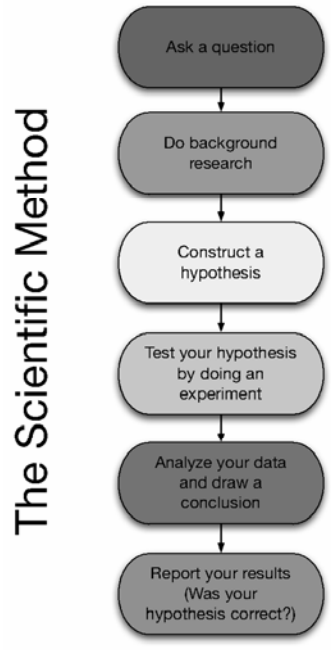
CHAPTER 7
HYPOTHESES



HYPOTHESES

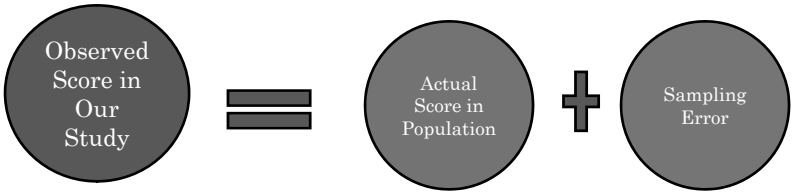
- An educated guess based on theory and past research
- Translate a research question into a testable form
  - Are men and women equally good at math?
    - Research Question-but how do we test it?
  - Women will score higher than men on the quantitative section of the GRE.
- Informs how you will test the hypothesis and thus answer the question
  - Should help you determine the measure, method, and appropriate sample…

HYPOTHESES

- Remember that almost all of the time its impractical/impossible to conduct your study on everyone in the **POPULATION** so you use a subset of the population referred to as the **SAMPLE**

SAMPLING ERROR

- How close the sample is to the population



SAMPLING ERROR

- The amount of sampling error influences how **GENERALIZABLE** our results are.
  - Can we infer that our results would hold for the population?
  - If the sampling error is large, we can't be sure…

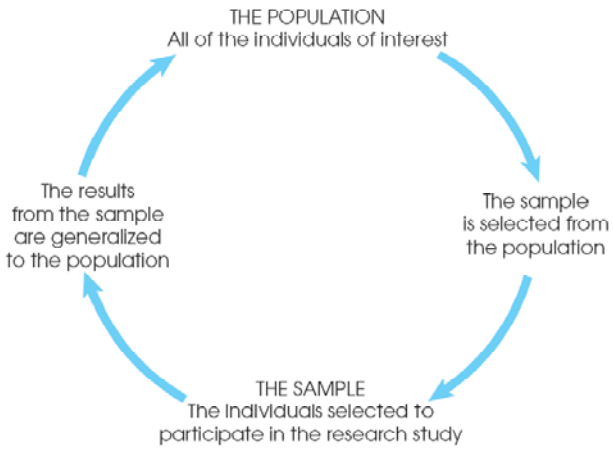
POPULATION VS. SAMPLE

- Population-level:
  - Are men and women equally good at math?
- Sample-level:
  - Women will score higher than men on the quantitative section of the GRE.
- *How sampling error could come into play…*
  - Goes back to the garbage in->garbage out idea

SO WHAT TO WE DO?

- **Hypothesis Testing**
  - a statistical method that uses data from **SAMPLES** to evaluate a question about the **POPULATION**

1) We state the hypothesis
2) Use the hypothesis to inform what we should see in our sample if the hypothesis is right
3) Obtain a random sample from the population
4) Compare the obtained sample data with the prediction made from the hypothesis
5) Generalize to the population



HYPOTHESES

- First step: State hypothesis
  - *Actually you "state" 2 different hypotheses*
    - The Null Hypothesis (H_0)
    - The Research Hypothesis (H_1)

THE NULL (H_0)

- Null always states that there will be no difference between your groups or no relationship between your variables
- Statements of equity
- Examples
  - There is **no** effect of this pill on depression
  - There is **no** difference between men and women in aggression
  - There is **no** relationship between the SAT and college GPA

THE NULL (H_0)

- The logic of hypothesis testing is that you assume the null is true until evidence is strong enough to suggest otherwise
  - Law: innocent until proven guilty
  - Statistics: Assume null is correct until your data "prove" otherwise
- The null is the *benchmark* against which you judge your data
  - Law: Reasonable Doubt
  - Satistics: Rejection of the null when you are confident any differences/relationship can't be explained by chance
    - This is called statistical significance—To be continued in chapter 9

THE NULL (H_0)

- The null is at the level of the population, not the sample

$$H_0 : \mu_a = \mu_b$$

- Not usually stated in journal articles—only implied.

THE RESEARCH HYPOTHESIS (H_1)

- Statement that there is a relationship between the variables/difference between groups
- Statements of inequality
- Unlike the null, the research hypothesis is at the level of the sample and directly linked to our method/measures
- Examples
  - Participants who take the pill will report less depression than participants who do not.
  - Men and women will report different levels of aggression on our measure.
  - There will be a relationship between SAT scores and college GPA
- This is what is stated in journal articles

THE RESEARCH HYPOTHESIS (H_1)

- Non-directional
  - Reflects a difference between groups, but the direction is not specified
  - Example: the mean on aggression will be different for men and women

$$H_1 : \bar{x}_a \neq \bar{x}_b$$

THE RESEARCH HYPOTHESIS (H_1)

- Directional Research Hypothesis
  - Direction of difference is specified
  - Men will have higher scores on our aggression measure than women

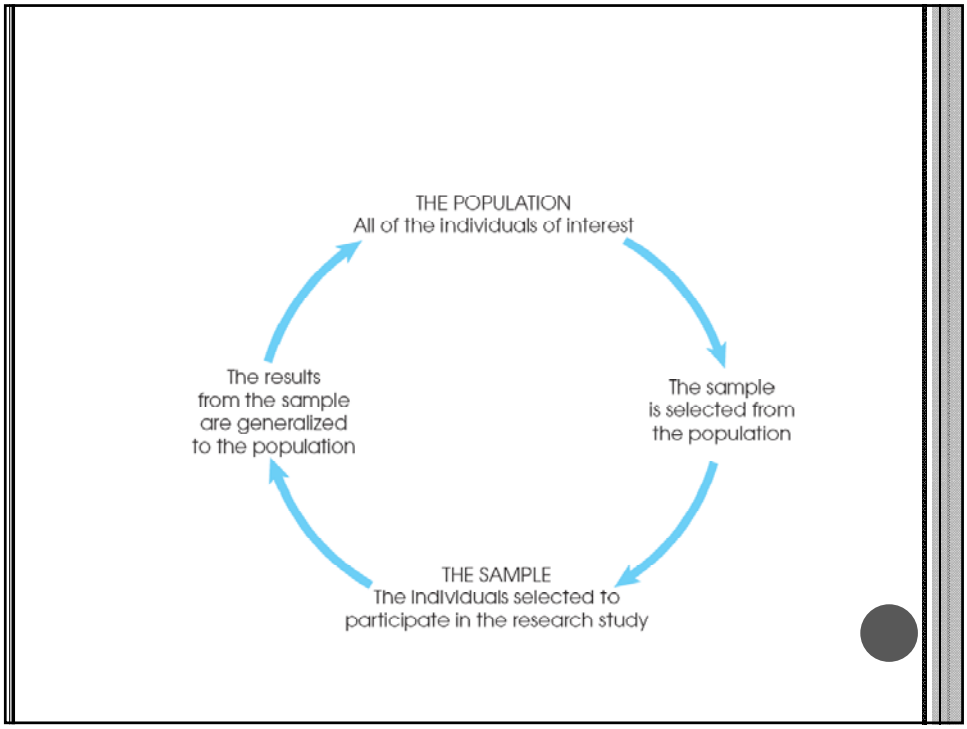
$$H_1 : \bar{x}_a > \bar{x}_b$$

TYING IT ALL TOGETHER…

- Why do we even have a null hypothesis?
  - Remember the null is actually our benchmark, so our goal is to reject the null rather than to accept or prove the research hypothesis
- Much easier to reject a universal (population) hypothesis than to prove one.
  - Example: "all dogs have four legs"
  - You have a sample of 10 dogs—will it be easier to reject or prove this hypothesis?
- The reason we reject the H_0 rather than prove the H_1 comes from the limitations of **inferential logic**.
  - Inference—the process of going from small to big
    - Small: Sample
    - Big: Population

TYING IT ALL TOGETHER…

- So what we do with hypothesis testing is this:
  - Try to find support for the **RESARCH HYPOTHESIS** with a **SAMPLE**
  - If we find it, then, we **INFER** from the sample findings that the **NULL** is not supported in the **POPULATION** and we **REJECT** it
  - This is called **STATISTICAL SIGNIFICANCE** and it provides indirect support for our research hypothesis since we can't test it directly in our entire population.
- In science we never use the word "prove" – we can only support our hypotheses.


THE POPULATION
All of the individuals of interest
The sample
is selected from
the population
THE SAMPLE
The individuals selected to
participate in the research study
The results
from the sample
are generalized
to the population