COGS 105

Research Methods for Cognitive Scientists

Week 3, Class 1:
Behavioral Methods I: Sampling and Such

Logistics and Such

- Exam date now posted. **First exam: Feb. 26**.
- We will take **Feb. 24th to review together**.

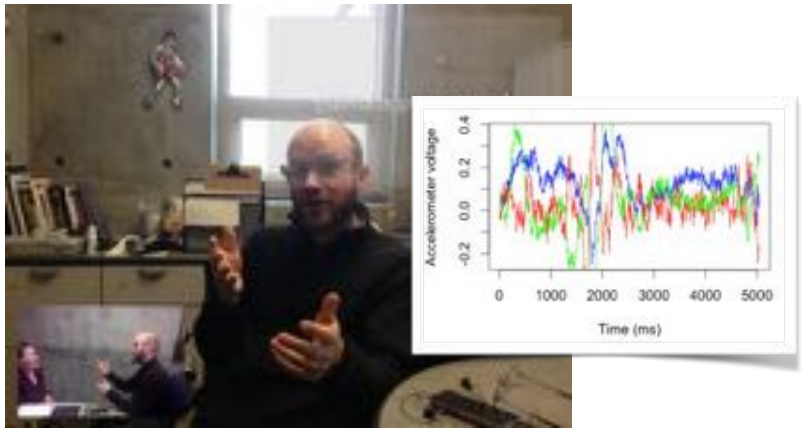
This Week

- Behavioral Methods I
  - Sampling
  - Measurement

You, in a Lab

Prof. Balasubramaniam's lab, SSM

You, in a Lab



Prof. Dale's office or… ahem… his "laboratory"

Reaction Time

Your standard "reaction time lab"; being replaced by the internet!

Question

How do we determine who we are going to run in our laboratory tasks, and how we are going to get them to participate?

Who, what, where, when… but why?

Sampling

- The techniques we will be discussing today apply across a **variety of behavioral research contexts**.
  - **Surveys and polls** (e.g., online surveys)
  - **Database analysis** (e.g., user logs, customer logs)
  - **Behavior in the laboratory** (e.g., RT!)

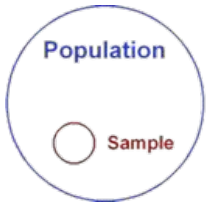
In most cases…

…as **cognitive scientists** we are **forever trapped** in drawing inferences about people and their cognitive processes using very **coarsely and crudely collected samples**…

So…

…**always be wary** of how you are making generalizations about people; always critique, question, explore and expand the ways that you **sample from people and measure their behavior**…

Basics of Sampling



Sampling

From required readings

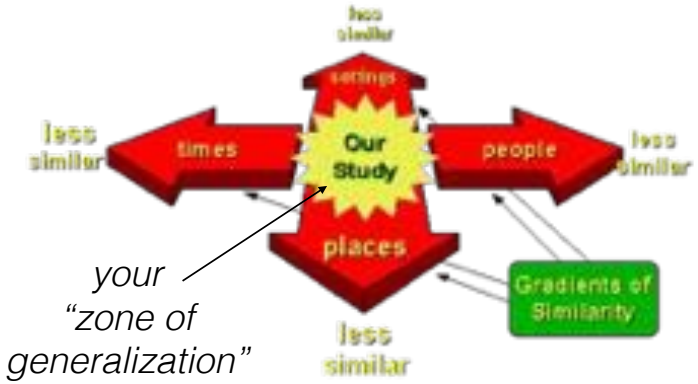
Sampling Model

- Identify the **population** you are interested in
- Draw a fair, representative **sample**
  - Very difficult to draw a fair, representative sample.
  - Very difficult to know if you can generalize to ***contexts*** such as time and place.

Proximal Similarity Model

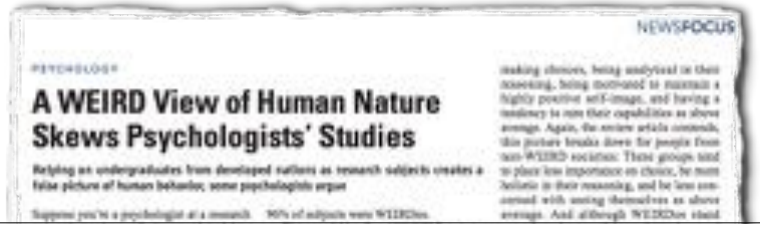
- Reason from our sample to a population: What *can* we generalize to? What situations / populations are *similar* to our sample?
- Lets us generalize to that context: “So, my study shows that people who are like X in condition Y will do Z.”
- You can visualize the “proximal similarity model” this way…

Proximal Similarity Model



External Validity

- Does my task and do my participants approximate the population “external to my study” that I want to generalize to?
- Threats to external validity… people, places, and times most common issues.


NEWSFOCUS

PSYCHOLOGY

A WEIRD View of Human Nature Skews Psychologists' Studies

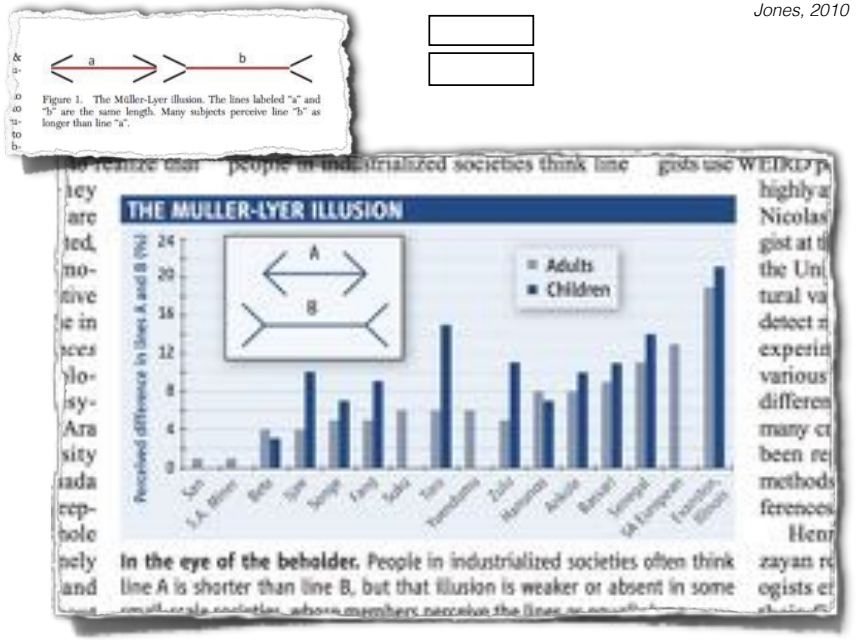
Relying on undergraduates from developed nations as research subjects creates a false picture of human behavior, some psychologists argue

We are all WEIRD

W estern
E ducated
I ndustrialized
R ich
D emocratic

We'll talk more about this problem later this semester…

Jones, 2010



Sampling Terminology

- **Theoretical population**: "the population you would like to generalize to."
- **Accessible population**: "the population that will be accessible to you."
- **Sampling frame**: list of available participants or also procedures for doing that sampling.
- **Sample**: the folks you recruited.

Sampling Terminology

"At this point, you should appreciate that sampling is a difficult multi-step process and that there are lots of places you can go wrong. In fact, as we move from each step to the next in identifying a sample, there is the possibility of introducing systematic error or bias."

Statistical Ideas

$$\text{Standard error} = \frac{\sigma_x}{\sqrt{N}}$$

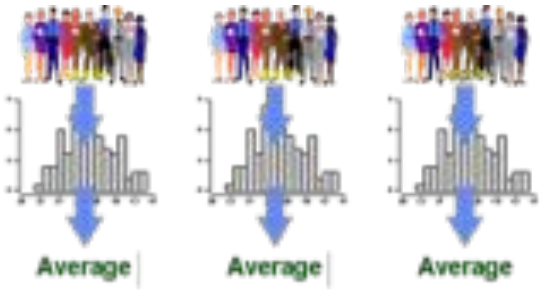
Statistical Terms

- **Response** = one or more responses are provided by participants in our sample; measured behavior in some way. (this measure is your **variable**)
- You can calculate a **statistic** from several responses across individuals. This is a property of your **sample**.
- You are trying to estimate a **parameter**; a "true" statistic in your broader **population**.

Statistical Terms (in RT)

- **Response** = A single reaction time score (RT) to one of our words.
- You can calculate a **statistic** from several responses across individuals; for example what is your sample's **average RT to common words**.
- You are trying to estimate a **parameter**; a "true" statistic in your broader **population**; is the "average person's" RT to common words truly faster than the RT responses to uncommon words?

Sampling Distribution



Example… from RT!

- When we reason about common vs. uncommon words and which induces faster mental processes, we are trying to **make an inference from a single experiment**.
- This **single experiment will have variability**, it will only approximate the 'true' mean.
- The idea of a sampling distribution is what our **average reaction times might look like if we did this experiment an infinite number of times.**

SD vs. SE

- **Standard deviation** (SD) is a measure in our original units of the variability of our measurement. There is a SD of RT.
- **Standard error** (SE) is an estimate of "how off" we probably are in our experiment from the true value; it is estimated from the SD.
- **SE = SD / sqrt(N)**

Example

- Let's go from RT's to something stupidly simple.
- Imagine labeling heads 1 and tails 0 and conducting a really boring coin flip experiment. (**response** = 0 or 1)
- What is the true average score in the game (**parameter**)?
  - Well, we know it, 0.5, ja?
- But this little scenario lets us see how SD and SE work. It's really quite simple, if unintuitive at first.

SE

=

SD / sqrt(sample size)

go to R script

Summary

- **Standard deviation describes your <u>sample</u>**; it is the tendency for your scores to vary, in the original units (e.g., a coin flip will tend to vary from the mean by 0.5, since the mean is 0.5 but heads is 1 and tails is 0).
- **Standard error** is used to estimate how precise your statistic is for **estimating the parameter**; you want to infer to the "**true mean**" of the distribution.
- **Importantly**: SE depends on how much data you have collected! How big is your sample!? The bigger, the more accurate your estimate of the "true average."

Types of Sampling

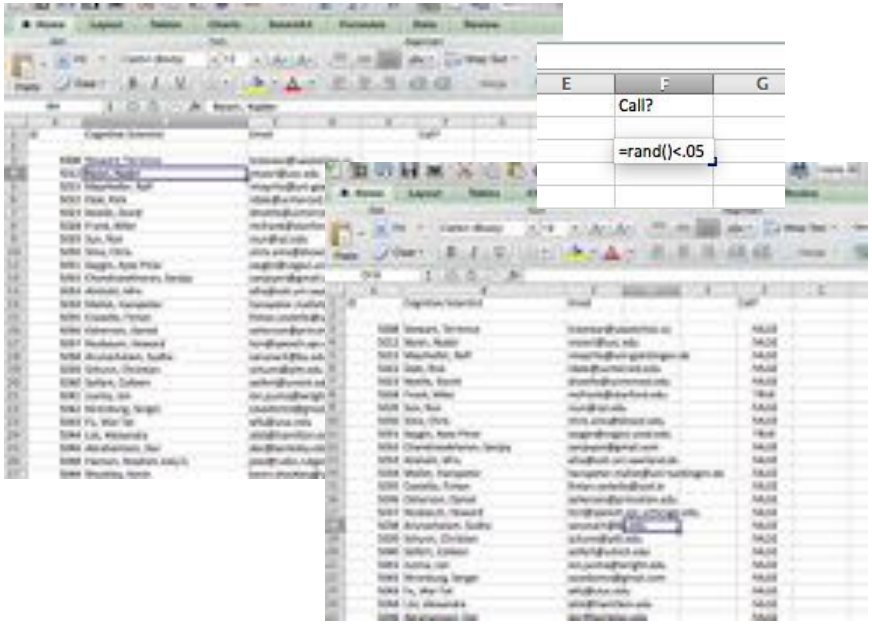
Probability Sampling

- "any method of sampling that utilizes some form of random selection. In order to have a random selection method, you must set up some process or procedure that assures that the different units in your population have equal probabilities of being chosen." (reading)

Probability Sampling

- **Simple random sampling**: "Make sure that everyone accessible through your sampling frame has an equal chance of being in the sample."
  - Often: random number generators.
  - E.g., Excel's "rand()" function.
- Ensures **representativeness** when you use large numbers; "proportional representation."

"Drawing Lots"



Better Way…

- You know… computers.
- Back in the day (which was I guess, in this case, before readily available computing tools), **figuring out the best way to sample randomly was a big big deal**!
  - Researchers and engineers used to buy random number books. You can still buy 'em on Amazon!

Reviews Are Hilarious

409 of 429 people found the following review helpful

Quite the opposite of random when viewed globally

By D. C. Froemke on January 14, 2008

Format: Paperback

At first, I was overjoyed when I received my copy of this book. However, when an enemy in my department showed me HER copy, I found that they were the OPPOSITE of random - they were IDENTICAL.

196 of 200 people found the following review helpful

Too unpredictable

By pontifex on January 24, 2011

Format: Paperback

The book is too hard to follow, the author randomly shifts from one number to another without any prior warning.

1 Comment | Was this review helpful to you? Yes No

607 of 619 people found the following review helpful

Wait for the audiobook version

By R. Rosini on October 19, 2006

Format: Paperback

While the printed version is good, I would have expected the publisher to have an audiobook version as well. A perfect companion for one's Ipod.

4 Comments | Was this review helpful to you? Yes No

Probability Sampling

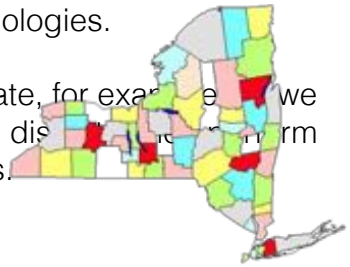
- **Stratified random sampling**: divide up your population into separate groups and draw a simple random sample from each.
  - Each level is called a “stratum.”
  - Ensures that you have **equal representation** of two strata of interest.
  - E.g., if one subgroup is super small.

Example from our RT

- Common words are way more common than uncommon words… but we include them in our study in equal proportion because we’d like our results to be as comparable as possible. This is essentially a “stratified” approach.
- Crucial observation here:
  - Note that this also means that reasoning about sampling ***also applied to the stimuli in our tasks!***
  - ***You can also ask “How do I sample from words for my study, because I want to generalize to all words.”***

Probability Sampling

- **Cluster (area) random sampling**: before sampling from your population, randomly choose a set of spatial (or "geographic") clusters of interest to you.
  - Relevant to survey methodologies.
  - Cannot sample a whole state, for exa[illegible]e we first randomly sample from dis[illegible]rm a sample on those districts.



Nonprobability Sampling

- **Accidental, haphazard, or convenience** sampling occurs in situations where you cannot easily control the availability of representative samples, so you draw from what is immediately available.
  - "Take 'em as they come."
  - "Clipboard at the mall."
- **Purposive**: You have a population segment you are interested in and you pursue data on those folks; "malls, clipboards."
  - Whole bunch of purposive sampling approaches: expert sampling, heterogeneity sampling, … (see reading)

SONA

- Is SONA **probability sampling** or **nonprobability sampling**?
- It is nonprobability sampling; convenience samples!
  - We often assume people sign up haphazardly (it is almost random) … but is it?
  - What other problems are there with SONA? Think of issues with generalization.

Next class…

- Measurement issues; "constructs"; reliability and validity.