V2 2015 USCOTS 1

What's Wrong with Stat 101?
Comments on Cobb and De Veaux Proposals

Milo Schield, Augsburg College
Member: International Statistical Institute
US Rep: International Statistical Literacy Project
Director, W. M. Keck Statistical Literacy Project

US Conference on Teaching Statistics

USCOTS

May 28, 2015

www.StatLit.org/pdf/2015-Schield-USCOTS-1up.pdf
www.StatLit.org/pdf/2015-Schield-USCOTS-6up.pdf

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Cobb 1: What's wrong with Stat 101?

- **Context**: Peripheral in math; central in statistics.
- **Algorithmic thinking**: Mt. Holyoke students do this in an introductory course with no prerequisite.
- Experience: nothing motivates **students** to learn **statistics** as effectively as an unsolved applied problem

Schield:
Q. What is context? Data context | student context?
Q. Algorithmic? Rank? Median? OLS? Standardizing?
Q. Mt. Holyoke students or all students?

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Cobb 2: What's wrong with Stat 101?

We spend **too little** time on randomized assignment

Don't study relation b/t study design & scope of inference

We **don't** teach Bayesian thinking

We **ignore** most of the steps in the scientific process. We encourage a mistaken view of statistics as separate from scientific thinking.

Agreed! But are any of these relevant if we aren't interested in causation or confounding?

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De Veaux: Two great examples of confounding

1. In studying diamond prices, his data indicated the most valuable stones (clear color) were the cheapest. But once he added size, that association reversed. Clarity was confounded by carets – weight.
2. After calculating average house price by the presence or absence of a fireplace, it seemed that having a fire place added about $65,000 to the value of a house. But when house size was included, the difference was $5,000. The association between fireplace and home prices was confounded by square footage.

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Kaplan's Study on Causation

Danny Kaplan did a study of six introductory statistics textbooks. He counted the number of indexed pages related to causation such as confounding, covariate, lurking variable, case-control and Simpson's paradox.

Utts and Heckard (35 pages) was #1. But 35 pages is a small amount in comparison to the 300 – 700 pages in most introductory textbooks.

Why don't our textbooks include more on confounding?
This is the key question for our discipline!

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De Veaux 2: The Problem & Take Away

The Problem:

We teach the wrong stuff, the wrong way in wrong order.
This presumes we know what is right in teaching statistics.

I want my students to take away:

1. Idea that stats is relevant, intuitive, cool and "valuable"
   Do we agree on what is essential and valuable about statistics?
2. Healthy skepticism for data quality, models and inference.
   Will they see value or relevance if we promote healthy skepticism?

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De Veaux 3: Advice & Where Are We?

Recommendations for Cool Stuff:

1. Introduce models early; motivate uni/bi-variate questions
   Does introducing models w/o inference promote bad practice.
2. Omit math of sampling distributions; omit some methods.
   Do you do this – or will you do this – in any of your texts?

Where are we?

Statistics is more than a collection of tools.

What do we do to support this? Where do statistics come from? How can statistics be influenced? Can significance be influenced?

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What is wrong with Stat 101? Schield 1

Wrong question! First answer these:

- Who are the students in Stat 101?
- What are their aptitudes, goals and attitudes?

Then answer this:

- What are the primary contributions of statistics to human knowledge?

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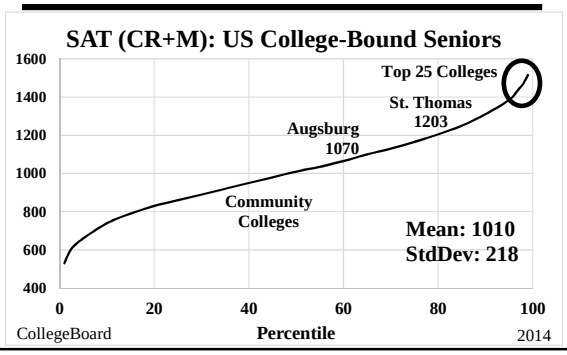
College Students What are their aptitudes?



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Stat 101 students: What are their goals?

Of those graduating with BA/BS, 51% took Stat 101

Of the 812,000 students in Stat 101 at US 4-yr colleges,

- 43% in *Business or Economics,*
- 21% in *Sociology or Social Work,*
- 15% in Health,
- 11% in Psychology
- 10% in Biology, and
- less than 1% are in mathematics or statistics.

64% deal mainly with observational studies where confounding is the big. problem. See Tintle et al (2014)

Assumes all graduates in these majors took statistics.
2012 USSA. Table 302. Bachelor's degrees earned by field (2009). 1.60 million graduates.

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Stat 101 students: What are their attitudes?

Of those taking Stat I:

- less than 1% take *Stat II* (10-yrs @ Univ. St. Thomas)
- less than 0.2% major in statistics (nationwide).
- most see less value in statistics after the course than they did before. Schield and Schield (2008).
- more say "Worst course I ever took" [anecdotal]

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Schield 2: What is Wrong with THE Intro Statistics Course*

"One size fits all" doesn't work any more.
We should drop the idea of *"the course"* in intro stats.

We should design/support three intro statistics courses:

Stat 102*: Applied Math-Stats. Calculus & model based.*

Stat 101*: Traditional. Algebra-based.*

Stat 100*: Statistical Literacy. Media-based; minimal Algebra*

All three must include the major contributions of statistics to human knowledge!

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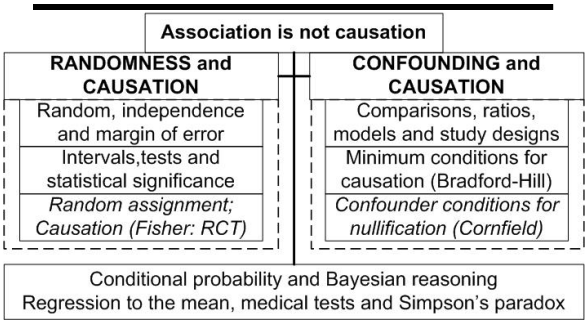

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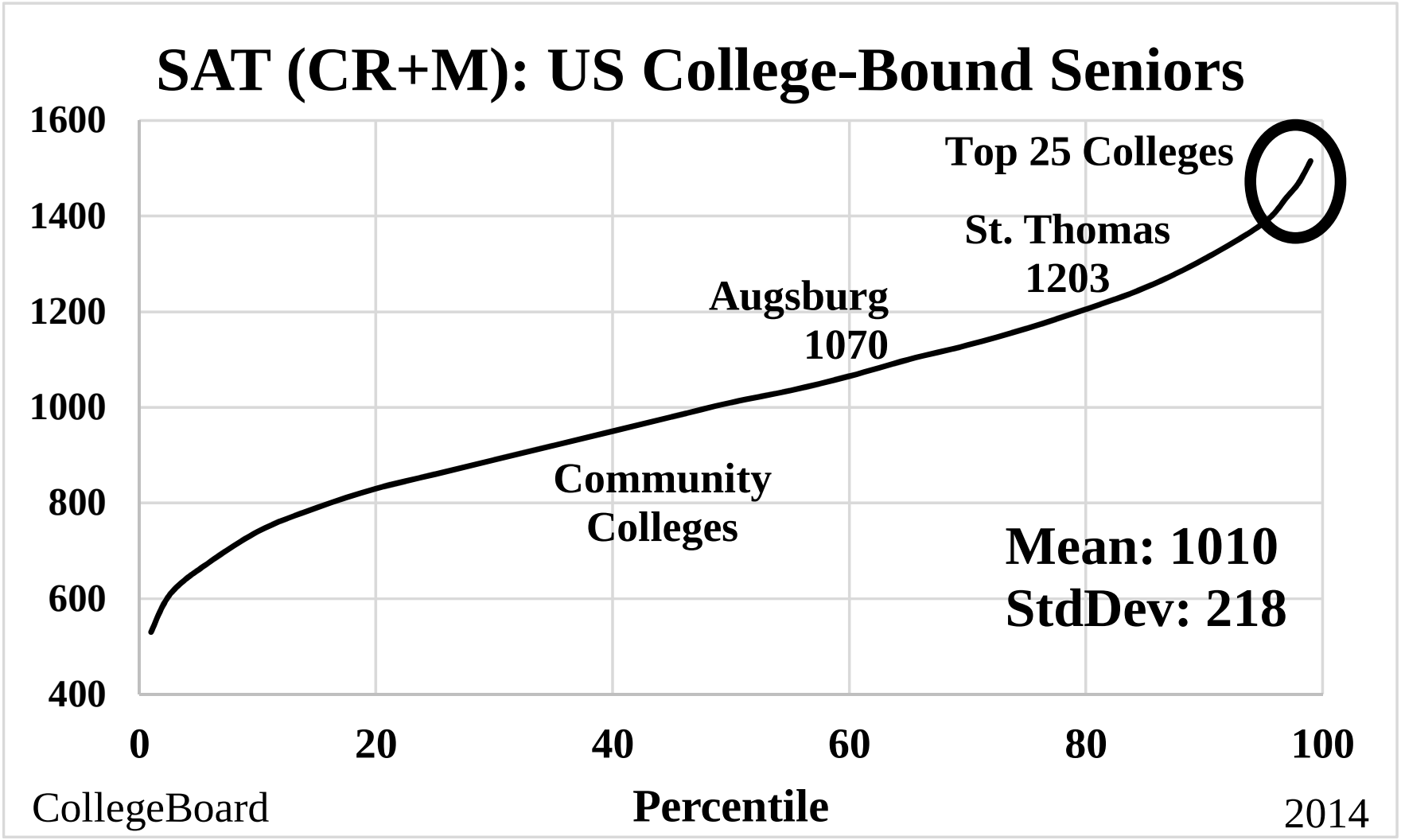

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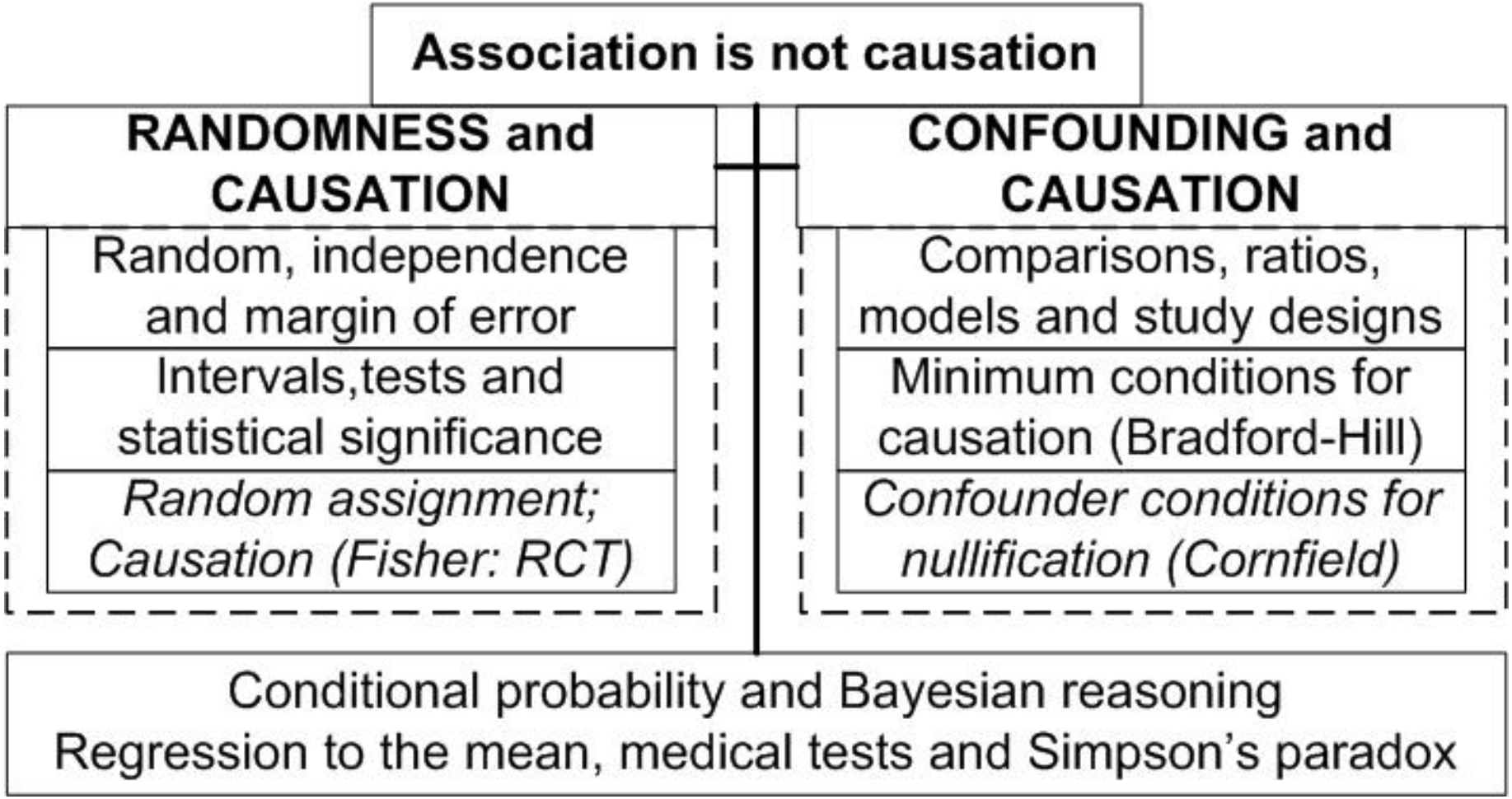

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