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Introductory Statistics: Three Flavors

*ECOTS: Beyond
June 12, 2024*

Milo Schield
*Visiting Professor: New College of Florida
 Adjunct: University of New Mexico (ABQ)
 Professor Emeritus: Augsburg University (MN)*

*Fellow: American Statistical Association
 Elected Member: International Statistical Institute
 US Rep: International Statistical Literacy Project*

*Slides: www.StatLit.org/pdf/2024-Schild-ECOTS-Slides.pdf
 Paper: www.StatLit.org/pdf/2024-Schild-ECOTS.pdf*

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2024 GAISE Update January Draft Highlights

Nine recommendations for Statistics and Data Science.

We anticipate that the final College GAISE report will also include the following:

- Student Learning Objectives for Intro Stats
- Student Learning Objectives for Intro Data Science

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2024 GAISE Update (Draft) Comments

Recommendations are nicely broad and high level. Two things I like:

1. Draft avoids making recommendations that are not strongly supported by statistical educators. It avoids making "multivariate thinking" a goal of all intro statistics courses
2. Draft proposes two flavors of introductory statistics: "Intro Stats" and "Intro Data Science." This is a major improvement. The idea of having "one size fits all" is long overdue.

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2024 GAISE Update (Draft) Three Issues

1. No mention of statistical literacy. Featured in first GAISE report.
2. No mention of multivariate thinking. Featured in 2016 GAISE II update.
3. No mention of confounding. Featured in 2016 GAISE II update.

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#1: Statistical Literacy

1951: ASA President, Helen Walker
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2007 Alan Rossman: *Most students would be better served by Stat 100 than Stat 101*
 2017 SERJ Statistical Literacy issue: *Statistical literacy: pre-requisite for informed democracy.*
 2020: UNM offers Statistical Literacy: *M1300. Satisfies General Education math requirement.*
 2024 International Statistical Literacy Project: *International Day of Statistical Literacy.*

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#2: Multivariate Thinking

2013 GAISE II:

1. Teach statistical thinking.
 - Teach statistics as an investigative process of problem-solving and decision-making.
 - Give students experience with *multivariable thinking*
2. Focus on conceptual understanding.

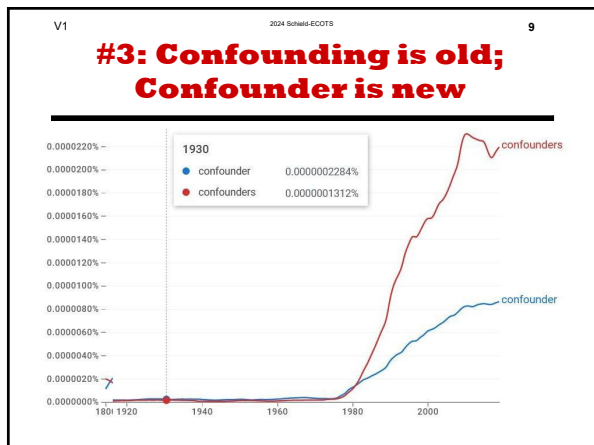
We live in a complex world in which the answer to a question often depends on many factors.

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#3: Confounding

2014 ASA guidelines undergraduate programs: *Students obtain a clear understanding of principles of statistical design to ... account for the possible impact of ... confounding variables.*

2017: Tintle, Rossman, Chance and Cobb: *confounding and variation are two major obstacles in analyzing data*



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Recommendation #1: Three Introductory Courses

- Stat 102: Data Science Statistics. For producers: data manipulation, resampling and simulation.
- Stat 101: Classic/analytic statistics. For professional consumers/analysts: population inference w univariate & two-group/factor data.
- Stat 100: Statistical Literacy. For consumers. Big ideas: correlation-causation, study design, confuse inverse, stat. significance & confound.

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Stat 100 Prevalence and Textbooks

Textbooks:

- Freedman, Pisani and Purves: *Statistics*
- Moore/Notz: *Concepts and Controversies.*
- Utts: *Seeing Through Statistics.*
- Schield: *Statistical Literacy*

Prevalence: 19% of colleges offer statistical literacy. Schield (2010).

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Recommendation #2: Restate GAISE #1 Goal

Teach statistical thinking about statistical inference

- Population inference and randomness
- Predictive (data) inference and modelling
- Causal inference and confounding

Three different courses:
 Stat 101 Classical Statistics: Population inference
 Stat 102 Data Statistics: Predictive inference
 Stat 100 Statistical Literacy: Causal inference

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Describing Stat 100: Causal Inference

Identify the primary influences on statistics.

- Confounding and randomness

Identify ways to control confounding

- Physical: study design, matching,
- Mental: selection, ratios and MV analysis

Introduce the Cornfield conditions:

- Minimum confounder effect size needed to nullify or reverse an observed association.

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Bibliography

Schild, M. (2024). Statistical Literacy: A New Course. International Statistical Literacy Project.

Schild, M. (2023). *Statistical Literacy: Critical Thinking about Everyday Statistics*. <https://he.kendallhunt.com/product/statistical-literacy-2023-critical-thinking-about-everyday-statistics>

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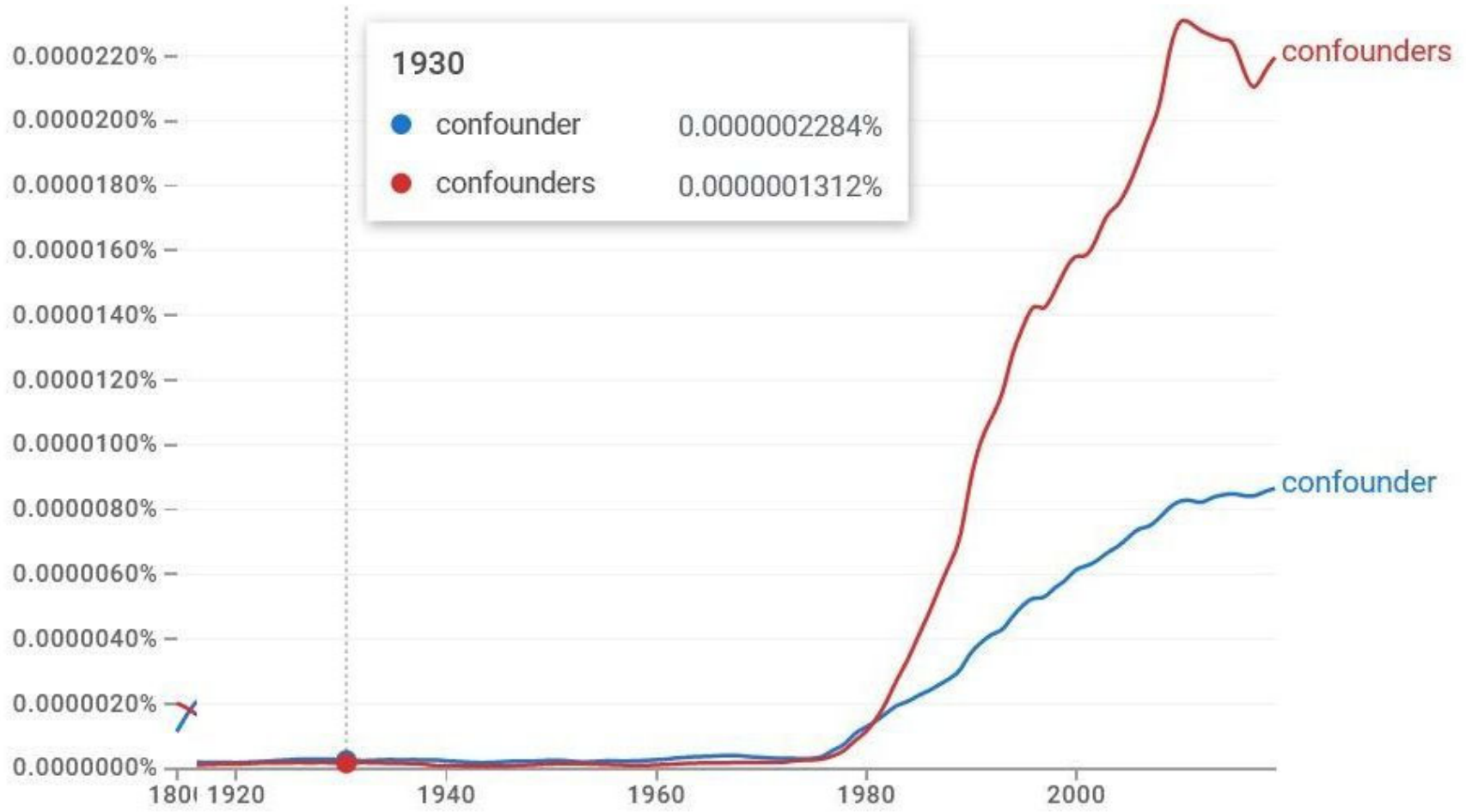
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the possible impact of ... confounding variables.*

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#3: Confounding is old; Confounder is new



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