# Course Overview

Ling 250/450: Data Science for Linguistics

C.M. Downey

Spring 2026

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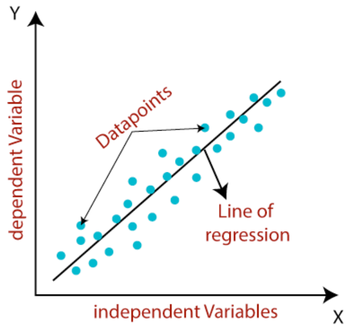


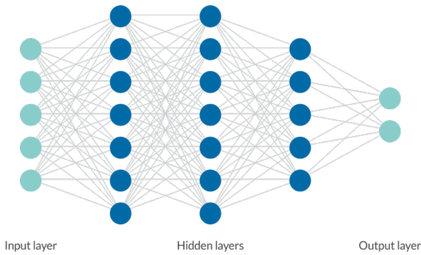


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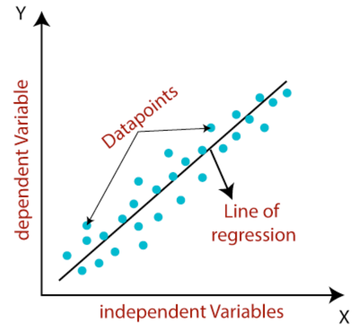


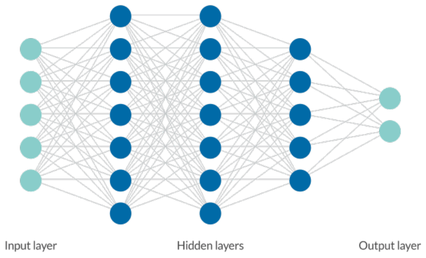


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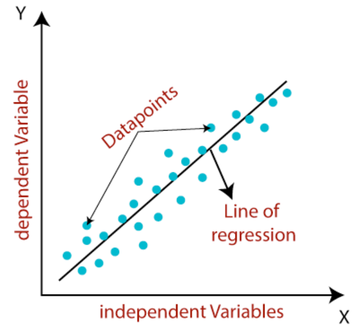


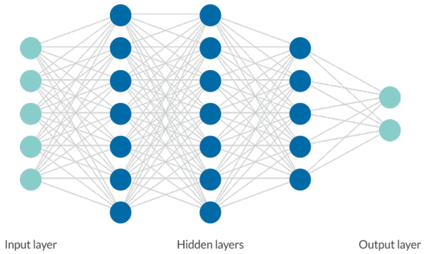


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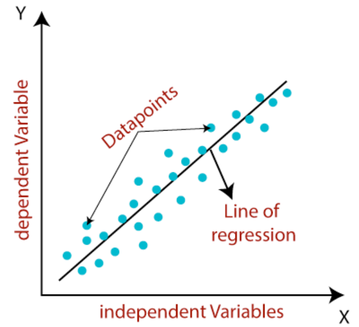


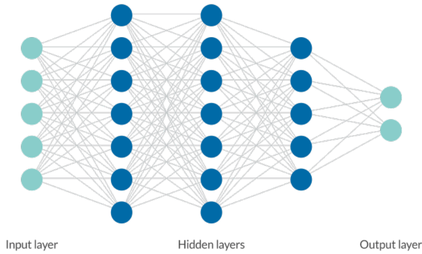


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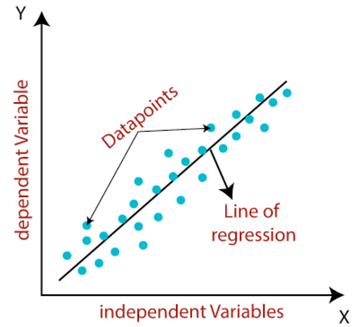


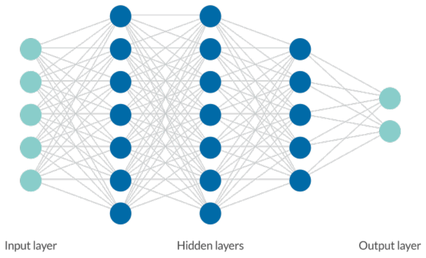


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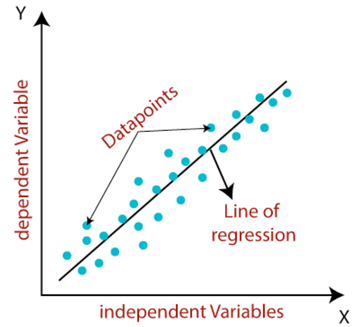


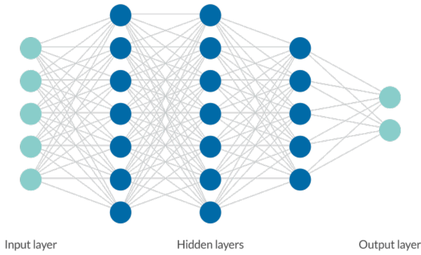


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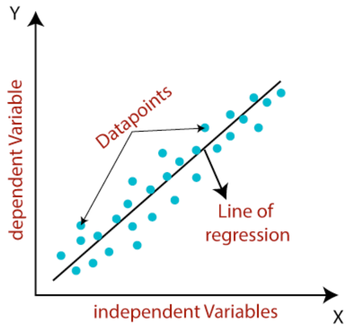


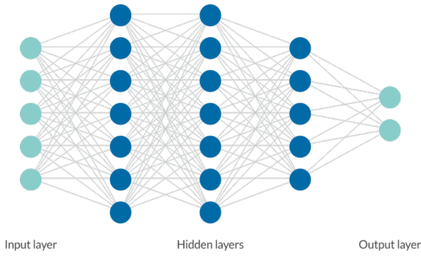


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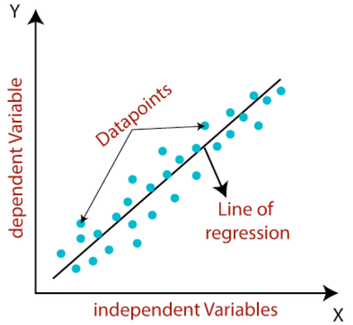


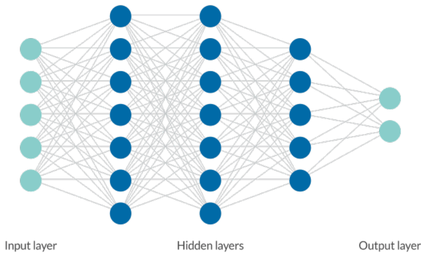


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- Data Scientists might only specialize in **one or a few** of these skills

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- These techniques are **often** but **not always** applied to science
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- While the name “Data Science” is here to stay, it might (sometimes) be more accurate to talk about **data {analysis, exploration, engineering}**

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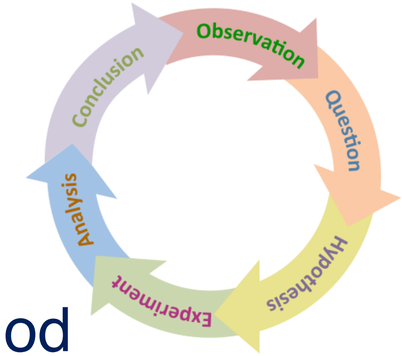


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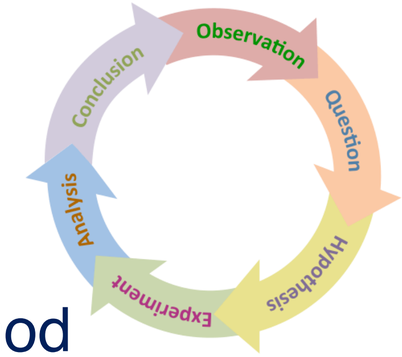


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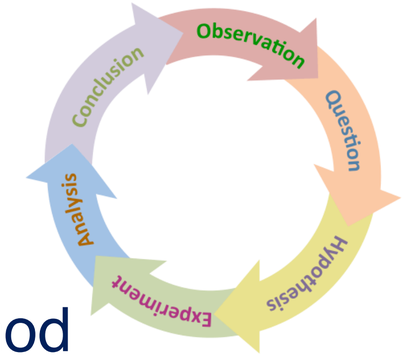


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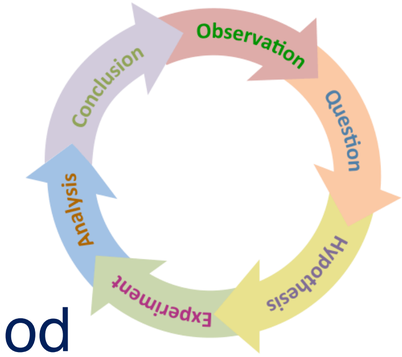


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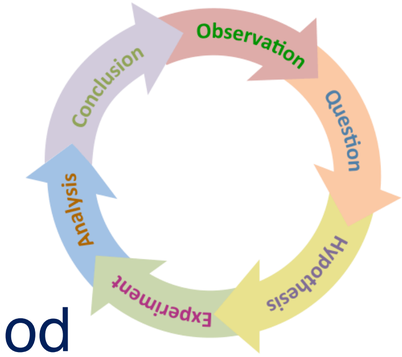


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- We will read later about the importance of **separating exploratory studies** and **hypothesis testing** (but we will engage in both in this course!)

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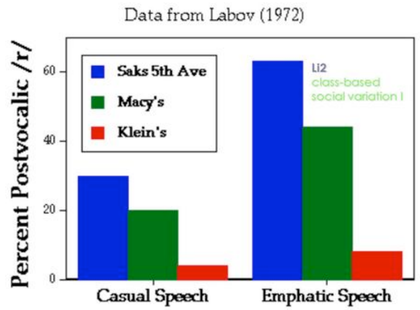

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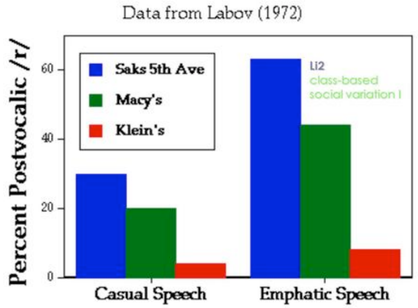
- Others have been historically **more resistant** (especially Chomsky)
  - “One’s ability to produce and recognize grammatical utterances is **not based on notions of statistical approximations** and the like” (Chomsky 1957)
  - Syntax and Generative Grammar have tended towards methods more similar to **math** and **philosophy** than (experimental) science




⟨SENTENCE⟩ → ⟨NOUN-PHRASE⟩⟨VERB-PHRASE⟩
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⟨ARTICLE⟩ → a | the
⟨NOUN⟩ → boy | girl | flower
⟨VERB⟩ → touches | likes | sees
⟨PREP⟩ → with

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- Note that these philosophies are **not mutually exclusive**, but researchers have historically tended to argue that one may be more reliable than the other

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- Empirical techniques are inherently better suited for **generalizing from variable data**

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  - Culturally, the Croats consider themselves as belonging to the West
- Investigating language from a **data-driven** approach reveals that it is **much more flexible** than the introspection-driven account

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- **They tend to claim too much**
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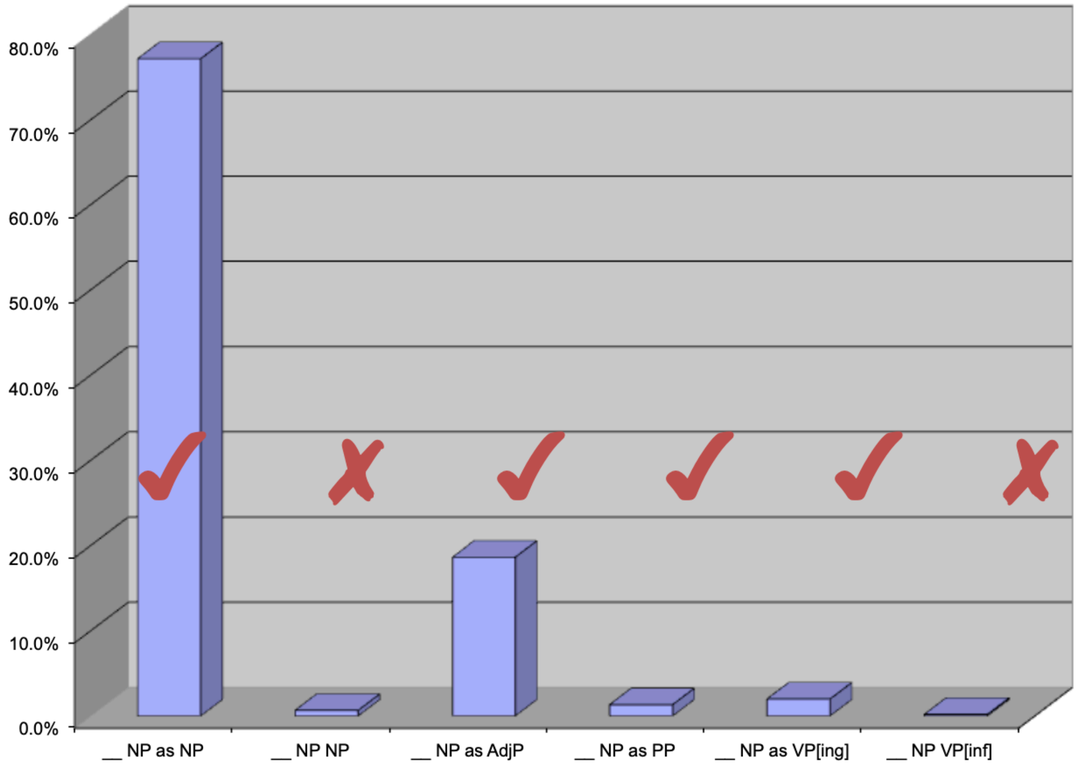
- **They tend to explain too little**
  - They say very little about the **soft constraints** that explain how people **choose to say things** in given situations. These types of soft constraints have long been of interest to e.g. sociolinguists

# Probability distribution for *regard*



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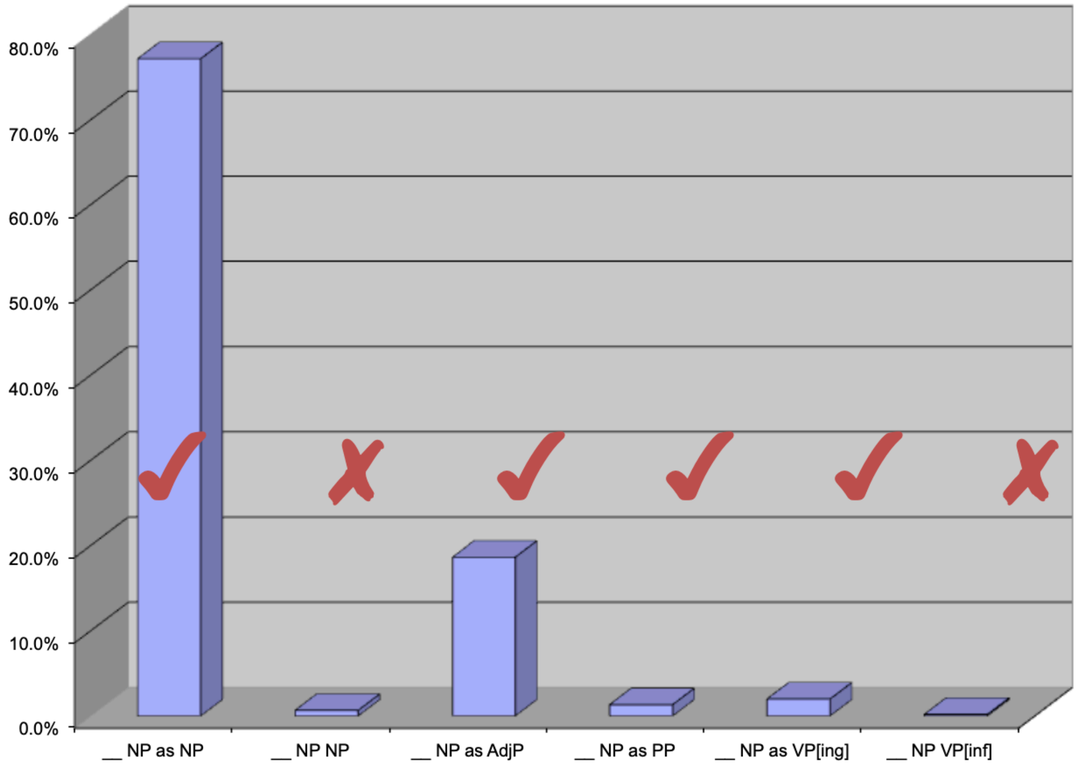

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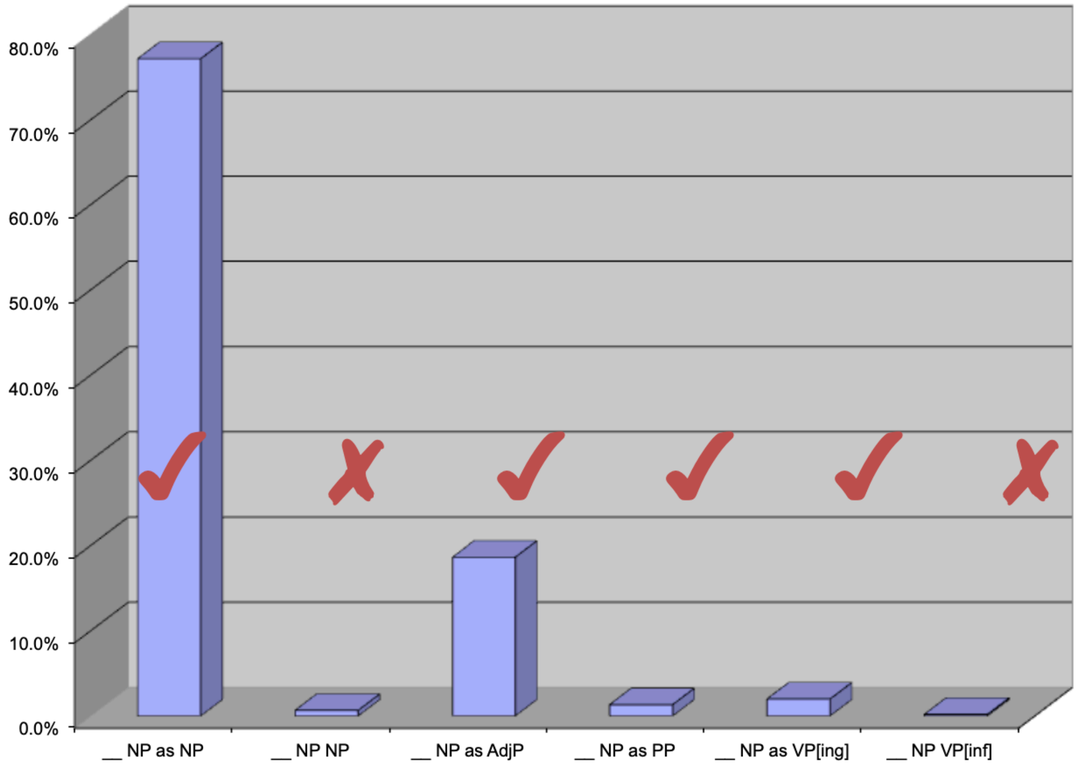

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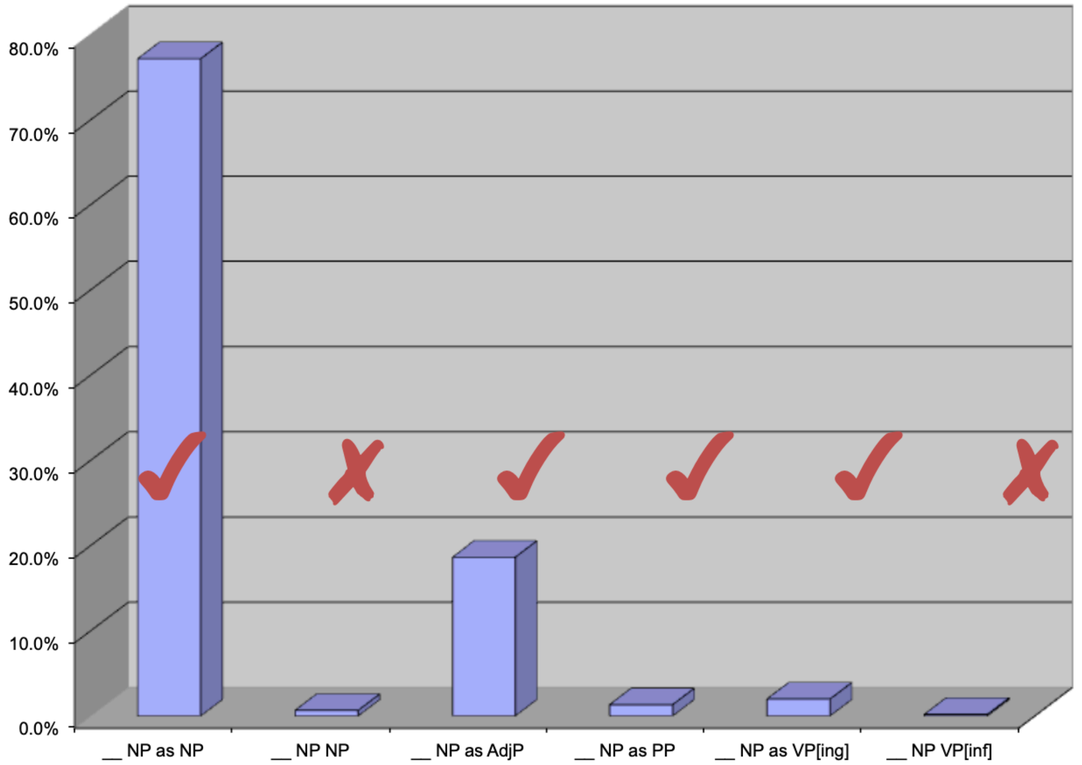
- We will discuss various standard corpora and **corpus linguistics methods** in this course



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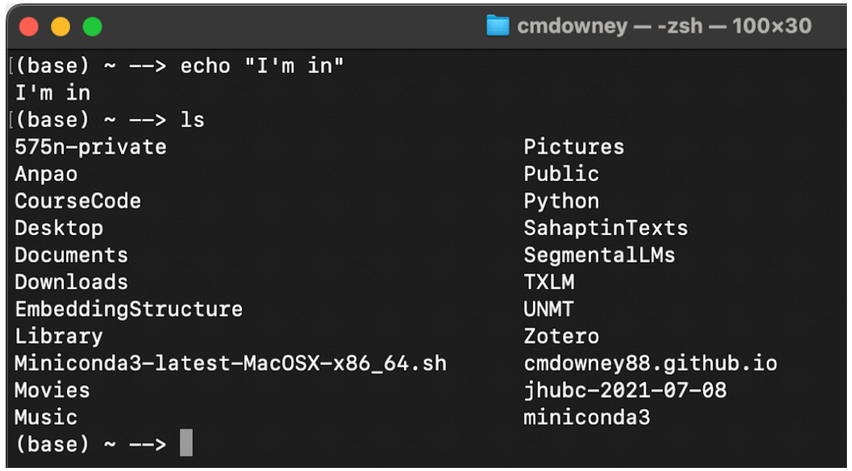
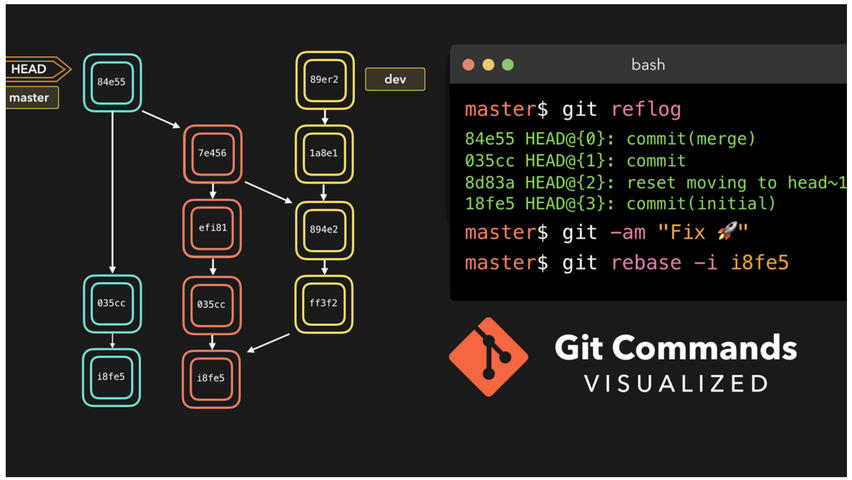
  - **Visualize** patterns in language, and **effectively communicate** your findings
  - **Test linguistic hypotheses** with statistical robustness

# Larger theme: Core Data Science Tools

- Covered in the first part of the course
- Using the **command line**
  - Will learn how to interface with computers in a new and **more powerful** way
  - Is sometimes the **only way** to interface with powerful servers for data science!
- **Version control** with **Git and Github**
  - The standard way to manage **collaboration, edits,** and **differing versions** of software



# Larger theme: Data manipulation in Python

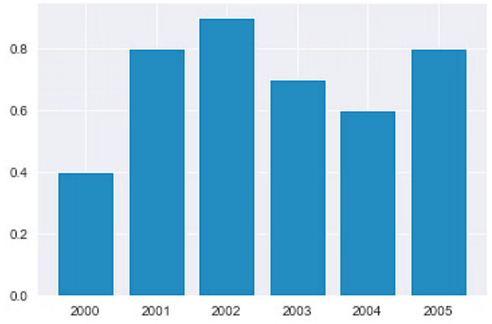
- Very basic introduction to **Python**
  - The dominant language for **Science** and **Data Engineering**
  - Easy language to **get started**
- Introduction to relevant **Python libraries**
  - Regular Expressions
  - Natural Language Tool Kit
  - Pandas

```
>>> nltk.corpus.sinica_treebank.tagged_words()
[('ä', 'Neu'), ('åæ', 'Nad'), ('åç', 'Nba'), ...]
>>> nltk.corpus.indian.tagged_words()
[('মহিষের', 'NN'), ('সন্তান', 'NN'), (':', 'SYM'), ...]
>>> nltk.corpus.mac_morpho.tagged_words()
[('Jersei', 'N'), ('atinge', 'V'), ('m\xe9dia', 'N'), ...]
>>> nltk.corpus.conll2002.tagged_words()
[('Sao', 'NC'), ('Paulo', 'VMI'), ('(', 'Fpa'), ...]
>>> nltk.corpus.cess_cat.tagged_words()
[('El', 'da0ms0'), ('Tribunal_Suprem', 'np0000o'), ...]
```

```
years = range(2000, 2006)
apples = [0.35, 0.6, 0.9, 0.8, 0.65, 0.8]
oranges = [0.4, 0.8, 0.9, 0.7, 0.6, 0.8]
```

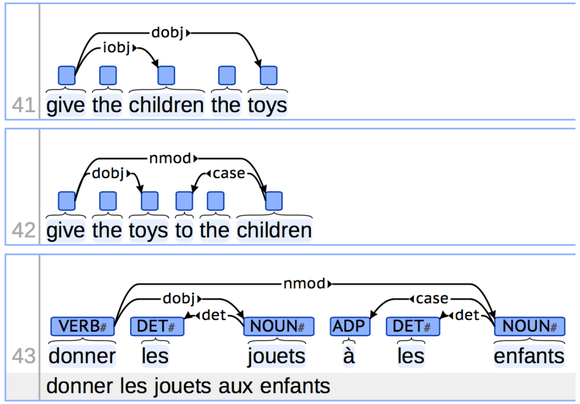
```
plt.bar(years, oranges)

plt.xlabel('Year')
plt.ylabel('Yield (tons per hectare)')

plt.title("Crop Yields in Kanto")
```

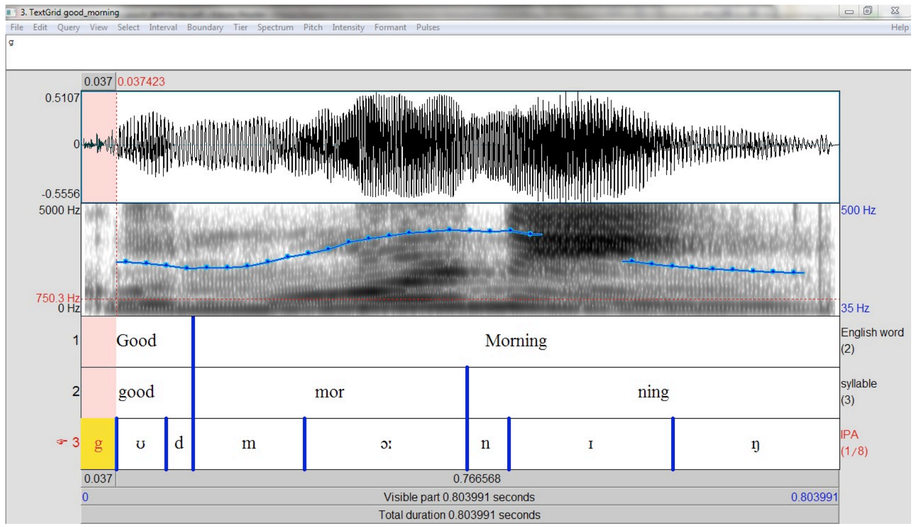
```
<BarContainer object of 6 artists>
```



# Larger theme: Linguistic annotation

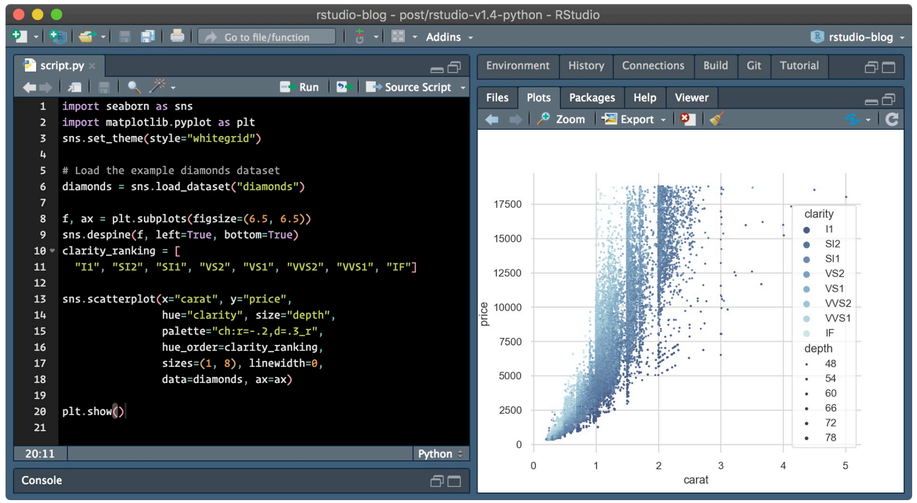
- Introduction to **common annotation schemes** for Linguistic data
- Discussion of why it is important to have **machine-readable** data
- Discussions of the **challenges** and **reliability** of annotation

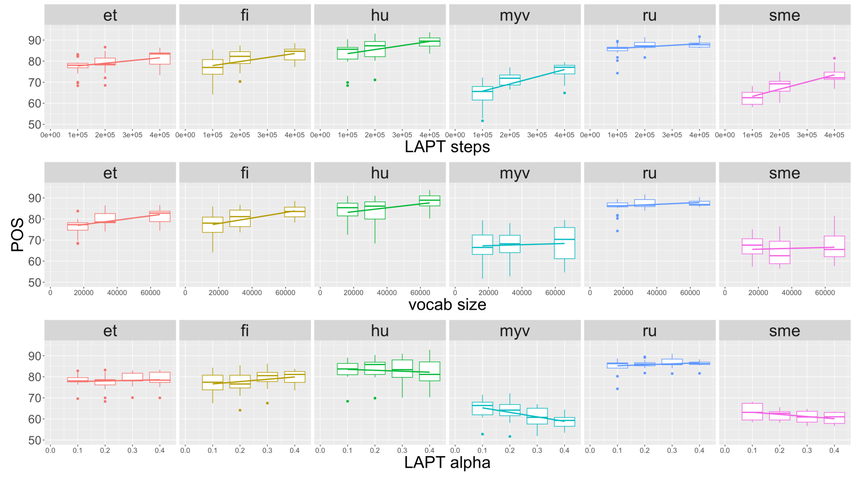


# Larger theme: R for testing and visualization

- Introduction to **R**
  - Most commonly used language for **statistical testing**
  - Also has the best libraries for **data visualization**
- **ggplot**
  - Library for developing **professional data visualizations**
  - Tricky at first, but gives the best results



# Policies and Organization

# Basic Information

- Instructor
  - C.M. Downey
  - Assistant Professor in Linguistics & Data Science
- Meeting time
  - Monday/Wednesday 9:00-10:15am
  - **This week only** we meet **Wednesday/Friday**
- **Office hours**: by appointment
  - Feel free to reach out to schedule an appointment any time!

# Online Resources

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- **Blackboard**
  - Announcements
  - Discussion boards
  - Homework submission

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- **Blackboard**
  - Announcements
  - Discussion boards
  - Homework submission
- **Course website** (cmdowney88.github.io/teaching/ling250/spring2026)
  - Detailed course schedule
  - Syllabus
  - Slides (posted after class)
  - Important links and documents

# “Required” Textbooks

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- You will sometimes be assigned **required readings** before class, but these will always be drawn from **free online sources**
  - Available online as PDFs

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- **Links** to these sources can be found here and on the **course website:**
  - *Natural Language Processing with Python*
  - *Data Science from Scratch*
  - *Speech and Language Processing*

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  - 10% Attendance
  - 10% Engagement in Discussion/Activities

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  - Pose and test a **scientific hypothesis**
  - Culminate in a **research paper** and **presentation**
- **Deliverables**: writeup, presentation, code repository
  - Scaffolded with **incremental milestones** due throughout the semester
  - First step: an **interest survey** due **next Thursday (1/29)**

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- **10%** of grade for **engagement in discussions / check-in activities**

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- **Before Friday:** follow the **setup guide** posted on Blackboard and the course website to get your device ready

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- **IMPORTANT: Generative AI Policy**
  - **NOT allowed for***: homework, midterm project, project milestones, project writeup
  - **allowed for**: programming work on the **term project only**
  - Rule of thumb: using AI to **learn and clarify concepts** is fine; using it to **generate work you submit as your own** is **not**
    - ***You can use AI to **help you learn** on assignments where it's not otherwise allowed; just don't have it do the work for you
  - **Honor system** - I don't want to be the AI police

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  - A **laptop or other device** on which you can conduct computational work

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- What I assume:
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  - A **laptop or other device** on which you can conduct computational work
- Computing resources
  - I will provide **access to UR's supercomputing cluster (BlueHive)**
  - Part of this class is learning how to use **command-line interfaces**
    - This is still important for **industry and research jobs**
  - Not mandatory to use, but helpful for intensive computing

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- Please **feel free to request extensions**, but you must request it **before the deadline**
  - I will be more willing to grant extensions the longer before the deadline it is requested

# Questions/Discussion?