Today's objectives:

- **Model building, hypothesis testing**
- **Representing speech sounds in the mental grammar**

Background preparation:

(none)

0. Today's key points

- In general: What it means to
  - build a **model**
  - test **hypotheses**
- Building a model of the mental representation of segments (speech sounds) that can
  - **describe** and **predict** individual **segments**
  - **describe** and **predict** segment **classes**

0. Check-in: Preparation questions on Canvas

- We will start having **preparation questions** due before many (most?) class meetings | due **10am**
  - Prep questions are graded Pass/Fail — a Pass earns a participation point
- How to **make use of the feedback**
  - Assume you have a "Pass" (if submitted) unless the feedback tells you otherwise
  - Look at your **point score** to see your **accuracy**
  - Read the **feedback comments**
  - Anything you should review, or ask about?

1. Building a model, testing hypotheses

- In scientific investigation, what is a **model**?
  - Can you think of any examples of models from various areas of science?

1. Building a model, testing hypotheses

- A model is an **abstract explanatory device** designed to **account for data**
  - ‘Abstract’ = exists in the minds of the explainers
  - **Data** = facts that we observe about the world

- Having a model allows us to…

1. Building a model, testing hypotheses

- A model is an **abstract explanatory device** designed to **account for data**
- Having a model allows us to…
  - **Describe** what we observe
  - **Predict** what else should happen
  - (Attempt to) **explain** why phenomena occur
- If our model is a **good match** with how the world works, we can make a case that properties of the world are **like** properties of our model
  - We check this by **testing hypotheses** on data

1. Building a model, testing hypotheses

- When we propose a model, what are some of the characteristics we have to give it?
  - We propose **entities** that exist in the model
  - We propose ways in which those entities **behave** or **interact**
  - We **carefully define** those elements or entities and their relations, so that it is clear what the model allows, or requires, them to do

1. Building a model, testing hypotheses

- Our first goal: Build a model of how **segments** (individual consonant and vowel sounds) are **represented** in the mental grammar
  - Based on the tongue-twister exercise, we start by proposing that…

1. Building a model, testing hypotheses

- Our first goal: Build a model of how **segments** (individual consonant and vowel sounds) are **represented** in the mental grammar
  - Based on the tongue-twister exercise, we start by proposing that segments are represented in the mental grammar in terms of their **properties**
    - This accounts for our observation that the grammar can "tell" if segments are "similar"
  - But what is the **inventory of properties** that is used for this?

2. What properties matter?

- How do US coins differ from one another? (<Wikipedia)

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- How do US coins differ from one another? (<Wikipedia)

				
Color	copper	silver	silver	silver
Size	smallish	medium	small	large
Edge	smooth	smooth	ridged	ridged
Weight	2.5 g	5.000 g	2.268 g	5.67 g
Image/text	Lincoln	Jefferson	FDR	Washington

- How could we **find out** which of these differences are **used by humans**? → **Hypotheses**?

2. What properties matter?

- We can ask this same question for **segments** (speech sounds)!
  - We can observe ways by which segments differ physically (phonetically) from one another
  - But…
    - Which of those potential differences are **used by the mental grammar**?
    - How can we **find out**?

2. What properties matter?

- How can we find out which properties of segments are used by the mental grammar?
- We can use evidence from…
  - **Phonologically active classes**: What properties are needed to account for groups of segments that *pattern together* in languages?
  - **Categories**: What properties are needed to distinguish all segments that are treated as *distinct mental sound categories* in languages?

3. Data from consonant classes

Data set: Arabic consonants

- What sound properties are used by the grammar?
  - *Hypothesis:* The traditional phonetic properties that we reviewed for the quiz are **necessary** and **sufficient** to uniquely describe each class
  - Test this hypothesis…what do you find?
- Data: "Groups" are **phonologically active classes**
  - That is, each group is distinguished from all the other consonants by speakers' mental grammar

3. Data from consonant classes

Data set: Arabic consonants

Group discussion

- For each "group" in the data set: Test the hypothesis! Try using the quiz properties to…
  - Give the group a **single, consistent description** (using one or more properties that is true of all sounds in the group)
  - Check to see if your description is able to **distinguish** the group from all other consonants seen in this data set

3. Data from consonant classes

Data set: Arabic consonants

Debriefing

- What sound properties are used by the grammar?
  - *Hypothesis:* The traditional phonetic properties that we reviewed for the quiz are **necessary** and **sufficient** to uniquely describe each class
- The hypothesis is **not** supported
  - The traditional phonetic properties are not a very good model of consonants in the human mental grammar

4. Data from vowel classes

Data set: Turkish

- Checking in: What information is provided in a "paradigm" data set like this?

4. Data from vowel classes

Data set: Turkish

Group discussion

- What determines the vowel in the **plural suffix**?

- What determines the vowel in the **genitive suffix**?

4. Data from vowel classes

Data set: Turkish

Group discussion

- What determines the vowel in the plural suffix?
  - **Two** phonologically active classes of vowels here
- What determines the vowel in the genitive suffix?
  - **Four** phonologically active classes of vowels here

4. Data from vowel classes

Data set: Turkish

- *Hypothesis:* The traditional phonetic properties that we reviewed for the quiz are **necessary** and **sufficient** to uniquely describe each class
  - Can each class be **uniquely identified** (distinguished from all vowels not in the class)?
  - What is the **smallest number** of vowel properties we need in order to do this?

5. The mental representation of segments

- A **feature model** — part of our model of the phonological grammar
  - This is the set of phonological properties that we propose to be relevant for the mental grammar
  - Subject to revision based on new evidence!
    - Does our model's behavior match the real world well?
    - Make predictions and test hypotheses!

- For next time: Read "Phonological features" handout; practice with Arabic and Turkish (prep Qs)