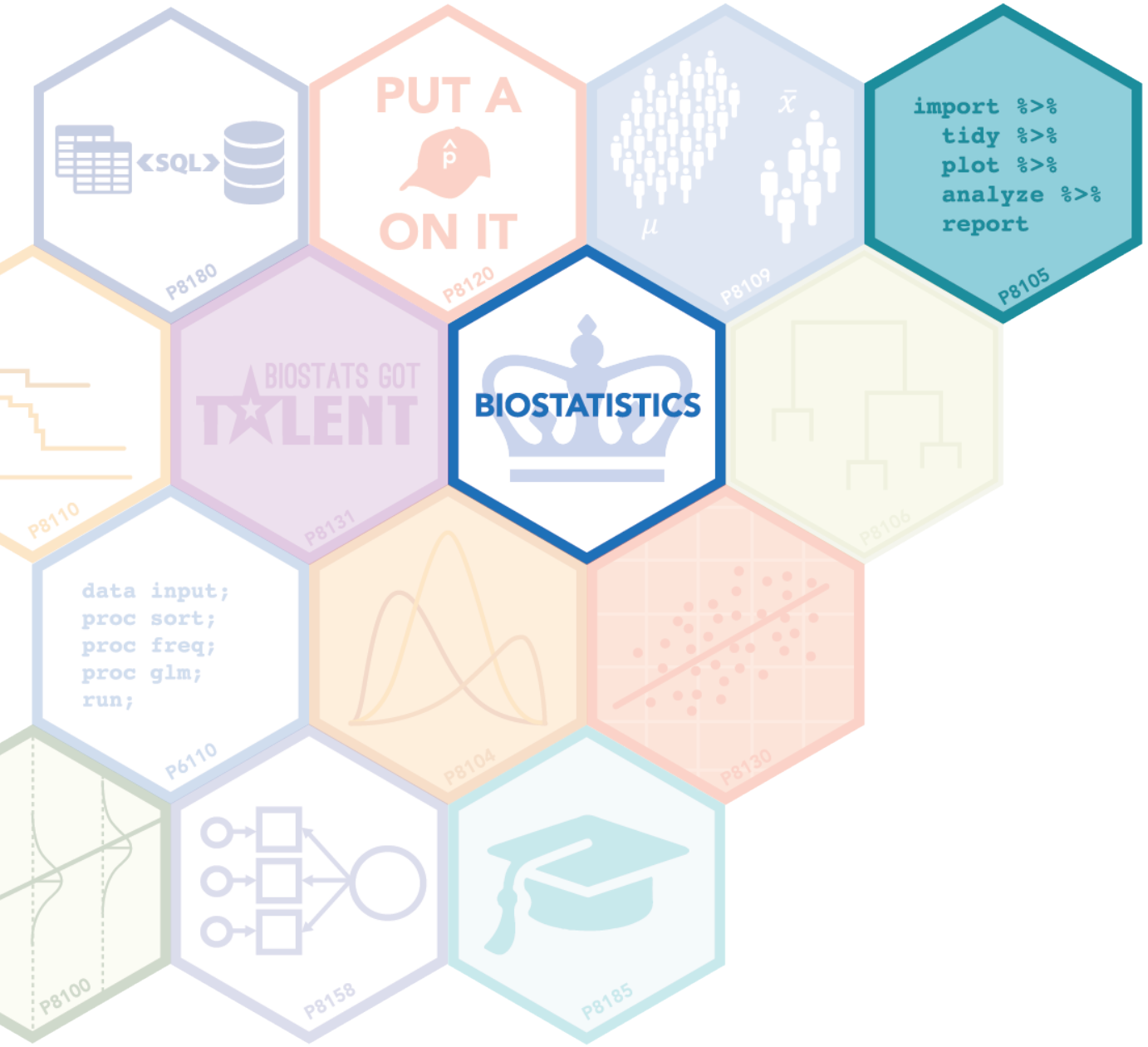

THE EMERGENCE AND FUTURE OF DATA SCIENCE

Jeff Goldsmith, PhD
Columbia Biostatistics

Data science is pretty new

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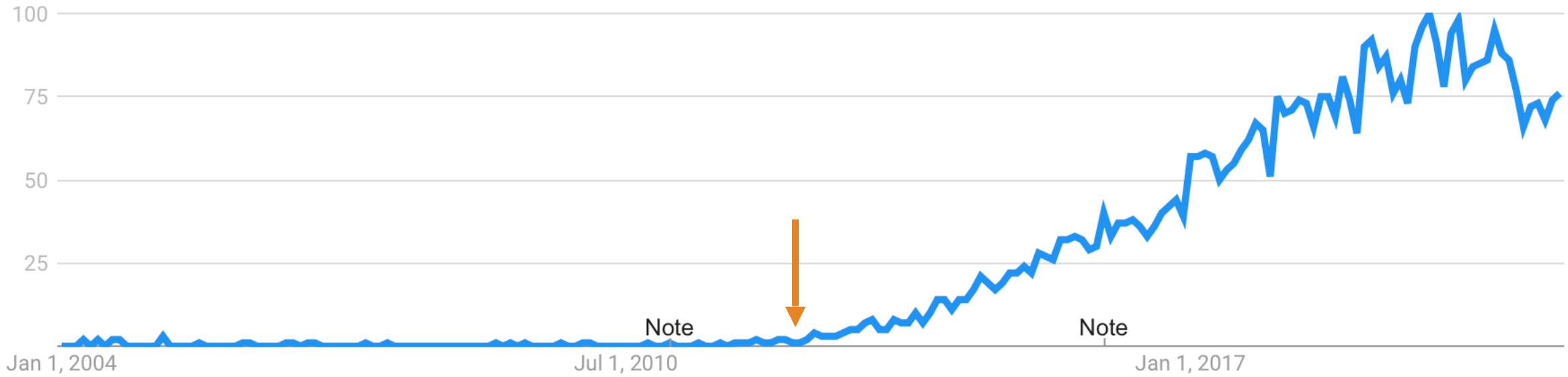


Coauthors

- The Emergence and Future of Public Health Data Science
  - Jeff Goldsmith, Yifei Sun, Linda P. Fried, Jeannette Wing, Gary W. Miller, Kiros Berhane

My background in data science

- I do functional data analysis motivated by
  - Wearable devices (accelerometers, mostly)
  - Motor control (stroke recovery; brain / behavior dynamics)

- I've taught P8105: Data Science I since 2017
  - Intended for MS students in biostatistics
  - Enrollment is now approx. 200
  - (That's more than 20, but less than a million)
  - Think "tidyverse as a service course"

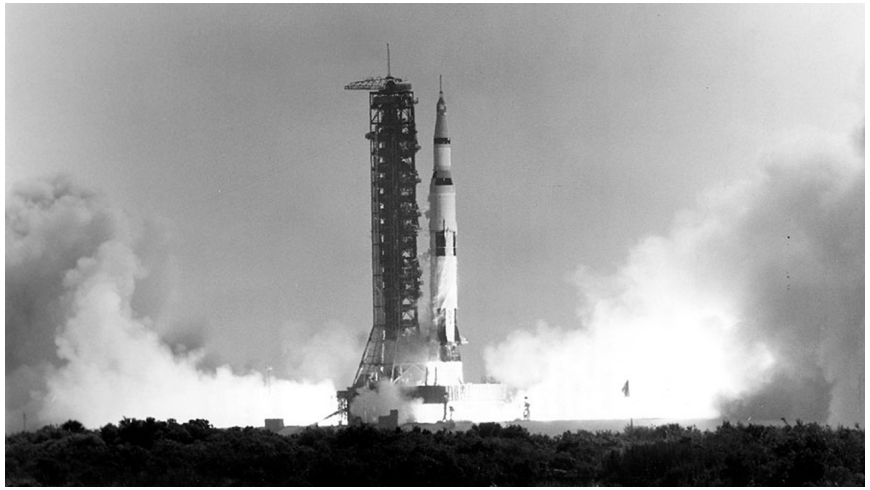
A data science analogy

1910s

A data science analogy

1910s

1969 / 1970



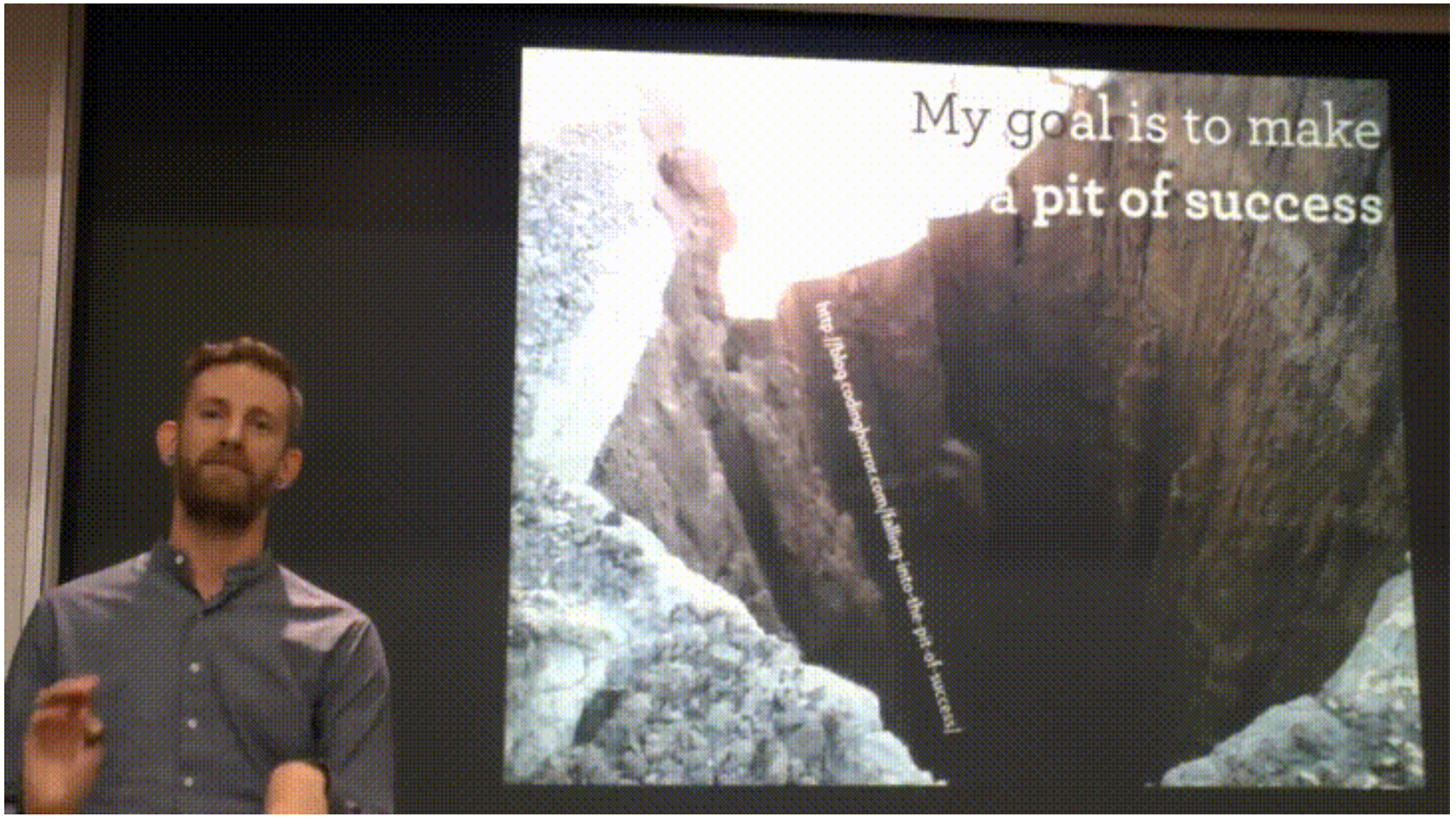
Defining data science

Data science is the study of extracting value from data.

Another definition

Data science is the study of formulating and rigorously answering questions using a data-centric process that emphasizes clarity, reproducibility, effective communication, and ethical practices.

ISI 2017



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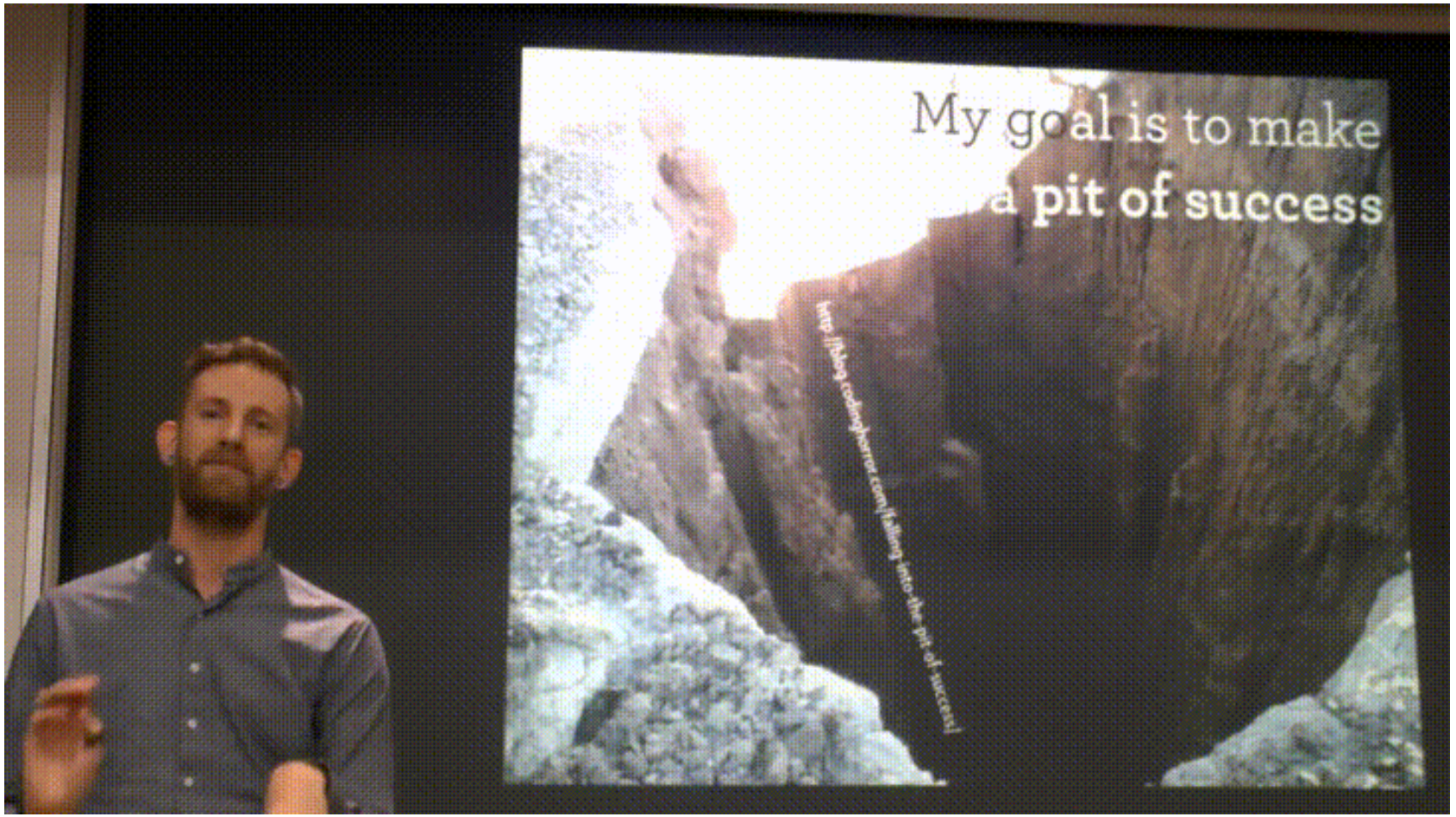

First question from the audience

"What is the point of 'data science'? Aren't *we* **already** data scientists?"

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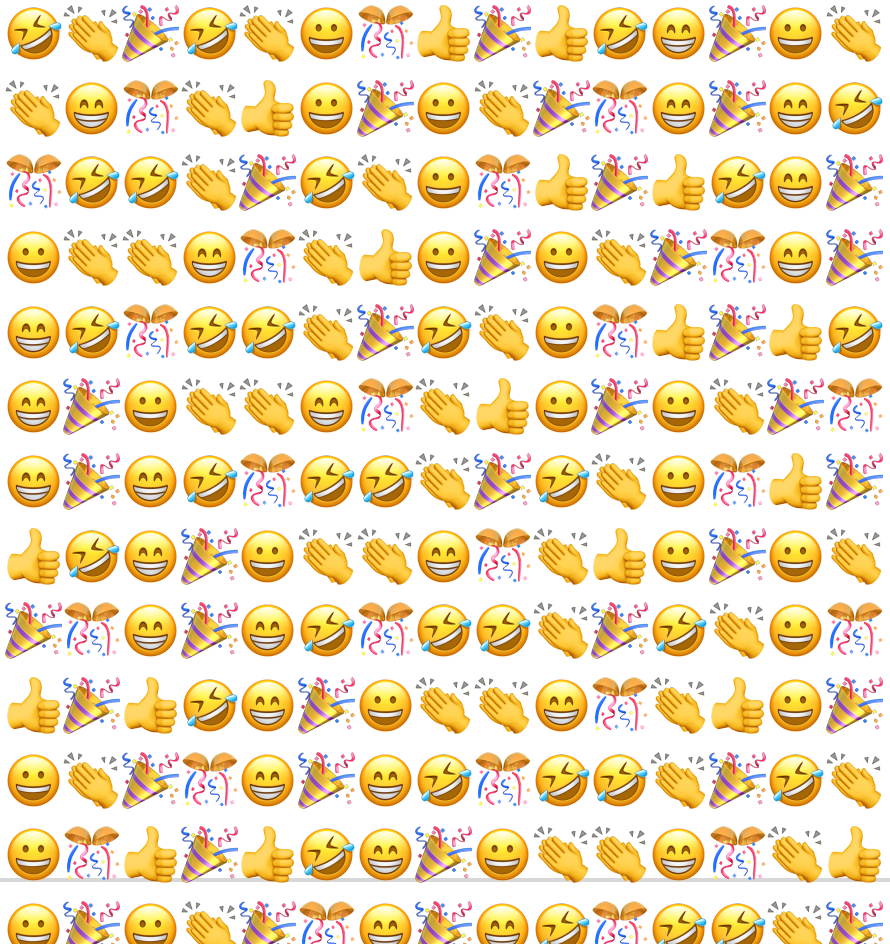

Response from Hadley Wickham (roughly)

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That question is understandable

- It's easy, in 2021, to forget what the statistical identity crisis phase was like
- But that was a whole thing, for quite a while

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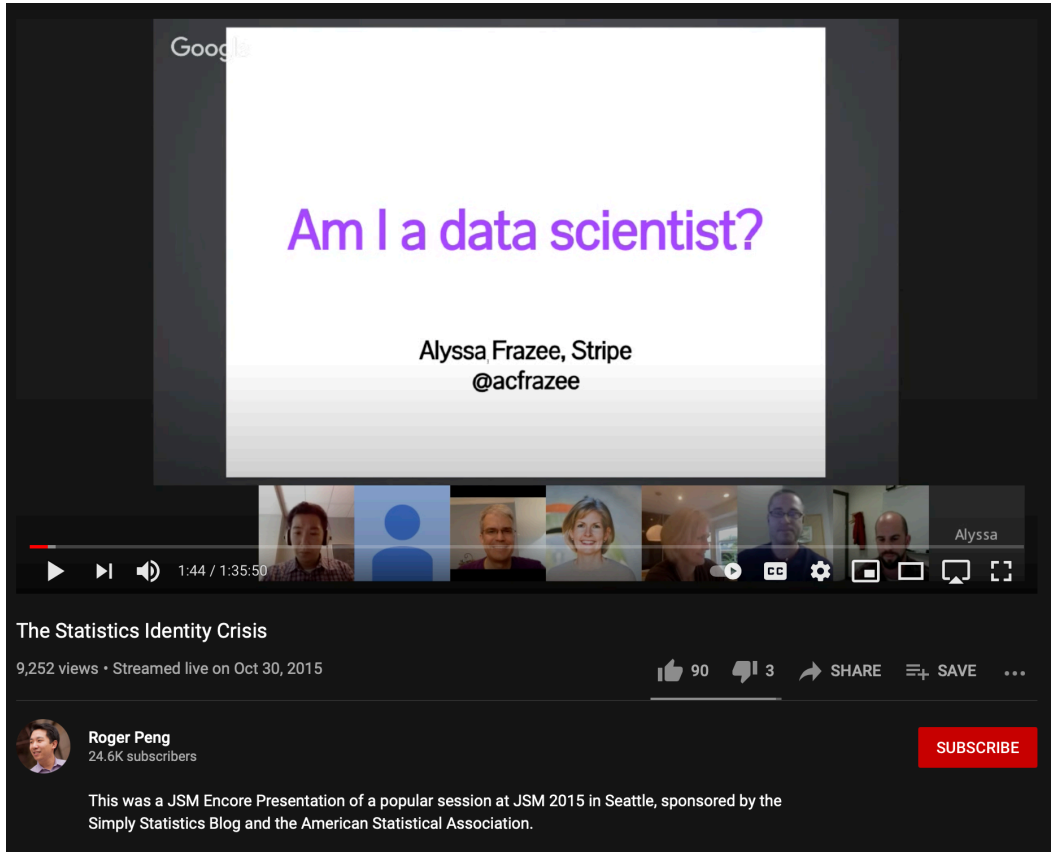

What made “data science” happen

- Data science emerged in parallel to six broad trends:
  - Big data
  - Emphasis on prediction
  - Reproducibility crisis in science
  - Interdisciplinary research
  - Diversity, equity, and inclusion
  - Everything should be on the internet

- These weren’t new in 2012 and aren’t unique to data science
- … but they had a big impact on the “data science” perspective

Connotation >> definition

- Core data science values aren't built into the definition, but were critical to the valence of "data science"

- In statistics, "data science" mapped onto existing arguments about what matters to the field
  - Connotation seemed to resonate with a lot of vaguely disaffected applied statisticians

Data science as external validation

- The fact that data science caught on implied that

stated values ≠ demonstrated values

- Ideally, this would suggest a need to bring these into closer alignment
  - Not saying old values were bad – but that other things should be valued, too

Did that happen?

- Some, yeah.
  - More awareness of issues around equity and inclusion
  - Broader view of important / valid publication outlets
  - Techniques for working with data are explicitly taught
  - Slow shift towards expecting better code / reproducibility

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  - (Exciting aside – reproducibility at JASA …)

- But also … not in other ways.
  - “Find ways to get traditional academic products / credit” is the advice given to academic data scientists

So … I think Jeannette is kinda right

- Data-oriented disciplines will slowly incorporate the values that "data science" implies in their own ways
- That'll be true enough that "data science" will be a secondary / situational academic identity
  - "I'm a […] and data scientist" not "I'm a data scientist"
  - "For this grant, I'm a data scientist"

- Upshot is that a maximalist definition of data science will win, in practice, over a definition that tries to create a clear boundary / distinct discipline
  - This is not a bad thing

Public Health Data Science

[Public health] data science is the study of formulating and rigorously answering questions [in order to advance health and well-being] using a data-centric process that emphasizes clarity, reproducibility, effective communication, and ethical practices.

"Public Health" is the important part

- Public health training emphasizes some elements that are critical data science thinking and work:
  - Study design
  - Sampling process
  - Measurement process
  - Desire vs ability to infer causation
  - Cross-disciplinary collaboration
  - Engagement with data ethics
  - Public dissemination and dialog

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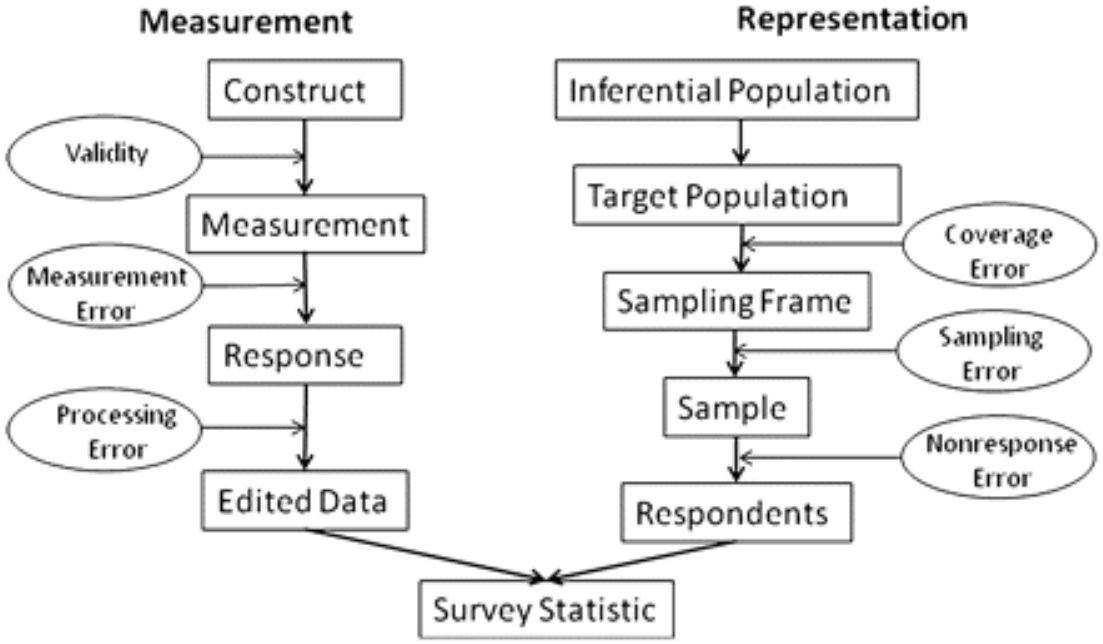

From "Total Survey Error: Past, Present, and Future" (Groves and Lyberg)
via "Data Alone Isn't Ground Truth" by Angela Bassa

DS ⟺ PHDS

- “Data science” will evolve as it draws on existing domain skills and traditions
- PHDS will add some ways of thinking and tools from other quantitative disciplines

Some easy predictions about PHSD

- It'll follow the data science trajectory, just delayed a few years
  - A "PHDS is just …" phase will happen and then be mostly over
  - Public health data scientists will be common outside academia
    - This is why people take my class …
    - $\Longrightarrow$ PHDS training programs will proliferate

Thanks!

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