Sociology 357
Methods of Sociological Inquiry

Hypothesis Testing

Methodological Concepts in Assignments

- Observation
  - Operationalizing a variable
  - Inter-subjective reliability
- Experiment
  - Isolating causal relations by controlling extraneous variables
- Questionnaire
  - Operationalizing a variable with multiple indicators
  - Construct validity (relations among different measures)

Induction

- Induction is reasoning from the specific to the general = Empirical generalization
- There is no logical proof of induction: future cases may be different from those you have seen
- However, sampling theory (which we will do later) tells us how we can use the observations we have make probabilistic statements about future cases (e.g. the probability is .99 that the population mean is between 22 and 25)

Deduction

- Deduction is reasoning from the general to the specific, following the rules of logic
  - *All men are mortal*
  - *Socrates is a man*
  - *Therefore Socrates is mortal.*
- Deduction is important in scientific research for the logic of **falsification**

Illogic of "Proof" of Theory

If theory is correct, then X is true.
X is true.
Therefore, theory is correct.

INVALID LOGIC: Affirming the consequent.
X might be true for another reason

Illogic of Rejecting Data Because You Reject the Theory

If theory is correct, then X is true.
Theory is false.
Therefore, X is not true.

INVALID LOGIC: Denying the antecedent.
X can be true even if the theory is wrong about WHY it is true.

Logic of Falsification

If theory is correct, then X is true.
X is not true.
Therefore, theory is not correct.

VALID LOGIC

Falsification

- We cannot prove theories to be correct
- We CAN prove theories to be INCORRECT
- Research proceeds on a logic of falsification
  - We subject theories to tests which could falsify them
  - If a theory avoids falsification, we say it is "confirmed" (not proven)
  - If a theory repeatedly avoids falsification, we build our confidence that it is correct, but it could still be proven wrong later

Causation

- It is generally difficult or impossible directly to observe causation
- Criteria for inferring causation from observables:
  - Statistical association: two things vary together
  - Cause precedes effect in time
  - "Extraneous variables" are eliminated as possible explanations for the relationship (We will study this in depth later.)
  - We can identify the mechanism for the cause-effect relationship, we know how it works

Statistical Association

- For now, we will focus on assessing the statistical relation between two variables
- For **qualitative** independent and **dependent** variables, we will compare **conditional percentages**
- For qualitative independent and **quantitative dependent** variables, we will compare **conditional means**
- For quantitative independent and dependent variables, we will calculate correlation coefficients and linear regressions

Sex and Ice Cream Cone Eating

	Male	Female
Bite	53%	24%
Lick	33%	59%
Other	13%	18%
Total	99%*	101%*
(N)	(15)	(17)

Statistical Association: Males bit 53% of the time compared to 24% of the women (a percentage difference of 29%); females licked 59% of the time compared to 33% for males (a percentage difference of 26%). "Other" was only slightly different for men and women.

Difference of Conditional Percentages

Sex and Time to Complete Sales Transactions

	Men	Women
Mean Seconds for Transaction	27.1	40.5
(N)	(20)	(27)

Interpretation: Women took 13.4 seconds longer than men, on average, to complete their transactions.

Difference of Conditional Means

Correlations

- Example: The correlation between amount of money spent and elapsed time of the transaction is .43.
- Correlations range between –1 (perfect negative correlation) to +1 (perfect positive correlation).
- A zero correlation means there is no monotonic linear relationship.
- The strength of a correlation rises with its square.
  - If correlation is .7 or -.7, then .49 of the variance is explained
  - If correlation is .9 or -.9, then .81 of the variance is explained
  - If correlation is .2 or -.2, then .04 of the variance is explained

Full Logic of Hypothesis Testing

Research Syllogism
If A causes B {theory}
And if X measures/indicates A
{measurement assumption}
And if Y measures/indicates B
{measurement assumption}
Then **X will be statistically associated with Y**
{prediction}

Confirmation of Theory

Research Syllogism:
If A causes B {theory}
And if X measures/indicates A {measurement assumption}
And if Y measures/indicates B {measurement assumption}
Then X will be statistically associated with Y {prediction}

Data 1: **X is statistically associated with Y**
{prediction is correct}
Cannot prove that A causes B, but **confirms or supports** theory that A causes B. (Also confirms measurement assumptions.)

Disconfirmation of Theory

Research Syllogism: If A causes B {theory} And if X measures/indicates A {measurement assumption} And if Y measures/indicates B {measurement assumption}
Then X will be statistically associated with Y {prediction}

Data 2: X is NOT statistically associated with Y
{prediction is wrong}
Then either A does not cause B, or X is not a measure of A, or Y is not a measure of B.
By logical necessity at least one assumption is wrong. Falsification of the research syllogism.
BUT: Falsification may be in error due to sampling error or extraneous variables – later.