Practical Data Science I:
Wrangling Data and Answering Questions

Adriane Fresh & Nick Eubank

What is Data Science?

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2. What (empirically) is Data Science?

What (in theory) should Data Science be?

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Study of how best to answer questions using quantitative data.

What (empirically) is Data Science?

How did Data Science become a thing?

Over the past several decades:

1. Availability of data ↑
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Over the past several decades:

1. Availability of data $\uparrow$
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$\Rightarrow$ Huge proliferation and increase in sophistication of computational methods

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    - Computer Science
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    - Economics
    - Political science
    - Engineering

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⇒ Development of new tools occurred *within* each silo.

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Very little cross-pollination across silos

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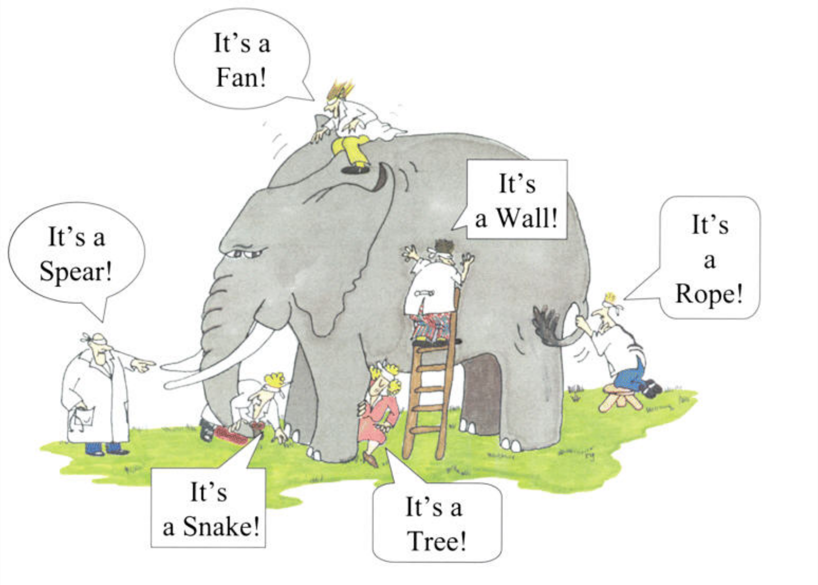
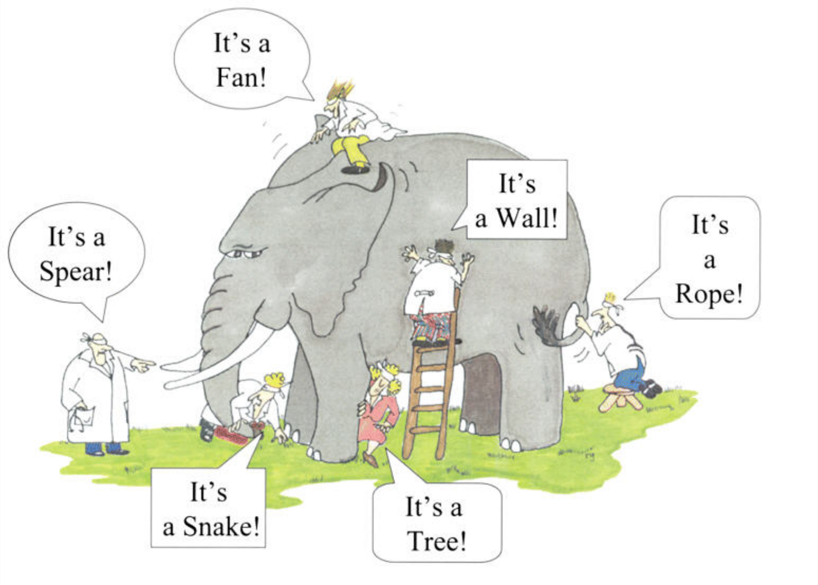
- Every silo has its own vocabulary.
- Each silo has focused on the aspects most relevant to their applications. e.g.:
    - CS likes to classify things and make predictions, don't care how model works
    - Social scientists like to make causal statements, don't care about predictive power


It's a Fan!
It's a Spear!
It's a Wall!
It's a Rope!
It's a Snake!
It's a Tree!



⇒ This is where we are *now.*

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An effort to unify the development of quantitative methods
→ Recognize the elephant

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- Most current researchers learned their skills in a silos.
  In many ways, *you* will have better perspective than your professors.
- Expect fragmentation in both software and vocabulary.
  The fact things don't always seem coherent isn't because you're missing something.

This Class

“The Python Class”

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- *Data Science* Python

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- *Data Science* Python
    - Python standard library, numpy, pandas, scikit-learn, matplotlib, statsmodels

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All through hands-on experience.

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⇒ Emphasis on generalizable data science skills

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- Find and organize data *on your own*.
- Understand how to clean, merge, and manipulate real-world data.
- Know how to approach organizing a full project.

Why Python?

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And why not:

- Stata
- R (Tidy-Verse)
- R (Base-R)

?

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- R (Tidy-Verse)

  Excellent for tabular data
- R (Base-R)

  Good for tabular, network, geospatial, some text and ML

?

Why Python?

Python:

- Tabular data
- Network data
- Geospatial data
- Natural Language Processing (NLP)
- Neural Networks
- Using with Cloud Compute
- Big Data
- Large Language Models
- All Machine Learning
- ...

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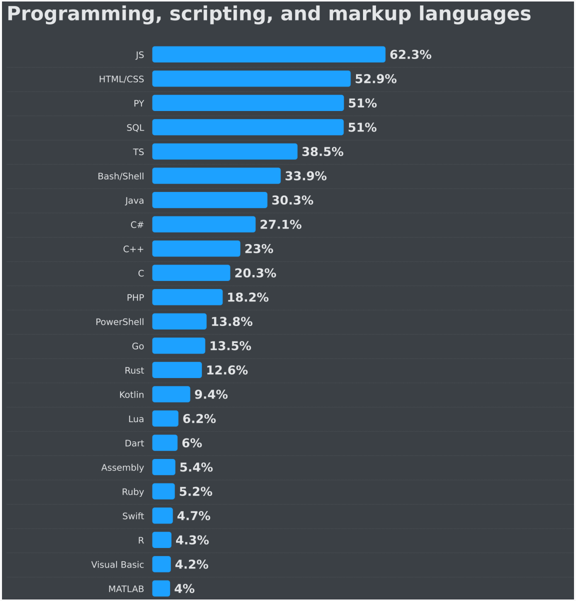
Network Effects:

- 90s and 2000s (even 2010s): most social scientists used Stata or R, developed for Stata and R.
- 2010s and 2020s: Businesses, computer scientists and software engineers moved to data science.
  - Wanted a fully-featured, general purpose language (ideally one they know).

Stack Overflow Developer Survey 2024



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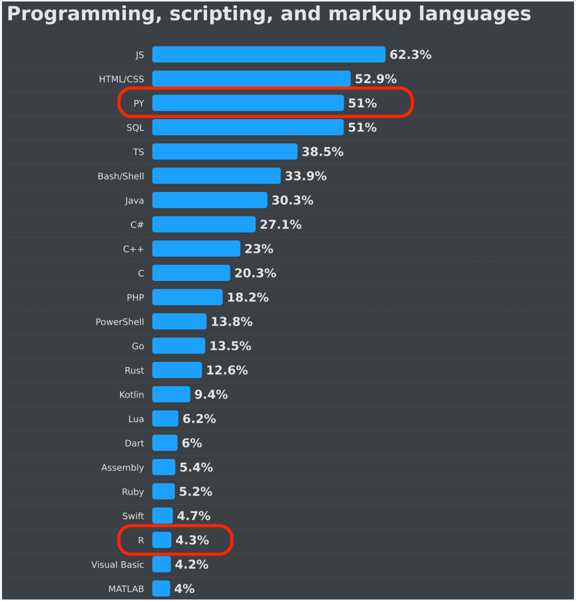
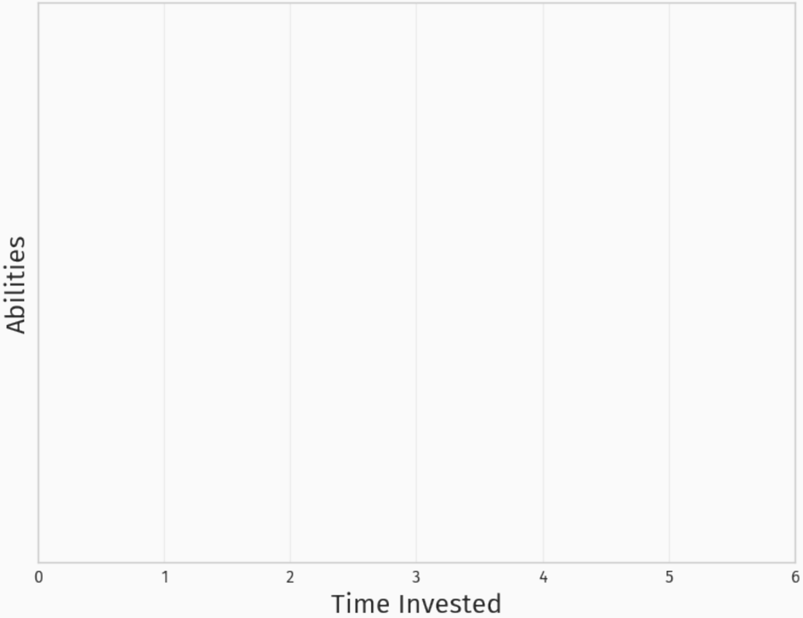
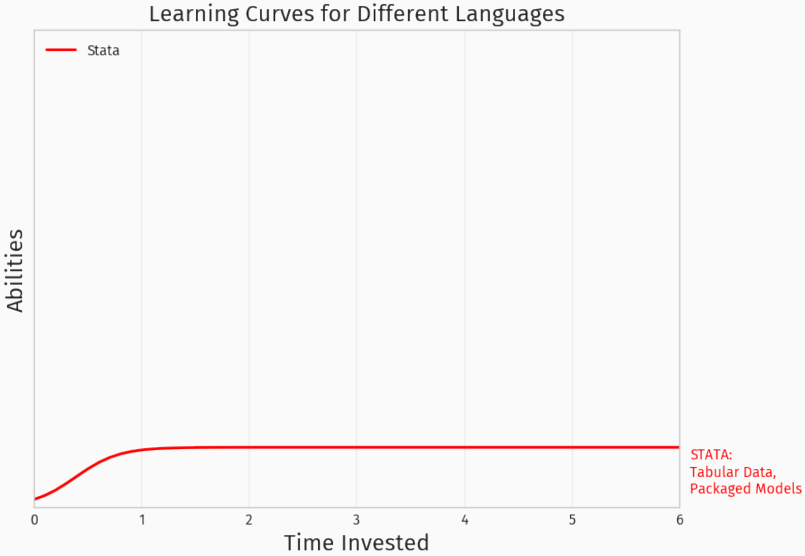
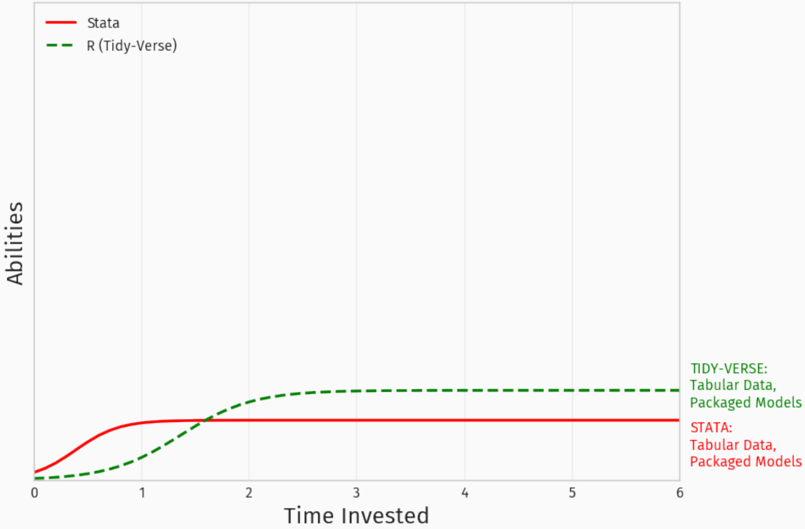


Learning Curves for Different Languages




Learning Curves for Different Languages
Stata
Abilities
STATA:
Tabular Data,
Packaged Models
0
1
2
3
4
5
6
Time Invested



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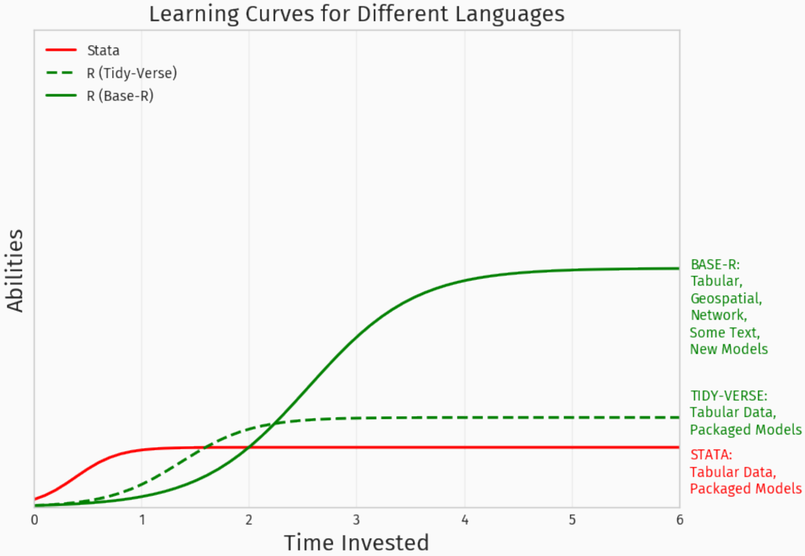
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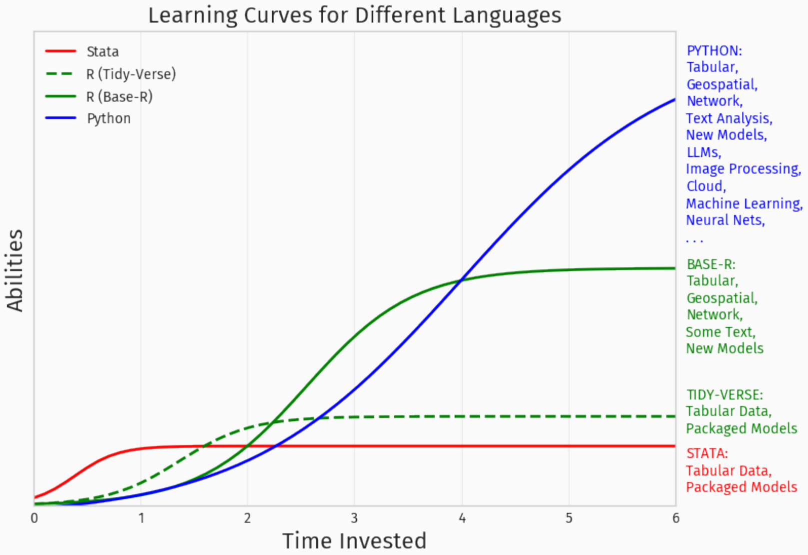

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So what?

- “This is so much easier to do in [Stata/R]”
  - You’re not wrong!
  - (Also easier ways in Python!)
- “This isn’t what I want to learn.”
  - Especially for the first 4 weeks.

By the end of this class...

- Manipulating and cleaning US census data,

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- and more.

If you also take IDS 591...

- Work with big (terabyte sized) datasets,

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You will have a strong understanding of computational thinking and Python
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instead of feeling limited by what existing packages make easy.

About Us: Adriane Fresh

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- Studying whether political elites in the US South turned to using incarceration to prevent black voters from exercising political influence after the Voting Rights Act removed their ability to use Jim Crow restrictions.

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www.practicaldatascience.org