Teaching the Past, Present, and Future of Statistics

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COPSS

- the Committee of Presidents of Statistical Societies (COPSS, `http://copss.org`) has the goal of working on shared problems and improving intersociety communication
- composed of the presidents of five associations: ASA, ENAR, IMS, SSC, and WNAR
- responsible for the Presidents' Award, Fisher Award and Lecture, Florence N. David Award, Elizabeth L. Scott, and the George W. Snedecor Award
- since its founding in 1961, involved in other projects (such as the formalization of the Joint Statistical Meetings in 1974)
- published the COPSS book to commemorate 50th anniversary of COPSS

COPSS Past, Present, and Future book

Figure 1:

COPSS Past, Present, and Future book

Figure 2:

COPSS Past, Present, and Future book (Wasserstein review in TAS)

"Fifty great thinkers about statistics provide the reader of the COPSS book with reminiscences to learn from, technical questions to tackle, and challenges that inspire."

COPSS Past, Present, and Future book (Wasserstein review in TAS)

"The COPSS book explores this present vibrancy and vitality across a range of topics that reflect the vast diversity of statistical practice. Statistical issues in public health, health care, genetics and genomics get a lot of play. Big Data, uncertainty quantification, and machine learning are well covered. ... Further, the book examines from multiple perspectives foundational issues that are at the heart of statistical science. ... What is particularly useful about this book—in my view—is the documentation of the stories of some statisticians, stories that have relevance for all of us, but perhaps especially for those new to the profession. Nancy Reid's chapter (*The whole women thing*) is an honest and thoughtful appraisal of the past and current state of women in the profession. Louise Ryan's *Reflections on diversity* also is inspirational."

COPSS Past, Present, and Future book (Wasserstein review in TAS)

"Indeed, for those new to our profession, the COPSS book presents an entire section directed to them titled *Advice for the Next Generation*. ... This book, together with the London Workshop report, provides a great view of the panorama of statistical science: past, present and future."

COPSS Past, Present, and Future book

In 2014 the Committee of Presidents of Statistical Societies (COPSS) published a book entitled *Past, Present, and Future of Statistical Science* that contains 52 short chapters contributed by past winners of one of the COPSS Awards. The goal of the book (which is freely downloadable from the COPSS website or `http://tinyurl.com/copss-ppf`) was to "showcase the breadth and vibrancy of statistics, to describe current challenges and new opportunities, to highlight the exciting future of statistical science, and to provide guidance for future generations of statisticians (page xvii)." I will describe how these chapters were integrated into a theoretical statistics course to help students see the big picture and potential for statistics.

Assignment statement: part 1

- (low stakes) assignment included as part of an undergraduate theoretical statistics course (n=20 students).
- Learning goals include a focus on computation (see Horton, TAS 2013, `https://arxiv.org/abs/1309.7445`) and communication (see Horton and Hardin, TAS, 2015, `http://amstat.tandfonline.com/doi/full/10.1080/00031305.2015.1094283`)
- "Each student will be giving individual short presentations on a chapter of your choice from the book *Past, Present, and Future* (see pdf below). Each student should submit a list of their top three choices for the chapter that they would like to present by Tuesday, March 28th. (Note that you can't pick chapter 14 as I'll be presenting on that.)"
- Presentations comprised most of one 80 minute class period

TOC samples

Figure 2:

TOC samples

Figure 4:

TOC samples

Figure 5:

Assignment statement: part 2

- The Past, Present, and Future presentations will take place on Thursday, April 13th in class.
- The presentations are to be no more than three minutes in length. In addition to providing a glimpse of what is in the chapter, they should:

1. be aimed at students in the class (keep track of your audience)
2. have a compelling opening (I will read the chapter title and name the author)
3. describe why you picked that chapter
4. describe one thing you learned, and
5. pose a question that you have that wasn't answered

Example presentation (that I gave in advance. . .)

Figure 6:

Sample presentation (that I gave in advance...)

Past, Present, and Future (Chapter 14, Iain Johnstone, Stanford University): Where are the majors?

- The following figure suggest that in the US, the field of statistics is spectacularly and uniquely unsuccessful in producing bachelor's graduates
- Compared to all other disciplines with AP exams and doctoral students, statistics is dramatically underrepresented
- "Spur to action or irrelevant curiosity"?

The Puzzle (and a chance to answer the questions)

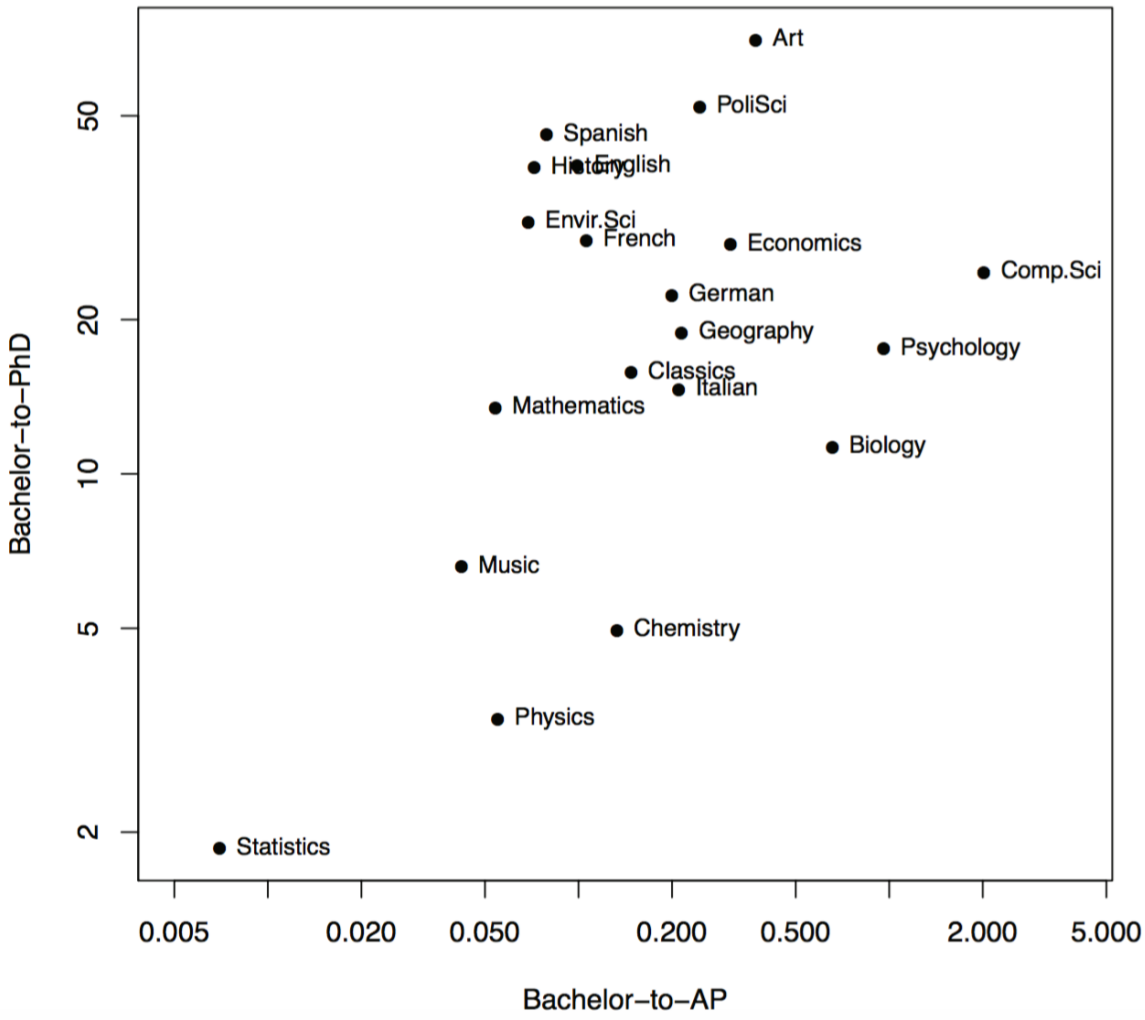

Figure 7:

The Solution?

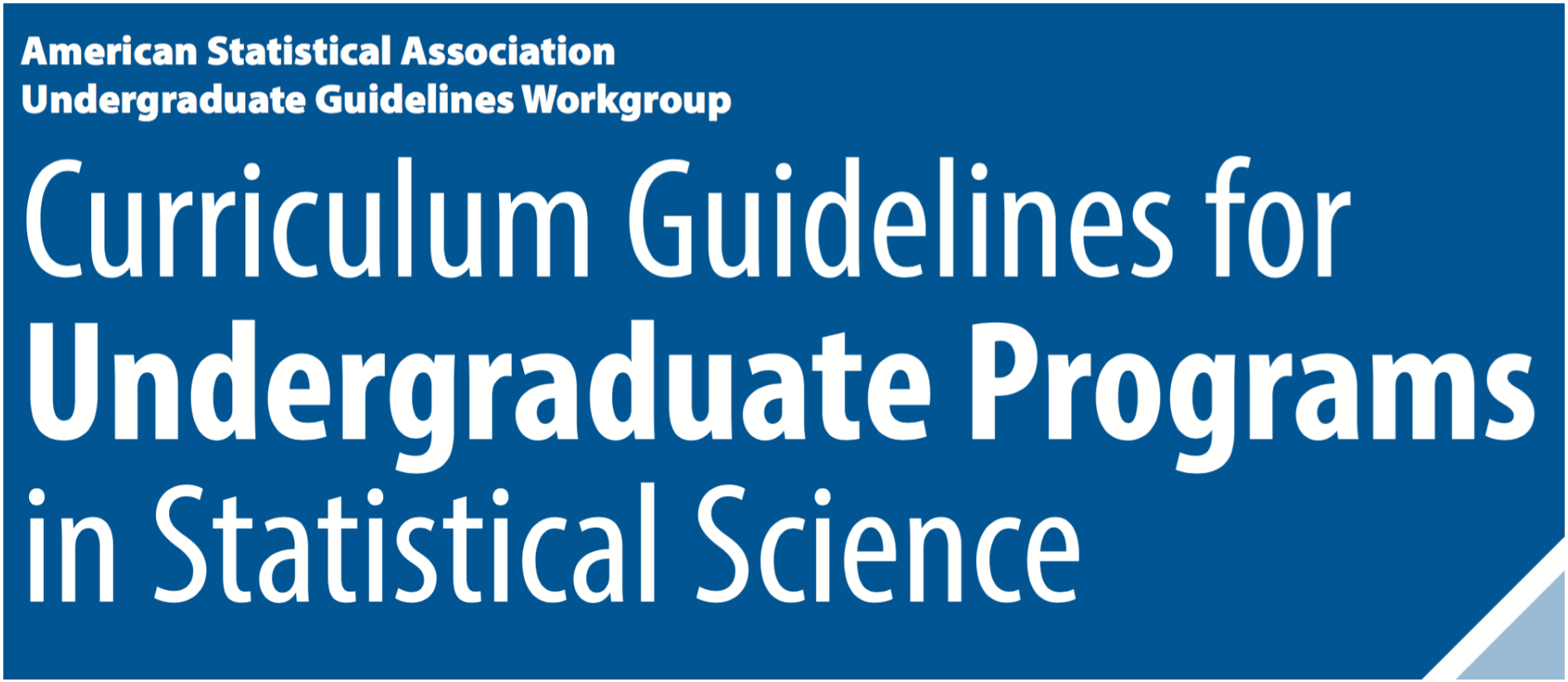

Figure 8:

Segue to TAS editorial (Horton and Hardin, 2015) introducing undergrad guidelines for stat majors

- Jon Kettenring noted that "Industry needs holistic statisticians who are nimble problem solvers."
- The idea that an undergraduate statistics major develops general problem solving skills to use data to make sense of the world is powerful.
- "We are concerned that many of our graduates do not have sufficient skills to be effective in the modern workforce."
- Thomas Lumley (personal communication, 2015) has stated that our students know how to deal with n $\to \infty$, but cannot deal with a million observations.
- If statistics is the science of learning from data, then our students need to be able to "think with data".
- My question: how should we fix these problems?

Back to the webinar (end of the play within a play)

- which chapters did the students pick?
- how were their presentations?
- feedback on their presentations

Student choices

- chapter 3: Chernoff: "A career in statistics"
- chapter 5: Brillinger: "how wonderful the field of statistics is. . . "
- chapter 10: Roeder: "Science mixes it up with statistics"
- chapter 12: Gray: "Promoting equity"
- chapter 13: Fienberg: "Statistics in service to the nation"
- chapter 16: Irizarry: "The bright future of applied statistics"
- chapter 21: Ryan: "Reflections on diversity"
- chapter 22: Fraser: "Why does statistics have two theories?"
- chapter 26: Gelman: "How do we choose our default methods"
- chapter 29: Billard "Past's future is now"

Student choices

- chapter 34: Laird: "Heterogeneity can be a good thing"
- chapter 35: Whittemore: "Good health"
- chapter 37: Little: "Survey sampling"
- chapter 43: Fan: "Features of big data and sparsest solution"
- chapter 44: Wasserman: "Rise of the machines"
- chapter 45: Meng: "A trio of inference problems that could win you a Nobel Prize"
- chapter 50: Rubin: "The importance of mentors"
- chapter 51: Speed: "Never ask for or give advice..."
- chapter 52: Efron: "Thirteen Rules"

Feedback on presentations (from teaching and learning center staff)

- "I loved the students that came out from behind the podium to get closer to the Powerpoint and still managed to speak to the audience vs. the screen. Yay!"
- "XX did a great job beginning his presentation with a question to the audience and then using their answer to continue his talk. Excellent.
- "I was energized after I left the classroom, both by the presentations and the content!"
- "Students can continue to improve by working on the unwanted 'upspeak' habit, making more consistent eye contact with the audience vs. the computer screen (rehearsal will solve this) and practicing the art of beginning each sentence with the word that starts the sentence. That word is hardly ever the word 'so.' "

Closing thoughts

- some chapters more accessible than others!
- allow students to practice and improve their communication skills
- multitude of short talks introduce a variety of interesting topics in a short period
- help students get perspective about the diversity and potential of the broader world of statistics

Questions