Studying Social Inequality with Data Science

INFO 3370 / 5371
Spring 2024

Sampling: Stratified, Clustered, and the Future

Learning goals for today

By the end of class, you will be able to

- sample from a population in R
- write an estimator function
- apply the function to your sample
- connect sampling to the replication crisis
- discuss the future of sampling

Baseball salaries

BASEBALL

The New York Times

GIVE THE TIMES

Channeling the Old Steinbrenner Ways, Yankees Stepped Up for Judge

Aaron Judge, who hit 62 home runs in 2022, agreed to a nine-year, $360 million contract with the Yankees after meeting with at least two other teams.

Share full article 129

Aaron Judge set career highs in batting average (.311), home runs (62) and R.B.I. (131) in 2022. Chris Donovan for The New York Times

Sections

Los Angeles Times

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Dodgers news | Teoscar Hernández | California dreaming | Dodgers pitchers rising | $1 billion boon?

DODGERS

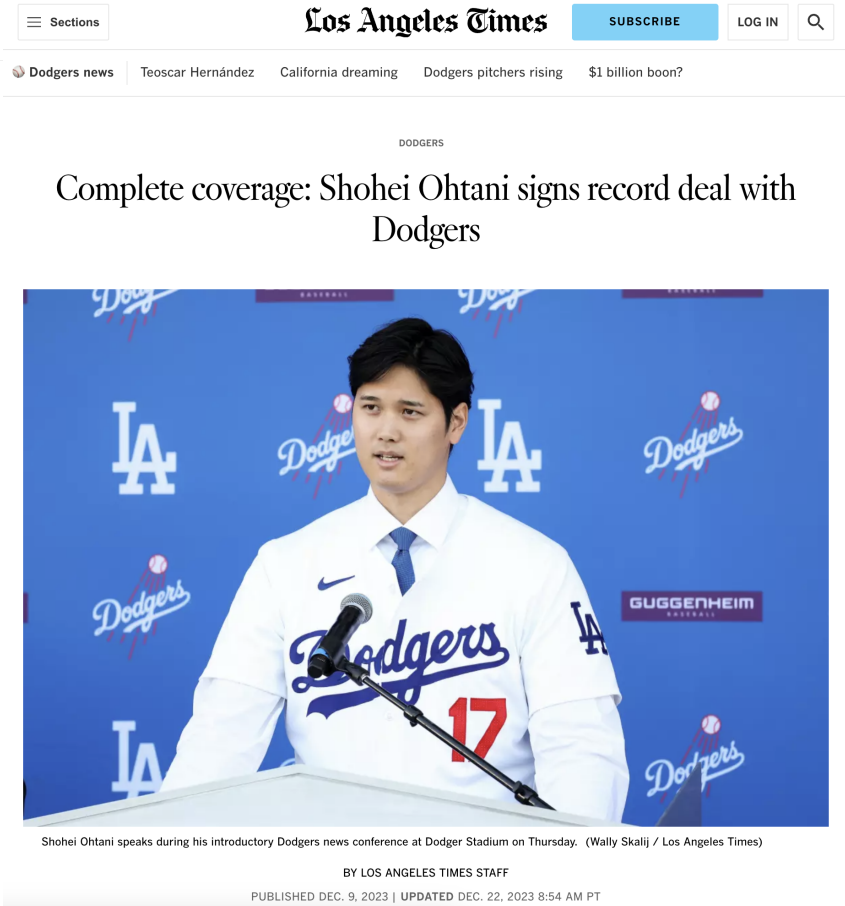
Complete coverage: Shohei Ohtani signs record deal with Dodgers

Shohei Ohtani speaks during his introductory Dodgers news conference at Dodger Stadium on Thursday. (Wally Skalij / Los Angeles Times)

BY LOS ANGELES TIMES STAFF

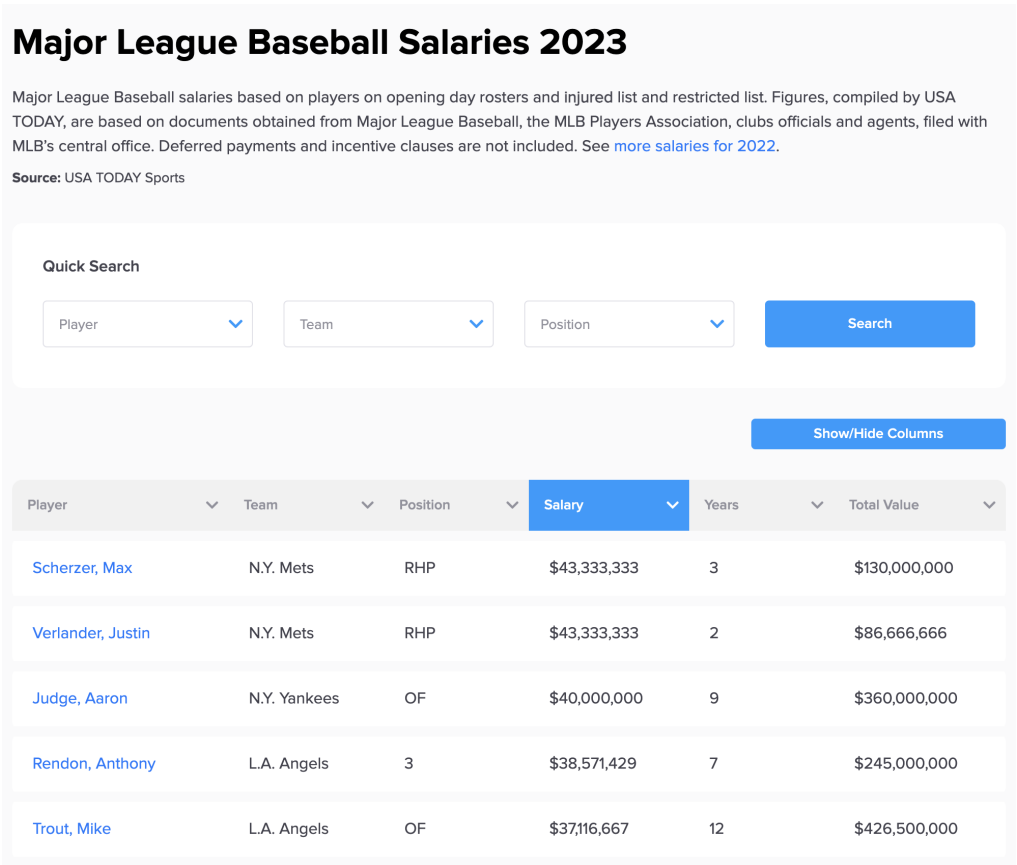
PUBLISHED DEC. 9, 2023 | **UPDATED** DEC. 22, 2023 8:54 AM PT

Baseball salaries



Major League Baseball Minimum: **$720,000**

Baseball salaries



Major League Baseball Salaries 2023

Major League Baseball salaries based on players on opening day rosters and injured list and restricted list. Figures, compiled by USA TODAY, are based on documents obtained from Major League Baseball, the MLB Players Association, clubs officials and agents, filed with MLB's central office. Deferred payments and incentive clauses are not included. See more salaries for 2022.

Source: USA TODAY Sports

Quick Search

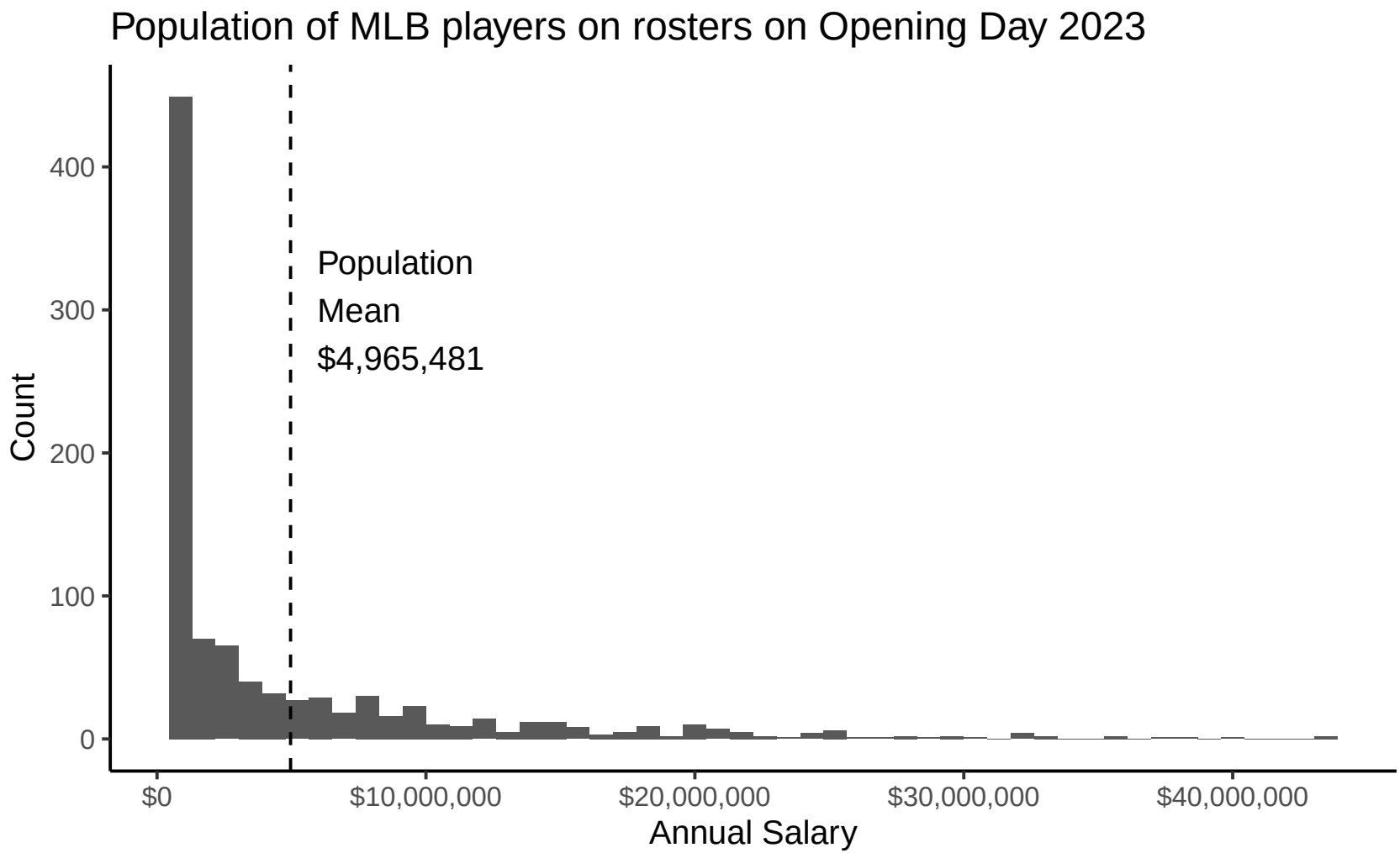
Player | Team | Position | Search

Show/Hide Columns

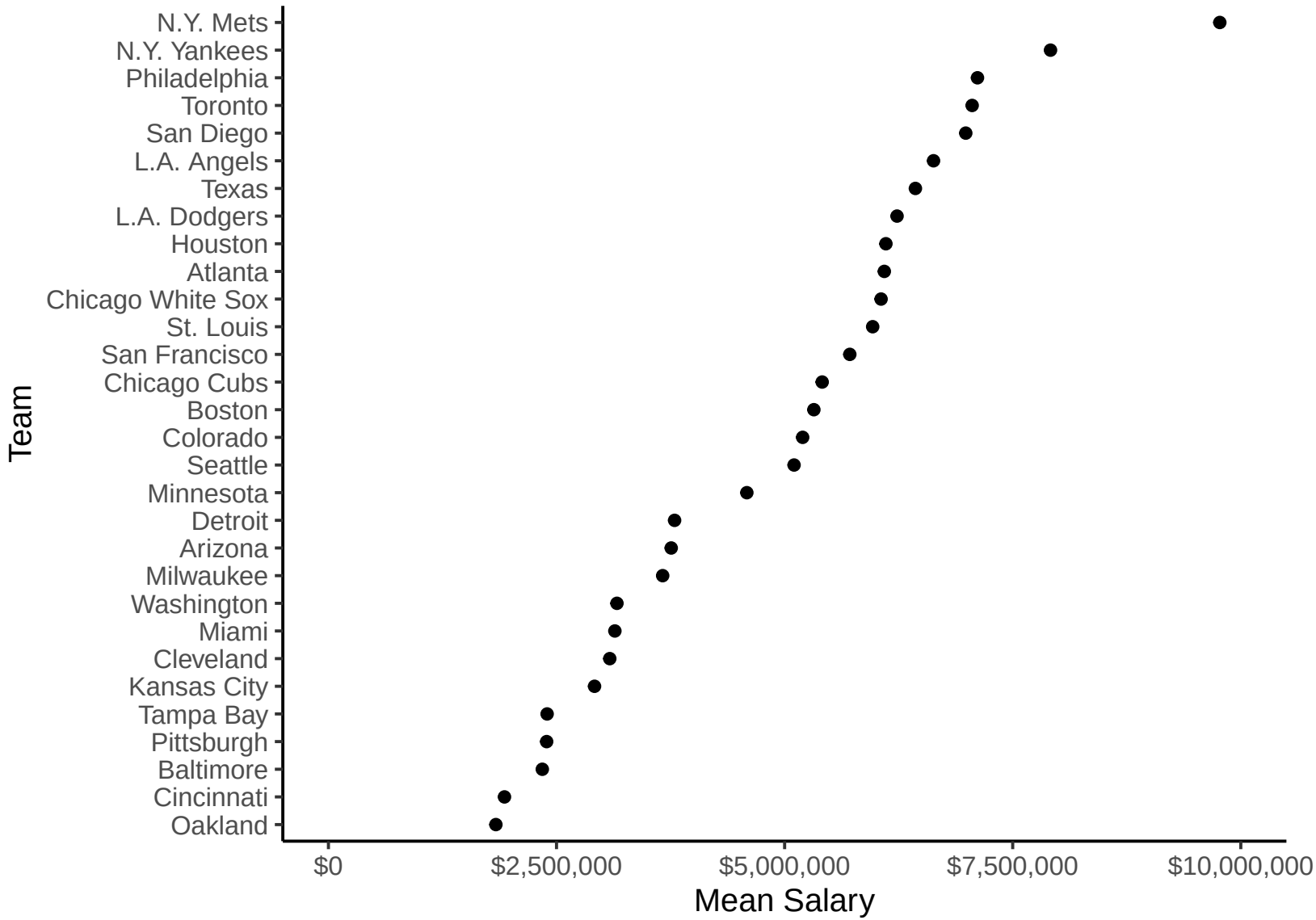
Player	Team	Position	Salary	Years	Total Value
Scherzer, Max	N.Y. Mets	RHP	$43,333,333	3	$130,000,000
Verlander, Justin	N.Y. Mets	RHP	$43,333,333	2	$86,666,666
Judge, Aaron	N.Y. Yankees	OF	$40,000,000	9	$360,000,000
Rendon, Anthony	L.A. Angels	3	$38,571,429	7	$245,000,000
Trout, Mike	L.A. Angels	OF	$37,116,667	12	$426,500,000

databases.usatoday.com/major-league-baseball-salaries-2023/

Baseball salaries



Baseball salaries



Draw a Sample to Estimate the Mean Salary

```
baseball <- read_csv("https://info3370.github.io/data/baseball.csv")
```

How would you design:

- Simple random sample of 60 players
- Random sample stratified by team
- Random sample clustered by team

and why would you do it each way?

Stuck? See last week's reading

Draw a Sample to Estimate the Mean Salary

simple random sampling	60 players chosen at random
stratified sampling	2 players on each of the 30 teams
clustered sampling	20 players on 3 sampled teams

Apply an Estimator

Write a function that I like to call `estimator()`

- input is a sample
- output is an estimate

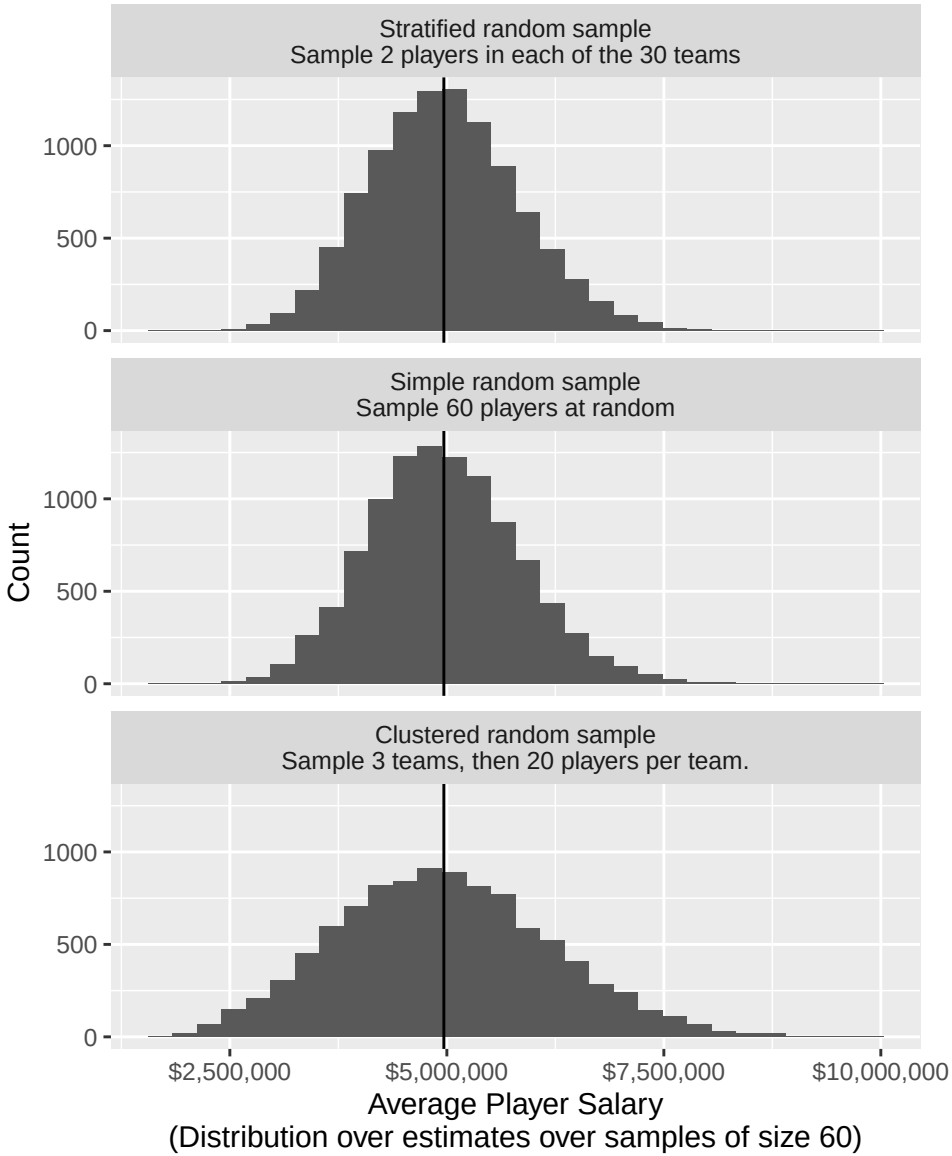
Evaluate performance

We will first calculate the population mean

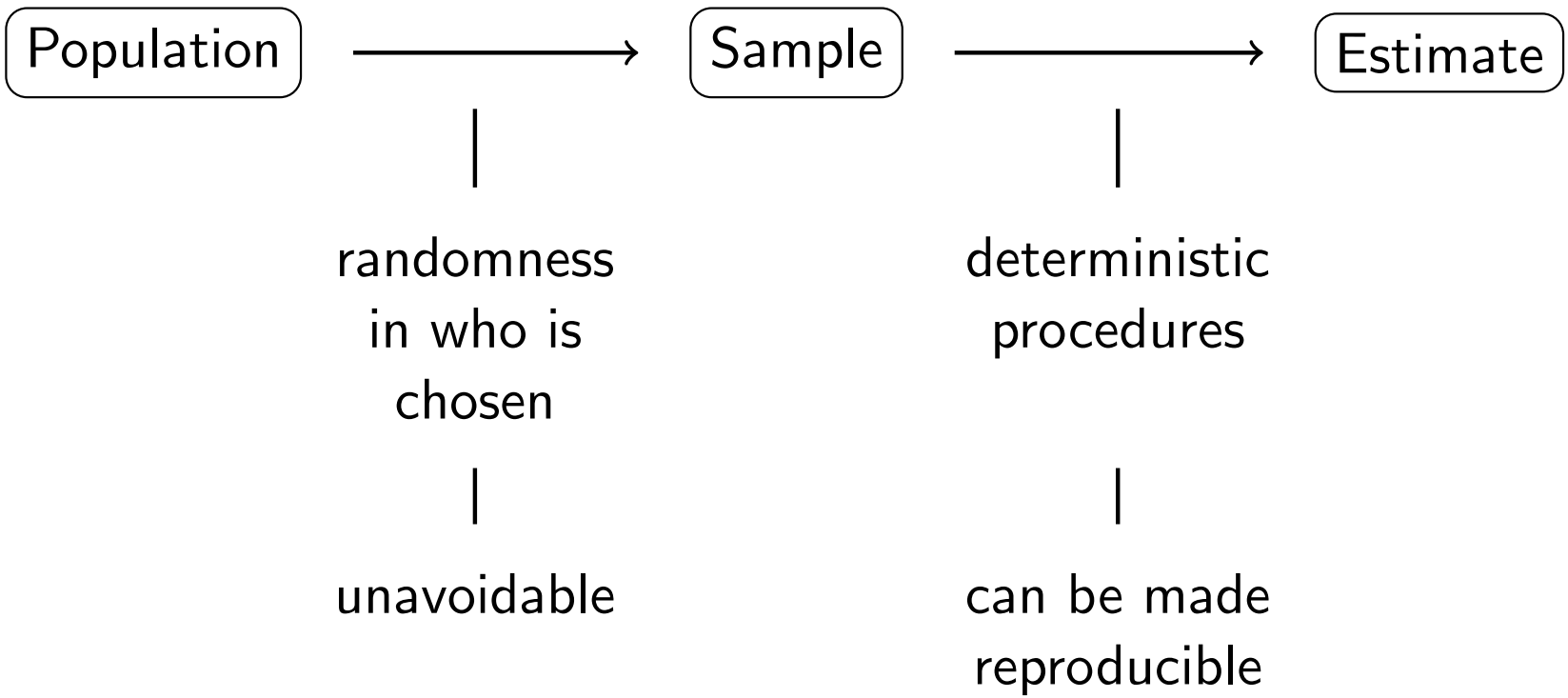
Then we will repeatedly

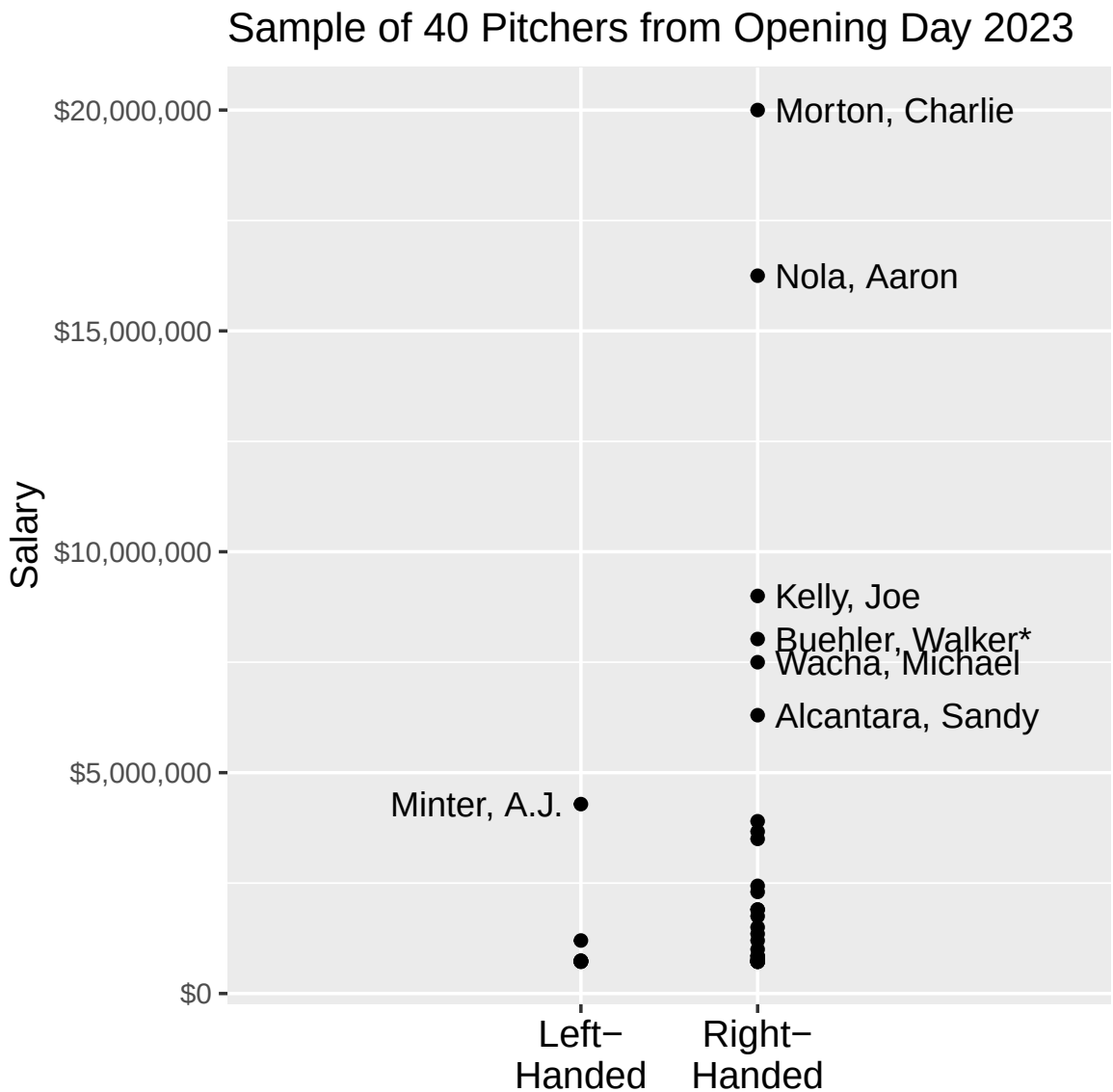
- draw a sample
- apply the estimator
- store the result

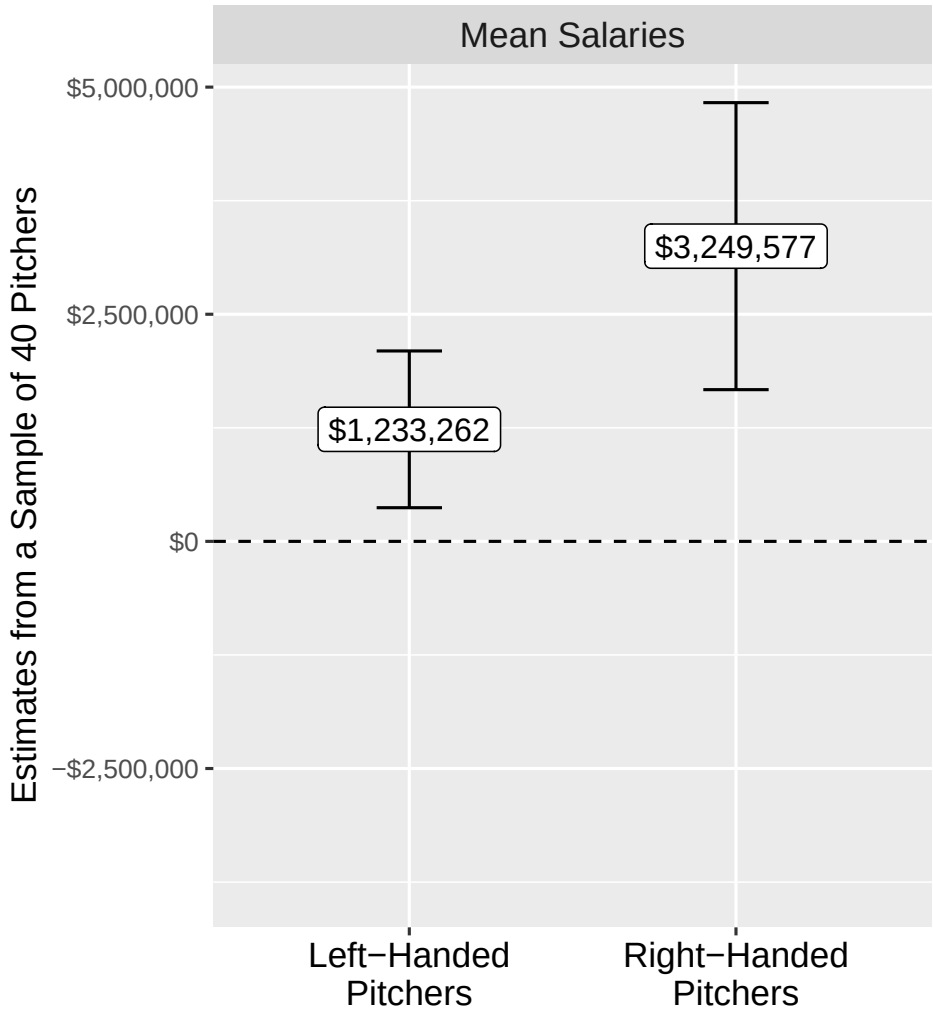
Three sampling strategies

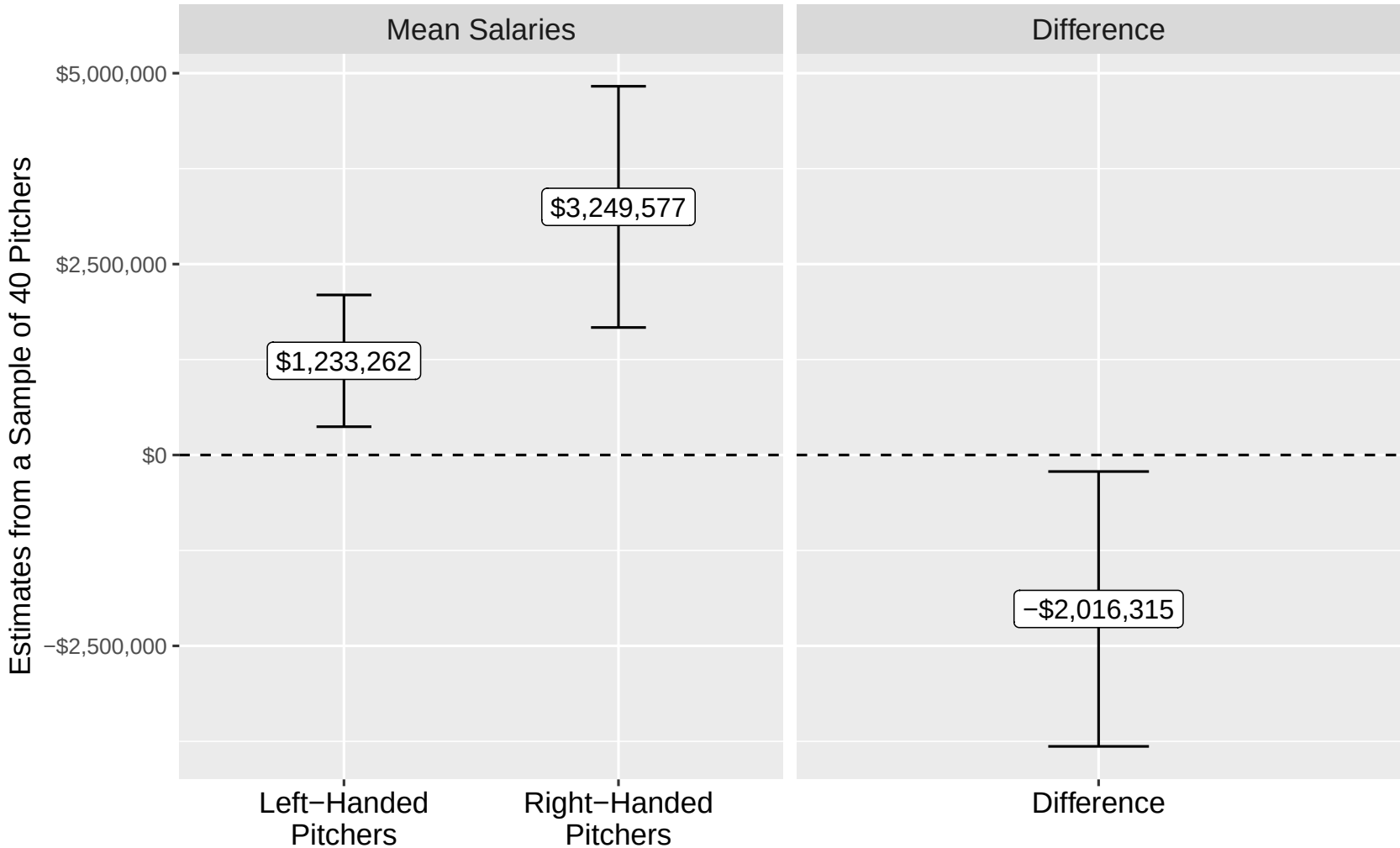


Danger of One Sample




Sample of 40 Pitchers from Opening Day 2023
Salary
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$0
Morton, Charlie
Nola, Aaron
Kelly, Joe
Buehler, Walker*
Wacha, Michael
Alcantara, Sandy
Minter, A.J.
Left−
Handed
Right−
Handed


Mean Salaries
Estimates from a Sample of 40 Pitchers
$5,000,000
$2,500,000
$0
−$2,500,000
$3,249,577
$1,233,262
Left−Handed Pitchers
Right−Handed Pitchers


Mean Salaries
Difference
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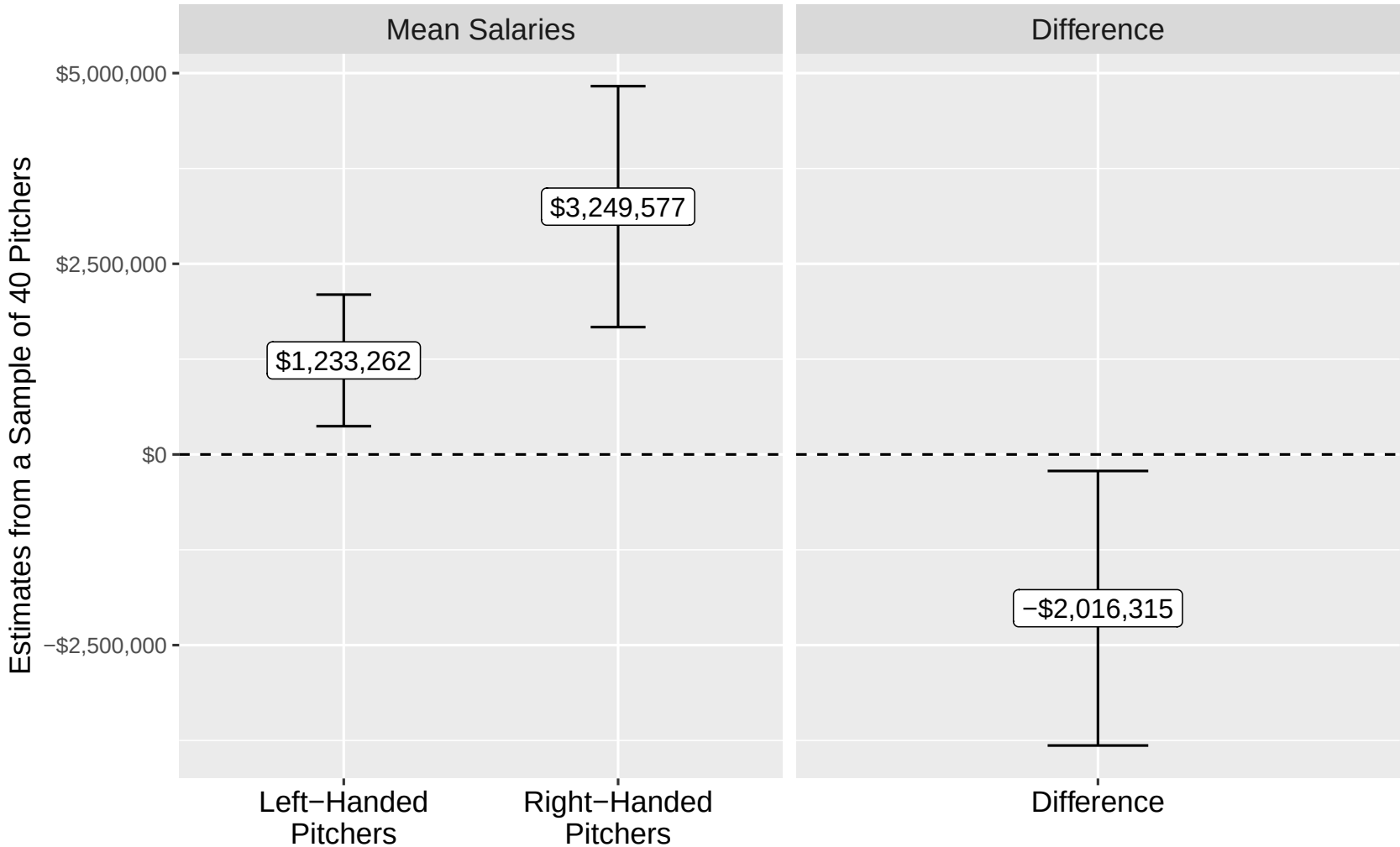
$2,500,000
$0
−$2,500,000
$3,249,577
$1,233,262
−$2,016,315
Left−Handed Pitchers
Right−Handed Pitchers
Difference

Why might right-handed pitchers earn more?



Your turn

- load the data
- take a sample of size 40
- group by position
- summarize the mean salary

Who has higher average salary in your sample?

- `RHP`: right-handed pitchers
- `LHP`: left-handed pitchers

I did this 1,000 times

Distribution of Sample Estimates

6% of sample estimates are statistically significant

The replication crisis

The replication crisis

- unless we see the population, all estimates involve noise

The replication crisis

- unless we see the population, all estimates involve noise
- surprising findings yield big rewards

The replication crisis

- unless we see the population, all estimates involve noise
- surprising findings yield big rewards
- unsurprising findings get ignored

The replication crisis

- unless we see the population, all estimates involve noise
- surprising findings yield big rewards
- unsurprising findings get ignored
- science is just discovering noise

Journal of Personality and Social Psychology
2011, Vol. 100, No. 3, 407–425

0022-3514/11/$12.00 DOI: 10.1037/a0021524

Feeling the Future: Experimental Evidence for Anomalous Retroactive Influences on Cognition and Affect

Daryl J. Bem
Cornell University

SCIENCE

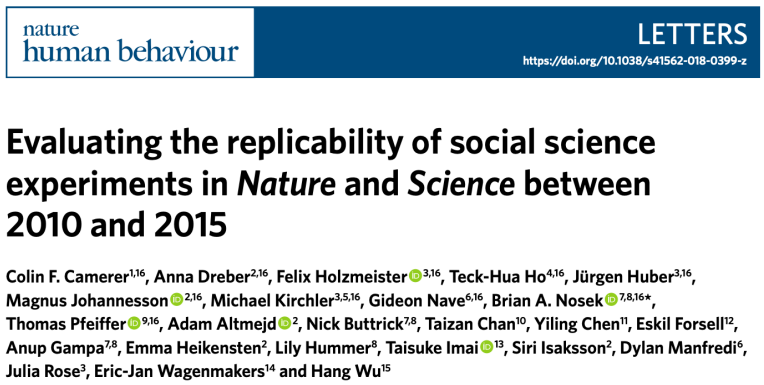
Daryl Bem Proved ESP Is Real

Which means science is broken.

BY DANIEL ENGBER

JUNE 07, 2017 • 2:57 PM

Slate link.



nature human behaviour

LETTERS

https://doi.org/10.1038/s41562-018-0399-z

Evaluating the replicability of social science experiments in *Nature* and *Science* between 2010 and 2015

Colin F. Camerer[1,16], Anna Dreber[2,16], Felix Holzmeister[3,16], Teck-Hua Ho[4,16], Jürgen Huber[3,16], Magnus Johannesson[2,16], Michael Kirchler[3,5,16], Gideon Nave[6,16], Brian A. Nosek[7,8,16*], Thomas Pfeiffer[9,16], Adam Altmejd[2], Nick Buttrick[7,8], Taizan Chan[10], Yiling Chen[11], Eskil Forsell[12], Anup Gampa[7,8], Emma Heikensten[2], Lily Hummer[8], Taisuke Imai[13], Siri Isaksson[2], Dylan Manfredi[6], Julia Rose[3], Eric-Jan Wagenmakers[14] and Hang Wu[15]

Camerer et al. in Nature Human Behavior.

The New York Times

SCIENCE TIMES AT 40

Essay: The Experiments Are Fascinating. But Nobody Can Repeat Them.

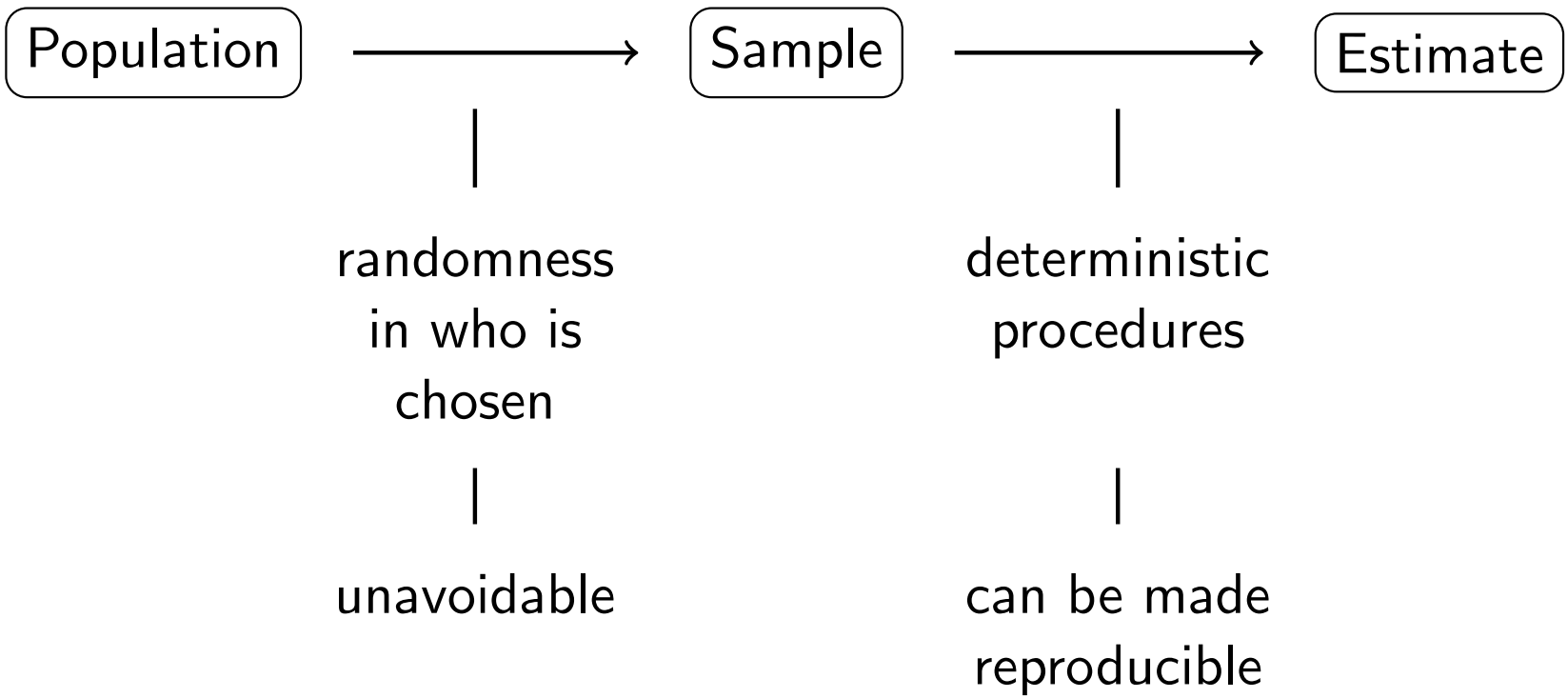
Science is mired in a "replication" crisis. Fixing it will not be easy.

Gelman in NYTimes.

The replication crisis

- unless we see the population, all estimates involve noise
- surprising findings yield big rewards
- unsurprising findings get ignored
- science is just discovering noise

Danger of One Sample



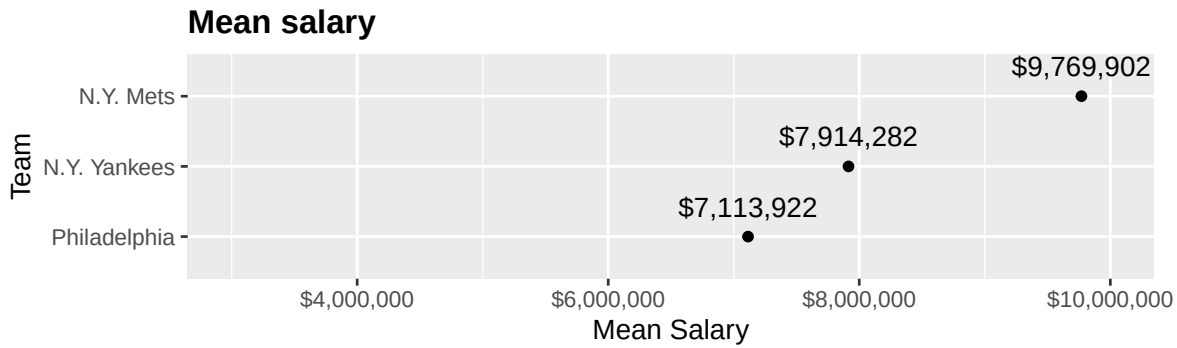
Reproducibility

What is a typical salary in the three highest-paying teams in American baseball?

- use the whole population
- summarize `salary` grouped by `team`
- be ready to tell use your estimates and how you got them

What is a typical salary in the three highest-paying teams in American baseball?

What is a typical salary in the three highest-paying teams in American baseball?



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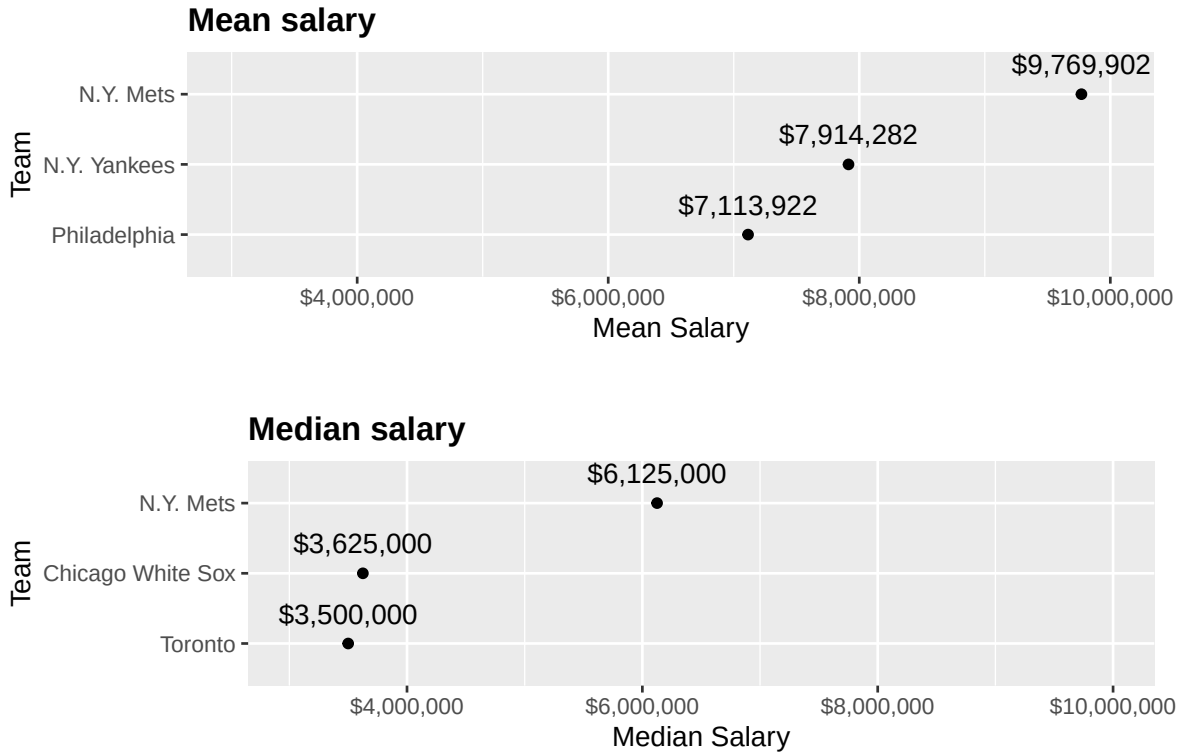

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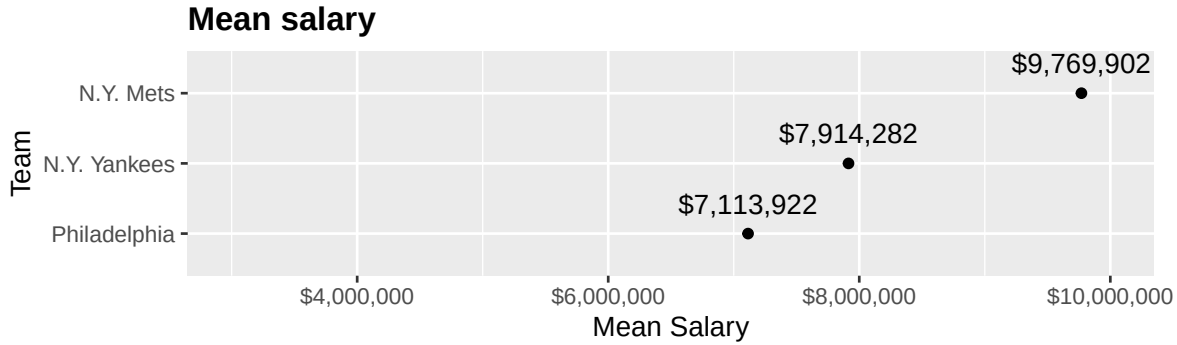
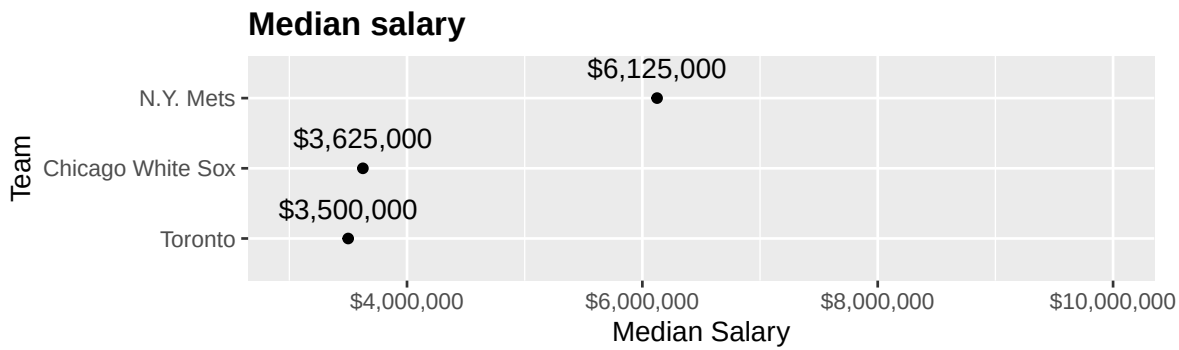
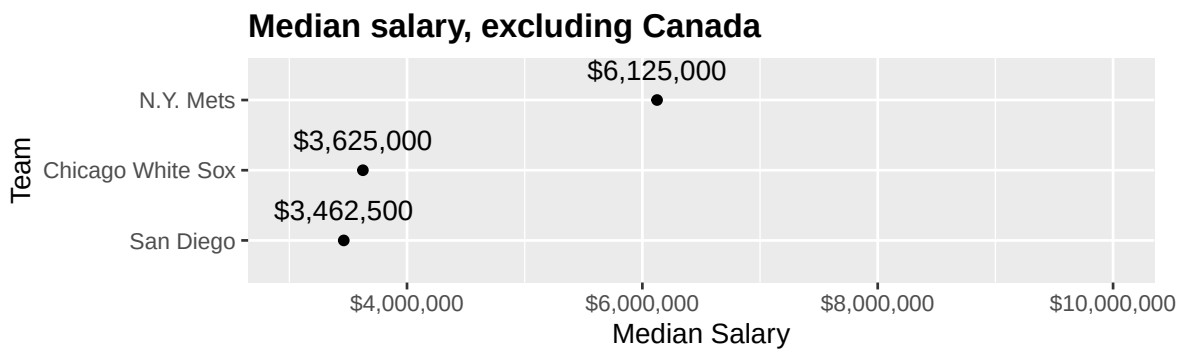






quarto

```
---
title: "Problem Set 1: Visualization"
format: pdf
---

**Due: 5pm on Wednesday, January 31.**

Student identifer: [type your anonymous identifying number here]

- Use this template to complete the problem set
- In Canvas, you will upload the PDF produced by your .qmd file
- Put your identifier above, not your name! We want anonymous grading to be
possible

This problem set involves both data analysis and reading.

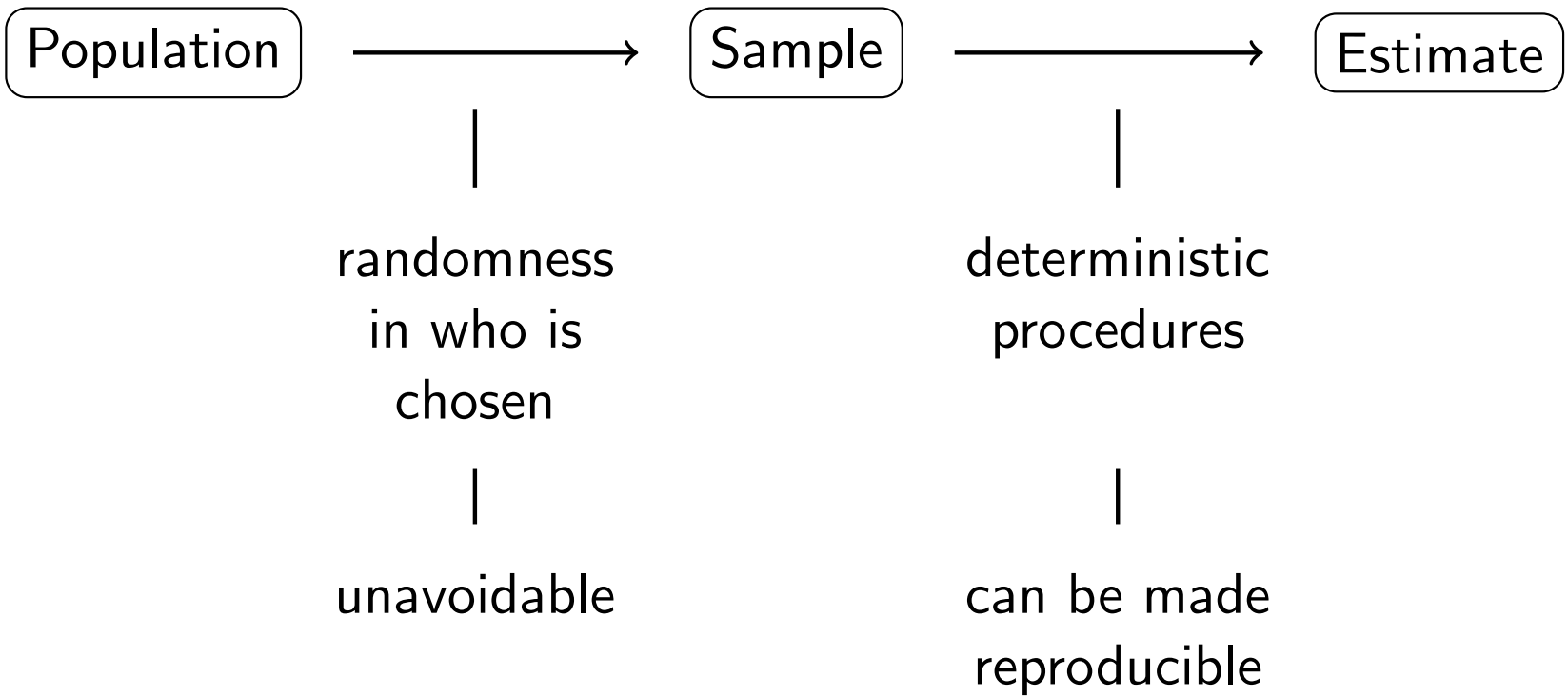
### Data analysis

This problem set uses the data
[`lifeCourse.csv`](https://info3370.github.io/data/lifeCourse.csv).

```{r, comment = F, message = F}
library(tidyverse)
library(scales)
lifeCourse <- read_csv("https://info3370.github.io/data/lifeCourse.csv")
```

The data contain life course earnings profiles for four cohorts of American
workers: those born in 1940, 1950, 1960, and 1970. Each row contains a
```

Danger of One Sample



The Future of Sample Surveys

Groves, R. M. (2011). Three eras of survey research. Public Opinion Quarterly.

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1930–1960: Era of Invention

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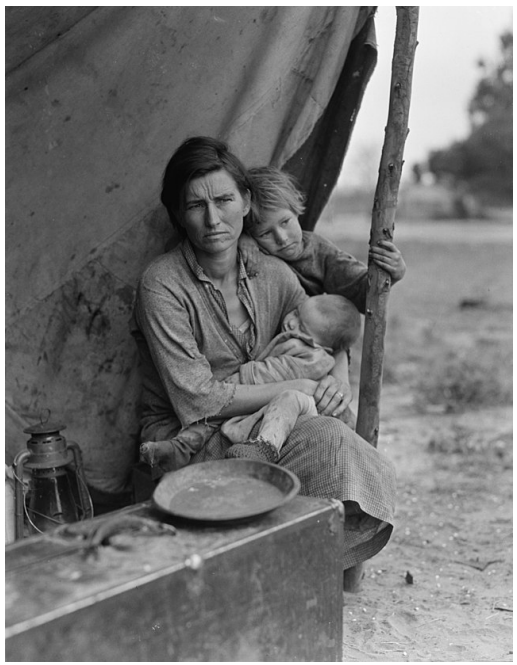

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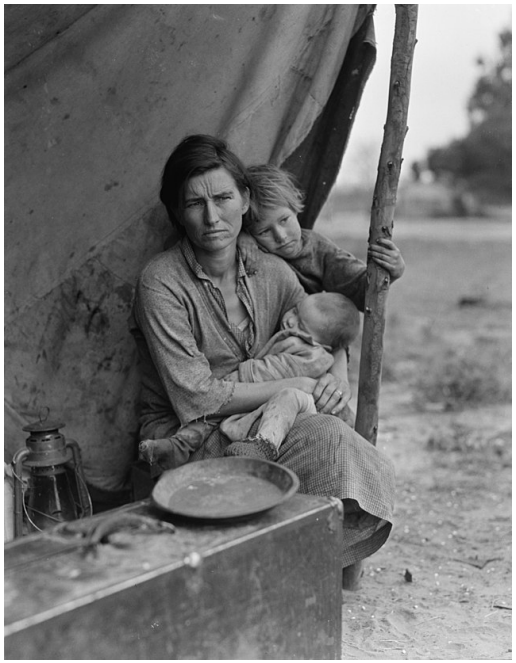

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sampling frame pieces of land

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sampling frame	pieces of land
mode	face-to-face interviews

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sampling frame	pieces of land
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cost	high

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1930–1960: Era of Invention

sampling frame	pieces of land
mode	face-to-face interviews
cost	high
response rate	over 90 percent

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Groves, R. M. (2011). Three eras of survey research. Public Opinion Quarterly.

1960–1990: Era of Expansion

Technology helped: Telephones

Source: Wikimedia

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1990–Present

Technology brought challenges Technology brought opportunities

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Technology brought challenges — answering machines

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Technology brought challenges — answering machines — cell phones

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— answering machines

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— caller ID

— response rates plummeted

Technology brought opportunities

— digital trace data

— internet panels

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1990–Present: Designed and Organic Data

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1990–Present: Designed and Organic Data

Designed data

Organic data

Example
Census age distribution

Example
Web histories

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1990–Present: Designed and Organic Data

Designed data
— high cost

Organic data
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— iffy for population

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Example
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future of **organic data**

future of **designed data**

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Census age distribution

Example
Web histories

the future is **together**

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