few) cases to refute some general claim
 - E.g. It is not true that women are good at X. Look at Yolanda; she stinks at X!
 - Look at the cold spell: what global warming?!

Biased Sample

- “28% of students ...!”
- Turns out they were only polling IT majors!

Again, Anecdotal Evidence and Personal Experience

- Think about it: why is it anecdotal? And why did it stick in your personal memory?
- Often, because it is unusual!
- So, cases of anecdotal evidence and personal experience are almost always not representative.

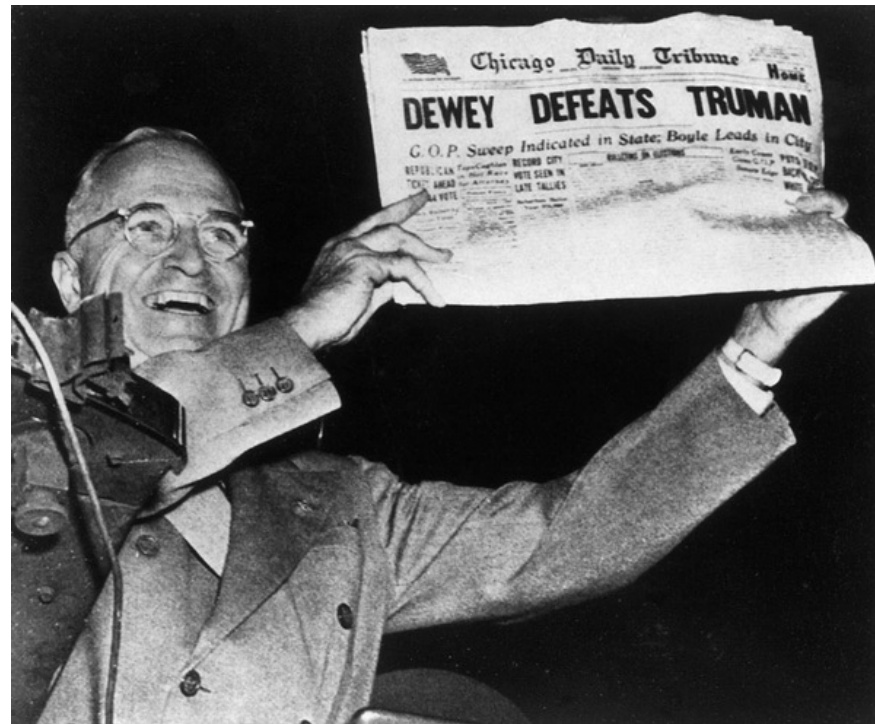
1936 Literary Digest Poll

- The Literary Digest magazine predicted that Alf Landon would win the presidential election based on the results of a questionnaire sent to 10 million (!) people, randomly selected from 3 sources: subscribers of the magazine, registered automobile users, telephone list. 2.4 million questionnaires were returned, the majority of which indicated that they would vote for Landon.
- Problems:
 - Self-selection (only certain people would respond)
 - Magazine subscribers, automobile users, and telephone users were all ‘well-off’ people, biasing the results.

Self-Selection

- Samples can 'select themselves' and thereby become biased.
 - this often happens with surveys that are returned on a voluntary basis, as those with strong feelings on the issue are more likely to respond.

1948 Poll Prediction: Dewey Defeats Truman



Two problems:

1. Polling stopped a few weeks before election, as it seemed abundantly clear that Dewey was going to win.
2. Interviewers were sent to physical address of people (so as to avoid bias from telephone lists), but this introduces its own bias (pollsters afraid to go into certain neighborhoods, for example).

Concern:

Can Polls Effect Outcome?

- Push-Polling ('polls' that aren't polls at all, but masquerade as such, but whose real point is (through leading questions) effect our thinking)
- Exit polls
- Constant Polling

Self-Reporting

- Many surveys suffer from self-reporting, i.e. rely on people reporting on their behavior:
 - People don't always accurately remember what happened to them
 - People may report things in a way that puts them in a more favorable light.

Annual Durex Sex Survey

- How often did you have sex the past year?
- 2001
 - US – 124
 - France – 110
 - Netherlands – 94
- 2002
 - US – 138
 - France 167
 - Netherlands – 158
- Further problems with Durex Sex Survey:
 - Survey can be found online at durex.com
 - Durex also went to popular spring break locations to ask people to fill out survey

Leading Questions

- “Do you support the new law, passed by Congress and signed by President Bush, that bans partial-birth abortion?”
 - Republican National Committee “Census Document Questionnaire”
- “Do you believe that women and their families should have the right to make their own private reproductive healthcare decision without interference from the federal government?”
 - League of Women Voters “Citizen’s Survey”

Weather.com Poll

- Which storm do you predict will be the largest this season?
 - Ernesto
 - Florence
 - Helene
 - Isaac
 - Michael
 - Nadine
 - Rafael
 - Other

Giving choices can Bias too!

- Survey question posted on TV on airline flight: How would you rate the cleanliness of the tray table?
 - Excellent
 - Very good
 - Good
 - Fair
 - Not Good

(the * was placed by default when the question came up)

Biased Reporting

- You can represent numbers in many ways; some more persuasive than others.

Poly Person of the Year



Geoff Seber

Julia Leusner

Casey Addy

***Bram
Van Heuveln***

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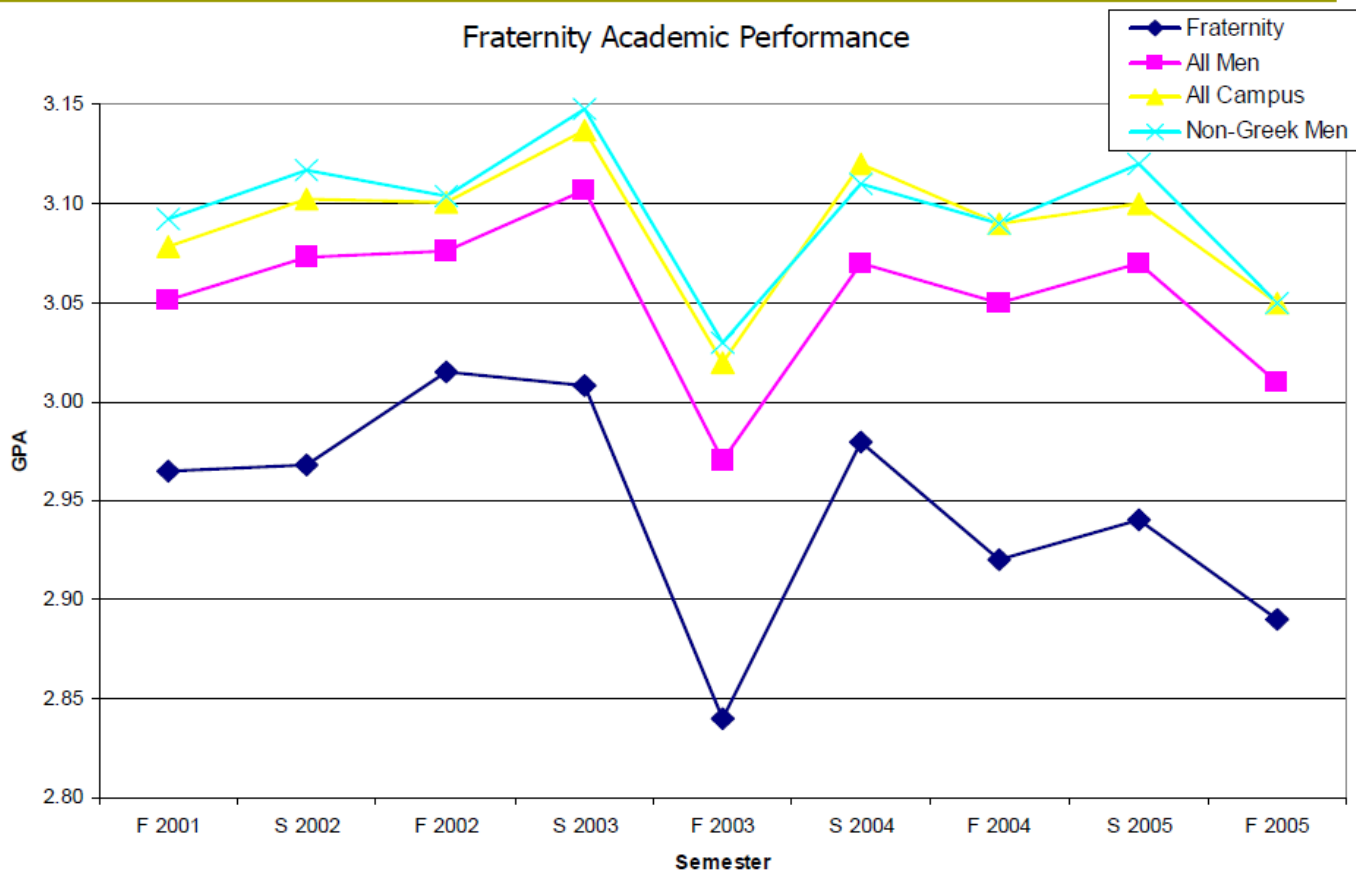
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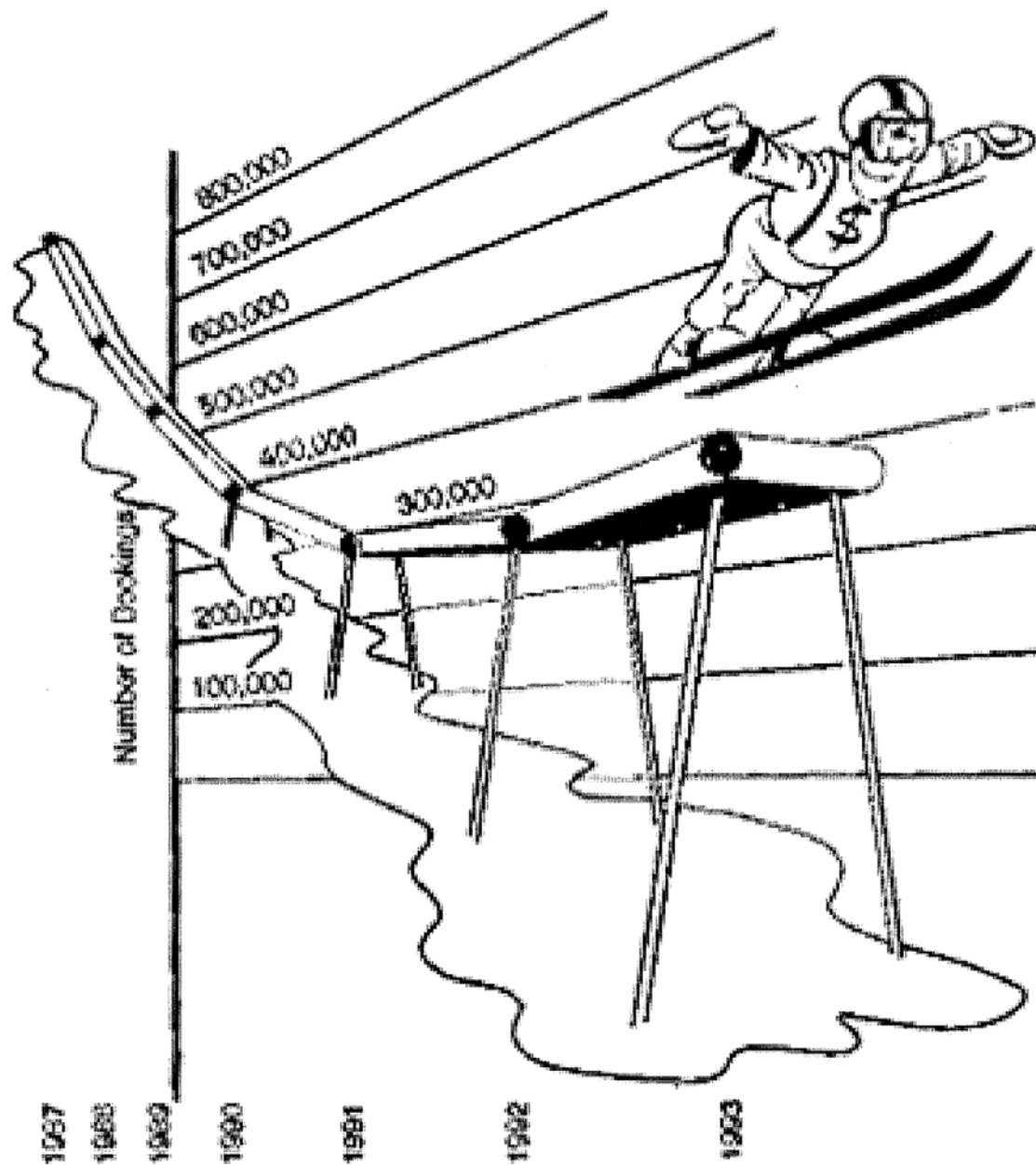
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Shoot!!

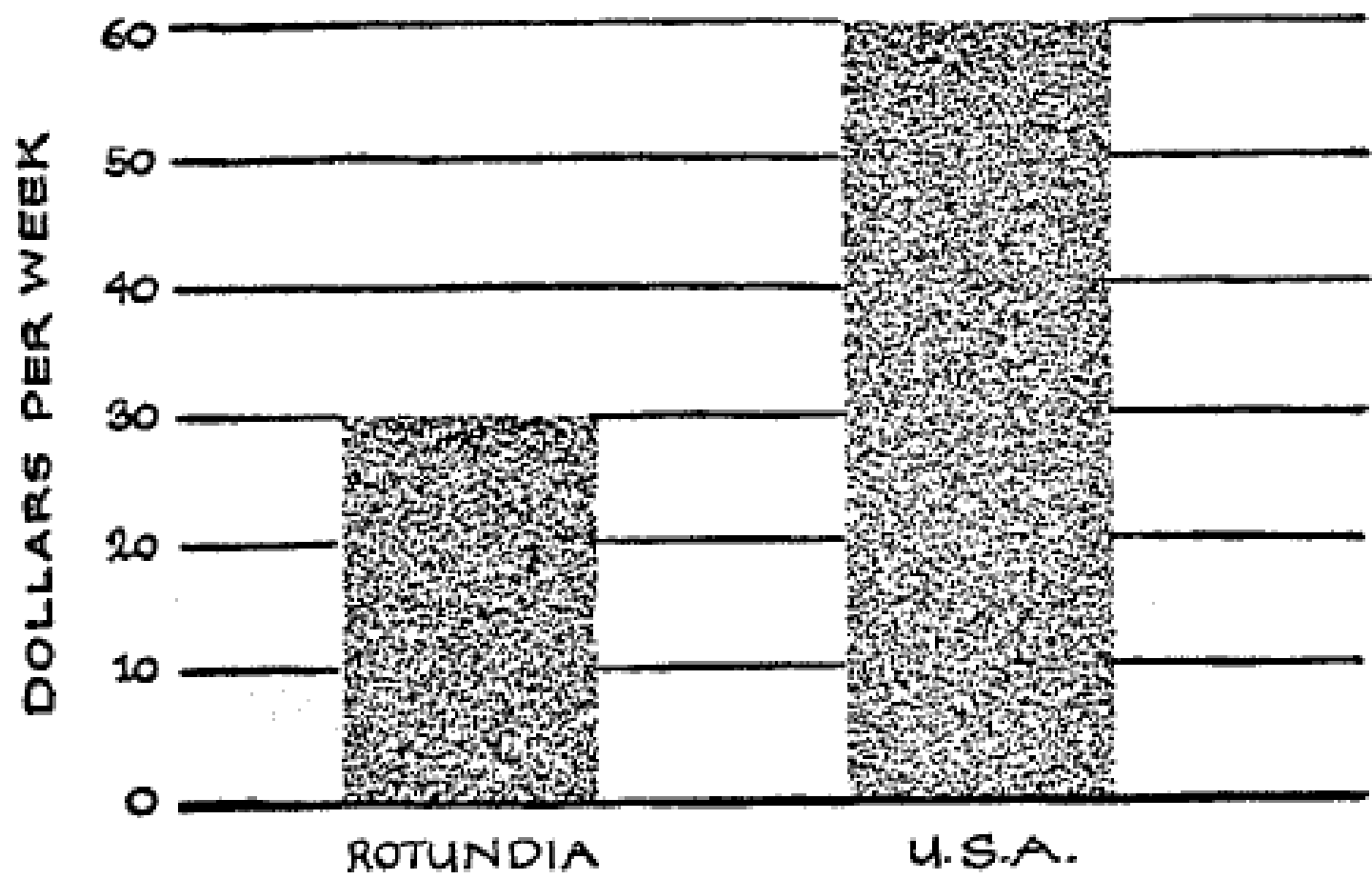
Five Year Trends in Greek Life

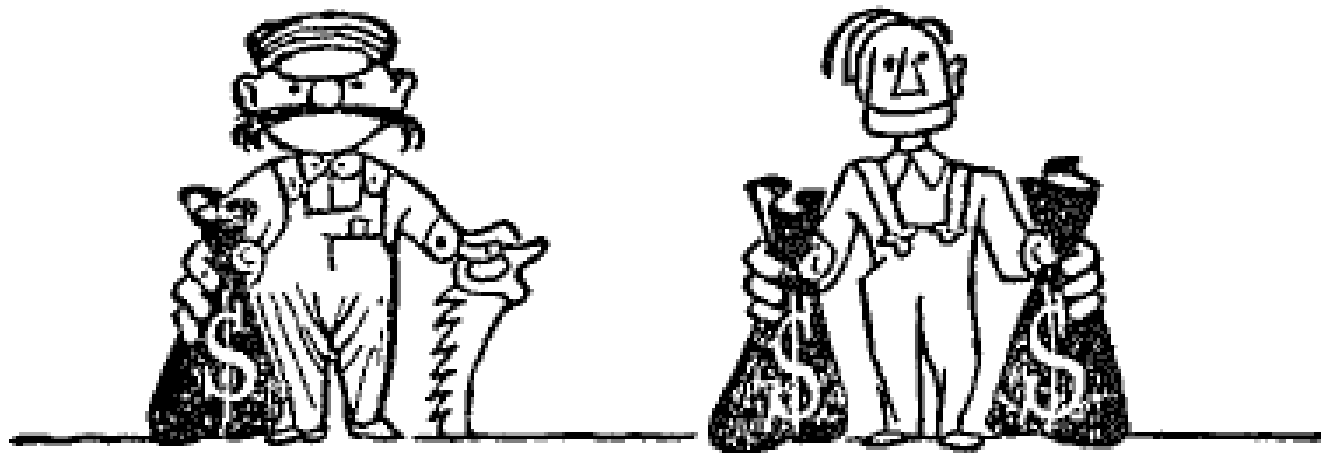


“We are observing trends that signal a growing disconnect between Greek chapter values and principles and its actions through[long list, including:] A decreasing academic performance in comparison to non-Greek and all campus performance”
 - ‘Greek Life: New Directions’, Office of Student Life, RPI



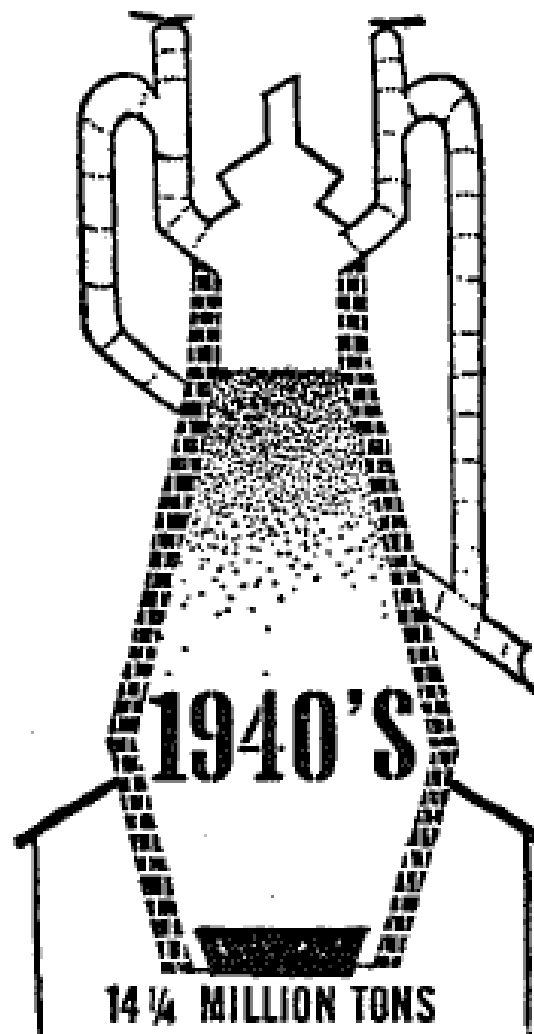
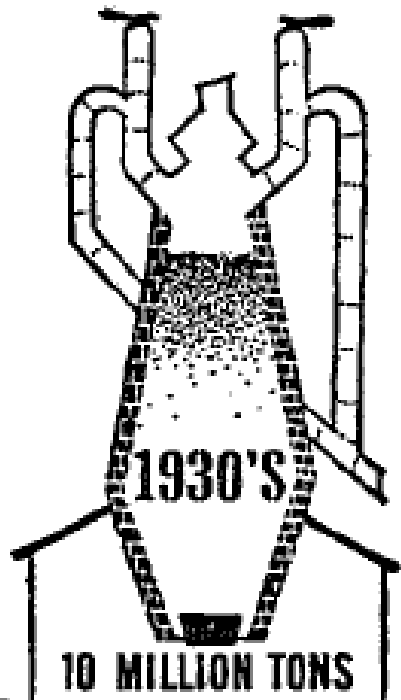
Winter Resort Industry Takes Off

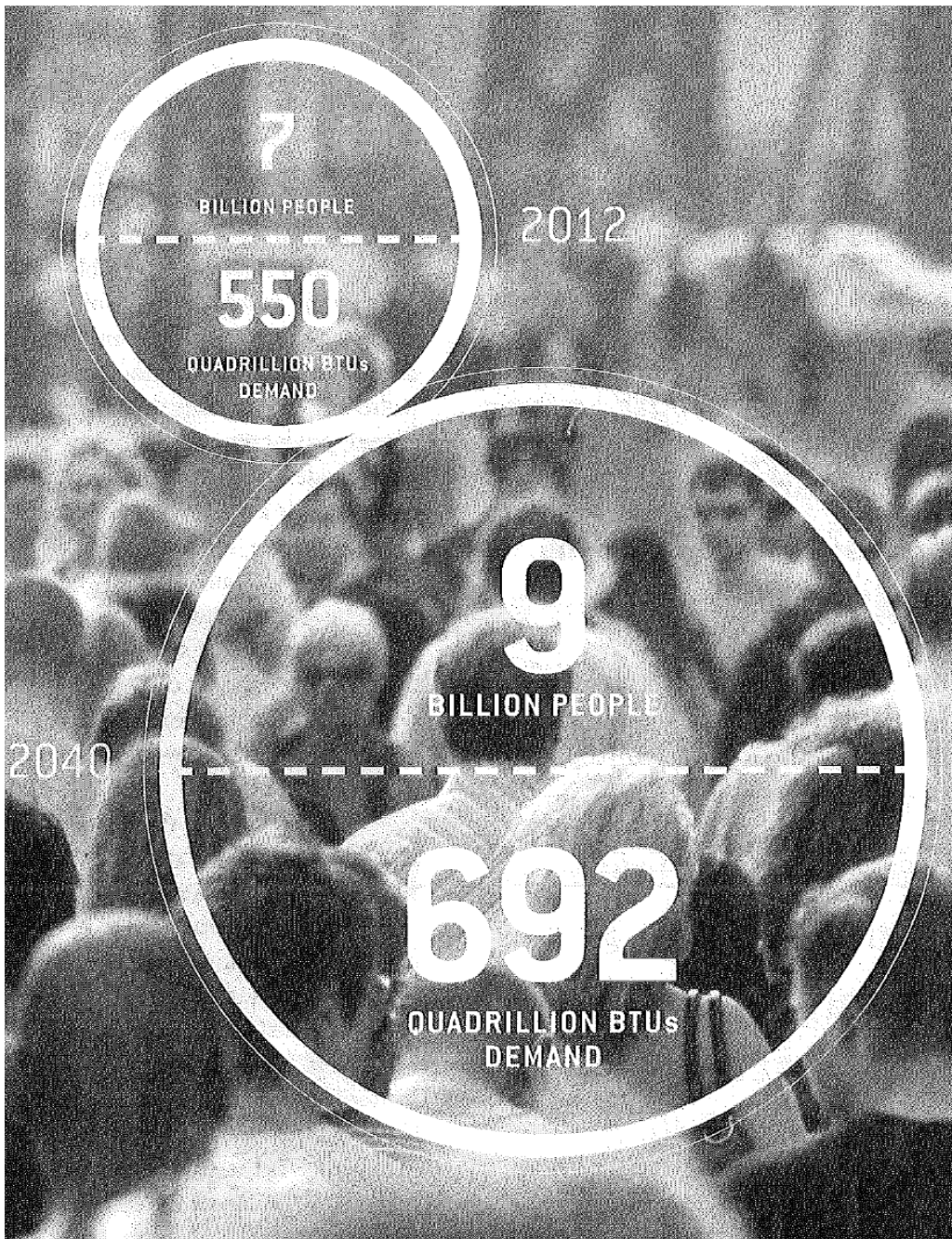






STEEL CAPACITY ADDED

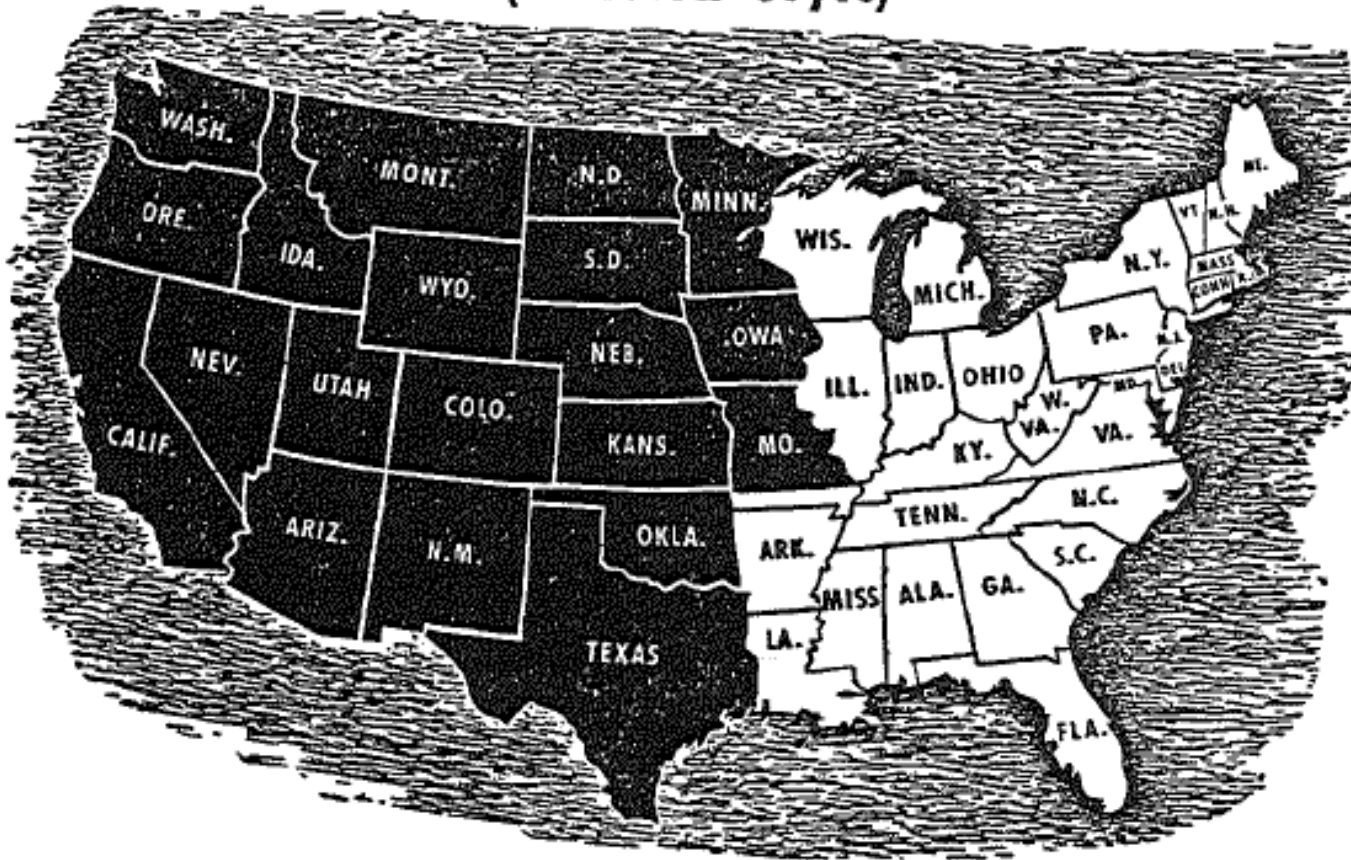




- From an article in the “Rensselaer” alumni magazine talking about the growing need of energy as the human population size increases

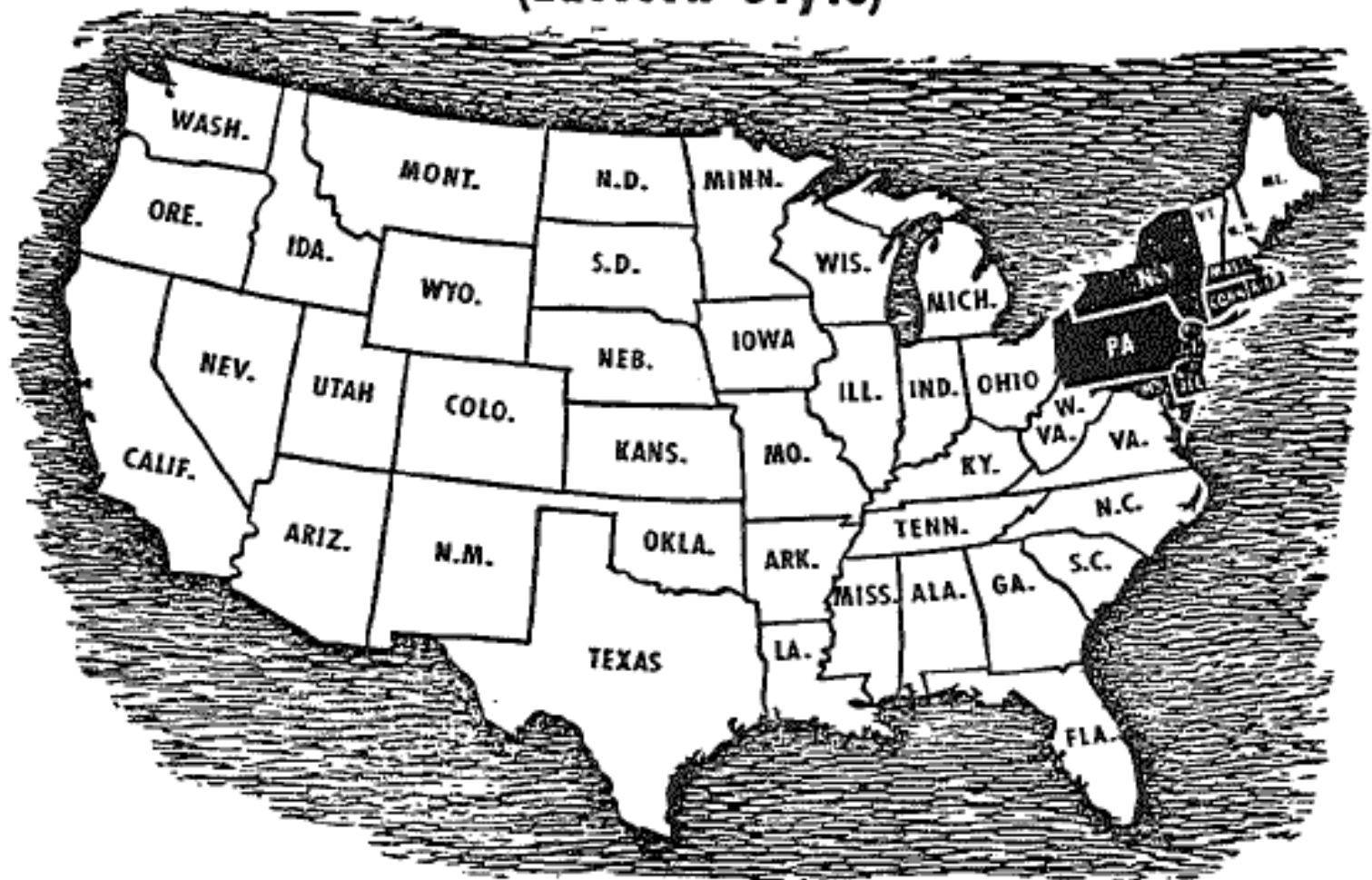
THE DARKENING SHADOW

(Western Style)



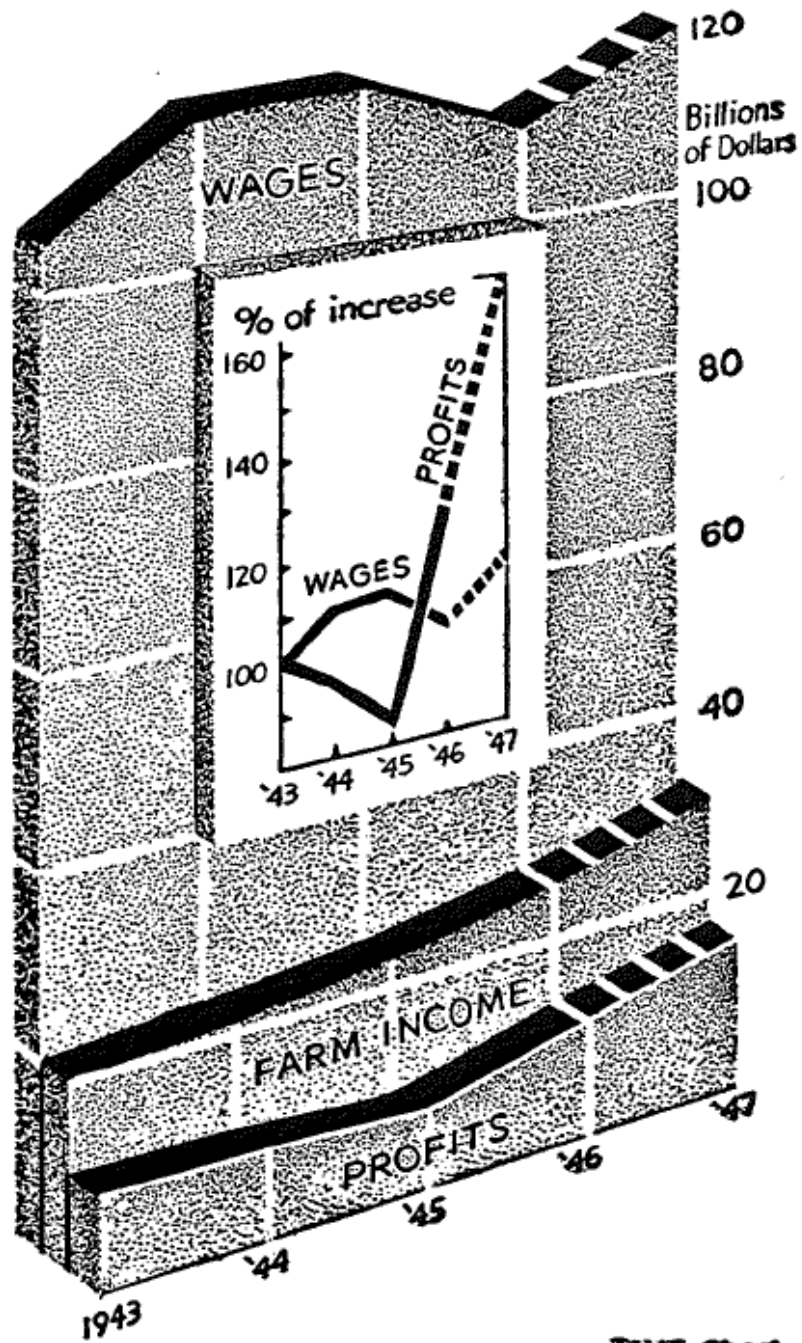
The dark area shows the portion of national income that is taken and spent by the federal government: it's the income of all people living in these states.

(Eastern Style)



To show we aren't cheating, we added MD, DEL., and R.I. for good measure

Same idea ... different states



Selective Reporting

- As with media, the biggest bias is selective reporting:
 - Leaving out important details that we would need to know in order to know what the numbers even mean:
 - “33% more crime” ... (which crimes? Compared to what?)
 - Cherry-picking of data and numbers, while not mentioning other data:
 - 3 out of the last 4 times ... (ok, what about the times before that?)

Do we even know what the numbers mean?!?

- Ambiguous comparisons
 - Our interest rates are 1% lower!
 - First of all: Lower than who?
 - Second: so if competitor offers 5% interest rate ... do they offer 4% interest rate ... or 4.95% interest rate?
- Base line:
 - Manufacturing jobs increased!
 - Do we still count the same types of jobs?
 - 33% increase in crimes!
 - Counting number of crimes, or counting number of crimes per capita? What time frames are being compared?
 - Is it 25% more now than what it used to be, or did it used to be 20% less than what it is now?
- Mean, median, mode:
 - “Average (typical) American will pay \$300 more (less) in taxes”



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Fun With Numbers

One of the most loaded statistics around sex-offender recidivism rates—is also one of the most commonly misstated

“When studies show that 40 percent [of sex offenders] find new victims in their first year out of jail, the need for immediate action is clear,” stated New York State Republican Chairman Stephen Minarik in a recent press release.

Minarik cites a 2003 Department of Justice study that, he claims, shows “40 percent of sex predators repeat their crimes within one year of release from prison.”

The actual results of the study, however, paint a far different picture of recidivism rates.

“Of the 9,691 male sex offenders released from prisons in 15 states in 1994, 5.3 percent were rearrested for a new sex crime within three years of release,” states the federal study cited in Minarik’s statement. The study then goes on to indicate that 40 percent of *those released sex offenders who reoffended* did so within a year. This makes the actual percentage of sex offenders who reoffend within a year of their release 2 percent, not 40—a difference of more than 3,600 offenders between Minarik’s claims and the actual results of the study.

A call placed to Minarik’s office for comment on this inaccuracy was first placed on hold, then disconnected.