Why Do Separate Departments of Statistics Exist? Will they survive?

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Historical Question

- DBR is no Steve Stigler with books on such
- BUT: statistics is very young, e.g., relative to mathematics, and DBR is a relative dinosaur
- Consequently, DBR knew many of the "founders" of the field and heard many "old war stories" about the early days
- List of personal friends/contacts/influences, all born before WW II

Some Personal Contacts of DBR

- Bill Cochran (RA Fisher) – DBR's PhD advisor
- Fred Mostellor – writer, Founding Chair at Harvard, expositor
- Art Dempster – Think Bayes
- John Tukey – Princeton, ETS: Genius, unusual
- Jerzy Neyman- Berkeley; NP organized leader
- Elizabeth Scott – Classical Statistics (Neyman)
- George Box- Wise, ribald great character & Joan Fisher Box
- Paul Meier- Very practical medical and law
- Pat Billingsley – Probability, acting
- Janet Norwood – BLS (Carter, Reagan, Bush)
- Eric Lehmann- Swiss gentleman
- Charles Stein- Deep; unusual; UCB->Stanford (McCarthy)
- David Wallace-Knowledgeable+ (John Nash MIT officemate)
- John Pratt-Sharp+; US Civil War!
- Herman Chernoff-Great understanding
- David Cox- Modest, extremely broad with remarkable depth and modesty
- C.R. Rao (Fisher PhD)- Vast contributions

DBR's idiosyncratic transition into the field of statistics

- Princeton Physics (John Wheeler) 1961
- Princeton Psychology (Silvan Tomkins)1965
- Harvard Psychology (Social Relations)-1965
- Harvard Computer Science-1965
- Harvard Statistics- 1970
- Harvard Statistics-1971
- ETS & Princeton –1971-1980; Tukey, Julian Jaynes
- U Wisconsin-1980 MRC & Box
- U Chicago-1980-1983; Wallace, Meier, Stigler,
- Harvard Statistics-1983-2018
- Yau Mathematical Science Center, Tsinghua U – 2018 - ?
  Fox Business School Fellow – 2018 - ?

Leads to idiosyncratic view of past!

- Not purported to be historically entirely accurate, but influenced by my mentors and what I gleaned was important for their helping to found stat depts
- Randomization-based (design-based) survey methods generated by Neyman (1934)
- Randomization-based experimental design generated by Fisher (1925)– geometry of ANOVA

  US and land grant colleges – Dept of Agriculture

  Chemistry – WWII

Notice focus on randomization-based inference, which replaced standard use of models on data

New “Religion” of Statistics! Indicators are the only random things

- Usual models go back hundreds of years, gambling, astronomy, genetics, etc.
- But new religion was different and had its own definitions of “validity”
  - Approximately unbiased estimation of estimands
  - Conservative interval estimation and hypothesis tests
  - But relied on asymptotics because of limited computing
- Personality of Neyman critical; when combined with forces of agriculture, WW II, genetics, chemistry, and success of Deming, Box, Tukey/Mostellor in consulting & education, including on TV
- Then into medicine FDA, EMA –Paul Meier

But what about the future? Any need for these statistical ideas?

- YES!
- But do we need separate statistics departments to teach the big ideas?
- Experimental design now critical with “big data”
- Many factors, many covariates, interactions
- Also with computer-based experiments, which are currently dreadfully designed (in general)
- Survey design – networked structure of units
  - Project on Russian election interference – Lincoln labs

Is the current definition of statistical validity (NP) adequate for science?

- No, too focused on estimatators and standard errors, estimate ± se (asymptotics), sometimes even without clearly defined estimands
- Asymmetries, non-ellipsoidal regions for tests
- Even when NP OK, should extend to "conditional calibration," which embraces Fisher's fundamental idea of fiducial inference:
  - Avoid accepting models that cannot plausibly generate the observed data –obvious?
  - But that's the topic for another talk

Appreciation for visual displays and role of classical tools -- ANOVA

- Most people cannot think beyond two dimensions: "I can get to about 2.3" – JW Tukey in private conversation about an ETS test question, which all the math guys blew!
- ANOVA, not just F-tests, but tells you which tables should be reported and the importance of the detail lost in that reporting
  - Fisher wisdom via Cochran, but recondite

Personal criticism of much of current practice of applied statistics

- “Dance of the bees” – following plug-in recipes with little or no understanding of the science or the underlying mathematical justification
- Doubt having separate statistics departments can cure this problem, especially if administrations evaluate depts by popularity rather than quality
- Tempting to become service departments for other departments pursuing “real” academics
- Need strong leaders with focus on science and with devotion to important statistical ideas