

Statistics Road Tour 2012

Changing Needs in a Changing World:

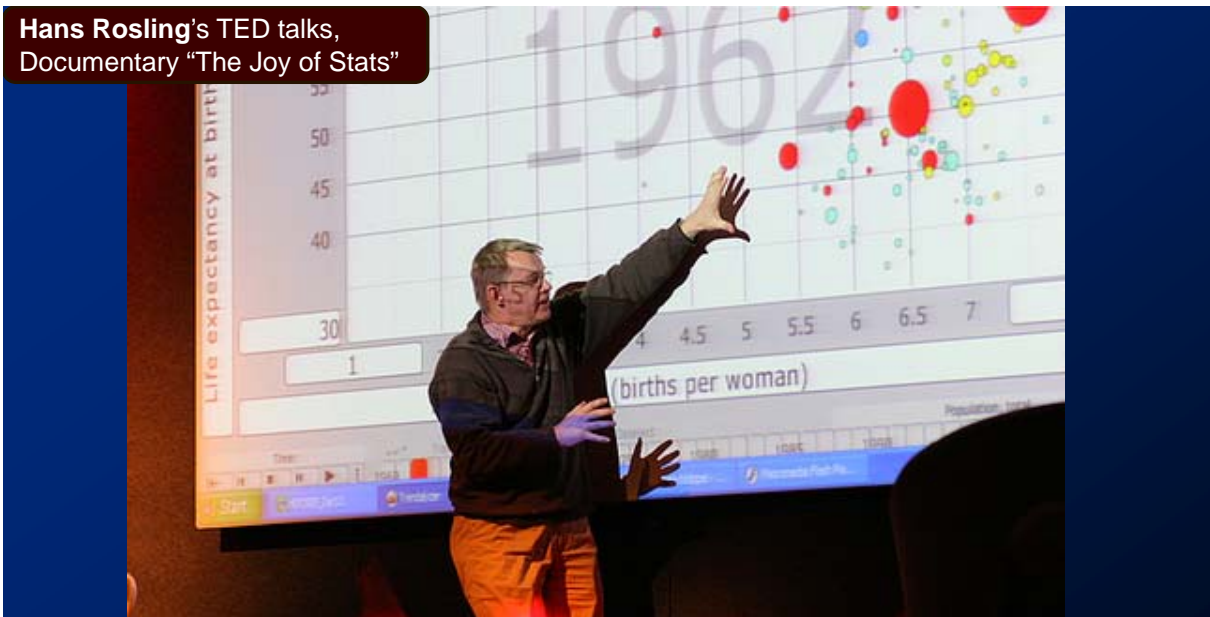
Part II: Maxine Pfannkuch



Department of Statistics
University of Auckland, New Zealand



Hans Rosling's TED talks,
Documentary "The Joy of Stats"



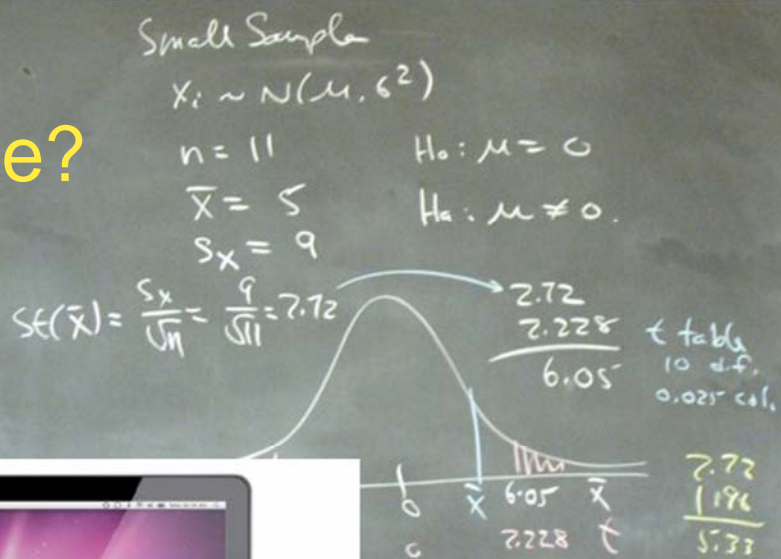
Changing needs in a changing world

Research supported by TLRI

Why change?

FROM STATISTICAL PRACTICE PERSPECTIVE

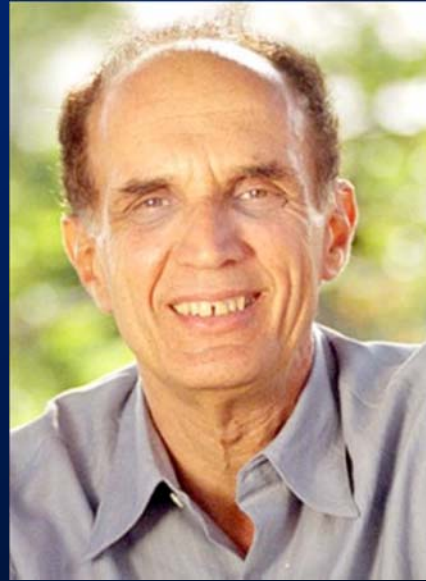
Why change?



Why change?



R A Fisher
– Randomisation 1935



Brad Efron
– Bootstrapping 1979

Why change? (Cobb, 2007)



Logic of inference

Why change? (Cobb, 2007)



[can teach] more fundamental ideas that now, thanks to computers, we could and should be teaching. Before computers, there was no alternative. Now, there is no excuse.

Why change to bootstrapping/randomisation methods?

- “Rapidly becoming the preferred way to do statistical inference” (Hesterberg et al., 2009)
- Efron (2000): “it has taken me a long time to get over the feeling that there is something magically powerful about formulas ... and to start trusting in the efficacy of computer-based methods ...”



THE NEXT BIG THING IN TEACHING STATISTICS WILL BE

Removing the letters **Z** and **t** from
introductory courses

Rossman & Chance, USCOTS 2011

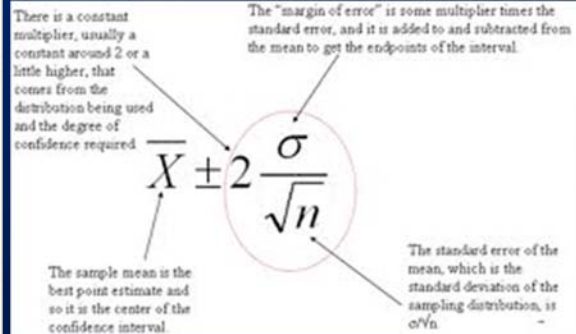
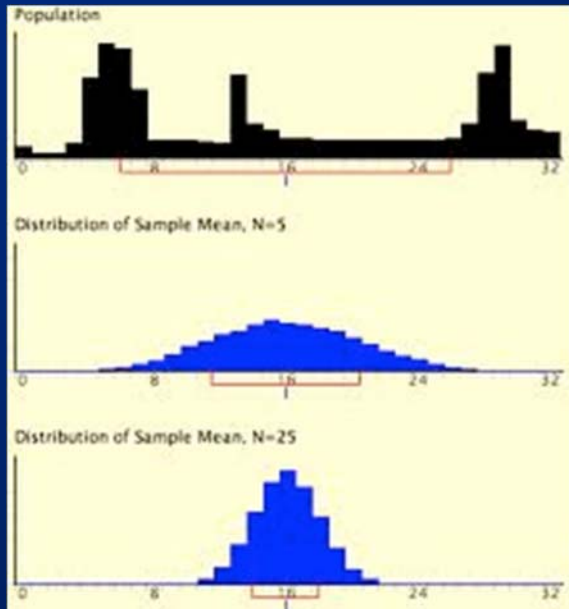
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Why Change?

**FROM STATISTICS
EDUCATION RESEARCH
PERSPECTIVE**

Why change? Inference research



Inference research

- Study on students' grasp of statistical inference concepts
 - the results from our study agree with the findings of the considerable research that has been done in the last thirty years ... **that people tend to think deterministically and lack awareness or understanding of variation and its relation to sample size.**

(Meletiou-Mavrotheris, Lee, & Fouladi, 2007)



Inference research

One course insufficient for developing inferential concepts

Research suggests students should be introduced to inferential concepts much earlier

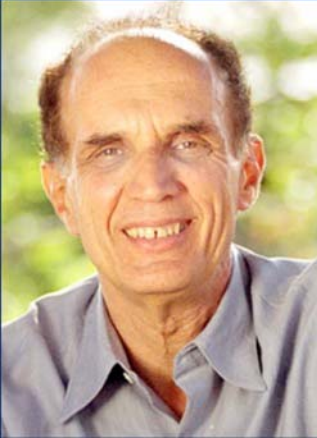
Students need a deeper understanding of sampling variability (Konold & Kazak, 2008)



Inference research

- Multitude of misconceptions associated with significance testing (Nickerson, 2004)
- And with confidence intervals (Fidler, 2006)
- From a learning perspective randomisation and bootstrapping methods should be more conceptually accessible to ALL students than normal-based methods

Our World has Changed in Statistics



Brad Efron

George Cobb

- Currently, too big a gap between statistical practice and statistics education
 - Stuck in the 1950s (Efron, 2000) and what was computable in 20th Century (Cobb, 2007)

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Our World has Changed in Statistics



- Currently, too big a gap between **statistical literacy** and **statistics education**
- *The final national NBC/Wall Street Journal Poll, released on Sunday, showed Obama with the support of 48 percent of likely voters, with Romney receiving 47 percent. The poll had a margin of error of 2.55 percentage points.*

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Example: Political Poll March 2008

MARCH POLL

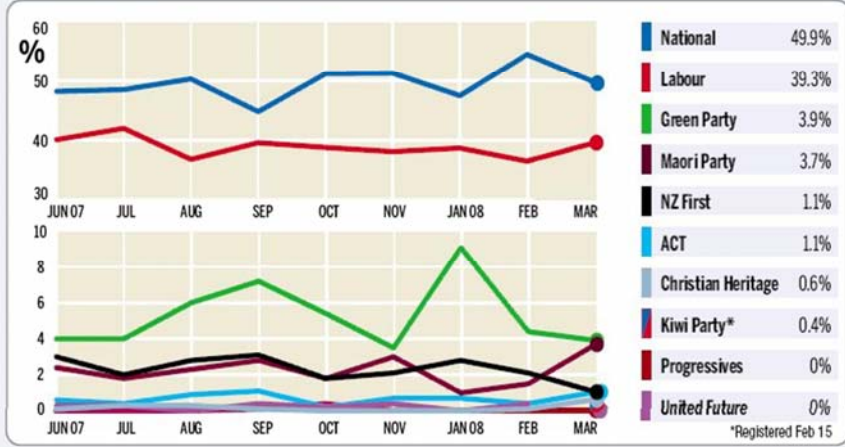
HERALD-DIGIPOLL



PREFERRED PM



PARTY VOTE



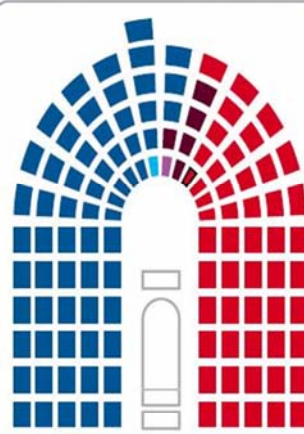
Example: Political Poll March 2008

John Key 45.9%



Helen Clark 45.6%
Winston Peters 3.9%
Bill English 0.8%
Jeanette Fitzsimons 0.6%

SEATS IN THE HOUSE



PARTY VOTE BREAKDOWN

... BY GENDER			... ISSUES				
	Male	Female	Which of the following issues is likely to influence your vote most at this year's election				
National	52.5%	47.2%	Tax cuts	23.7%			
Labour	35.4%	42.9%	The economy	19%			
Green Party	4.5%	3.4%	Law and order	13.9%			
Maori Party	3.3%	4%	Hospital waiting lists	12.5%			
NZ First	0.8%	1.5%	Global warming	10%			
ACT	1.7%	0.6%	Leadership	7.3%			
			The anti-smacking bill	6.3%			
			The electoral finance bill	1.3%			
... AUCKLAND COMPARISON							
	Auckland	Rest of NZ					
National	55.7%	46.7%					
Labour	33.9%	42.1%					
Green Party	2.1%	4.9%					
Maori Party	4.9%	3.1%					
NZ First	-	1.6%					
ACT	2.1%	0.6%					
... BY AGE							
	18-24	25-29	30-39	40-49	50-59	60-69	70+
National	43%	47.9%	45.1%	56.8%	54.7%	53.6%	40.8%
Labour	44.3%	41.5%	38.2%	31.4%	36.6%	37.6%	53.7%
Green Party	3.8%	2.1%	6.1%	5.9%	2.5%	3.3%	1.5%
Maori Party	6.3%	4.3%	7.7%	3.5%	2.1%	2.2%	1.0%
NZ First	-	-	2.0%	0.3%	0.8%	2.2%	1.0%
ACT	2.5%	-	-	1.0%	2.1%	-	2.0%

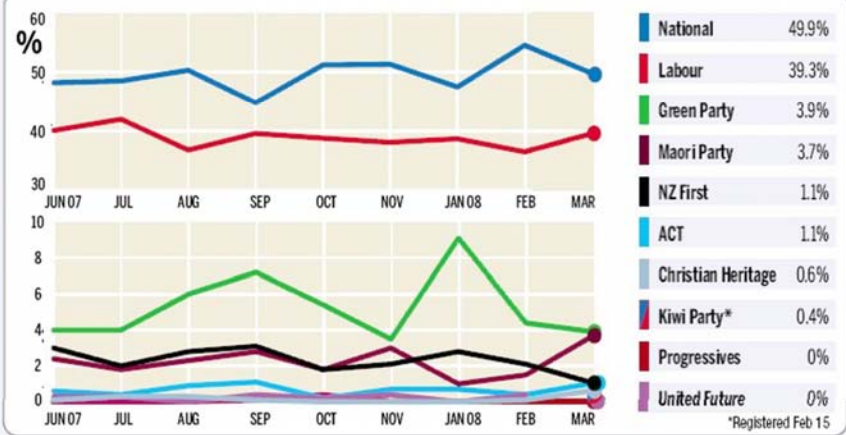
Based on an assumption that party leaders with electorate seats keep them.

750 respondents, February 27 to March 6. Margin of error 3.6% / HERALD GRAPHIC

Example: Political Poll March 2008

■ The poll of 750 respondents was conducted between March 6 and 27 and has a margin of error of 3.6 per cent.

PARTY VOTE



- National MOE?
- ACT MOE?

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Example: Political Poll March 2008

- MOE for males?
- MOE for RONZ?
- MOE for AGE?

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ACT	2.5%	-	-	1.0%	2.1%	-	2.0%

Example: Political Poll March 2008

- Claim: More females vote for National than Labour
- MOE for this difference?
- Claim: More people in Auckland vote for National than the RONZ
- MOE for this difference?

PARTY VOTE BREAKDOWN

... BY GENDER

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... ISSUES

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... AUCKLAND COMPARISON

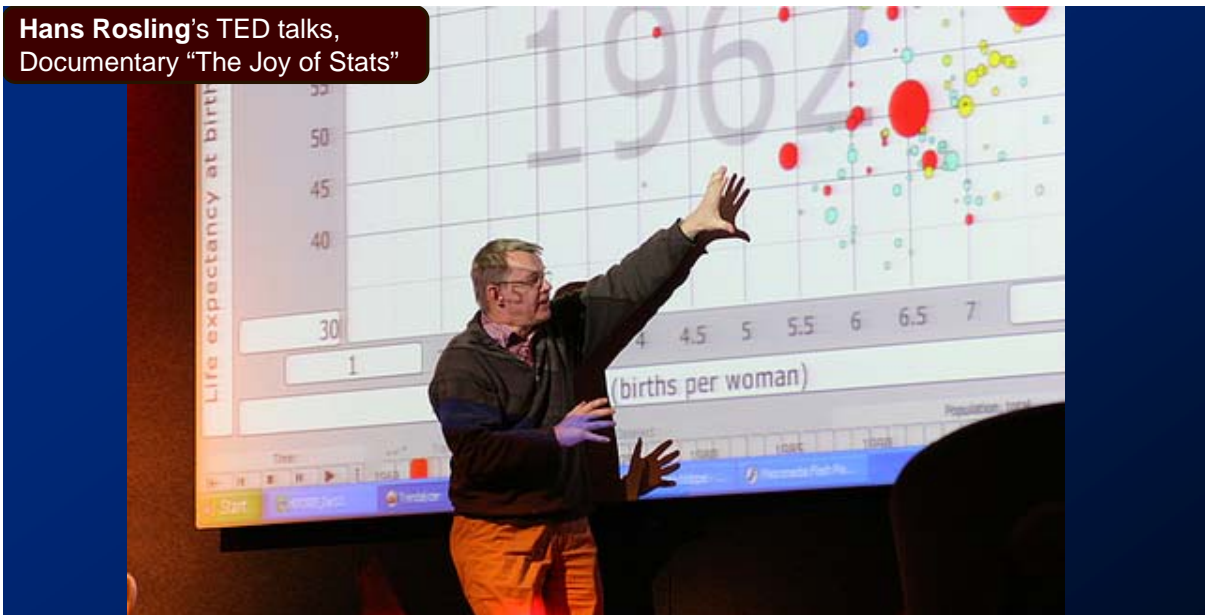
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Changing needs in a changing world: Rethinking what we teach