

“Nothing exists until it is measured”.  
-- Niels Bohr

“Innumeracy is the mathematical equivalent of illiteracy”.  
-- Joel Best

### What we'll cover...

- Background and context.
- How you can recognize good, reliable, well-reported statistics.
- A chance for YOU to interpret some statistics.

### What is 'Statistical Literacy'?

**STATISTICAL LITERACY, NUMERACY AND THE FUTURE**  
Peter Holmes, Senior Consultant,  
RSS Centre for Statistical Education,  
Nottingham Trent University, Nottingham England, 2003

"I think the whole thing started in England. Brits do start some things. We started with a word. We had a word that you didn't have. In 1959, there was a government report in England that talked about the numeracy problem. ... it was talking about the education of 16-year-olds saying that they needed to be literate. There was a literacy strand, but they also needed to be numerate. So there was a numeracy strand.

So from 1959, we have had a very good English word called **numeracy**."

"... There's now  
"Statistical Numeracy,"  
"Statistical Literacy," or  
"Statistical Reasoning" or  
"Statistical Thinking"...."

"But they're all in the same ballpark. The word numeracy when it was first introduced was in the context of **the ability to use numbers in practice.**"

"... particularly in the context of statistics that you might have to **read and interpret**. In fact in that first use of [numeracy] in 1959, it was in terms of **reading tables.**"

STATISTICAL LITERACY, NUMERACY AND THE FUTURE  
Peter Holmes, 2003

A more recent take on Statistical Literacy...

"Statistical Literacy studies the use of statistics as evidence in arguments" (Schiold, Milo 1998, 1999)

"A key element of statistical literacy is **assembly**: how the statistics are defined, selected and presented"

*Schiold, Milo (2004). "Information Literacy, Statistical Literacy and Data Literacy". IASSIST Quarterly 28 (2-3): 6-11.*

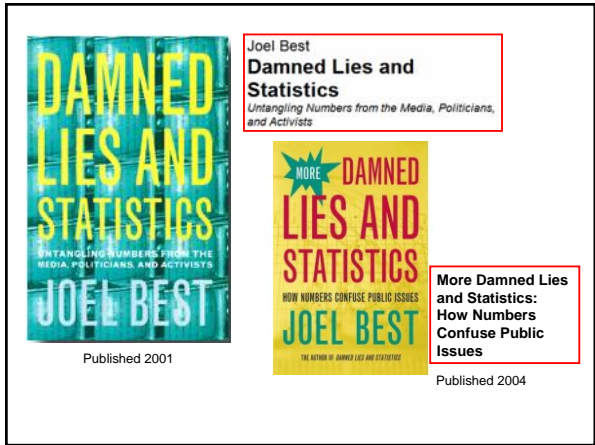
"Literacy matters. There is no argument about that fundamental statement. But numeracy counts. Research in numeracy trails research in literacy by 50 years. It will never catch up if elected leaders and politically appointed officials continue to exclude numeracy. That means numeracy needs to count more."

Lynda E. Colgan:  
Kingston Whig-Standard,  
January 18, 2006, p. 5

What Librarians Need to Know:

- Know about and how to use major statistical sources (print and electronic, national and international)
- Know about value-added commercial products that may 'hide' statistical details from us.
- Be critical consumers of statistics
- Be familiar with and able to make informed decisions about the use of charts, graphs, mapping, etc used in the presentation of statistics.

Summarized from:  
Data and Statistical Literacy for Librarians  
Ann S. Gray  
IASSIST Quarterly, Summer/Fall 2004  
Special Issue:  
Developing Statistical Literacy  
Issue 2/3

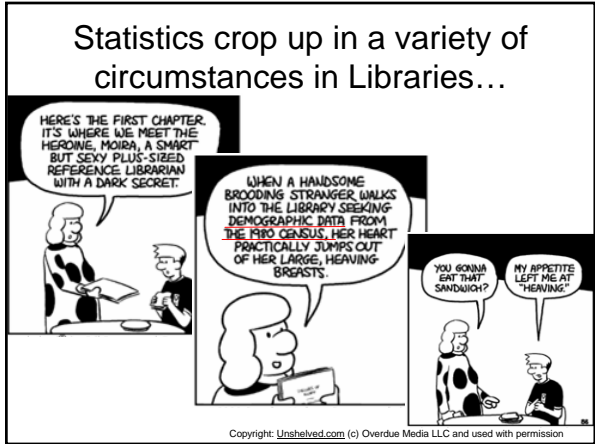


**Statistics**

The word "statistics"

- Origins in the 1600's
- 'Political arithmetic' used to calculate population size & life expectancy
- A growing population was thought to reflect a healthy 'state' – so early number crunchers became known as 'statists'.
- Hence, development of the term 'statistics'...

Joel Best  
**Damned Lies and Statistics**  
*Untangling Numbers from the Media, Politicians, and Activists*



### Statistics Create Social Problems

Contrary to Laine's email signoff:

**"Smoking is a major cause of statistics"**

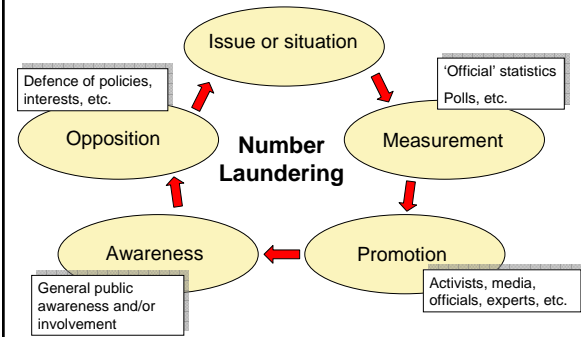
statistics are in fact, a major 'cause' of social problems.

Statistics identify and define social issues (a.k.a. *problems*) and provide 'ammunition' to those who would promote these issues.

Belief in 'the numbers', especially those reported by 'experts', typically solidifies popular conviction that a problem exists.

Joel Best  
**Damned Lies and Statistics**  
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### Statistics Create Social Problems



Best describes *three* types of people when it comes to statistics: **Cynical**, **Naïve**, and **Critical**

**Cynical** – Suspicious of statistics; as consumers of statistics, not willing to give them much stock. They will often discount or ignore statistics that don't align with their views. Worse, as **producers** of statistics, cynics will collect and report statistics in such a way as to support their point of view.



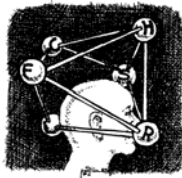
Derived from Best, 2001, p 162-167

**Naïve** – “Slightly more sophisticated than the Awestruck”; they think they understand something about statistics (but often don't), and are basically accepting of any numbers they encounter, and accept that they mean what they appear to mean. As consumers of numbers, they are bad enough, but as producers of numbers they can be as dangerous as cynics, if not worse.



Derived from Best, 2001, p 162-167

**Critical Thinkers** – Not negative or hostile; thoughtful in approaching statistics. Recognize that statistics summarize **complex** information into relatively **simple** numbers and that as a consequence “some of the complexity is lost”.



Statistics are a product of **choices** and more specifically a **compromise among choices**. Given this, approaching statistics with a 'critical' eye is only being prudent and responsible. 'Critical thinkers' ask questions about statistics.

Derived from Best, 2001, p 162-167

### Some Common Problems

**Geographic comparisons** – “there is a good chance statistics gathered from different places are based on different definitions and different measurements”.

For example, comparing US and Canadian statistics on 'race' is complicated by different perspectives on this issue (i.e. definitions and measurements can vary widely).

### Comparing groups

**“Cult ‘X’ is the fastest growing religion in Canada”**  
 On closer examination, the cult grew from **20 to 200** members (a 1000 % increase). To match this, the Catholic Church in Canada would have to grow from **13 million to 130 million** – far more than the population of Canada.

**SIZE MATTERS...**

(derived from Best, 2001 p. 113)

### Numbers vs Percentages

- **“Most poor people are white”**

Take, for example, a population of **700** families  
**600** white families, of which **60** are poor → **10%**  
**100** visible minorities, of which **20** are poor → **20%**


Number

Percentage

In **absolute numbers**, more white families are poor, but...  
**Proportionally**, more visible minority families are poor.

### Mutant Statistics

*“Not all statistics start out bad”.*




Even good numbers can be “stretched, twisted, distorted, or mangled”... generating “mutant statistics”.

There are three main ways “mutant statistics” are created:  
**Generalizations, Transformations, & Confusion**

Best, 2001, pp. 62 - 95

### Generalizations...

An **Economist, Physicist, and Statistician** were driving through Scotland, and they see a **brown cow**...



The **Economist** says, “Fascinating that the **cows in Scotland are brown**”.

The **Statistician** shakes his head at both of them. “Wrong again. Completely unwarranted by the evidence. All we can infer, logically, is that **there exists at least one cow in this country, at least one side of which is brown.**”


Robert Ludlum,  
 The Ambler Warning  
 2005, p. 465-466.

### Generalizations

Measuring ALL the cases of a given social phenomenon is normally not feasible. We collect samples and generalize, but problems can arise:

- Definitions**
- Measurements**
- Sampling**

Best, 2001, pp. 62 - 95



**Definitions** – In 1996, “... news media reported on what was considered to be a rash of arson fires against black churches in the southern U.S. Amid those images were fears of raging racism.”

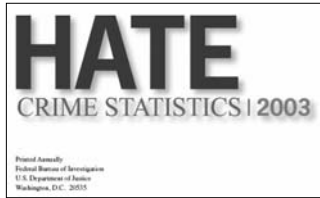
Statistics were *suspect* because of **poor definitions** of what was an ‘appropriate’ church fire to include in the counts.

Analysis of six years of federal, state and local data found that the number of arson cases was up, but that these increases applied to **both black and white** churches in roughly equal proportions.

...There was **NO** dramatic increase in the number of insurance claims made against church fires.

<http://www.emergency.com/arsnstat.htm>  
 & Best, 2001, pp. 62 - 95

**Measurements** – Hate crimes statistics are gathered across many jurisdictions.



Race  
Religion  
Sexual Orientation  
Ethnicity/National Origin  
Disability  
Multiple-Bias Incidents

But, ultimately, any crime could be a hate crime. It comes down to a question of ‘motive’ – and how do you objectively and consistently measure ‘motive’?

Best, 2001, pp. 62 - 95

**Sampling** – Bad sampling can give rise to mutant statistics. If you’re in the *wrong* place, or at the *right* place at the *wrong* time, your sample won’t be representative. A report on ‘racial profiling’ by Kingston Police was criticized for this.



Calculation of the Police Stop Rate:

$$\frac{\text{Number of Stops}}{\text{Population Estimate}} \times 1,000$$

Best, 2001, pp. 62 - 95

Weekend Nightlife Observations and Police Stops, By Racial Group

Race	# Weekend	% of Weekend	% of All Weekend	Revised Ratio (Stops/ % Obs.)	Revised Rate
White				0.98	91.8
Native				26.00	3,454.0
Black				1.50	139.9
Asian				0.35	31.3
South Asian				0.77	71.8
Hispanic				1.00	75.7
Arab				2.00	176.4
Other	0	0.0	0.4	-----	0.0
TOTAL	15,840	100.0	1,488 (N)	1.00	93.9

**BUT...**  
**How, when and where was this ‘mini-census’ conducted?**

**Transformations**

This form of ‘mutant statistics’ results from transforming the meaning of a number.

Take the estimate that 6% of the 52,000 Roman Catholic Priests in the US are at some point in their adult lives sexually preoccupied with young people

**Source:** A former priest turned psychologist who treated disturbed clergy and derived this estimate from his observations.

→ transformed into 6% of priests are pedophiles.



Best, 2001, pp. 62 - 95

**Transformations:**

1. People forgot that it was an *estimate* and treated it as *fact*.
2. The original ‘sample’ was drawn from priests who sought psychological help (hence a biased sample) and generalized to all priests.
3. People turned “Sexual preoccupation” into actual behaviour.
4. “Young people” were morphed into “children” – bringing the word ‘pedophile’ into the mix.



Best, 2001, pp. 62 - 95

**Confusion**

“Garbling complex statistics”

Wendy Watkins of Carleton University provided an example:

Two polling companies, **Decima** and **Compass**, surveyed Canadians regarding Harper’s policy on the Middle East.

**Decima** – 30 % approval of policy

Statistic based on a single question:

“What do you think about Harper’s Middle East policy?”

**Compass** – 60% approval of policy

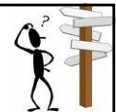
Statistic based on an amalgam of responses to several questions –

Israel’s right to defend itself...

Syria flouting UN sanctions...

Iran flouting UN sanctions... etc.

Compass Survey sponsored by a ‘right-leaning’ Think Tank



“This kind of statistics is about  
as valid as the one that argues  
that *the average Canadian has  
one testicle*”